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A New Fiscal Framework for Resource-Rich Countries

By Luc Eyraud, William Gbohoui, and Paulo Medas

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ABSTRACT: This paper revisits the debate on the design of fiscal rules in resource-rich countries. Its main objective is to assess alternative systems of rules against their policy objectives, while taking into account country characteristics. One of the contributions of the paper is to propose fiscal frameworks that are centered around the principle of insurance against shocks and less reliant on estimating precisely resource wealth, which tends to be highly volatile.

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* "The author(s) would like to thank" footnote, as applicable.

WORKING PAPERS

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Glossary

CAB Cyclically-Adjusted Balance

CEMAC Central African Economic and Monetary Community

FSF Fiscal Sustainability Framework

FX Foreign Exchange

GDP Gross Domestic Product

MPIH Modified Personal Income Hypothesis

NFA Net Financial Assets

NFW Net Financial Wealth

NFACR Ratio of Net Financial Assets to Commodity Revenues

NRPB Non-Resource Primary Balance

PIH Permanent Income Hypothesis

SWF Sovereign Wealth Fund

I.   Introduction

Commodity prices have displayed very large fluctuations in the past two decades. From the beginning of the new millennium until 2014, prices of most natural resources rose sharply. The "2000s commodities boom"—as this period has been called—was primarily due to rising demand from emerging markets, particularly China, concerns over long-term supply availability, and portfolio reallocations towards commodities after the burst of the housing bubble in advanced economies. Global commodity prices collapsed by about a third in the second half of 2014 as result of both supply and demand factors. More recently, commodity prices have experienced an upward surge during the Covid-19 crisis and the war in Ukraine, with prices more than doubling between March 2020 and December 2022. The upswing in prices has prompted speculation that a new "supercycle" may have started. In the longer term, the energy transition in the face of climate change is likely to reduce global demand for fossil fuels, creating significant downside risks to the price of key commodities, especially oil (IEA 2023).

These large, and, sometimes, persistent movements in commodity prices put traditional fiscal frameworks of resource-rich countries to the test. About one quarter of these countries suspended their rules following the commodity price crash of 2014 (Mihalyi and Fernández 2018). This episode also highlighted the challenge of developing frameworks that are, at the same time, resilient, sustainable, fair, and well anchored in sound economic principles in an environment marked by large and unpredictable shocks, public scrutiny, and sometimes governance problems. More recently, the Covid-19 crisis has also prompted a rethink of fiscal frameworks worldwide, including in resource-rich countries. The severity of the shock has caused a large deterioration in fiscal deficits and public debt in almost all countries in the world. Many of them have activated escape clauses to allow deviations from their rules (Gbohoui and Medas 2020, Caselli and others 2022).

This paper revisits the debate on the design of fiscal rules in resource-rich countries. Its main objective is to assess alternative systems of rules against their policy objectives, while taking into account country characteristics. In the past decade or so, the analysis of fiscal frameworks for commodity producers has become more and more sophisticated, driven by a multiplication of tools, models, and analytical frameworks, but this has come at the cost of simplicity, transparency, and usability. This paper proposes to take a more holistic approach to reframe the discussion, while offering practical guidance. One of the contributions of the paper is to present frameworks that are less reliant on precise estimation of resource wealth—a very elusive and difficult-to-measure concept. To this end, the paper proposes to shift the focus of the discussion from the traditional concept of sustainability towards that of building fiscal buffers as insurance against a variety of risks.

The paper comprises eight sections. After outlining the challenges and objectives of these frameworks in section II, the paper reviews and draws lessons from international experience with rules' design and effectiveness in section III. The rest of the paper discusses two main paradigms. Section IV discusses the traditional approach based on the fiscal sustainability framework, which is analytically sound, but raises difficulties when it comes to its practical implementation. Section V explores an alternative framework centered around the principle of insurance against shocks and accumulation of buffers. Section VI and VII discuss in greater details various options for fiscal anchors and operational rules within this framework. Section VIII concludes.

II. What Are the Objectives of Fiscal Rules in Resource-Rich Countries?

A. Challenges Associated with Natural Resource Management

Revenues from non-renewable natural resources[1] can be a windfall for commodity producers, allowing them to finance infrastructure programs and scale up health and education spending to support short-and long-term growth. But the volatility and exhaustibility of nonrenewable resources pose significant challenges to the design and implementation of fiscal policy in these countries.

First, commodity prices are **volatile and unpredictable**, with the shocks presenting a high degree of persistence (Figure 1, Panel A). For example, after a steady increase over 2001-08, oil prices suddenly felt by around 40 percent to near $60 per barrel in 2009, and quickly rose to above $100 in 2010 (Figure 1, Panel B). Booms and busts can involve prices moving by as much as 40–80 percent over a decade (IMF 2015). Commodity prices also seem to follow longer-term fluctuations, often referred to as "super cycles", although the evidence seems less robust.

The volatility inherent to commodities prices significantly impacts governments' budgets, raising concerns about the capacity of fiscal policy to achieve macroeconomic stability. Commodity revenues often account for a very large share of budget revenue in resource-rich countries, up to more than 80 percent in some cases (Figure 1, Panel C). As a result, government revenues, which co-move with commodity prices, can vary dramatically in percent of non-resource GDP (Figure 2, Panel A). The policy response to these revenue shocks tends to be highly procyclical for two main reasons. (1) When commodity prices are high and rising, countries often spend a large part of the revenue windfalls. For instance, average non-oil primary deficits, which had fluctuated around 15 percent of non-oil GDP since the mid-1990s, increased significantly during the 2001-08 oil price upturn to about 25 percent of non-oil GDP, mainly driven by a sharp increase in primary spending that more than doubled during the period (Figure 2, Panel B). (2) During commodity price downswings, borrowing costs tend to go up at a time when countries need to access markets, which limits their ability to smooth negative shocks and may result in large and disruptive spending cuts (Figure 2, Panel C). Overall, fiscal policy has, on average, not been stabilizing in resource-rich countries.[2]

Beyond the problem of fiscal policy procyclicality, the volatility of resource revenues poses risks to fiscal sustainability. Indeed, pressures to scale up spending during booms may lead to unsustainable expenditure envelopes, exposing countries to rapid and painful fiscal adjustments during price reversals. Many expenditure programs are also difficult to contain or streamline following expansions. Evidence suggests that spending tends to increase when prices go up but does not fall by the same amount when prices decline (Figure 2, Panel D).

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[1] Throughout the paper, the terms "commodities", "non-renewable natural resources", and "resources" are used interchangeably.

[2] For further evidence on the procyclicality of fiscal policy in resource-rich countries, please refer to IMF (2015), Villafuerte and López-Murphy (2010), Sturm, Gurtner, and Alegre (2009), York and Zhan (2009).

Figure: 1. Commodity Prices and Fiscal Performance in Resource-Rich Countries

A - Historical Real Prices of Selected Commodities

Energy
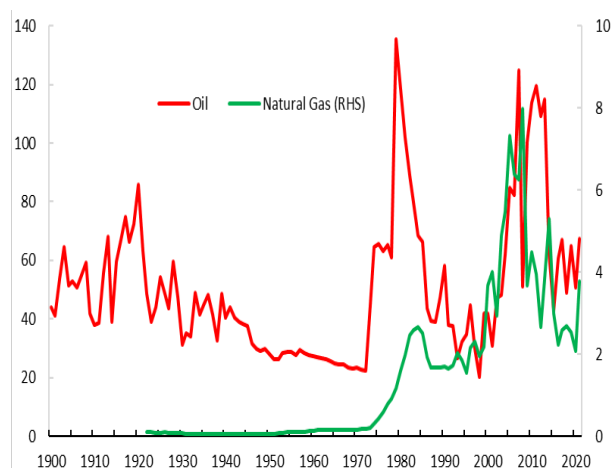
Other commodities (Real USD)
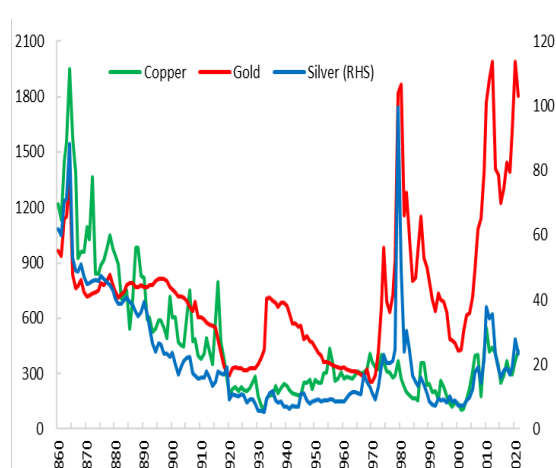
B- Forecasts and Actual Oil Prices[1]
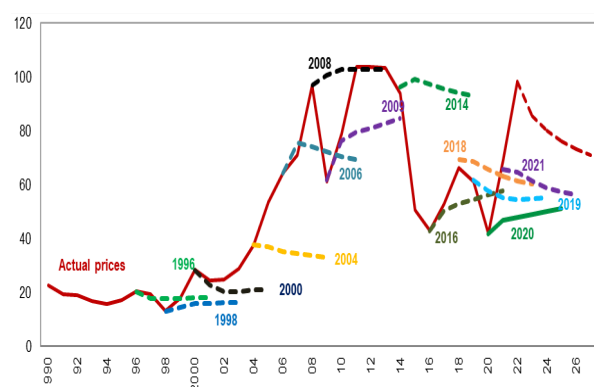
C - Oil revenue to General Government Revenue, (Average 2000-20)[2]
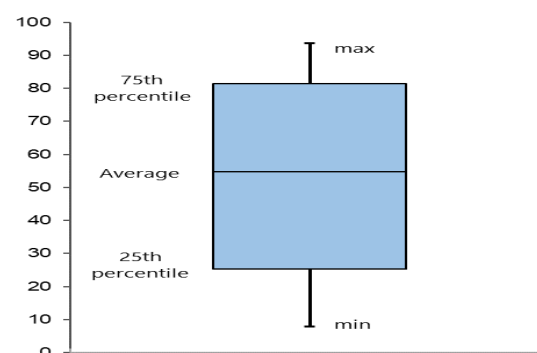
Sources: WEO, IMF Primary Commodity Price System, Global Financial data, and Thomson Reuters DataStream.
Notes: 1/ The solid (dashed) line represents actual (5-year ahead projections) crude prices for the year. 2/ The sample includes Algeria, Angola, Azerbaijan, Bahrain, Brunei Darussalam, Cameroon, Canada, Colombia, Congo, Cote d'Ivoire, Ecuador, Equatorial Guinea, Gabon, Indonesia, Iran, Iraq, Kazakhstan, Kuwait, Libya, Mexico, Nigeria, Norway, Oman, Papua New Guinea, Qatar, Russia, Saudi Arabia, Syria, Timor-Leste, Trinidad and Tobago, United Arab Emirates, Venezuela, and Yemen.

The volatility of commodity prices and export receipts also affects the economy through its impact on exchange rates, since the currencies of resource-rich countries tend historically to co-move with commodity prices. Large depreciations or appreciations impact trade, inflation but also external liabilities both for the public and private sectors. The size of these effects also depends on the fiscal response to commodity-related shocks.

Figure: 2. Commodity Prices and Fiscal Performance in Resource-Rich Countries (Cont.)

A- Oil Prices and Oil Revenue[1]

B- Non-Oil Primary Balance and Expenditure[1]

C- Oil Price and Difference in EMBI Spreads between Commodity Exporters and Non-Commodity Exporters

D- Procyclicality Coefficient (elasticity) of Expenditures to Commodity Prices[2]

Sources: WEO, IMF Primary Commodity Price System, Global Financial data, and Thomson Reuters DataStream.
Note: 1/ Same sample as in Figure 1, Panel C. 2/The bars show coefficients of real expenditure growth rates regressions on commodity price changes. Positive numbers indicate procyclicality. *** indicates a p-value<0.01.

Second, nonrenewable resources are **exhaustible** and may possibly become obsolete in the future for some commodities (e.g., oil and natural gas), posing intergeneration equity and long-term fiscal sustainability challenges. Resource horizons vary greatly across countries and commodity types, depending on the size of underground reserves that are economically viable to explore, as well as consumption and extraction rates (Figure 3, Panel A). Overconsuming the current revenue windfall from exhaustible resources not only increases the risk of massive fiscal adjustment once resource wealth is depleted, but it also creates intergenerational inequity as current generations achieve higher welfare at the cost of lower welfare for future generations. Hence, resource exhaustibility calls for intertemporal decisions about how much of resource wealth to consume now versus how much to save for future generations. Many resource-rich countries accumulate financial assets to offset the depletion of nonrenewable natural resources (Figure 3, Panel B). But these intertemporal decisions are very complicated to implement, because they require estimating future resource revenues—an exercise marked by significant uncertainty about the underlying assumptions, including future resource prices and

production costs, the size of resource reserves in the ground, the fiscal regime applied to the resource sector, and future interest rates. In addition, in the case of fuel fossils, the extraction of these resources are impacted by the domestic and international strategies regarding climate change.

Figure: 3. Resource Reserves and Growth Performance in Resource-Rich Countries

A-Reserves Horizon in Selected Countries (Years)[1]

B- Accumulated Assets in Selected Countries[2]

C-Growth Rate, 1970 - 2021 (Real GDP per capita, 1970 = 100)

Sources: Fiscal Monitor 2015, IMF staff estimates and market projections, IMF Primary Commodity Price System, BP Statistical Review of World Energy 2021, Sovereign Wealth Fund Institute, and Thomson Reuters DataStream.
Note: 1/Reserves over Annual Production of Natural Resources in Years, 2021
2/Sovereign Wealth Fund Asset (USD billion), 2021

Third, nonrenewable resource revenues can be **detrimental to growth**. For example, after the boom-bust of the late 1970s, many resource-rich countries endured a long period of low or negative growth, and in some cases, per capita GDP in the late 1990s was at or below 1970 levels (Figure 3, Panel C), though some countries (including Botswana, Chile, and Norway) have been able to navigate successfully through commodity price cycles and achieve sustainable growth. The negative impact of commodities on growth is explained by at least two factors. The first one is the "Dutch disease." Higher resource prices generate higher wages and profits in the resource sector, raising aggregate demand including in the domestic non-tradable sectors. This raises production costs, appreciates the real exchange rate, and impact negatively exports competitiveness

(Corden and Neary 1984).[3] Second, the exploitation of nonrenewable resources also generates sizeable rents, which in turn, can exacerbate political economy and governance problems, particularly in terms of rent-seeking behavior, "voracity", corruption, or even civil conflict, thus undermining entrepreneurial activity and other pro-growth activities (Alesina and others 2008, April 2019 Fiscal Monitor).[4]

B.   Main Objectives

Fiscal policy, including through fiscal rules, can be used to address the challenges discussed in the previous section. Therefore, rules have, in general, four main objectives in resource-rich countries:

- **Economic stabilization.** One of the functions of rules is to mitigate or avoid a procyclical fiscal stance by delinking yearly government expenditure from volatile resource revenues. When commodity prices are temporarily high, "stabilization" requires that the government does not spend all resource revenues and uses the windfalls either to repay past debt or accumulate financial assets. When commodity prices are temporarily low, stabilization is achieved by tapping the funds accumulated in good times or by borrowing. Thus, fiscal rules with good stabilization properties should (1) incentivize countries to save a share of resource revenues when commodity prices are high, and (2) not prevent them from either borrowing or tapping into accumulated financial assets when prices are low.

- **Insurance against large and persistent shocks.** Beyond short-term volatility, commodity prices may also be subject to less frequent but larger shocks, with valuations shifting abruptly between high and low-level regimes for prolonged periods of time. In this context, fiscal rules can have an "insurance function" by making sure that governments accumulate enough precautionary savings when prices are at high levels. This insurance function is particularly relevant for resource-rich countries, which need larger buffers than other countries given the size and duration of the commodity shocks and their potentially big effects on the economy.

- **Fiscal sustainability and Intergenerational equity.** While all countries need to have financially sound fiscal frameworks, the issue of sustainability is particularly important in countries with exhaustible natural resources where resource revenues tend to decline over time, putting future generations at a disadvantage. Fiscal rules can be used to promote intergenerational equity and sustainability by ensuring that (1) spending is affordable for the government, (2) the rule dictates a split between consumption and saving that allows sufficient accumulation of financial assets, ensuring that some wealth is transferred to future generations, and (3) the profile of spending is relatively smooth over time, which means that future governments will not be forced to cut spending drastically when resources are eventually exhausted.

- **Mitigation of Dutch disease effects.** The Dutch disease is primarily caused by revenue windfalls in the commodity sector associated with external shocks. Fiscal rules can help mitigate adverse effects by managing the use of the windfalls as part of the government's budget. However, the role of fiscal

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[3] This assumes that the country is small and does not influence the prices of tradable goods, which are determined by world supply and demand. Under a fixed nominal exchange rate system, the real appreciation will materialize in the form of higher inflation.

[4] The voracity effect, coined by Lane and Tornell (1996) and Tornell and Lane (1999), refers to a more-than-proportionate increase in fiscal redistribution following a terms-of-trade windfall. On corruption, see Mauro (1995) and Leite and Weidmann (1999). Gylfason (2004) shows empirically that natural resource dependence is positively related with corruption. Collier and Hoeffler (2004) find a strong and nonlinear effect of the share of natural resources in GDP on the probability of civil conflict.

rules in addressing Dutch disease risks in a lasting manner should not be overstated. A full policy response requires broader structural efforts to diversify the economy and mitigate the loss of competitiveness in the non-commodity economy, for instance by boosting productivity in the nontraded goods sector and diversifying exports (Ebrahimzadeh 2003).

No fiscal rule can achieve all four objectives simultaneously. Depending on country circumstances, the type of commodity, and national preferences, some objective(s) are likely to dominate. For instance, using fiscal rules for stabilization purposes is more warranted for countries with long reserve horizons where exhaustibility is not a primary concern. By contrast, sustainability and intergenerational equity are more important in countries with a relatively short reserve horizon, where issues of resource exhaustibility feature more prominently (IMF 2012a).

III.   Lessons From Resource-Rich Countries' Experiences with Fiscal Rules

The experience of fiscal rules has varied greatly across resource-rich countries. Beyond the challenges posed by the volatility and uncertainty characterizing resource revenue, other factors such as revenue sharing in federal states (e.g., Nigeria, Peru) or resource revenue earmarking (e.g., Chad, Venezuela) further complicate fiscal management. Resource-rich countries have then tried different approaches to manage their revenue. This section is divided into three parts. It starts by briefly presenting some stylized facts on the types of rules adopted by resource-rich countries. Then, it assesses the performance of fiscal rules against their intended objectives, and finally concludes with a short review of country experiences with resource funds.

A.   Overview of Fiscal Rules in Resource-Rich Countries[5]

In resource-rich countries, the adoption of fiscal rules has been motivated by various reasons, including reducing the procyclicality of fiscal policy (e.g. Russia, Chile), limiting the risks of Dutch disease (e.g., Norway), achieving some intergenerational equity (e.g. Norway, Timor-Leste), and reducing debt (e.g., Chile and Peru).

A growing number of resource-rich countries have used numerical rules to guide their fiscal policy over the past two decades. In 2000, Canada, Colombia, Indonesia, Niger, and Peru were the only resource-rich countries that had rule-based fiscal frameworks. The number of resource-rich countries with at least one numerical fiscal rule grew thereafter to 23 in 2019 before declining to 17 in 2021, reflecting the suspension of fiscal rules by several countries at the onset of the COVID-19 pandemic to deploy emergency fiscal measures (including Azerbaijan, Colombia, Indonesia, Niger, Peru, and Russia).[6] The growth in the number of rule adopters was particularly strong during the first half of the 2000s, tripling from 5 in 2000 to 15 in 2004.

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[5] This section builds on the 2022 update of the IMF Fiscal Rules Dataset. More information on the dataset can be found here.

[6] Please refer to Davoodi and others (2022) for further discussion about the developments on fiscal rules during 2020-21.

Figure 4. Number of Fiscal Rules in Resource-Rich Countries[1]

Sources: IMF Fiscal Rules Database (2022) and Staff Calculation.

Note. 1/ The number indicates the number of countries with each type of fiscal rules in 2019.
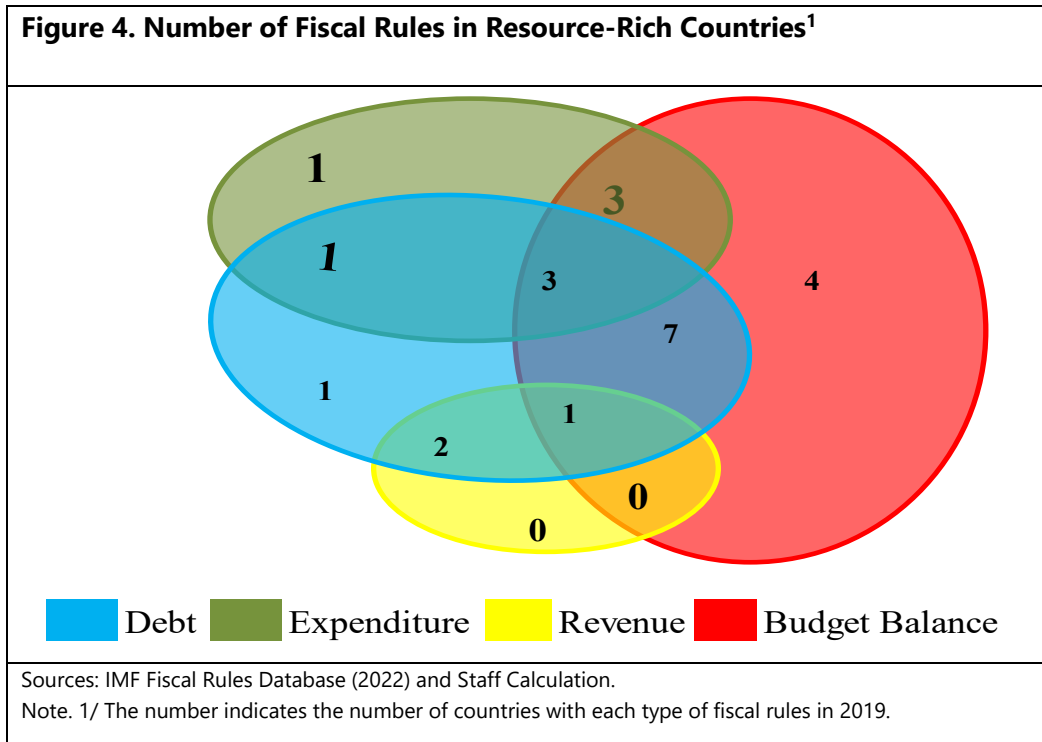
The Ven diagram of Figure 4 depicts the use of rules across resource-rich countries in 2019, the latest year before the disruptions in 2020-21.[7] Fiscal rules adopted by resource-rich countries can be categorized into four broad categories: debt, budget balance, expenditure, and revenue rules. Resource-rich countries have often adopted a combination of rules with the most common combination being a blend of a debt rule together with operational limits on expenditures and/or budget balance, while fewer countries have targeted a single fiscal indicator. The most widely adopted rules are the balance budget rule implemented by more than three fourths of resource-rich countries, followed by the debt rule and expenditure rule. Revenue rules are less frequent, partly reflecting the fact that governments have less control over yearly revenues. Countries that have adopted revenue rules include Iran and Timor-Leste, while Niger is also subject to the WAEMU-wide second-tier floor on tax revenue. Liberia has only a debt rule while Chile, Nigeria, and Norway have adopted only a budget balance rule. Peru's system of fiscal rules combines a budget balance rule and a debt rule. Mongolia combines all four types of fiscal rules. A number of countries have implemented fiscal rules in conjunction with resource funds (e.g., Azerbaijan, Norway, Russia, and Saudi Arabia). Other did not adopt any fiscal rule but used alternative frameworks (such as medium-term fiscal or expenditure frameworks[8]) or resource funds to guide the budgetary use of resource revenues. One example is Kuwait, which does not have a fiscal rule but has one of the largest sovereign wealth funds in the world, representing more than five times its annual GDP in 2021.

The specific design of fiscal rules in resource-rich countries varies greatly, reflecting country-specific needs and challenges. Debt rules are usually set as ceilings on government gross debt in percent of GDP. Kazakhstan

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[7] Data are available up to 2021. The year 2019 is selected for the analysis to provide a more relevant benchmark given the large number of countries that suspended or modified their rules in 2020-21 to mitigate the effects of the COVID-19 pandemic.

[8] For example, the Federal Spending Control Act limited all program spending except self-financing program in Canada during 1991-96.

introduced a debt rule in 2016 that requires the amount of government debt and external debt of the quasi-sovereign entities to be maintained below the foreign exchange assets of the oil fund—akin to a "net debt" rule. Some countries set caps on debt service (Timor-Leste, Namibia). The exact definition of budget balance rules varies also across countries, ranging from an overall balance in Indonesia to more complicated definitions. Several non-renewable resource-rich countries have designed their budget balance rules to reflect the specificities of a resource-based economy. This includes fiscal rules that target the non-resource balance (like in Azerbaijan before 2019, or Timor-Leste); non-resource current balance (Ecuador, Equatorial Guinea); non-resource balance to be achieved on average over the cycle as in Norway; structural balance adjusted for nonrenewable resource prices (Chile, Colombia, Mongolia); and the reference balance rule in the Republic of Congo since 2017.[9] Non-resource balance rules are defined either in percent of total GDP (Papua New Guinea) or as a percent of non-resource GDP (Azerbaijan). Expenditure rules are often set as a ceiling on annual nominal growth of total (Mongolia), primary (Mexico), or current expenditure (Colombia until the rule's suspension in 2020). Some countries also set caps on real expenditure growth (Peru) or on the expenditure-to-GDP ratio (Namibia).

B.   Performance of Fiscal Rules in Resource-Rich Countries

This section draws lessons from the experience of countries with fiscal rules. Overall, the empirical evidence suggests that, while rules can be helpful, they have had limited success in insulating fiscal policy from resource revenue fluctuations and ensuring sustainability. To some extent, this is explained by the difficulty in designing rules that can withstand the fundamental uncertainty and volatility of resource revenues as well as rapid changes in the economic environment. The lack of success may also reflect weak compliance, arising from the political economy of spending resource rents. Finally, successful rules also require solid institutional arrangements for monitoring and implementation (such as adequate public financial management systems and transparency frameworks), which are absent in many countries.

Procyclicality

The literature on the performance of fiscal rules in preventing fiscal procyclicality yields mixed results. Cespedes and Velasco (2014) assess the behavior of fiscal variables across the commodity cycle in a sample of 32 highly commodity dependent economies over the period 1900-2019. They identify two boom episodes: one in the 1970s and early 1980s and the second immediately prior to 2008 and find that countries that implemented fiscal rules displayed a larger shift towards fiscal counter-cyclicality between the two episodes. Pieschacon (2012) also provide evidence that fiscal rules reduce fiscal procyclicality using a counterfactual analysis for Mexico and Norway over 1986-2006. But other empirical studies have found that fiscal rules had only limited impact in holding back expenditure growth during oil boom years—for instance, Ossowski and others (2008), Villafuerte and Lopez-Murphy (2010), and Arezki and Ismail (2013). In the same vein, IMF (2015) suggests that the presence of fiscal rules has not reduced procyclicality in a statistically significant way (Figure 5). In a sample of 48 non-renewable commodity exporters over the period 1970-2014, Bova and others (2016) conclude also that the adoption of fiscal rules does not seem to reduce the procyclicality of fiscal policy although the quality of fiscal institutions matters for stabilization. More recently, Coutinho and others (2022) find

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[9] See Ossowski (2013), Mihalyi and Fernandez (2018), or Davoodi and others (2022) for the list of countries that have adopted fiscal rules in the past.

that fiscal rules have not been effective in stabilizing the economy in a sample of 84 resource dependent countries over the period 1960-2011.

Figure: 5. Procyclicality of Fiscal Policy in Resource-Rich Countries

Funds/Rules and Procyclicality[1]

Institutions and Procyclicality[2]

Source: IMF Fiscal Monitor October 2015.

Note: Note: Sample period is 1972–2014. Procyclicality is measured by estimating the elasticity of changes in real expenditure to changes in real commodity price index. *, **, *** indicate statistical significance at 90%, 95%, and 99%. The absence of *indicates a coefficient that is not statistically significant.

1 Reported numbers show the impact of a change in procyclicality coefficient following the introduction of a fiscal rule, saving fund, or stabilization fund. SFI = Special fiscal institutions (includes both fiscal rules and resource funds).

2 Reported numbers show the impact of a 1 standard deviation increase in institutional quality index on procyclicality.

Case-studies suggest that, in some cases, resource-specific rules have displayed some success to mitigate fiscal procyclicality, but this effectiveness has not proven universal, perhaps due to differences in rule design. Norway's framework, which has capped the central government's non-oil deficit to the expected long-run real rate of return—currently 3 percent of the assets held by the Government Pension Fund-Global, has been successful in protecting the government budget from the volatility of oil revenue. In Chile, the structural balance rule adjusted for copper prices has also been the cornerstone of prudent fiscal policy and contributed to delinking expenditure growth from revenue volatility (Fuentes and others 2021). However, Timor-Leste's framework has been challenged in the context of a substantial scaling-up of public investment, which pushed total spending far above the level of the estimated sustainable income consistent with the fiscal guideline during the 2003-08 boom. In Ecuador, fiscal rules were repeatedly changed, and fiscal policy became more procyclical mostly driven by capital spending which more than doubled during 2003-14 (see Villafuerte and others (2010), Baunsgaard and others (2012), Lledo and others (2019)). Similarly, the non-oil balance guideline applied in Azerbaijan did not prevent procyclical fiscal policy, leading to rising government expenditures during oil booms in the early 2010s. In Equatorial Guinea, the use of a non-resource current balance rule was also associated with procyclical fiscal policy during the 2003-08 boom, with capital spending growing substantially and dwarfing current spending levels (Baunsgaard and others (2012), Ossowski (2013)).

Expenditure rules seem to have been helpful in containing spending pressures during booms and providing room for discretionary spending during downturns. Experience suggests that this type of rule can be particularly effective when combined with an overall balance rule (like in Peru, Mexico, or Colombia). In Peru, the expenditure rule has helped mitigate fiscal policy procyclicality and contributed to maintaining fiscal prudence (Ossowski (2013), Baunsgaard and others (2012)). In addition, expenditure rules can accommodate revenue shortfalls which do not have to be compensated, thereby providing some stabilization effects in downturns—as illustrated by the policy conducted in Colombia when commodity prices collapsed in 2015-16.

Compliance and resilience to shocks

Traditional nominal budget balance rules tend to be easy to comply with in good times, but they rarely withstand negative shocks. The experience during the 2003-08 oil price outturn suggests that fiscal rules targeting the overall balance have achieved a greater degree of compliance when resource prices surged as higher resource revenue allowed to reduce or maintain low deficit. But improved overall balances during booms often masked fiscal expansions through unsustainable increases in spending. When nonrenewable resource prices fell, balance rules came under pressure and several of these rules were modified or suspended. For example, Nigeria comfortably achieved its 3 percent nominal deficit ceiling in the oil boom years before the 2015 price collapse, while allowing increases in spending, and without accumulating significant savings. As a result, the government missed its deficit ceiling when prices plummeted in 2015-16 (Villafuerte and others (2010), Mihalyi and others (2018)). Peru's deficit rule, established in 2000 when natural resource represented less than 2.5 percent of government revenue, failed to adapt to the structural changes of the economy as the country became more dependent on resource revenue, leading to continuous amendments of the rule (Santos and Werner 2015).[10] Mexico invoked the escape clauses over several consecutive years to accommodate higher deficits under its 2006 Fiscal Responsibility Law that imposed a zero balance on federal budget providing an illustration of how the use of escape clauses and transitory provisions may become the norm rather than the exception (Mihalyi and Fernandez 2018).[11] No CEMAC resource-rich countries observed the regional zero-domestic balance floor rule after the commodity price crash of 2014, leading to a revision of the rules in 2017.[12]

Non-resource balance rules and structural balance rules correcting for the commodity cycle provide more flexibility to respond to shocks, and hence have recorded relatively better compliance during commodity price busts. For example, Mihalyi and Fernandez (2018) conclude that most of the resource-rich countries that complied with their fiscal rules in 2015-16 used a structural or a non-resource balance rule. It is indeed easier for countries to meet non-resource (or structural) balance rules adjusted for resource prices during bad times, likely because they require much less adjustment than in the case of overall nominal balance rules, as the correction for resource price (or economic cycle) provides additional fiscal room. For instance, Colombia complied with its 2011 structural balance rule during the oil price crash of 2015-16 (although financial conditions at the time prevented also a looser fiscal stance). On the other hand, Mongolia provides an example of persistent non-compliance with a resource-specific rule. Exuberance around mining prospects led to a public

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[10] The Law on Fiscal Prudence and Transparency, enacted in December 1999, has set a limit of 1 percent deficit on the nominal consolidated public sector deficit. The nominal budget balance rule was replaced by a structural balance rule in 2013.

[11] IMF (2019) provides further discussion on the evolution of the fiscal framework in Mexico.

[12] The convergence criteria adopted by CEMAC member countries in 1999 established a floor of zero on the domestic balance-to-GDP ratio, where the domestic balance (referred to as "solde budgétaire de base") is defined as the difference between total revenue (excluding grants) and domestic expenditure (total expenditure minus externally financed capital spending).

spending boom over 2006-2012, despite the 2006 Fiscal Stability Law (FSL) which had set a target on budget balance adjusted for mineral prices. In the 2013 FSL, the country set ceilings of 2 percent of GDP for the budget deficit and 40 percent of GDP for debt. After repeated breaches of these targets following the crash of mineral prices, the government amended them several times, setting higher debt limits, as government debt rose to about 90 percent of GDP (Bauer and Mihalyi (2015); Mihalyi and Fernandez (2018)).[13]
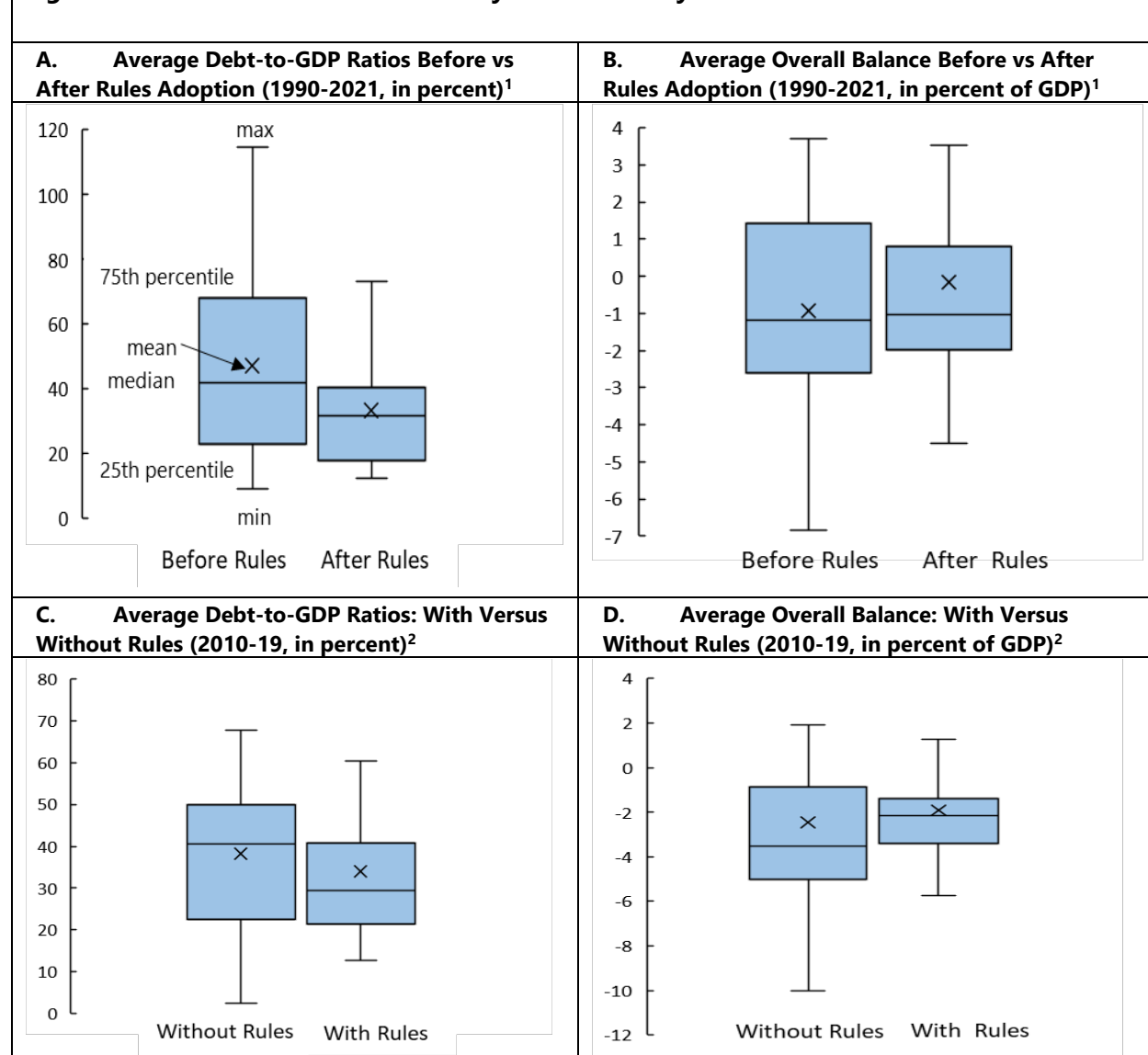
Sustainability

At first glance, the implementation of fiscal rules seems to be associated with stronger fiscal positions. Resource-rich countries tend to improve their overall balance (reduce their deficit) and lower debt after the adoption of fiscal rules (Figure 6). On average, debt-to-GDP ratios stood at 47 percent of GDP before the adoption of fiscal rules against 33 percent thereafter over the past two decades (Figure 6, Panel A). Likewise, overall deficit has declined from an average deficit of around 0.9 percent of GDP to 0.2 percent of GDP after the implementation of fiscal rules (Figure 6, Panel B). The adoption of fiscal rules is also associated with a narrowing of the distribution of fiscal deficits and debts towards lower deficit and debt levels, suggesting that the average improvement in fiscal outcomes is not driven by a few best performers. Moreover, resource-rich countries that adopt fiscal rules record higher fiscal balance and maintain lower levels of debt-to-GDP ratios compared to those that have never implemented fiscal rules (Figure 6, Panels C and D). In fact, overall deficit (debt)-to-GDP ratios averaged around 2.5 percent (34 percent) of GDP for countries that never implemented fiscal rules against 1.9 percent (38 percent) of GDP for those that did over the period 2010-19.

But these correlations are not sufficient to conclude that the implementation of fiscal rules is the cause of better fiscal outcomes, as both the adoption of rules and the improved fiscal outcomes could be driven by other factors like societal preference for fiscal prudence. To our knowledge, there is no paper that systematically assesses the casual link between fiscal rules and fiscal discipline (sustainability) focusing specifically on resource-rich countries. The existing empirical literature, combining both resource-rich and non-resource rich countries, suggests that the positive correlation between the adoption of fiscal rules and fiscal balances is likely biased due to endogeneity (Caselli and Reynaud, 2020, Heinemann and others, 2018). These studies rather conclude that the rules' stringency (that is, how binding its design features are) and the supportive arrangements, like independent monitoring or good public financial management systems, enhance the impact of fiscal rules on fiscal outcomes. Stringent and well-designed rules are found to have a positive and statistically significant impact on fiscal balances (Badinger and Reuter (2017), Schmidt-Hebbel and Soto (2018), Caselli and Reynaud (2020)). Asatryan and others (2018) show, for instance, that the introduction of constitutional budget balance rules is associated with a substantial reduction in debt, while there is no such effectiveness with non-constitutional ones.

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[13] The Fiscal Stability Law of 2013 sets a threshold budget deficit of 2 percent of GDP and 40 percent of GDP for debt ceiling.

Figure: 6. Fiscal Rules and Sustainability of Fiscal Policy in Resource-Rich Countries

A. Average Debt-to-GDP Ratios Before vs After Rules Adoption (1990-2021, in percent)[1]	B. Average Overall Balance Before vs After Rules Adoption (1990-2021, in percent of GDP)[1]

C. Average Debt-to-GDP Ratios: With Versus Without Rules (2010-19, in percent)[2]	D. Average Overall Balance: With Versus Without Rules (2010-19, in percent of GDP)[2]

Source: WEO, IMF Fiscal Rules Database, Staff Calculation.

Note: 1/ The sample covers countries that have adopted a fiscal rule at any time over the period: Azerbaijan, Botswana, Cameroon, Canada, Chad, Chile, Colombia, Ecuador, Equatorial Guinea, Gabon, Indonesia, Iran, Kazakhstan, Mexico, Mongolia, Namibia, Niger, Nigeria, Norway, Russia, Turkmenistan. 2/ The sample of rule adopters include Botswana, Cameroon, Canada, Chad, Chile, Colombia, Congo, Ecuador, Equatorial Guinea, Gabon, Indonesia, Iran, Liberia, Mexico, Mongolia, Namibia, Niger, Nigeria, Norway, Peru, Russia. The group of non-rule adopters include Algeria, Angola, Australia, Bahrain, Bolivia, Brunei Darussalam, Democratic Republic of Congo, Ghana, Guinea, Guyana, Iraq, Kuwait, Mauritania, Mozambique, Oman, Papua New Guinea, Qatar, Saudi Arabia, South Africa, Sudan, Suriname, Trinidad and Tobago, United Arab Emirates, Yemen, Zambia.

Simplicity

When it comes to simplicity—one of the criteria used to assess the effectiveness of rules (including to facilitate communication)—resource-specific rules are generally more complicated to compute and monitor than traditional expenditure or budget balance rules.

One fundamental problem is that some rules for commodity producers rely on longer-term, structural, or projected commodity prices, which are very difficult to estimate, limiting the capacity of these rules to ensure economic stabilization, and, most importantly, withstand large shocks. For example, the revenue forecasts, based on the long-term price of copper in Chile, have systematically been above actual revenues (Larrain and others 2019). More generally, commodity price projections tend to depend heavily on the prices prevailing when the projections are made (Dudine and others 2019). Therefore, commodity price-based fiscal rules relying on these projections may not be resilient to regime shifts.

Another related difficulty is that the budget and the non-oil economy of resource-rich countries are impacted by commodity price cycles (displaying persistent large fluctuations), not just standard business cycles. The volatility of resource revenue exacerbates the complications inherent to the estimation of potential output and, hence, the computation of the structural balance correcting for both types of cycles.[14] Chile's experience shows that, despite its strong institutional framework, the cyclical adjustment to the business cycle has mostly been asymmetric due to a persistent overestimation of potential output, which in turns implies an overestimation of structural revenues, and—for a given structural balance target—higher expenditure (Larrain and others 2019).[15] Copper price projections made by the technical committee have also underestimated future prices during unanticipated price booms and over-estimated prices during bursts, leading to larger deficits when prices collapsed (Fuentes and others 2021). Ex-post data on the output gap in Colombia also provides evidence that ex ante estimates by the Consultative Committee on the Fiscal Rule have overstated the size of negative output gaps when oil prices collapsed (hence, overstating the cyclical part of the revenue shortfalls) and underestimated the size of positive gaps during oil price booms (treating revenue windfalls as structural while they were partly cyclical). As a result, spending has systematically been above structural revenue, and the underlying structural deficits have always been above the limit (Dudine and others 2019).

Competitiveness

Empirical assessments of the importance of fiscal rules in reducing Dutch disease or supporting competitiveness are limited. Caputo and Valdes (2016)—one of the few papers on the topic—find that the correlation between the real exchange rate and the terms of trade has been negative and statistically significant in Chile and Norway until the late 1990s. But this correlation has declined significantly after the introduction of the fiscal rule in these two countries. They also show that the real exchange rate has remained stable despite the large and unprecedented positive terms of trade shocks both in Chile (2009-10) and in Norway (2003-2010), suggesting that the rule-based framework has helped contain Dutch disease effects in these countries.

C. Resource Funds

Many resource-rich countries establish resource funds in an attempt to shield their budget from the volatility of resource revenue or save for future generations.[16] Many of these funds accumulate assets in foreign currencies

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[14] It is not even clear whether commodity prices follow well-behaved cycles or not.

[15] Trend output and the long-term price of copper are estimated by technical committees, independently of the fiscal authority.

[16] In this section, resource funds refer to funds linked to fiscal resource revenues. In practice, they have many names depending on their specific objective: stabilization funds, liquidity funds, savings funds, funds for future generations, or even sovereign wealth funds.

(some are sovereign funds with large foreign assets) to provide a fiscal buffer and protect from the volatility of commodity exports.

Figure 7 portrays the size of funds across countries. Resource funds cover a wide range of models depending on their specific objectives: stabilization funds (to smooth and reduce the uncertainty of resource revenues flowing into the budget, like the Chile's copper stabilization fund until 2006), saving funds (to create a store of wealth for future generations like the Azerbaijan's State Oil Fund), and financing funds (combining both stabilization and saving objectives) that receive all resource revenues and finance the non-resource deficit through transfers to the budget (e.g., the Norway's Government Pension Fund Global or the Petroleum Fund of Timor-Leste).

Figure 7. Sovereign Wealth Funds (2021, percent of GDP)

Sources: Sources: Global SWF 2022 Annual Report; IMF World Economic Outlook; staff calculations.
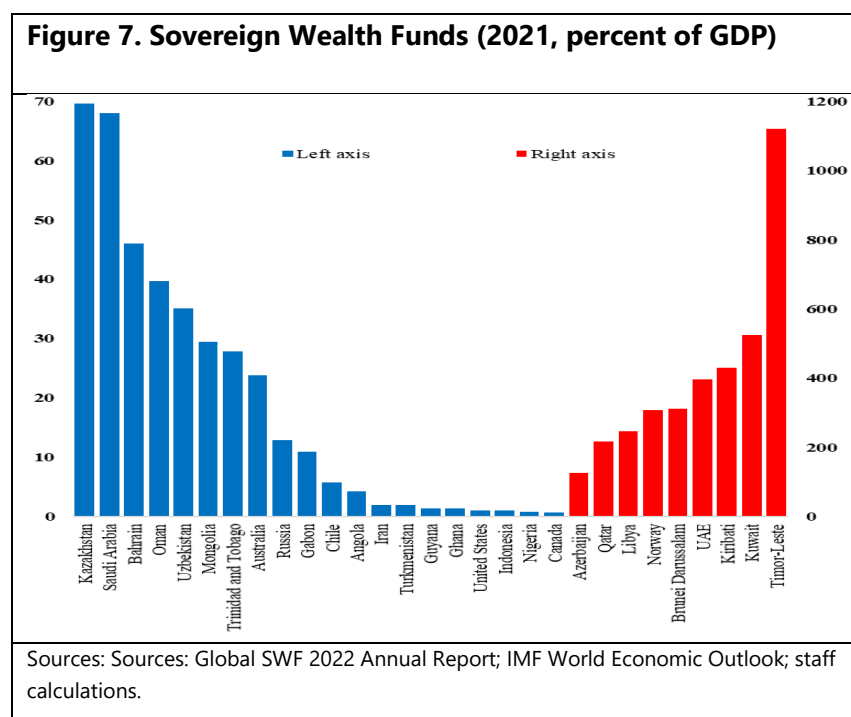
The empirical literature is not conclusive regarding the effectiveness of resource funds on the management of fiscal policy (Carpantier and Vermeulen 2021). On the one hand, Davis and others (2001) find that resource funds do not have a significant impact on the cyclicality of government spending in selected countries (11 oil exporters and Chile) from 1965 to 1999. Ossowski and others (2018) argue also that oil funds do not seem to have a meaningful impact, and, in some cases, can complicate fiscal management, although this depends on the institutional setup. Crain and Devlin (2003) suggest that resource funds can increase fiscal spending volatility, particularly in oil-exporting countries. On the other hand, both Sugawara (2014) and Koh (2017), which base their analysis on a different sample of resource-rich countries, find that the volatility of public spending is smaller in countries that have established a sovereign wealth fund (SWF), particularly in countries with high institutional quality. El Badawi and others (2018) also conclude that SWFs have a robust stabilizing role against fiscal procyclicality and have also been a strong contributor to the sustainability of fiscal positions in a large sample of countries covering both resource-rich and non-resource-rich countries over 1985-2015.

Individual country experiences highlight that a synergy between the management of resource funds and the broad fiscal rule and policy framework is key for success. For instance, Botswana, Chile, and Norway are notable successes where the resource funds are well integrated into the overall fiscal framework, and the rules governing their operations are consistent with the fiscal rules. However, some countries have suspended or abolished their funds due to inconsistencies between the funds' rules and other policy objectives (e.g., Ecuador, Venezuela, Chad). In some countries, the funds have their own operational rules to set deposits and withdrawals that are not necessarily fully consistent with broader fiscal goals (e.g., Ghana, Trinidad and Tobago[17]). For example, Gabon has made deposits into its savings fund with low returns while paying higher interest rates on its public external debt. Ecuador has, in the past, complied with its deposit rules while accumulating payment arrears due to extensive revenue earmarking and fragmentation of cashflow management (Ossowski 2013). In Ghana, the government saved about $500 million in oil revenues in two sovereign wealth funds from 2012 to 2014, but borrowed, at the same time, approximately $7 billion on international financial markets, at interest rates approximately 5 percent higher than the rate of return on SWF assets (Bauer and Mihalyi 2015).

IV.   Using A Fiscal Sustainability Anchor: An Appealing but Difficult-To-Implement Approach

A.   Rationale and Main Aspects of the Fiscal Sustainability Framework

A widely discussed fiscal framework for resource-rich countries is an extension of the standard fiscal sustainability framework that incorporates more explicitly commodity revenues and the prospect of resource depletion (Baunsgaard and others 2012; IMF 2021). This builds on an extensive literature applying the Permanent Income Hypothesis (PIH) model to oil countries (with a seminal paper by Engel and Valdes, 2000). The PIH model is based on a theoretical model that stabilizes consumption out of resource wealth. The main policy implications of the PIH and the sustainability framework are identical; therefore, we do not make a difference between these two approaches in the rest of the paper, which focuses primarily on the fiscal sustainability approach.

In the fiscal sustainability framework (referred to as FSF, for simplicity, in the rest of the paper), the fiscal anchor is the government's "net wealth" variable, defined as net financial assets (financial assets minus debt) plus resource wealth under the ground, measured as the discounted sum of future resource revenues. The operational rule is the non-resource primary balance (NRPB), usually expressed as a share of non-resource GDP. The analytics are presented in Appendix 1.

The FSF calculates a NRPB target that, if maintained in the years ahead, would stabilize net wealth at its current level. Depending on the model formulation, the NRPB target can be computed with a view to maintaining net wealth constant either (1) in real terms, (2) as share of non-resource GDP, or (3) in real per capital terms.

[17]See Ossowski and others (2008), Sugawara (2014), as well as Boval and others (2016) for a review.

The choice between these alternative formulations reflects various appreciations about the notion of intergenerational equity. For instance, if population grows less quickly than real non-resource GDP, keeping net wealth constant as share of non-resource GDP would, in general, imply a tighter nominal NRPB (hence, a lower spending ratio) compared to stabilizing net wealth in real per capita terms. This means that future generations would be better off if the policy objective is to keep net wealth stable as a share of non-resource GDP.

The central result of the FSF is that preserving wealth at its current value requires that the government consumes each year the sum of (1) the return on financial wealth already accumulated, (2) the implicit return on the net present value of future resource revenues, and (3) non-resource revenues. This general principle should be adapted to the model's specific formulation. For instance, in the model expressed in ratio of non-resource GDP, the government's current expenditure ratio will be equal to the growth-adjusted real return on the net wealth ratio plus the non-resource revenue ratio (see detailed computations in Appendix 1).

One of the advantages of this approach is that it derives targets for the non-resource fiscal balance. Targeting the non-resource balance is appealing for resource-rich countries since this indicator can be treated as broadly constant under unchanged policy. This is not the case of the primary balance or the overall balance, which are expected to deteriorate in the long term, even under unchanged policy, because of the structural decline in resource revenues. Targeting a fixed overall (or primary) balance could be problematic for resource-rich countries, since they would have to resort to increasingly larger spending cuts to offset the revenue shortfalls associated with the depletion of resource reserves.[18]

Although the model focuses primarily on sustainability/intergenerational equity objectives, it can be adapted to achieve economic stabilization as well. To this end, a correction could be applied to the rule. Instead of comparing the NRPB to the rule's numerical target, a "cyclically-adjusted" NRPB would be used. This "cyclically-adjusted" NRPB is based on the exact same formula, except that nominal revenues are replaced with structural revenues, which are corrected for the non-resource economic cycle.

For instance, to stabilize wealth as a share of non-resource GDP and mitigate procyclicality due to the business cycle, a country could follow the cyclically-adjusted rule:

$$(Nonresource\ cyclically\ adjusted\ primary\ balance/nonresource\ potential\ GDP)_{t+i}$$
$$= (r - g).(net\ wealth\ ratio)_{t-1}$$

where the non-resource cyclically-adjusted primary balance is based on structural non-resource revenues $R^s = R.(\frac{Y^*}{Y})^\propto$, with R referring to nominal revenues, $(\frac{Y^*}{Y})$ being the non-resource output gap and $\propto$ being the elasticity of revenues with respect to this gap.

B. Operational Challenges

The FSF described in the previous section is analytically sound and intellectually appealing, but presents a number of practical and conceptual limitations, which undermine greatly its usability.[19] These limitations

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[18] In general, resource revenues follow an inverted U curve throughout the duration of their exploitation.

[19] See further discussion in IMF (2012).

become particularly apparent when countries use the FSF to guide annual fiscal policy, which is not truly its purpose.

First, the FSF framework is difficult to calibrate. While financial wealth is directly observable, the evaluation of underground resource wealth depends on estimates of long-term commodity prices, which are hard to predict and are often based on current prices (and thus, very volatile). This problem is compounded by the fact that there is a nonlinear relationship between resource wealth and prices. Proven reserves may not be commercially viable when prices fall below certain levels. Therefore, the estimated value of resource wealth can change abruptly over time when expected prices are revised.

Second, although the main benefit of the FSF framework is to calibrate a stable path for spending, it may, in practice, lead to sizeable revisions of the expenditure plans in case of large and unexpected shocks to commodity prices. This is because price forecasts over the medium to long term horizon tend to be very dependent on current observed prices. When current prices change significantly, forecasters tend to revise their projections. This leads to re-estimations of resource wealth, which affect the corresponding non-resource primary balance target and the optimal level of spending.[20] Difficulties in separating temporary from permanent price shocks could result either in excessive volatility of spending (if all shocks are treated as permanent) or too little saving (if all negative shocks are treated as temporary).[21]

Third, although the FSF model is primarily concerned with achieving fiscal sustainability, it could paradoxically endorse unsustainable fiscal trajectories in case of significant price changes. Indeed, at the beginning of the extraction cycle, when resource wealth is initially elevated, compliance with the framework may allow very low net financial assets, which could even be negative and translate into high debt. But maintaining low net financial assets can be risky. If commodity prices collapse and resource wealth is revised down, a country may end up with high debt at a time when it is most vulnerable (and faces possibly difficulties in rolling over its debt). In other words, an initially optimistic estimate of resource wealth may give the false impression that the country can sustain a high level of spending today and in the future (initially financed through borrowing), based on expectations of future resource revenues that may not materialize.[22] Therefore, the framework could put debt on an unsustainable path when commodity price forecasts are subject to sharp and unexpected negative shocks.

For a similar reason, the saving rate of commodity revenues suggested by the FSF may be structurally too low in good times when resource wealth is estimated using currently elevated commodity prices. This created a particular challenge for low-income countries during the price collapse of 2014-15 when the expenditure envelope assessed to be sustainable based on the prices observed between the mid-2000s and mid-2010s proved to be too high ex post, requiring large and painful adjustments.

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[20] When resource wealth is revised down (as a result of a negative price shock assessed to be durable), net wealth is also revised down, and the non-resource primary balance necessary to stabilize net wealth has to increase. Thus, expenditure needs to be scaled down, that is savings should go up.

[21] In principle, only permanent price shocks should affect the estimate of resource wealth.

[22] Another key assumption in the model pertains to the rate of return on financial wealth. Governments invest a certain fraction of their commodity revenues in alternative forms of wealth (in this case, financial). These assets generate a rate of return from which the government can finance a primary deficit when reserves are depleted. Therefore, a critical assumption in the FSF is the rate of financial return. If is it overestimated, the spending envelope could be set at an unsustainable level.

Concerns about sustainability arise also from the very formulation of the NRPB rule, which excludes interest payments. Any rule based on the primary balance may put the fiscal position on a divergent path.[23] This is because, for net debt to stabilize, the primary balance needs to exactly compensate the automatic dynamics. If the primary balance is lower than its net debt-stabilizing level for just one period (e.g., due to a fiscal slippage), net debt will increase, the interest bill will become too high for the primary balance to offset it, then net debt increases even further, creating a self-reinforcing explosive loop. Conversely, if the primary balance is above its net debt-stabilizing level, net debt will keep declining towards an unbounded negative number. Therefore, for the NRPB rule to be implemented in a way that is consistent with the anchor, countries should comply with it exactly in every period (which is not realistic) or a correction mechanism should be added to the rule.[24]

Fourth, the FSF does not include physical assets in its definition of the government's "net wealth" and does not incorporate the feedback effect of public investment on growth. As such, it has been criticized for preventing countries from expanding their capital budgets in response to rising resource revenues, even when higher investment could boost potential growth and be consistent with long-term fiscal sustainability. This issue can be addressed by using alternative models—for example, the "modified PIH" that incorporate the possibility of scaling up investment in an initial period (and relaxing the non-resource primary deficit accordingly) before stabilizing it in the medium term (see IMF 2012b).

Fifth, a more fundamental question is whether preserving resource-generated wealth constant across generations is a realistic and reasonable policy goal. In most countries, the time preference is high and social preferences do not support the high levels of savings that are necessary to transfer wealth to future generations. This is particularly true in low-income countries facing pressing and immediate developing needs. Governments can hardly justify that they should save for the future and not build a school or expand the welfare system now. In fact, investing today in infrastructure, education and health will benefit future generations; thus, one may argue that it is fair for future generations to inherit less "net wealth" (as defined and measured by the FSF).

Another way of looking at this question is to note that, when the interest-growth differential is persistently negative, like it is in many developing countries, the FSF model (based on stabilizing wealth as a share of non-resource GDP) calls for NRPB *surpluses*, which can be seen as undesirably elevated. This is because the income generated from the stock of net wealth is insufficient to prevent net wealth from declining over time (in percent of non-resource GDP); therefore, additional income is required by running non-resource primary surpluses in order to maintain a constant level of net wealth.[25]

C.   Variants of the Fiscal Sustainability Approach

Alternative approaches, also based on the intertemporal budget constraint, are possible. For instance, non-constant but sustainable non-resource primary balance paths can be derived from the framework described in

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[23] This claim is only valid when the interest-growth differential is positive, which is a reasonable assumption in the longer term.

[24] For a review of fiscal rules correction mechanisms, see, for instance, EC (2012, 2017), Burret and Schnellenbach (2013), and Larch and others (2021).

[25] Most low-income countries have limited amounts of financial assets. Therefore, net financial wealth (financial assets minus debt) is typically negative. But total net wealth (comprising both resource and financial wealth) is generally positive, since the estimated stocks of resource wealth can easily exceed 100 percent of GDP and more than offset the negative net financial wealth. Thus, a negative interest-growth differential decreases total net wealth over time, all else equal.

Appendix 1. The computation of these paths is more demanding. And these mores sophisticated frameworks do not allow the calibration of "fixed" fiscal rules.[26] Their main purpose is rather to determine a path for public spending that is constantly changing during a transition period.

Approaches with scaling-up of investment

The "modified PIH" (MPIH) is designed to accommodate a temporary scaling-up of capital expenditure (IMF 2012a). This model considers a more front-loaded spending path financed by resource revenue that may be offset by lower spending (and higher NRPB relative to the standard PIH) in the future. In this framework, the expenditure path would no longer be smoothed, although fiscal policy would remain anchored within a sustainable framework.

In its simplest version, the MPIH model assumes that the scaling-up of investment does not impact growth.[27] In the absence of a fiscal multiplier effect, net wealth would initially decline (given that the stock of financial assets would not increase as fast as under the PIH, and therefore would not fully offset the decline in resource wealth over time). Then, to ensure fiscal sustainability, there would be a need for fiscal consolidation following the period of investment scaling-up: spending would have to be reduced to improve the NRPB up to the point where net wealth is stabilized at the lower level[28]—or even beyond this point if the government wishes to bring net wealth back to its initial level for equity reasons (IMF 2012b).

If higher investment translates into higher potential growth (through a fiscal multiplier effect) and, indirectly into higher non-resource revenues, future NRPBs will improve. In this case, to restore fiscal sustainability, it may not be necessary to consolidate as much on the spending side, because the improvement of the NRPB would come "automatically" from the revenue side. Relatedly, the "automatic" improvement in the NRPB would allow sustaining the (lower) level of net wealth.

The MPIH highlights an interesting trade-off between investing resource revenues in real assets (not recorded in net wealth as defined in the FSF) versus financial assets (recorded in net wealth). Although investment in real assets is likely to raise GDP growth and non-resource revenues with a positive indirect effect on financial asset accumulation in the long-term, the multiplier effect of higher real assets (and higher taxes) may not be sufficient to offset the forgone financial assets (and associated forgone financial returns) during the scaling-up period. As result, absent fiscal consolidation in the future, a scaling-up of investment would generally result in a higher stock of real assets but at the expense of a lower stock of net financial assets (and lower net wealth[29]) in the long term.

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[26] According to the IMF definition, fiscal rules are defined as fixed numerical limits (floors or ceilings) on fiscal variables set in legislation and binding for at least three years (Lledó and others 2017). A path for expenditure or fiscal balance that would change every year would not be considered a fiscal rule.

[27] Fiscal multipliers tend to be higher on public investment than other types of expenditure, but they remain relatively small in the case of developing countries (see, for instance, IMF 2017).

[28] A higher NRPB is necessary to stabilize a higher level of net debt (or, equivalently, a lower level of net wealth).

[29] Given that natural wealth is exhausted in the long term, net wealth W_t will eventually be equal to net financial wealth.

Approaches that do not stabilize wealth across generations

Another range of models departs from the assumption of wealth stabilization—by assuming that wealth will either decline or increase over time.

A first example involves limiting the horizon to a finite number of years (Baunsgaard and others, 2012). In this case, wealth is assumed to get depleted after a certain period rather than being maintained for future generations. Then, public expenditure will be more front-loaded. Adhering to this fiscal policy anchor will require a gradual fiscal adjustment at some point in the future to avoid an abrupt decline in the non-resource primary balance at the end of the resource extraction period.

In contrast, other frameworks foresee that net wealth would grow over time. This is the case of the "bird-in-hand" policy rule, in which only the interest income accruing from accumulated financial assets is spent. Specifically, this rule targets each year a non-resource primary deficit equal to the anticipated return on existing financial assets that year.[30] Under the rule, resource revenues are almost fully saved. By comparison, in the FSF, preservation of wealth requires that the government consumes each year the return on financial wealth already accumulated as well as the implicit return on the net present value of future resource revenues. Therefore, the bird-in-hand rule could be viewed as an extreme form of precautionary saving—equivalent to assuming that there is no future resource revenue. While this policy is fiscally sustainable, it may create social and political tensions because public spending would be very low, while resource revenues are accumulated during the period of exploitation. Also, there could be a high opportunity cost in terms of foregone social and infrastructure spending in the early years at the expense of future spending.

V.   A New Medium-Term Fiscal Framework for Resource-Rich Countries

The complex issues and trade-offs faced by resource-rich countries make it very difficult to design fiscal rules that can achieve all policy objectives and respond to very different shocks. An alternative to the FSF, proposed in this paper, is to enhance medium-term fiscal frameworks based on a mix of principles and rules centered around the concepts of fiscal buffer accumulation and insurance against shocks. We discuss below the key elements of such frameworks, before turning in the rest of the paper to a more in-depth discussion of fiscal anchors (section VI) and operational rules (section VII).

A.   Long-term Fiscal Analysis and Strategy

Before presenting possible *medium-term* frameworks, it is important to briefly mention a topic that will not be covered further in this paper: the need for *long-term* fiscal strategies in resource-rich countries, with such strategies having a time horizon of several decades (generally 10 to 30 years).

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[30] Like the FSF, this rule could be formulated in real terms, as share of non-resource GDP, or in real per capital terms. It could also be expressed in nominal terms. For instance, in the model in real terms, the NRPB in real terms would be equal to the real return on accumulated financial assets (IMF 2012).

Resource-rich countries face specific challenges of volatility and resource depletion that highlight the importance of assessing long-term macro-fiscal dynamics and formulating broad policy principles to guide the design of medium-term fiscal frameworks and annual budgets. Some elements of this long-term analysis include: (1) assessing the economic size of the natural resources and risks around their valuation;[31] and (2) assessing the effects of other longer-term trends that can have a significant fiscal impact, like demographics, technological changes, infrastructure needs, and climate change.

Based on this long-term analysis, countries can develop a broad strategy to manage non-renewable resource wealth and ensure consistency with other strategies that address climate change and other long-term factors. The considerations vary depending on whether the country is a producer of fossil fuels or metals: the strategy for oil and gas producers needs to incorporate the possible negative impact of the energy transition and climate change-mitigation reforms adopted globally in the industry, whereas some metal producers may benefit from the climate agenda and the stronger demand for specific metals necessary to green the economy. In any case, all countries should analyze the possible risks from climate shocks on their populations and contemplate national policy responses.

Some countries have already started developing this type of long-term fiscal analysis:

- In Norway, the government published in 2017 a report on the "Long-term Perspectives on the Norwegian Economy". This report analyzed the challenges faced by the economy and public finances over time, including spending pressures from aging and the expected gradual decline in returns from oil wealth over the next decades.

- In New Zealand, a legislation requires that the Treasury produces a Statement on the Long-term Fiscal Position, an Investment Statement, and a Wellbeing Report at least every four years to identify trends and risks to the assets, fiscal position, and the government's ability to provide services that support living standards. The legislation also requires that a Long-term Insights Briefing be published at least every three years on policy options to address long-term trends and risks. Recent reports have discussed long-term fiscal sustainability and risks, including the impacts of climate change and aging.

B. Medium-Term Fiscal Framework

In addition to (and consistent with) the long-term strategy, countries should also strengthen their ability to prepare and implement medium-term fiscal frameworks, which, in general, cover a time span of 3 to 5 years. These frameworks are used to set the multiyear projections of key fiscal aggregates (expenditures, revenues, and budget balances), provide a costing of new measures, and conduct risk assessments.[32] Relying too heavily on annual budgets could be particularly problematic for countries depending significantly on volatile resource revenues. A medium-term perspective linked to the long-term analysis allows for more stable and credible policies.

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[31] Although the shortcomings of the FSF limit its usefulness for designing specific fiscal rules and policies (no country uses a strict PIH model in practice), the FSF remains a useful benchmark to analyze long-run challenges.

[32] International experience shows that for to be most effective, such frameworks should include (1) fiscal plans that are feasible and stable, (2) flexibility in response to shocks, (3) transparent fiscal anchors, (4) risk-based rules that ensure a path to debt sustainability and buildup of fiscal buffers, and (5) checks and balances to promote accountability (Caselli and others, 2022).

The need to build precautionary buffers against shocks

This paper proposes that the fundamental principle underlying the medium-term fiscal framework of resource-rich countries should be to build fiscal buffers to respond to shocks, which is critical to promote economic stability and sustainable growth. This approach is not exclusive of other objectives and can still be useful if countries decide to save for other reasons than for insurance purposes (see Box 1).

A key concern for resource-rich countries is to protect their budget and economy from large and persistent shocks in commodity prices. Terms of trade shocks can result in large movements in the external position, create macroeconomic imbalances, and impact the domestic economy. Increases in commodity prices can also be disruptive if they fuel inflation and hurt the non-commodity economy, for instance through a real appreciation of the currency. Because governments receive a large share of economic rents in the form of tax and nontax revenues, changes in terms of trade can also have significant impacts on public finances. In many cases, the government budget is a key channel of transmission from commodity prices to the economy (since public spending has to adjust).

Governments have a key role in protecting the economy from this volatility. But, to achieve this insurance objective, fiscal rules must incentivize saving in boom periods and allow countries to use buffers during busts to protect spending plans. Because shocks can be large and persistent, the size of the precautionary buffers often needs to be larger than in non-resource rich economies.[33]

Accumulating buffers to insure against shocks is particularly important and relevant in economies that are highly dependent on commodities and with long reserve horizons. For instance, Saudi Arabia has oil reserves equivalent to more than 200 times its annual consumption. At such long-time horizon, countries are subject to long commodity price cycles and are very likely to experience periods of durably low prices. In contrast, for countries with more modest and short-lived reserves, the main priority is less to build up buffers against future shocks than to ensure that any increase in spending financed by resource revenues is sustainable once resource revenues disappear in the short to medium term. Some of the considerations developed in this paper may still be relevant, but an ad hoc framework may be more appropriate to guide policy decisions in this case (without necessarily resorting to an explicit fiscal rule).

Finally, it is useful to note that fiscal buffers can be accumulated either by reducing debt or accumulating financial assets—a distinction that matters for the design of fiscal rules, as discussed in Section VI:

- On the asset side, the buffer is simply measured as the *size of the accumulated financial assets* that can be sold to smooth out spending in the event of a shock. These assets should be both liquid and available to finance the budget whenever needed.

- On the liability side, the *room for additional borrowing* constitutes another form of buffer. In case of negative shock, a country can decide to borrow to support spending. The debt buffer is typically measured as the distance between the current debt level and a maximum level of debt that is deemed problematic—a "debt limit" above which debt would become unsustainable with high probability or hurt growth (see IMF 2018a). For instance, if a country's debt distress threshold is estimated at 90 percent

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[33] If commodity prices fall more durably and the loss in revenues is deemed to be "permanent", the appropriate policy response should be to adjust downward spending. However, a sudden expenditure cut could be suboptimal for efficiency reasons and may not be socially acceptable. In this case, the financial buffer will be used to smooth the adjustment over time.

of GDP and its current debt level is 70 percent of GDP, the debt buffer, which is the borrowing space, would be equivalent to 20 percent of GDP.

- Overall, when countries generate savings, they can decide to either accumulate financial assets, reduce debt or a combination of both. The fiscal buffer includes not only the financial assets, but also the capacity of the country to borrow without generating unsustainable debt dynamics. And when countries are hit by shocks, they may decide to smooth spending by either depleting their reserve of financial assets or borrowing more—which is what resource-rich countries do in practice (Figure 8).

Figure: 8. A Snapshot of Assets and Liabilities in Selected Resource-Rich Countries

Panel A. Net Financial Assets, latest (percent of current year GDP)[1/]
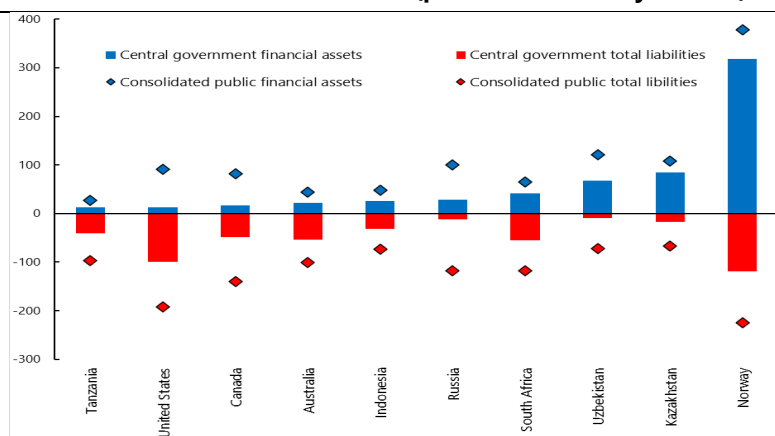
Panel B. Gross Debt, 2021 (percent of current year GDP)
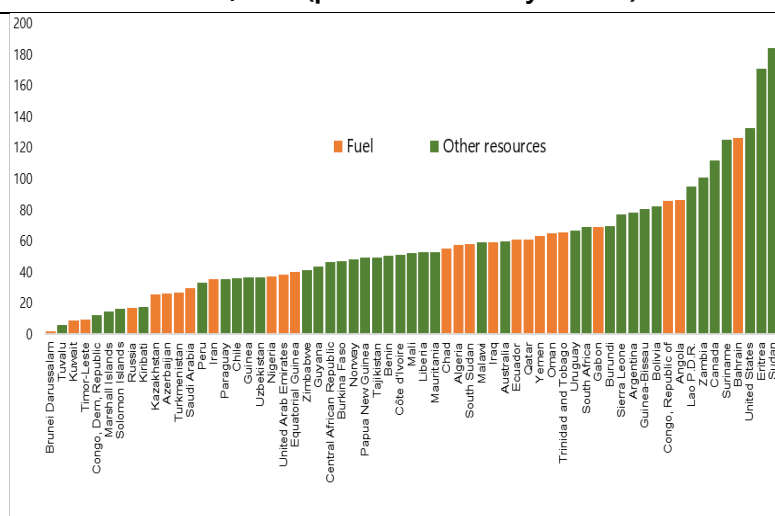
Source: IMF Public Sector Balance Sheet; IMF World Economic Outlook; IMF staff calculations

Note: 1/ Most recent available data used for each country.

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Box 1. Link Between Insurance and Intergenerational Equity/Sustainability

This paper proposes to design the fiscal framework of resource-rich countries based on the principle of insurance by building precautionary buffers to hedge against shocks, especially large and infrequent shocks to the terms of trade. A natural question is whether this type of framework would still be consistent with intergenerational equity and long-term fiscal sustainability.

A first concern is that the proposed framework may unduly favor the current generation. It is a complex question, since there is no easy way to measure and assess intergenerational equity, which is a multidimensional concept colored by national preferences. Despite its shortcomings, the FSF framework has the advantage of proposing a simple and intuitive definition of intergenerational equity, which is the preservation of wealth across generations. However, even the FSF criterion is not without its flaws. Most developing countries tend to prefer to invest in the future by accumulating real assets, like hospitals and schools, rather than financial assets. The accumulation of physical assets is not captured by the concept of "total wealth" of the FSF. In addition, saving in anticipation for future adverse shocks is already expensive for current generations and, to some degree, helps future generations. Preventing large fluctuations in output and mitigating the risk of disruptively large fiscal adjustments could be seen as a powerful way of transferring wealth to the future. Therefore, we deem that an insurance-based framework does achieve some degree of intergenerational equity.

A second concern is whether the proposed framework could put the fiscal trajectory on an unsustainable path. The buffer constituted through the insurance motive may be sufficient to smooth out expenditure when large shocks hit, but expenditure may still be too high once resource revenues are depleted in the longer run—forcing countries to adjust massively to restore fiscal sustainability. This means that the fiscal deficit that would materialize once resource revenues are exhausted may be so high that it would not stabilize the net debt ratio at its steady state value (this ratio could then become explosive). We will discuss this question in Section VII and propose a possible solution.

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Key variables of the fiscal framework: fiscal anchors and operational rules

A characteristic of well-designed medium-term frameworks is that they define an explicit **fiscal anchor**, which is a quantified target that helps calibrate medium-term fiscal plans, consistent with policy goals and fiscal responsibility.[34] This anchor may or may not take the form of a formal fiscal rule. In many countries, a debt rule helps guide fiscal policy over the medium term. The next section of the paper will discuss alternative fiscal anchors to support the objective of building buffers, including a financial asset floor or a debt ceiling.

An important aspect to keep in mind is that the fiscal anchor is not expected to be binding in every annual budget but should be achieved over the medium term. The role of an anchor is to provide medium-term direction to fiscal policy and help calibrate the operational rule. It is generally preferable to separate clearly the functions of these two types of rules and avoid using the anchor as an operational rule. The annual budget

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[34] See Eyraud and others (2018) for a discussion on the benefits of combining a fiscal anchor and one (or a small number of) operational rule. At the technical level, the anchor is used to calibrate the operational rules in a sequential and comprehensive manner (IMF 2018a). See also discussion in IMF (2022c) on reforming fiscal rules in the European Union.

should be constrained by the operational rule, not by the anchor which provides more indicative guidance.[35] In fact, some deviations from the anchor should be expected when buffers are used in response to shocks. In the same way as countries should be allowed to deplete partly their financial assets when commodity prices collapse, they should also be able to temporarily raise debt above the anchor (but below the debt limit) in economic downturns.

In order to link the medium-term fiscal strategy to the annual budget, countries should also adopt **operational fiscal rules** that usually apply to flow variables that are under the control of the government, like the fiscal balance or the expenditure envelope (Appendix 2). Using operational rules to constrain annual budgets increases the credibility of the framework. While the medium-term anchor may not be binding in any given year, annual fiscal plans should be constrained by binding operational rules that ensure that the annual plans are consistent with achieving medium to long-term objectives.

The choice of the operational rule(s) is country-specific. Its function is to promote macroeconomic stability and support the accumulation of buffers, while avoiding any unnecessary complexity. For example, choosing, as operational rule, an overall nominal balance floor could lead to large volatility and exacerbate the effects of commodity price shocks. Given that a critical challenge for resource-rich countries is to avoid a procyclical response to changes in commodity prices, rules that promote stable expenditure growth in both booms and busts tend to be preferable. In subsequent sections, we will discuss in greater detail why multiyear expenditure ceilings, which have been adopted in many countries, can be particularly useful.

Balancing credibility and flexibility

A framework combining anchor and operational rules should incorporate some flexibility without undermining its credibility. This can be done in several ways:

- Given the high degree of uncertainty faced by resource-rich countries, it is particularly important that the fiscal anchor be based on risk analysis and that the framework be reviewed regularly (for example every five years or after large shocks) to ensure it remains relevant. The process of revision should follow clear procedures and objectives to avoid undermining the credibility of the system—for example, reviews of the fiscal anchor should be based on fiscal sustainability principles and linked to the long-term analysis (if there is a need to reassess the level of risks or the valuation of economically-viable underground reserves).

- Instead of being long-lasting and overly complicated to address all types of circumstances and contingencies, the operational rules could instead be set in the medium-term budgetary plans based on macroeconomic projections and consistent with the medium-term anchor. The operational limits (e.g. on deficits, expenditures) would be binding for the specified period and could be re-adjusted periodically (say every three to five years) based on a baseline economic scenario.

- Escape clauses can also be used to accommodate exceptional circumstances and large adverse shocks (Gbohoui and Medas 2020).

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[35] This point has been extensively discussed in the case of a debt rule (see, for instance, Eyraud and others 2018). If the debt ratio is used as an operational rule and the government tries to stir the annual budget to compensate any deviation from the debt target, this would make fiscal policy highly procyclical.

VI.   Alternative Fiscal Anchors to Insure Against Shocks

Country characteristics inform the precise design of the fiscal anchor that supports the accumulation of buffers against shocks. In practice, countries are likely to focus on either a financial assets-based anchor or a debt-based anchor depending on their preferences, circumstances, and degree of vulnerability. This section starts by describing two types of (single) anchors—either a financial asset floor or a debt ceiling—and explains which anchor would seem more adequate under which circumstances. Then, the section discusses the possibility of combining two anchors.

In principle, a fiscal anchor should play the role of medium-term *target* in the fiscal framework. But in practice, the anchor is often formulated as a ceiling (for debt) or a floor (for financial assets) rather than a target. This is because countries may have reasons to accumulate buffers beyond and above what is recommended by the insurance approach—in which case, it would make sense for countries to overperform relative to the anchor's threshold (that is, keep debt below the ceiling or keep financial assets above the floor). In addition, given the poor track record of compliance with fiscal rules, it may be prudent to require countries to build, at least, a certain level of buffers to ensure that the minimum is achieved. For these reasons, the rest of the paper discusses floors and ceilings rather than targets.

A.   Anchoring on a Financial Assets Floor

The first type of anchor is a floor on the government's financial assets, which can be used to respond to shocks.[36] The financial assets considered under the rule are the liquid assets of the government—financial investments, cash, or other liquid assets. Importantly, the financial asset anchor is measured from observable variables and does not rely on an elusive estimate of resource wealth; therefore, this approach avoids problems associated with assessing underground reserves and projecting future resource revenues.

The financial asset floor should preferably be calculated in net terms, which means that it deducts government debt from financial assets. The reason is that the assets should be readily available to respond to shocks and smooth government expenditure—that is, they should be unencumbered. Netting out liabilities will also prevent governments from complying with the financial asset floor by simply borrowing, which is not a genuine way of accumulating saving.

A financial asset anchor can be particularly useful for large commodity exporters, where economic activity and budget are particularly vulnerable to the volatility of commodity-related revenues. For these countries, it is crucial to have rules that help deal with the macroeconomic consequences of both large positive and negative commodity-related shocks. Sizeable buffers are needed to preserve the delivery of public services and, at least partially, shield the economy from shocks. Contrary to traditional business cycle fluctuations, some commodity price shocks tend also to be longer lasting, which requires building up larger buffers allowing for any necessary

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[36] Note that even under this anchor, countries may still incur some debt (but usually at a significantly lower level than the size of financial assets) for different reasons. For example, some may use it to help develop domestic financial markets; others because they receive debt on concessional terms; or because other parts of the public sector borrow for their own needs (e.g., subnational governments or state-owned enterprises).

fiscal adjustment to be more gradual. Since ex ante policymakers do not know whether a shock will be large and/or persistent, they need to prepare for all possible scenarios.

Furthermore, in these large commodity exporters, the cost of borrowing is often very sensitive to fluctuations in commodity prices. When commodity prices fall, the assessment by creditors of the creditworthiness and wealth of the sovereign can be downgraded.[37] In addition, exchange rates of commodity producers often depreciate. Thus, external debt service and debt stock of both the public and private sectors tend to fluctuate with the exchange rate and spreads. For these reasons, debt costs are likely to surge in bad times, which is another reason why the accumulation of a financial asset buffer, generally in foreign currency, is appealing to smooth the effect of negative shocks.

Definition of the NFACR floor and link to fiscal adjustment

There are several ways of designing a financial asset floor. We propose here that this floor be defined as a ratio of the stock of net financial assets (financial assets minus liabilities, or NFA) to annual commodity revenues. We refer to this anchor as a NFACR floor. For instance, a ratio of 3 means that the stock of NFA should be, at least, equivalent to 3 years of commodity revenues. The authorities' medium-term budget plans would have to be consistent with this anchor.

The main function of the NFA buffer is to protect the authorities' spending plans and ensure a more stable role for fiscal policy in the face of commodity revenue shocks. The NFACR has indeed important stabilization effects both when commodity prices surge or fall sharply. When commodity prices surge, the ratio of assets to commodity revenue declines, and compliance with the anchor would call for saving a significant share of revenues. And when commodity prices fall, the ratio would initially increase, allowing to use financial savings to fund the budget and avoid a large and disruptive fiscal adjustment (for instance, through spending cuts).

An important aspect to consider for the rest of the discussion is that, in response to shocks, especially large and persistent ones, the financial asset buffer will often be used in conjunction with fiscal adjustment. This means that revenue shortfalls are likely to be accommodated by both using the buffer (that is, by selling assets or spending the returns on these assets) *and* carrying out some fiscal consolidation.[38] Protecting spending *fully* against shocks—without any fiscal adjustment—would require very large asset buffers, as commodity prices can experience sizeable and persistent falls. Many countries are unlikely to be willing to accumulate such large amounts of assets. Thus, a more realistic goal is to provide *partial* protection through financial assets, while resorting to gradual fiscal adjustment as a complement. Note that, to absorb smaller and more short-lived shocks, the asset buffer could be sufficient (without resorting to any fiscal adjustment).

Calibration of the NFACR anchor

The size of the asset buffer should be set to help manage larger and more persistent shocks. While the buffer can be used to respond to all shocks (small or large), its calibration needs to consider the most extreme scenarios that the government wants to insure against. For example, the government may want to be sure that, even in low probability events—that is, if there is a very large fall in commodity prices that persists for several
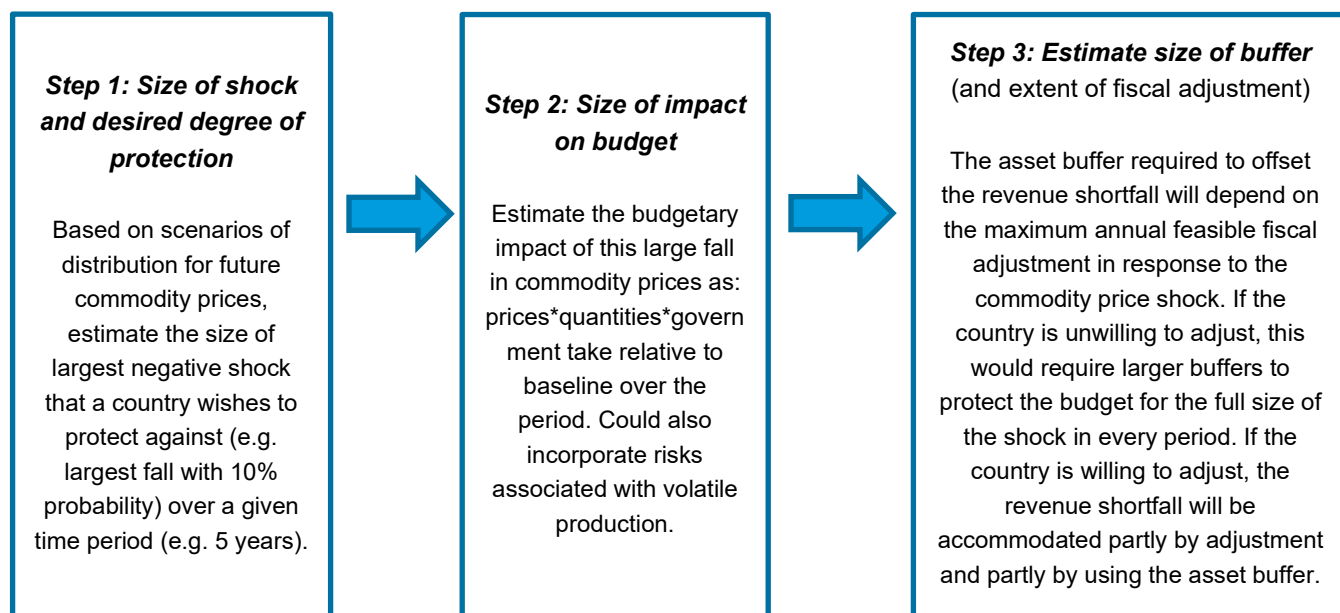
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[37] This is partly because the valuation of natural resource reserves underground, which are an implicit or explicit collateral, will fall.

[38] This is similar to traditional debt anchors which are calibrated using methodologies that incorporate a fiscal reaction function and assume that governments carry out some fiscal adjustment as debt rises (IMF 2018a).

years—the buffer will be sufficient to avoid too large a fiscal adjustment, which would be very disruptive for the economy and the population.

In practice, the estimation is conducted in three steps (Figure 9). First, the impact of a commodity price shock on the budget depends on the probabilistic distribution of the prices of the most important commodities for the country. Once this distribution is estimated using historical data or prior assumptions, it is then possible, in a second step, to estimate the budgetary impact of shocks with different probabilities. For example, it is usually assumed that the oil price follows a random walk with structural breaks. One can simulate scenarios with low oil prices over a given number of years—say 5 or 10 years—with different probabilities (e.g. 10 percent worse shocks). Then, assuming projections for oil production/sales and the government share of revenues, one can estimate the government revenue shortfalls (relative to the baseline) under the downside scenarios. This analysis could also include possible risks to oil production if this has been a source of volatility in the past. Finally, in a third step, the financial asset buffer is calibrated in the initial period to be able to offset a given portion of the cumulative revenue shortfalls over the selected time horizon, the remainder being offset by fiscal adjustment. Box 2 offers an illustrative example.

Figure 9. Decision Tree to Determine the NFACR Floor

Step 1: Size of shock and desired degree of protection

Based on scenarios of distribution for future commodity prices, estimate the size of largest negative shock that a country wishes to protect against (e.g. largest fall with 10% probability) over a given time period (e.g. 5 years).

Step 2: Size of impact on budget

Estimate the budgetary impact of this large fall in commodity prices as: prices*quantities*government take relative to baseline over the period. Could also incorporate risks associated with volatile production.

Step 3: Estimate size of buffer (and extent of fiscal adjustment)

The asset buffer required to offset the revenue shortfall will depend on the maximum annual feasible fiscal adjustment in response to the commodity price shock. If the country is unwilling to adjust, this would require larger buffers to protect the budget for the full size of the shock in every period. If the country is willing to adjust, the revenue shortfall will be accommodated partly by adjustment and partly by using the asset buffer.

Overall, the calibration will reflect the following country-specific assumptions:

- *The degree of volatility of commodity revenues*. This depends both on the historical volatility of commodity prices and the reliance of the budget on commodities. Countries where resource revenues represent a large share of the budget face larger volatility and require a higher NFACR floor.
- *The opportunity cost of building self-insurance*. Accumulating financial assets helps protect against future shocks, but may imply some costs (e.g., the resources saved as financial asset buffers are diverted from other policy objectives). The calibration of the NFACR anchor should balance the different needs.

- *The desired degree of insurance against shocks.* The more protection the government desires, the more it needs to save upfront. And the less the government saves in buffers, the more fiscal adjustment it will have to implement in response to a negative shock. When the government is reluctant to conduct large disruptive fiscal adjustments in response to a fall in commodity revenues, it has to build larger buffers to protect against shocks.


Box 2. Illustration of NFACR Calibration

This box estimates the amount of savings needed to insure against most shocks for a large oil exporter. In the example, the country is assumed to generate yearly oil revenues averaging around 30 percent of GDP.

We assume that the government responds to large shortfall in oil revenues by combining some fiscal adjustment (to cover half of the revenue shortfalls through spending cuts or increases in non-oil revenue) with using the returns of financial assets to cover the remaining half.

Figure 10, Panel A shows oil price simulations using a random walk distribution (around a baseline which is the authorities' forecast for commodity revenues) over the next 5 years. Figure 10, panel B estimates the size of the buffer depending on the share of the shocks that the government wants to be protected (e.g. 90 percent of the most favorable shocks, meaning up to the 10 percent worst shocks). The level of assets is calibrated to hedge against repeated shocks each year over the next 5 years. Concretely, this means that, with a 90 percent probability and given a predetermined path of fiscal adjustment, the asset returns could absorb half of the revenue shortfall in year 2023 (that is, the difference in revenue between oil price at $86 in baseline versus an oil price of $74 in the 10 percent downside scenario), then again absorb half the revenue shortfall in year 2024 (that is, following the 10 percent lowest trajectory: a revenue shortfall corresponding to a difference between a baseline oil price at $80 versus $63 under the downside scenario), cumulatively until 2027. The initial asset level is estimated in nominal terms at end-2022, and is then expressed in percent of the 2022 oil revenue or GDP in Panel B.

The results show that the size of the buffer depends on the degree of protection that is desired by the government. A high degree of protection requires savings equivalent to around 3-4 years of oil revenues. For example, a NFA ratio of around 3 (which represents about 90 percent of a large oil exporter's GDP) would allow to maintain spending in 90 percent of the most favorable shocks, provided that fiscal adjustment offsets half of the oil revenue losses. This means that, under most shocks, the returns on financial assets would be sufficient to compensate for the residual revenue shortfalls. For more extreme shocks (e.g., 5 percent worse shocks), the asset buffer based on the NFA ratio of 3 would be gradually depleted, unless the government accepts to carry out an even larger fiscal adjustment. For smaller shocks, the government would need less fiscal adjustment.

Figure 10. Illustrative Example of Calibration

Panel A. Fan Chart of Oil Prices (USD per barrel)
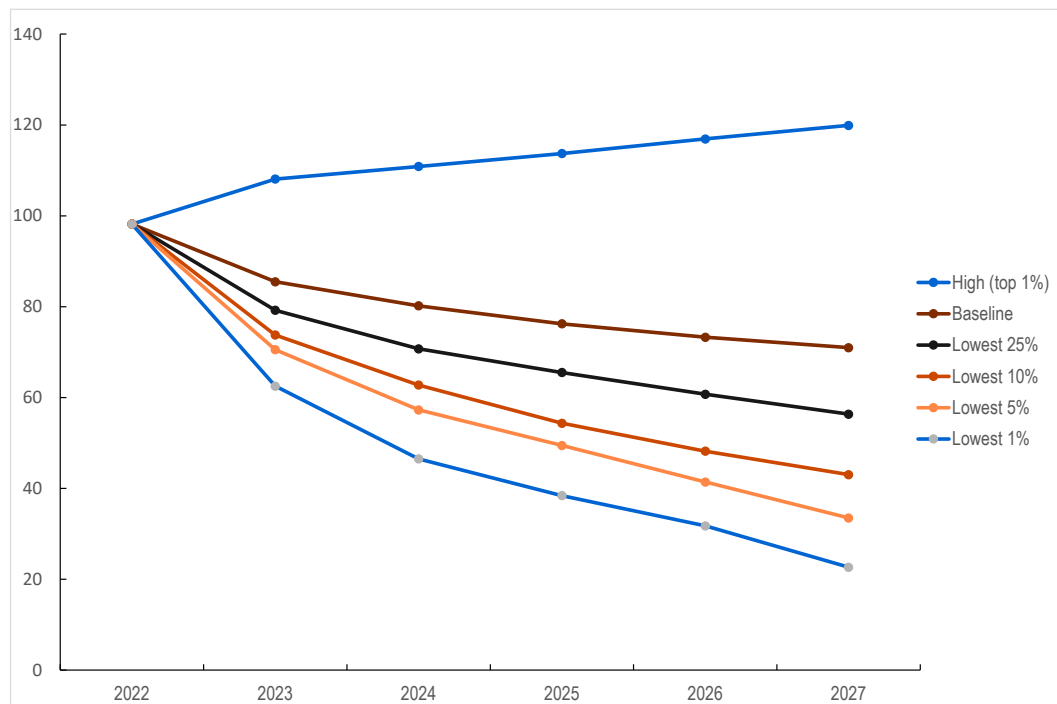
Panel B. Estimated NFA Depending on Range of Shocks a Country Wants to Protect Against (degree of risk aversion)1/
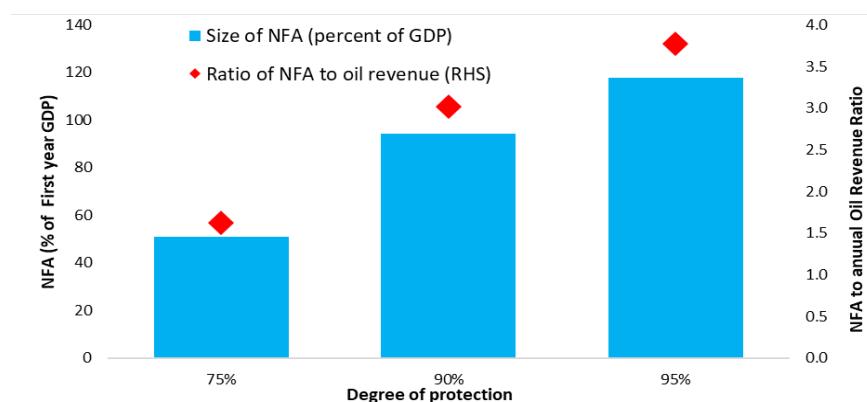
Source: IMF Public Sector Balance Sheet; IMF World Economic Outlook; IMF staff calculations
Note: 1/ The chart shows an estimation of the size of buffer as a function of the degree of protection, to insure against 75%, 90% or 95% of the most favorable shocks for a country that has large oil revenues (about 30 percent of GDP). The simulations assume the government carries out fiscal adjustment (e.g. cut in expenditure or increase in non-commodity revenues) equivalent to half the loss in revenue in any given year (and uses the financial assets' returns to absorb the other half of the revenue shortfall).

Responses to shocks under the NAFCR rule

When the NFA ratio deviates from its anchor value, the country should aim at gradually converging towards it. As every fiscal anchor, the NFACR floor is not meant to be observed in every single year, although compliance with the anchor should be achieved on average over the medium term. In particular, when there are large shocks, the authorities can adopt an approach that ensures a gradual return to target, as it becomes clearer whether the shock is persistent or temporary.[39] Appendix 3 describes in detail a possible adjustment mechanism in the case of a positive shock.

The anchor is intended to protect spending plans, which are partly funded from annual commodity revenues. In the previous sections, we have assumed that, in the steady state, all annual commodity revenues were used to fund annual spending. However, this may not be the case if part of these revenues is being saved as mentioned before (e.g. during the transition period to rebuild buffers or for other objectives). Thus, outside the steady state, the NFACR could be based on the annual commodity revenues *that are actually used to fund the annual budget*.

Response to a positive shock. Consider a scenario where there is a positive shock to commodity revenues. Figure 11 shows that, when commodity prices surge, the NFACR anchor calls for saving a significant share of revenues upfront, and raising spending gradually over time. This leave time for the authorities to assess whether the shock is persistent or not. The example, which is developed in Appendix 3, assumes that the anchor is an NFACR ratio of 3, and the country starts from a steady state with initially 30 of assets and 10 of resource revenues (which are initially used fully to fund the annual budget). Due to the rise in commodity prices, annual revenues increase to 13. One possible response to the shock is to initially spend any surprise revenue in a similar proportion to the anchor (e.g., if the anchor is 3, only spend one fourth of the revenue surprise), gradually increasing spending if the higher revenue proves to be more persistent. In such a scenario, the ratio of NFA to commodity revenues (that are used to fund spending) is always kept at 3. Eventually, if the rise in commodity prices proves to be persistent, annual spending would increase by 3, similar to the increase in commodity revenues, and the buffers would go to 39. This approach based on spending one fourth of the revenue surprise is just an example, as the exact path would depend on specific country circumstances and operational rules. In practice, the speed of scaling up spending also depends on the needs and the country's capacity to spend efficiently.

Response to a negative shock. In years when commodity prices fall, the NFACR framework allows for significant flexibility to use financial savings to fund the budget and avoid a large and disruptive fiscal contraction. The country's decision to use the buffer versus tighten the budget (by cutting spending or increasing non-commodity revenue) will depend on the type of the shock and country circumstances. For example, for small and temporary shocks, the government can simply use the buffers to maintain its spending plans during the first(s) year(s). However, for larger shocks and more persistent, in general, a fiscal adjustment will also be needed, and governments should prepare plans to rebuild buffers over time as needed.

After being used to absorb the shock, the buffer should be subsequently restored. A fundamental question is whether a country should pursue active fiscal adjustment to restore the buffer or wait for economic conditions to improve and take advantage of the cyclical increase in revenue to generate savings. The response to this

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[39] While the proposed framework is intended to be resilient--as for any other rules--after very large shocks, countries may need to review their framework and calibration of rules to ensure that they remain adequate for the intended objectives.

question may depend on the nature of the shock. As a result of moderate and frequent macroeconomic shocks, NFA are likely to fluctuate cyclically (declining when a country sells assets or borrows in bad t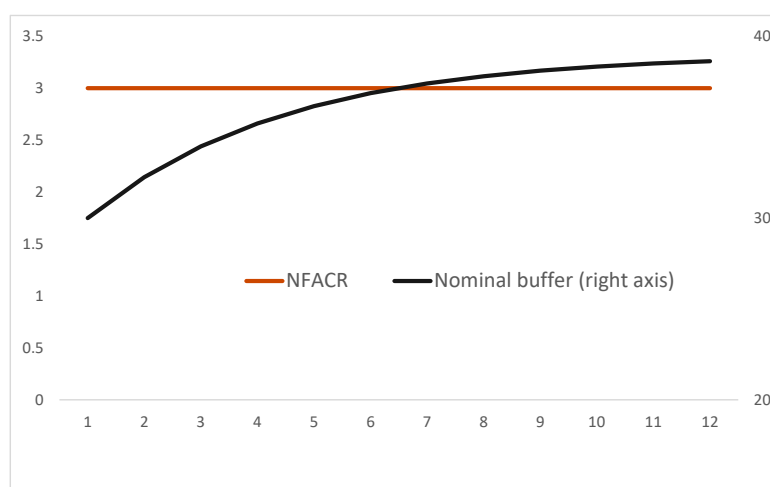imes and decreasing when savings are generated in good times). But this stabilizer effect, which is both automatic and symmetric, may not be at play in the case of large shocks. Since negative tail risks may not be offset by positive tail risks at a reasonable time horizon, the buffer may not replenish automatically. In this case, more active fiscal adjustment, by compressing spending for a few years, would be needed.

Figure 11. Positive Price Shock: Transition Path

Panel A. Revenue and Spending

- Change in spending (cummulative; right axis)
- Commodity revenue used to fund the budget
- Commodity revenue

Panel B. Buffer
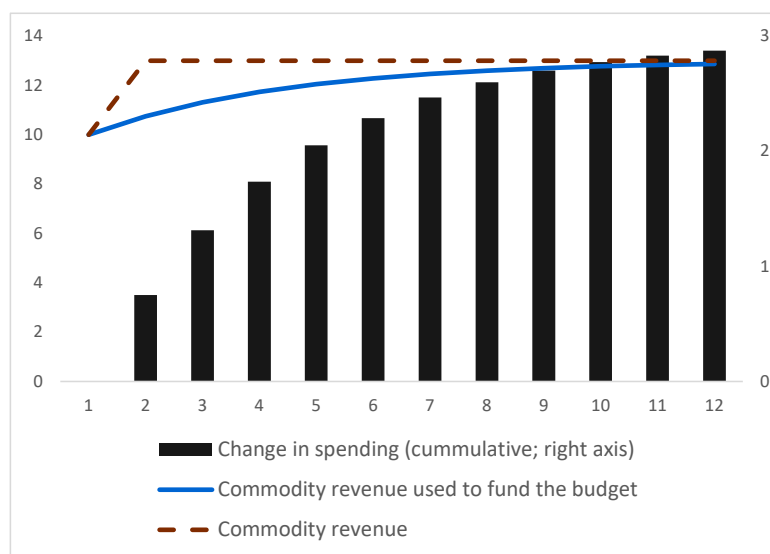
- NFACR
- Nominal buffer (right axis)

Source: Authors' simulations. Note: Calculations are identical to Appendix 3. The NFACR, used for the transition, is defined as the stock of NFA divided by the commodity revenues going to the budget.

Other possible financial asset anchors

Besides the NFACR, countries could consider alternative ways of setting a financial asset floor. Another possibility is to calibrate the nominal NFA buffer to ensure that it is *fully* depleted after a particular shock. The initial amount of NFA should, by construction, cover the revenue losses over a certain horizon. For instance, IMF (2012a, b) uses a value-at-risk approach and a model-based approach to estimate the minimum buffer that can absorb tail risks in resource revenue volatility. Specifically, the buffer should be set large enough to ensure that, with high probability, there are enough resources to respond to shocks in the forecast horizon.

This alternative approach tends to require a smaller accumulation of buffers compared to the NFACR anchor.[40] However, if the shock turns out to be more persistent than expected, this approach will require significant fiscal adjustment once the buffers are depleted. Countries will need to assess the benefits versus the costs of the insurance provided by different buffer sizes.

B.   Anchoring on a Debt Ceiling

An alternative anchor to the NFA floor is a traditional debt ceiling that exists in many countries around the world. For countries that do not display a large budgetary dependence on resource revenues, a debt ceiling is likely to be the most practical and politically-acceptable anchor. It may be sufficient to achieve the objectives described at the beginning of the paper, including providing sufficient space for countries to smooth spending in the face of shocks.

Design of the debt anchor

The design of the debt rule is fairly standard. For commodity producers, best practice is to express the anchor as a gross debt ratio ceiling, with the denominator being non-resource GDP to ensure that the anchor is not too volatile. The numerator should cover both domestic and external debt.

It is useful to note that, even if a country has a debt anchor, it may still accumulate some financial assets, like government deposits. This may be necessary for liquidity management purposes. But, in this case, financial assets would not be considered a primary buffer to absorb shocks and would be of much smaller size than debt; hence there would be no need to set a specific financial asset target.

Conditions to adopt a debt anchor

The debt anchor seems best suited for countries where the budget displays a lower dependence on resource revenues, and where there is less willingness of governments to insure against risks. This includes cases where most negative shocks to commodity revenues, including persistent ones, have a moderate budgetary impact and could be accommodated through a temporary rise in debt and gradual fiscal adjustment. Conversely, revenue windfalls during commodity price booms would be used to reduce debt.

Under this approach, the degree of insurance would likely be lower than under the financial asset floor approach, especially for larger and more persistent shocks. But this anchor could still provide significant

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[40] Indeed, nominal NFAs are not expected to be fully depleted after a large persistent shock under the NFACR rule.

protection to many shocks and would fit the risk profile of countries that are ready to adjust more significantly when negative shocks hit.

Another important consideration—highlighted by portfolio allocation models—pertains to the response of debt cost and asset returns to shocks. Compared to financial assets, debt could be seen as a "better" shock-absorber buffer if, under a negative shock scenario, (1) debt costs do not increase too much and/or (2) financial asset prices decline significantly (that is, asset returns increase).

A clear-cut example is provided by a developing country having access to concessional debt financing—the cost of which is uncorrelated to shocks. Provided that donors are ready to support the country during the crisis, debt issuance should probably be favored to absorb shocks (compared to selling financial assets), not only because this option is less expensive but also because its cost does not increase in response to the shock. In this case, a well-calibrated debt anchor could be implemented to ensure that the debt accumulation remains manageable and consistent with fiscal sustainability in the medium term.

There are other situations where debt costs could increase less markedly than financial asset returns in response to shocks—for instance when debt is issued on a different market (e.g. domestic) than financial assets. But these cases tend to be atypical, since debt costs of resource-rich countries often surge when commodity prices collapse, whereas their financial assets' returns are likely to be more resilient (in part because these assets are often held abroad, and their returns expressed in domestic currency are supported by the likely exchange rate depreciation).

Finally, a debt ceiling may also be warranted for reasons that are not directly related to shock absorption, but, more generally, to the management of debt vulnerabilities. If public debt rises significantly, the debt burden can have adverse effects on the economy, such as elevated default risk, crowding out of private credit or sovereign-debt nexus that threatens financial stability. Under these circumstances, the policy priority should be to lower debt to a level that is more compatible with macroeconomic stability, and the strategy could be supported by a prudently calibrated debt anchor.

Calibration of the debt anchor

The calibration of the debt ceiling could follow the principles described in IMF (2018a), where the debt anchor is computed as a "safe" debt level by setting first a maximum debt limit (debt level above which the fiscal position becomes too vulnerable or unsustainable) and deducting from it a safety margin that reflects the volatility of macroeconomic shocks, such as shocks to GDP or exchange rate. Exchange rate shocks are particularly relevant in resource-rich countries, since the currency tends to comove with commodity prices; these shocks have strong impacts on the economy and the budget, partly due to the direct transmission to external debt stock valuation and external borrowing costs.

Nonetheless, the methodology of IMF (2018a) needs to be tailored to the specific circumstances of commodity producers—some of these adjustments are suggested in Appendix 4 of the paper:

- *Sample.* IMF (2018a) relies on the econometric estimation of a fiscal reaction function over a large country sample. This function could be re-estimated to focus on the subsample of commodity producers.
- *Specification of the fiscal reaction function.* For commodity producers, it would be advisable to replace the terms-of-trade variable with a variable that captures more explicitly the commodity prices, like the

"commodity terms of trade" developed by Gruss and Kebhaj (2019). In addition, given the non-linear response of the fiscal balance to commodity price gaps observed among commodity producers, it may be useful to differentiate the elasticities between positive versus negative gaps.

- *Macroeconomic shocks.* IMF (2018a) estimates the impact of shocks by drawing them randomly through techniques, like the multivariate normal law, that do not capture adequately the persistence of commodity price shocks over time. In addition, given data limitations, the relatively short time horizon over which the shocks are calibrated could "miss" the occurrence of very large and rare shocks on commodities that may not have been observed over the recent past. Therefore, the module generating the shocks would need to be designed to capture the characteristics of shocks faced by commodity producers—including their skewed distribution with some non-zero probability for tail events.

Response to shocks under the debt anchor

When there is a positive or negative shock to GDP, the ratio of debt-to-GDP tends to vary significantly (much more than the fiscal deficit ratio). This is because the response of a ratio to a GDP shock is mechanically proportional to its level. The greater the ratio, the greater is the response to a given shock. Given that debt ratios tend to be elevated in most countries, large fluctuations are observed in practice.[41]

If the debt ratio is initially at its anchor level, a negative GDP shock will lead to a breach of the ceiling. In principle, if the operational rule, like the fiscal deficit ceiling, is calibrated in a consistent manner with the debt rule, maintaining the deficit at or below its ceiling should bring back the debt ratio asymptotically to the anchor.[42] Nonetheless, this may take a very long time and be a noncredible strategy to correct debt breaches.

A more credible policy response could be to introduce what is commonly called a "correction mechanism" in the operational rule. For instance, the fiscal deficit or the expenditure ceilings could include an adjustor that automatically tightens the rule in proportion to the excess of the debt ratio relative to the anchor. This turns the operational rule into a sort of fiscal reaction function. For instance, in 2013, Poland introduced an expenditure rule where the expenditure growth rate is reduced gradually if certain public debt-to-GDP thresholds are exceeded (OECD 2019).

The response to positive and negative shocks is not symmetric though. In case of positive shock to GDP, the debt ratio would fall under the ceiling, but the optimal policy response may not necessarily be to relax fiscal policy to bring back debt to the anchor. Indeed, if the positive shock proves to be temporary, a significant increase in the fiscal deficit could be problematic from stability and sustainability standpoints. On the other hand, for large negative shocks, the optimal response would depend on the economic context. For instance, during the Covid-19 pandemic, debt ratios around the world were allowed to increase significantly to tackle the crisis and save human lives. That said, even after negative shocks where deviations are initially warranted, a transition path is still needed to bring debt back under the ceiling.

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[41] By differentiating the ratios, we get, for the deficit ratio: $\Delta\left(^{deficit}/_Y\right) = -\left(^{Exp}/_Y\right).\left(^{\Delta Y}/_Y\right)$. And, for the debt ratio:
$\Delta\left(^{\text{debt}}/_Y\right) = -\left(\left(^{debt}/_Y\right) + \left(^{Rev}/_Y\right)\right)\left(^{\Delta Y}/_Y\right)$ (see Eyraud and Weber 2013). Thus, the effect is generally much larger on the debt ratio than on the deficit ratio.

[42] For instance, if the deficit ratio is kept at 3 percent of GDP indefinitely, the debt ratio would eventually converge to 60 percent of GDP, regardless of its initial level, provided that nominal GDP growth is 5 percent (see formulas in Escolano 2010).

C.   A Dual Anchor System?

The previous two sections have described single-anchor frameworks for resource-rich countries: either a financial asset floor or a debt ceiling. While, in these cases, countries may still manage a combination of assets and liabilities, the underlying assumption is that fiscal buffers would be primarily accumulated on one side, and the frameworks would not set explicit rules for both debt and financial assets. This section discusses other frameworks where two types of anchors may co-exist.

A natural question is whether countries may wish to accumulate both types of buffers and target both debt and financial asset anchors with two separate rules. This configuration is much more complicated than single anchors, and, in general, one buffer is likely to dominate the other one, as the main shock absorber. The discussion below should be viewed as a first attempt to analyze dual anchor systems. Further work is needed to fully capture the policy implications, design features and calibration methods.

A fundamental distinction is whether a dual anchor system is warranted on a temporary basis or as a permanent feature of the fiscal framework. We will discuss these two cases separately.

The situation of *transitional arrangements* is probably the most straightforward. It is not uncommon for two anchors to co-exist during a transitory period, although only one type of rule is meant to be maintained in the longer term. Two examples can illustrate this point. Let's assume, first, that a country wishes to establish a financial asset buffer, but the accumulation or replenishment of the financial cushion takes some time, perhaps several years. Thus, during the (re)constitution period of the buffer, the country will resort primarily to debt to absorb shocks. In these conditions, a country may keep a debt ceiling to ensure that debt accumulation is not excessive—that is, the debt rule would impose a limit to how much expenditure smoothing is feasible until the financial asset buffer is fully established. Another example is provided by a developing country at early stage of the exploitation of natural resources (with large future inflows of revenues), which initially benefits from donor loans on concessional terms. In this case, the country should take advantage of borrowing at relatively affordable rates (given that its future revenue capacity will increase) within a debt ceiling to avoid the buildup of debt vulnerabilities. Concurrently, a financial asset anchor could be justified to promote the accumulation of assets as resource revenues rise.

The question of whether a dual anchor is warranted *in the steady state* is subject to debate. Countries may opt to accumulate both types of buffers on a more "permanent" basis to minimize the cost of insurance, since debt and asset returns present different correlations to shocks. Then, it could make sense to constitute both buffers to be in a position to select the most cost-effective option when a particular shock hits. [43] For instance, even if a country uses a debt anchor to preserve some borrowing space to respond to shocks, accumulating liquid assets could still be warranted, especially in the event of large shocks, when borrowing costs spike temporarily and some countries lose market access. Selling some liquid assets could help weather the initial period of turbulence as governments prepare medium-term fiscal plans that are credible and allow the country to borrow

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[43] The composition of the total shock-absorbing buffer between financial assets and debt space depends on cost and risk considerations, both in normal times and when shocks occur. An important variable is the difference between the return on financial assets and the implicit return associated with reducing debt—which corresponds to the interest windfall of not paying higher debt. For countries paying high interest, it may be more cost-effective to create some borrowing space (by reducing their debt) than to build up financial assets, sometimes invested abroad, at a very low interest rate. Since returns are neither certain not constant, this comparison should also take into account the possible response of returns to shocks.

at lower cost. Symmetrically, even if a country holds a large financial asset buffer, it may also want to keep some borrowing space, since a negative economic shock could reduce the liquidity of financial assets to the point that it could make more sense to smooth spending by borrowing than by selling assets that have lost part of their value.[44]

The calibration of dual anchor systems is likely to be an elaborate exercise. Existing methods developed for calibrating the debt and financial asset anchors cannot easily be applied without risking double-counting buffers. The debt ceiling calibration tool of IMF (2018a) tries to capture the impact of all shocks on net debt, but it may not estimate adequately tail events related to commodity price collapses considered by the financial asset calibration tools. Furthermore, the calibration of rules during transitional arrangements may require ad hoc approaches that need to be tailored to the specific case under consideration.

To carry out an accurate joint calibration of two anchors, a small calibrated model of portfolio optimization would seem necessary. A number of papers have done such exercise to determine the optimal level of international reserves—taking into account jointly debt and assets. These models compute the optimal mix of debt and FX assets with a view to smoothing consumption (see, for instance, Alfaro and Kanczuk 2009). Similar models could be considered for and adapted to commodity producers, although they would likely be more complex because of the need to take into account the different tradeoffs and policy choices. Such approach would also require developing a comprehensive asset-liability management capacity, which is absent in many countries. In general, countries that lack this capacity and have relatively expensive debt should focus on keeping debt low rather than accumulating significant financial assets.

VII.   Selecting and Calibrating the Operational Rule(s)

To complement the fiscal anchor, an operation rule (or a few) should be added to the framework. Its function is to guide fiscal policy on a yearly basis, linking annual budgets to medium-term fiscal plans. Several options exist, such as the overall balance rule, the non-resource balance rule, or the expenditure rule.

This section examines more extensively the expenditure rule, which has several advantages. As mentioned above, a key challenge for countries is to prevent excessive expenditure growth during booms to allow for the accumulation of buffers and support more stable and sustainable economic growth. Expenditure rules are also, in some respects, simpler to operate and monitor, since governments have much greater degree of control over the spending envelope. Beyond the expenditure rule, other types of operational rules could also be considered, although they present some shortcomings, as discussed in Appendix 2.

All the recommendations made in this section are indicative and do not substitute for deeper country-specific analysis which should simulate the effect of alternative rules on fiscal and economic variables under various shock scenarios. Experience shows that no rule dominates others in all circumstances and all cases.

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[44] If the shock is a housing market crash, the cost of debt may be unaffected (especially if borrowing takes place on international markets), while the price of domestic assets may collapse; in this case, it would be more efficient to borrow than to sell domestic assets.

A. Period of Accumulation of the Precautionary Buffer

During the period of constitution of the buffer, imposing a formal operational rule is possible, but it is not a necessity, especially if this convergence period is relatively short. The priority is rather to set an indicative benchmark for how much annual fiscal adjustment is needed to bring the buffer towards its targeted level by a given date.

IMF (2018a) offers a formula to compute the transition path.[45] In the general framework, two parameters would need to be specified: the date by which the buffer (debt or financial assets) should reach its target and the duration of the adjustment. These parameters could possibly differ; it is, for instance, possible to plan to achieve the buffer target in five years but consolidate only for three years and maintain the fiscal balance constant thereafter for two years. For simplicity, we suggest applying the formula by assuming that the duration of adjustment is equal to the time needed to constitute the buffer. In any case, as expenditure ceilings would be set for the duration of the medium-term fiscal plans (say 3-5 years), they can be revised if needed.

Two considerations should be kept in mind when deciding on the duration and timing of this transition period. First, the annual fiscal adjustment should be realistic (politically and socially) and not entail excessive economic costs. Second, given that the adjustment applies to the nominal fiscal balance in the formulas, it could possibly be achieved without "structural" tightening of the fiscal position: a country could simply take advantage of an upturn in the business or commodity price cycle to build up the buffer. In fact, this may well be the best solution and the most acceptable one for the population. It is much easier to build up a buffer when resource revenues are historically elevated.

B. Period of Maintenance and Use of the Precautionary Buffer

The importance of containing government spending

In resource-rich countries, the main function of the operational rule is to contain and stabilize spending. Countries should ensure that resource revenues are not fully spent in good times for two main reasons: the first one is to be able to protect spending plans in bad times (what we have called the stabilization and insurance functions), and the second one is to ensure that the fiscal position is sustainable, meaning that the spending envelope partly financed by resource revenues can be maintained once reserves are eventually depleted[46]— that is, an unrealistically high fiscal adjustment will not be required in the longer term.

For these reasons, a natural operational rule is the expenditure rule. Expenditure rules have become increasingly popular over the last decade or so. Some evidence suggests that countries comply more often with expenditure rules than with other rules. These rules can take the form of a cap on the annual rate of growth of

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[45] See approach 3 ("Convergence by a Given Date Following a Transition Period") on page 15 of the How-to Note. The asymptotic formulas should not be applied in this case, since they only bring net debt to its targeted level asymptotically over the long term. Nonetheless, asymptotic formulas are useful to stabilize net debt when the target is achieved (see discussion on maintenance of the buffer below).

[46] Or if commodity prices fall sharply and durably.

expenditure, either in nominal or real terms (IMF 2018b). To avoid the risks of creative accounting and segmentation of the budget, the rule should cover all types of spending.

An expenditure rule has several advantages. The first one is that it reduces expenditure volatility and tends to display good stabilization properties (although it depends on its specific design, see IMF 2018b). In particular, the rule encourages the creation of buffers by saving some revenue windfalls when commodity prices are high. The second advantage is that, by focusing on the spending envelope, the expenditure rule forces countries to consider squarely the question of sustainability.[47] Other advantages include its simplicity of monitoring and direct articulation with the budget. The rule can also lead to stricter prioritization and greater efficiency in expenditure, as spending needs compete under the binding constraint.[48]

Although very appealing in principle, this rule should be feasible. Feasibility requires a good calibration of the rule's threshold, but also the ability to tap buffers to support spending in bad times. If a country cannot offset cyclical revenue shortfalls by borrowing more or depleting some financial assets, an expenditure rule cannot be realistically implemented. The fiscal anchor, as defined in this paper, serves this very function: the anchor is maintained at such level that it leaves sufficient room to borrow or use financial assets to stabilize spending.

Calibration of the expenditure envelope

Regardless of the exact design of the expenditure rule, a fundamental question pertains to the determination of the sustainable expenditure envelope. To approach this question, it helps to separate two different time horizons. At a short to medium term horizon, the expenditure envelope should be calibrated to ensure that the anchor is complied with, and, thus, the buffer is maintained at its target value.[49] Stabilizing the anchor (net financial assets or gross debt) is a sufficient condition for fiscal sustainability. At a longer-term horizon, once resource reserves are eventually depleted, the expenditure envelope should also be sustainable in the sense that it does not place gross debt on an explosive path (assuming, for simplicity, that financial assets are not needed anymore once resources are depleted and the fiscal position is not exposed anymore to commodity prices shocks).

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[47] The objective of fiscal sustainability can certainly be supported by other rules, like a deficit or debt rule. But the advantage of the expenditure rule is that it forces country to directly consider the level of sustainable spending, including for intergenerational equity purposes. Sustainability risks in resource-rich countries come primarily from excessive expenditure growth in the face of elevated commodity prices.

[48] There are a few disadvantages though. By focusing on the expenditure side, the rule does not incentivize revenue efforts (contrary to rules applying to the fiscal balance), which can be a problem in low-income countries where domestic revenue mobilization is a policy priority. That said, some specific designs of the rule, like the European expenditure benchmark, can mitigate this risk by correcting the spending envelope for permanent changes in revenue.

[49] If there are dual anchors (on debt and financial assets), the calibration of the operational rule would require combining the two anchors into one net financial wealth (NFA) threshold. For instance, if the gross debt ceiling is 50 percent of GDP and the financial asset floor is 90 percent of GDP, the resulting NFA floor would be 40 percent of GDP. The consolidated NFA should preferably be expressed in percent of GDP to facilitate the computation of the thresholds of the operational rule(s) and ensure consistency. If the anchor is not defined as a GDP ratio (for instance, if the financial asset floor is expressed in percent of resource revenues), a simple conversion should be operated to make sure that both the anchor and the operational rules are consistent.

These two conditions can easily be expressed with standard debt-stabilization formulas, using as an example the net financial asset anchor (NFA):[50]

- If the objective is to stabilize the NFA ratio on average over the cycle, the sustainable expenditure ratio during the period of maintenance of the buffer will be:

$$\left(\frac{E_t}{Y_t^{TREND}}\right)^{MT} = \frac{Resource\ Rev_t^{CA}}{Y_t^{TREND}} + \frac{Other\ Rev_t^{CA}}{Y_t^{TREND}} - NFA\ ratio^{MT} * \left(g_{TREND}^{MT} \middle/ 1 + g_{TREND}^{MT}\right)$$

   with "CA" denoting cyclically-adjusted variables, g^{POT} denoting trend GDP growth, and Y_t^{POT} denoting trend GDP.

- If the objective is to stabilize the gross debt ratio in the longer term, once resources are depleted, the sustainable expenditure ratio will be:

$$\left(\frac{E_t}{Y_t^{TREND}}\right)^{LT} = \frac{Other\ Rev_t^{CA}}{Y_t^{TREND}} + Debt\ ratio^{LT} * \left(g_{TREND}^{LT} \middle/ 1 + g_{TREND}^{LT}\right)$$

It cannot be assumed that these two expenditure ratios are identical ex ante. Therefore, the expenditure envelope consistent with the medium-term NFA anchor may need to be adjusted to ensure that it is also consistent with long-term sustainability.

An important caveat though: any estimate of expenditure envelope that could be financed ad infinitum is necessarily very imprecise (Box 3). Benchmarks would need to be updated regularly as new information becomes available. Some critical factors determining whether spending plans are sustainable are indeed outside the control of governments like commodity price shocks, their persistence, and possible turning points in commodity super-cycles. Other factors relate to policy choices that are difficult to predict at a long horizon, such as the prospects for revenue mobilization outside the resource sector. Periodic updates of the calibration should be conducted, especially when the buffer deviates significantly from its target.

Design of the expenditure rule

Once the country's expenditure ratio (in percent of potential GDP) has reached its sustainable level, it could be maintained by following a simple expenditure growth rule where real expenditure grows like real potential growth. Therefore, the operational rule could be a simple expenditure growth rule: $\Delta E/E = \Delta Y^{TREND}/Y^{TREND}$.

Some other designs are also possible. In some countries, like in the European Union, the expenditure envelope is defined net of new revenue measures. This means that, if revenues increase for policy reasons (e.g. higher tax rates), some expenditure increase would be allowed under the rule. However, such design seems less justified for commodity producers, where the priority should be to establish and maintain a firm expenditure path. In these countries, governments are often tempted to revise upwards spending ceilings when commodity

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[50] For instance, the NFA stabilizing fiscal balance is: $\frac{OB_t}{Y_t} = \frac{NFA_{t-1}}{Y_t} * \left(\frac{g}{1+g}\right)$. See Escolano (2010).

prices increase, and revenues go up. This can be problematic if expenditure cannot be adjusted downward when revenues go down for cyclical reasons.

Box 3. Suggested Steps to Calibrate the Sustainable Expenditure Envelope

This box provides an example of calibration in case of a gross debt ceiling, which, for the purpose of rule calibration, is treated as a target. The same steps would apply to a financial asset floor.

Step 1: set the anchor's target. The anchor and operational rule need to be calibrated in a consistent manner. The starting point of the exercise is to set the anchor's target based on the principles discussed in the sections V and VI. For illustrative purposes, we assume that the debt rule is expressed as a share of GDP and that the targeted ratio is 40 percent of GDP.

Step 2: derive the anchor-stabilizing overall balance. For a given anchor, it is possible to infer the fiscal balance that would stabilize it. Assuming a nominal GDP growth of 6 percent, the fiscal balance consistent with a debt of 40 percent of GDP is a fiscal deficit of 2.3 percent of GDP (= -40*0.06/1.06).

Step 3: derive the expenditure ratio. The third step estimates the spending ratio that can be sustained in the steady state. This ratio is expressed in percent of trend GDP (rather than actual GDP, which would make nominal spending too volatile). The analysis should be conducted with all variables expressed in structural terms. An assumption should be made regarding the steady-state revenue ratio. For the resource revenue ratio, the long-term average of resource prices could be used to estimate future revenues; the critical point is to ensure that this ratio is not too dependent on the state of the commodity price cycle and transitory shocks. For non-resource revenue, it is prudent to assume no revenue mobilization gains going forward; since the framework will be periodically updated, new reforms could be factored in when they have effectively borne fruit. In the example above, if the projected revenue ratio is 30 percent of GDP (of which 10 percent of GDP for resource revenues and 20 percent of GDP for non-resource revenues), the expenditure ratio would be 32.3 percent of GDP in our example—the difference between the debt-stabilizing balance and the revenue ratio.

Step 4: adjust, if needed, the expenditure ratio according to the long-term sustainability benchmark. The expenditure ratio derived from step 3 may still be high from a long-term perspective. Let's assume that the long-term gross debt anchor is 60 percent of GDP and growth is still estimated at 6 percent. The debt-stabilizing balance would be a fiscal deficit of about 3.4 percent of GDP. Given the absence of resource revenues in the long term (once reserves are depleted), the critical assumption is the size of the non-resource ratio in the long term. If this ratio is projected to increase from 20 percent of GDP to 28.9 percent of GDP, this would preclude any adjustment in the steady state (since 28.9-32.3=3.4). If this is deemed unachievable, the expenditure ratio would need to be adjusted downward, perhaps during an adjustment period preceding the exhaustion of resources.

Importantly, this process should be done every time the country defines the medium-term fiscal plans (say, every 4 years) within a well-defined fiscal framework. As such, countries can adjust expenditure ceilings and anchors if needed depending on specific circumstances prevailing at that time.

VIII. Conclusion

Fiscal policy in resource-rich countries faces the difficult task of achieving multiple and sometimes conflicting objectives, including economic stabilization, insurance against large and persistent shocks, fiscal sustainability, intergenerational equity, and competitiveness.

Historically, commodity producers have struggled to promote stable and sustainable economic growth, while keeping public finances in order. Designing robust fiscal frameworks can contribute to making fiscal policy more stable, fair, and sustainable. Fiscal rules are often a central component of these frameworks, although relying on overly complex rules to address all challenges is likely to be counterproductive.

This paper proposes a broad approach to guide fiscal policy at various time horizons. This entails formulating a long-term strategy and broad principles for the management of resources, strengthening the capacity to identify and measure risks, and designing a medium-term framework that guides annual budget processes in a way that protects public finances and the economy against shocks, especially those related to highly volatile commodity prices.

We argue that fiscal rules can be a useful part of this medium-term framework, with the primary goal of promoting the accumulation of buffers during good times as an insurance mechanism. Other considerations, like intergenerational equity or long-term fiscal sustainability could be dealt with in the context of long-term strategies. However, we advise against using PIH-type rules or approaches that are too complex to design and implement.

The choice of fiscal anchors and operational rules depends on country-specific circumstances and policy priorities. Preferably, countries should use simple and easy-to-monitor fiscal rules that commit governments to fiscal disciple in a credible manner, while allowing enough flexibility to withstand large shocks. One of the contributions of the paper is to present frameworks that are less reliant on precise estimation of resource wealth—a very elusive and difficult-to-measure concept. In our view, simple financial asset floor or debt ceiling constitute sound anchors for resource-rich countries.

Appendix 1. Fiscal Sustainability Framework for Resource-Rich Countries

This Appendix summarizes the main equations of the Fiscal Sustainability Framework (see Baunsgaard and others (2012) and IMF (2012b) for additional information). The variables used in this Appendix are defined in Box A1. We assume that the no-Ponzi game (transversality) condition holds (Escolano 2010).

Box A1. Variables (in nominal terms)

NRT_t : non-resource revenues of the government.

RT_t : resource revenues of the government.

A_t : Financial assets of the government.

D_t : Commercial debt of the government.

OB_t: overall balance of the government, defined as total revenue minus total expenditure $= \Delta(A_t - D_t)$

i : interest rate on government assets and debt (assumed to be equal).

E_t : government primary expenditure $= NRT_t + RT_t - OB_t - i.(D_{t-1} - A_{t-1})$. Thus, $OB_t = NRT_t + RT_t - E_t + i.(A_t - D_t)$.

$NRPB_t$: Non resource primary balance $= NRT_t - E_t = OB_t - RT_t + i.(D_{t-1} - A_{t-1})$.

N : resource horizon in number of years.

$A_t - D_t$: financial wealth of the government $= OB_t + A_{t-1} - D_{t-1} = NRPB_t + RT_t + (1 + i).(A_{t-1} - D_{t-1}) = -\sum_{s=t+1}^{\infty} \frac{NRPB_s}{(1+i)^{s-t}} - \sum_{s=t+1}^{s=N} \frac{RT_s}{(1+i)^{s-t}}$

V_t : Resource wealth of the government $= \sum_{s=t+1}^{s=N} \frac{RT_s}{(1+i)^{s-t}}$

W_t : Total wealth of the government (financial and resource) $= A_t - D_t + V_t = -\sum_{s=t+1}^{\infty} \frac{NRPB_s}{(1+i)^{s-t}}$.

Y_t : non-resource GDP.

From the definitions above, a key equation can be derived in nominal terms: $\boldsymbol{W_t = (1 + i).W_{t-1} + NRPB_t}$.

This is because $\Delta(A_t - D_t) = NRPB_t + RT_t + i.(A_{t-1} - D_{t-1})$ and $\Delta(V_t) = i.V_{t-1} - RT_t$. Then, given that $\Delta(W_t) = \Delta(A_t - D_t) + \Delta(V_t)$, it appears that total wealth grows with the interest rate on previous wealth stock plus the non-resource primary balance.

Option 1: Net wealth constant in real terms

Dividing the above equation by the price level to express all variables in real terms, we get: [51]

$$w_t = \frac{(1+i)}{(1+\pi)} \cdot w_{t-1} + nrpb_t = (1+r).w_{t-1} + nrpb_t$$

with $w_t = \frac{W_t}{P_t}$ and $nrpb_t = \frac{NRPB_t}{P_t}$; $1 + r = \frac{(1+i)}{(1+\pi)}$ (which is the definition of the real interest rate).

Then, it appears that if, $\forall i \geq 0$, $nrpb_{t+i} = -r.w_{t-1}$, then $w_{t+i} = w_{t-1}$. In other words, if real NRPB is set at a constant value from period t onwards: $\boldsymbol{nrpb_{t+i} = -r.w_{t-1}}$ (with t being current year), then real wealth will be stabilized at its value t-1 in all subsequent years $t+i$.

Under this assumption, real expenditure would be equal to real non-resource revenue plus the real return on net wealth: $e_{t+i} = nrt_{t+i} + r.w_{t-1}$.[52]

In practice, w_{t-1}, is the latest data available, while $nrpb_{t+i}$ is the constant balance from the current year onwards. If current year is 2023, then the constant $nrpb$ equal to $-r.w_{2022}$, would maintain net wealth constant in real terms from end-2022 onwards.

Note that, while $nrpb_t$ is constant in real terms, the ratio of non-resource primary balance to non-resource GDP will, by construction, decline over time, since real $nrpb_t$ is divided by real GDP (assuming identical deflators for numerator and denominator), with real GDP expected to grow. In other words, if $w_{t-1} > 0$, and real $nrpb_{t+i}$ is a deficit ($-r.w_{t-1} < 0$); then this deficit, in percent of non-resource GDP, will decline over time.

Option 2: Net wealth constant as a share of non-resource GDP

For simplicity, we use the term "GDP" in the rest of this section to denote "nominal non-resource GDP". Dividing the above equation by GDP to express all variables in percent of GDP, we get:

$$w_t = \frac{(1+i)}{(1+g)} \cdot w_{t-1} + nrpb_t = \frac{(1+r)}{(1+g_r)} \cdot w_{t-1} + nrpb_t$$

With $w_t = \frac{W_t}{Y_t}$; $nrpb_t = \frac{NRPB_t}{Y_t}$; $1 + g_r = \frac{(1+g)}{(1+\pi)}$ (g is nominal GDP growth, while g_r denotes real GDP growth); and $1 + r = \frac{(1+i)}{(1+\pi)}$.

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[51] ***For simplicity, we use the same variable names across the 3 options, but they refer to different concepts***. For instance, $nrpb_t$ refers to $NRPB_t/P_t$ in option 1, to $NRPB_t/Y_t$ in option 2, and to $NRPB_t/(P_t.Pop_t)$ in the third option.

[52] In terms of growth rate, real expenditure growth is equal to the weighted average of non-resource revenues real growth (which should grow at about the rate of real non-resource GDP) and the growth rate of real wealth (which is zero by construction, since it is stable). Thus, real expenditure growth should be below the growth on real non-resource GDP (and, given the weight nrt/e, could be significantly below if non-resource revenues are a small share of total expenditure). Thus, the ratio of expenditure to non-resource GDP would decline over time.

Then, it appears that if, $\forall i \geq 0$, $nrpb_{t+i} = -\dfrac{(r - g_r)}{(1 + g_r)} \cdot w_{t-1} = -\dfrac{(i - g)}{(1 + g)} \cdot w_{t-1}$, then $w_{t+i} = w_{t-1}$ in all subsequent periods $t + i$. Thus, the ratio of net wealth-to-GDP is stabilized at its more recent value if the ratio NRPB-to-GDP is set constant at $\boldsymbol{nrpb_{t+i} \approx -(r - g_r).w_{t-1}}$.

Under this assumption, the expenditure-to-GDP ratio would be equal to the non-resource revenue ratio plus the growth-adjusted real return on the net wealth ratio: $e_{t+i} = nrt_{t+i} + (r - g_r).w_{t-1}$.[53]

If the interest-growth differential is negative, the income generated from the stock of net wealth[54] is insufficient to prevent net wealth from declining over time (in percent of GDP), and additional income is required by running non-resource primary surpluses in order to maintain a constant net wealth ratio. It appears from the first equation that, if i<g and $nrpb_t = 0$, then $w_t < w_{t-1}$. On the contrary, if the interest-growth differential is positive (meaning that the real return on financial wealth exceeds real GDP growth), the $nrpb$ stabilizing the wealth-to-GDP ratio is a deficit, since the positive differential is a force increasing the wealth ratio over time, all else equal.

Option 3: Net wealth constant in real per capita terms

Dividing the above equation by population and price level, to express all variables in real terms per capita, we get:

$$w_t = \dfrac{(1 + i)}{(1 + \pi).(1 + n)} \cdot w_{t-1} + nrpb_t = \dfrac{(1 + r)}{(1 + n)} \cdot w_{t-1} + nrpb_t.$$

With $w_t = \dfrac{W_t}{P_t.Pop_t}$ and $nrpb_t = \dfrac{NRPB_t}{P_t.Pop_t}$; n denotes population growth and Pop_t is population level.

It appears that if, $\forall i \geq 0$, $nrpb_{t+i} = -\dfrac{(r - n)}{(1 + n)} \cdot w_{t-1}$, , then $w_{t+i} = w_{t-1}$. Thus, real net wealth per capita is stabilized in subsequent years at its value *t-1* if real NRPB per capita is kept constant at the value: $\boldsymbol{nrpb_{t+i} \approx -(r - n).w_{t-1}}$.

Retrieving nominal values and comparing the three options

In this section, $NRPB_t$ and W_t denote the non-resource primary balance and wealth in nominal terms.

For option 1, $NRPB_t = -r.w_{t-1}.P_t = -r.W_{t-1}.(1 + \pi)$. And given that the non-resource primary balance is kept constant in real terms, its value in nominal terms in subsequent periods is: $NRPB_{t+i} = NRPB_t.(1 + \pi)^i = \boldsymbol{-r.W_{t-1}.(1 + \pi)^{i+1}}$.

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[53] Assuming that the ratio of non-resource revenues to non-resource GDP is constant, this means that the expenditure ratio is constant (since w_{t-1} is constant), which means that nominal expenditure grows like nominal non-resource GDP.

[54] Recall that, in nominal terms, $\Delta(A_t - D_t) = NRPB_t + RT_t + i.(A_{t-1} - D_{t-1})$ and $\Delta(V_t) = i.V_{t-1} - RT_t$. Then, $\Delta(W_t) = i.W_{t-1} + NRPB_t$. Therefore, wealth increases automatically through both the actual return on financial wealth and the notional return on resource wealth.

For option 2, $NRPB_t = -\dfrac{(r - g_r)}{(1 + g_r)} \cdot w_{t-1} \cdot Y_t = -(r - g_r) \cdot W_{t-1} \cdot (1 + \pi)$. And given that the non-resource primary balance is kept constant in percent of GDP, its value in nominal terms in subsequent periods is: $NRPB_{t+i} = NRPB_t \cdot (1 + g)^i = -(r - g_r) \cdot W_{t-1} \cdot (1 + \pi)^{i+1} \cdot (1 + g_r)^i$.

For option 3, $NRPB_t = -\dfrac{(r - n)}{(1 + n)} \cdot w_{t-1} \cdot P_t \cdot Pop_t = -(r - n) \cdot W_{t-1} \cdot (1 + \pi)$. And given that the non-resource primary balance is kept constant in real per capital terms, its value in nominal terms in subsequent periods is: $NRPB_{t+i} = NRPB_t \cdot [(1 + \pi) \cdot (1 + n)]^i = -(r - n) \cdot W_{t-1} \cdot (1 + \pi)^{i+1} \cdot (1 + n)^i$.

The comparison of the options is not straightforward and depends on the value of the parameters. If population grows at a slower pace than real non-resource GDP, option 2 would often set a tighter benchmark for the nominal non-resource primary balance than option 3, that is $NRPB_t^2 > NRPB_t^3$. For instance, if $g_r > 0$ and $n = 0$, $NRPB_t^2 > NRPB_t^3 \Leftrightarrow r < \dfrac{g_r \cdot (1+g_r)^i}{(1+g_r)^i - 1}$, a condition that is likely to be met for standard parameter values. More generally, simple simulations confirm that option 2 tends to be more restrictive in a majority of cases.

The comparison of option 1 with options 2 and 3 depends also on the value of r. For instance, if $r = 0$ or $r = g_r$, it is easy to show that option 2 sets a tighter benchmark for the nominal non-resource primary balance than option 1: $NRPB_t^2 > NRPB_t^1$. But if r is larger than g_r, option 1 may become tighter than option 2. Indeed, $NRPB_t^2 < NRPB_t^1 \Leftrightarrow r > \dfrac{g_r \cdot (1+g_r)^i}{(1+g_r)^i - 1}$; a condition that may require very high interest rates, except if growth is very small (note that if $g_r = 0$, this condition would be met for any positive r). Thus, in most cases, option 1 would set looser benchmarks than option 2.

Conversion of resource wealth into financial wealth

As shows above, net wealth is composed of financial wealth and resource wealth: $W_t = A_t - D_t + V_t$.

Each year, nominal resource wealth declines by $\Delta(V_t) = i \cdot V_{t-1} - RT_t$. The depletion by RT_t reflects the revenues from natural resources extracted from the ground that year.

And each year, net financial wealth increases by $\Delta(A_t - D_t) = NRPB_t + RT_t + i \cdot (A_{t-1} - D_{t-1})$. For instance, in option 1, $\Delta(A_t - D_t) = RT_t - r \cdot W_t + i \cdot (A_{t-1} - D_{t-1})$. This means that, beyond the automatic increase due to returns $i \cdot (A_{t-1} - D_{t-1})$, all resource revenues RT_t are saved except the portion $r \cdot W_t$ that is consumed. Alternatively, given that $E_t = NRT_t - NRPB_t = NRT_t + r \cdot W_{t-1} \cdot (1 + \pi)$, it appears that the government can spend all non-resource revenues plus a portion of the resource revenues corresponding to the return on net wealth. In options 2 and 3, lower (higher) amounts are saved (consumed). For instance, in option 2 the government can only consume the GDP growth-adjusted returns of wealth, while in option 3, it can consume the population growth-adjusted returns (in addition to non-resource revenues).

Total wealth remains constant (in real terms, or in percent of GDP, or per capita depending on the option), but its composition changes over time. Thus, the decline in resource wealth (in real terms, or in percent of GDP, or

per capita) is exactly compensated by an increase in net financial wealth (in real terms, or in percent of GDP, or per capita) due to savings.[55]

However, the equality between the decline in resource wealth and the increase in net financial wealth does not hold in nominal terms. This is obvious since total nominal wealth is not constant over time under options 1 to 3.[56] Nominal net wealth would only be constant under the following condition: $-\Delta(V_t) = \Delta(A_t - D_t) \Leftrightarrow NRPB_t = -i.(A_{t-1} - D_{t-1}) - i.V_{t-1} = -i.W_{t-1}$. This differs from the above formulas for the three options. For instance: $NRPB_t = -i.W_{t-1} \approx -(r + \pi).W_{t-1}$ is distinct from option 1 where: $NRPB_t = -r.(1 + \pi).W_{t-1}$.

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[55] The framework implicitly sets targets for net financial wealth every year. For instance, under option 1: $a_t - d_t = w - v_t$ (with all variables expressed in real terms).

[56] Depending on the selected option, total net wealth in nominal terms grows at the rate of (1) inflation, keeping it constant in real terms; or (2) nominal non-resource nominal GDP growth, keeping it constant as a share of non-resource GDP; or (3) inflation plus population growth, keeping it constant in real per capita terms.

Appendix 2. Choice of Operational Rules

This Appendix discusses the pros and cons of various operational rules that could be considered to support the fiscal anchor—with the exception of the expenditure rule already mentioned in the main text.

Overall or primary balance rule[57]

The simplest operational rule is probably the overall balance rule, which can take the form of a minimum fiscal surplus (if the balance is positive) or a deficit ceiling (if the balance is negative). The fiscal balance is measured as total government revenue minus total government spending. Associating a fiscal anchor with an overall balance rule is a common combination for fiscal frameworks in the world.[58]

Beyond its simplicity and transparency, an advantage of the overall balance rule is that it is relatively easy to calibrate in a manner that is consistent with the anchor. Simple formulas relate the overall balance to net debt (or, equivalently, net financial assets). And, provided that estimates of potential growth are available, these formulas can help set the overall balance target that would bring net debt to its anchor level at the end of a predetermined period (see IMF 2018a). This is not a small benefit, since one of the main weaknesses of fiscal frameworks worldwide is that the various rules are often mutually inconsistent and not calibrated in a holistic manner.

However, the overall balance rule can prescribe a very procyclical and unstable fiscal stance. To maintain the nominal balance target, the short-term volatility of revenues (both resource and non-resource) must be offset on the spending side. Relatedly, the rule may allow a temporary increase in revenue to drive a permanent increase in expenditure. To address these problems, the rule can be adjusted for the business and commodity price cycles. But these adjustments raise other problems (Box A2).

Box A2: Challenges with Correcting the Fiscal Balance for the Commodity Price Cycle

The starting assumption is that government revenues can be decomposed into a "structural" (trend) component, a cyclical component related to the business cycle of the non-resource economy, and another cyclical component related to the commodity prices' short-term cycle. The cyclically-adjusted balance (CAB) excludes the two cyclical components by filtering out the effect of high-frequency shocks.[59]

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[57] The arguments are broadly similar for the overall balance rule and the primary balance rule (which excludes net interest payments from expenditure). The only differences between these two rules are that (1) governments have better control of the primary balance than the overall balance, thus the primary balance rule may be easier to comply with; but (2) this latter rule is more likely to place net debt on an unsustainable path, as explained in section IV.B on the FSF.

[58] In general, this combination takes the form of a debt-to-GDP ceiling associated with a deficit-to-GDP ceiling.

[59] Conceptually, it is important to distinguish between the short-term volatility of commodity prices (high-frequency cycle) from tail risks that manifest through less frequent, sharp and persistent declines in prices (long-term uncertainty). The policy response to the first issue is to select and use an operational rule with good stabilizing properties (e.g., CAB rule, expenditure rule or non-resource balance rule). As discussed in the sections on the fiscal anchor, the response to the second issue is to set a prudent financial asset floor or debt ceiling—this creates a fiscal buffer that will be tapped when tail risks materialize, thereby smoothing the necessary adjustment.

The "CAB rule" is a ceiling imposed to the CAB, generally expressed in percent of potential GDP. For instance, a possible rule could be that the CAB should not exceed 3 percent of potential GDP.

Implementing the CAB rule requires capacity to estimate both the economic and commodity cycles. There has been much discussion about the difficulty in measuring the economic cycle and the possible policy bias created by CAB rules (see Eyraud and others, 2018).[60] But the commodity cycle poses even greater challenges. Commodity prices are indeed subject to several cycles of various frequencies, including very long "super-cycles." In practice, it may be difficult to separate the underlying trend, the short cycle, and the long cycle, and estimate their respective impacts on revenue. This is in part because commodity price shocks display high persistence. In the case of oil, for instance, prices have been found to behave like a random walk without drift, and most shocks seem to be "permanent."

This problem is compounded by the way "structural" commodity prices (which are used to estimate cyclically-adjusted resource revenues) are usually calculated. When they are not determined by an independent committee, they are often computed as moving average of either past prices or both past spot prices and futures market prices. If shocks are persistent and the degree of smoothing is elevated (for example through a long moving-average formula), both the size of average forecasting errors and the length of same-sign forecast errors will be high. Furthermore, f the estimates of structural resource prices are very correlated with actual prices, there will not be much difference between the CAB and the nominal balance, and fiscal policy dictated by the rule is likely to remain highly procyclical despite the adjustment.

Non-resource (primary) balance rule

The main strength of the non-resource balance rule is that it delinks expenditure from resource revenues, which mitigates greatly the risk of procyclicality and leads to a more stabilizing fiscal stance. The rule decouples fiscal policy from volatile commodity prices and volumes in the short run, and, in time, as financial buffers are built, also from less frequent and larger shocks. It should be noted that, although the rule insulates policy from the resource cycle, there is a residual degree of procyclicality associated with the non-commodity economy, which can be addressed by applying a cyclical adjustment (Box A2).

A key challenge of this type of rule is calibration. Like all types of fiscal balance rules that exclude selected expenditure or revenue items (e.g., current balance rule, golden rule, rule that excludes grant revenue, etc.), compliance with the rule does not guarantee convergence towards the anchor, since the excluded items, which, in this case, can be very volatile, impact also the government's financing needs. As such, this type of rule may be a better option if the main objective is to promote macroeconomic stability and not as useful when the main objective is to build buffers or reduce debt vulnerabilities. That said, the non-resource balance could be re-calibrated every, say, 3-5 years (or at another frequency) to ensure that the country is converging towards the anchor.

An additional practical difficulty is separating between revenue (and spending) associated with resources versus "other" revenue and spending. Finally, the non-resource balance rule can create difficulties of

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[60] The computation of the nonresource cycle and nonresource automatic stabilizers is more complex in resource-rich countries than in diversified economies, because the nonresource cycle can be strongly affected by the volatility of resource revenues.

communication with the public, which may not understand why all resource revenues are removed from the indicator targeted by the government. It may also be confusing for a non-technical audience that the rule is likely to be expressed as a deficit ceiling on the non-resource balance when the overall fiscal position (including resources revenues) typically generates a surplus. All these issues argue in favor of using an expenditure rule instead, but the choice will depend on country circumstances.

Revenue allocation rules

These rules focus on allocating resource revenues between a portion that is saved and a portion that is used in the budget. The excess (deficit) of actual resource revenues relative to budgeted revenues is generally accumulated in (withdrawn from) a resource fund. Several types of rules function like this:

- *Revenue split rules* set aside a certain percentage of revenues using an ad hoc criterion. For instance, the rule may require saving revenues above a certain threshold, such as the amount initially budgeted or the average of past revenues. Or the rule may require saving a predetermined percentage of commodity revenues.
- *Price smoothing rules* are also meant to split revenues, but the allocation criterion is more complex and involves the calculation of a reference price. If actual resource revenues exceed resource revenues consistent with the reference price of the commodity, the difference is saved and can be used in periods of shortfall. In other words, only the "reference revenues" are made available to the budget and can be spent. Reference prices are derived from an automatic formula (for example, average of past and future prices) or provided by an independent committee using economic analysis and judgment.

An important weakness of the revenue allocation rules is that they only constrain the split of revenues (between savings and spending) but do not impose limits on borrowing. In an extreme scenario, such rules might require setting aside all commodity revenues, but the fiscal position could still deteriorate significantly if a high level of spending is financed through borrowing. Thus, these rules might not be sufficient to achieve macroeconomic stability, and they do not guarantee that the fiscal anchor is eventually achieved.

Appendix 3. Transition Path Under the NFACR After a Positive and Persistent Revenue Shock

This Appendix proposes a simple correction mechanism to allow the gradual accumulation of the NFA buffer after a resource revenue shock that is both positive and persistent. For simplicity, we assume that the initial NFACR is 3, with 30 of NFA divided by 10 of resource revenues. The simulation assumes that resource revenues increase durably from 10 to 13, but the degree of persistence of the shock is not known immediately when it occurs. If the shock proves to be temporary, assuming that 13 is the new steady state for revenue could be wrong and lead to undesirable policy responses—e.g., an initially large increase in spending followed by abrupt cuts to realign the expenditure envelope with available resources. More generally, given the uncertainty on future prices, a reactive approach where spending responds one-to-one to revenue changes would result in frequent budget adjustments (upwards and downwards), which would create some volatility and undermine macroeconomic stability.

This Appendix proposes a smoother response to the shock. The objective is still to accumulate NFA gradually as the authorities discover whether the shock is persistent or not, and, if the shock turns out to be less persistent, can adjust (that is, pause or even offset the moderate spending increase that has already taken place). This is possible if, when there is a revenue windfall, spending increases only gradually. Because spending does not increase immediately as much as the revenue windfall, this generates savings, which leads to a steady accumulation of NFA.

As mentioned in the main text, the NFA buffer should protect the budget from volatility—that is be sufficiently large to accommodate the loss of revenues that were expected to fund the budget. The NFACR, in this transition path (when it is not clear what will be the new steady state) could be calculated as the *stock of NFA divided by commodity revenues that are used to fund the annual budget*. The government could respond to the initial increase in revenue by spending any surprise revenue in a similar proportion to the anchor (e.g., if the anchor is 3, only spend one fourth of the revenue surprise and save the rest), and gradually increase spending if the higher revenue proves to be more persistent—always in a way that keeps the NFACR stable at 3 in all years. Eventually, if the rise in commodity prices proves persistent, annual spending would eventually increase by 3, similar to the increase in commodity revenues, and the buffers would go to 39. This allows a gradual increase in both spending and financial assets.

Table A1 shows the transition dynamics and the calculation of the NFACR, as defined in the previous paragraph. We assume that the overall balance is initially zero (with spending equal to 10 and zero non-resource revenue). Going forward, changes in both the spending and NFA paths are solely the result of the decision to spend/save the commodity revenue windfall. Absent any revenue windfall, spending and NFA would remain constant at their initial values (respectively 10 and 30).

In year 1, the country starts from the steady state with an NFACR ratio of 3, a nominal NFA of 30 and 10 of resource revenues going annually to the budget (which is equal to actual revenue, since this is the steady state). The table illustrates the policy response to a positive shock to commodity revenues that brings realized (actual) revenue to 13 from year 2 onward.

In year 2, the "budget revenue baseline" (which is the revenue assumption used for budget purposes) is still 10 since the authorities do not know if the shock will be persistent or not. The revenue windfall is then 3 (13 minus

10), with one quarter going to the budget to fund additional spending (hence, revenues going to the budget are 10.75 = 10 plus one quarter of 3) and three quarters being saved as extra NFA, which therefore increases from 30 to 32.25 (= 30+ ¾ *3). Spending increases by 0.75 relative to the pre-shock baseline. Thus, in year 2, the revenue going to the budget is 10.75. The budget records a fiscal surplus of 2.25 (that is, 13 of actual revenue minus 10.75 of spending), which raises the stock of NFA by the same amount. The NAFCR, defined as NFA divided by revenues used to fund the budget, is still equal to 3 (= 32.25/10.75).

In year 3, the new revenue baseline is 10.75, which we assume to be the revenues that went to the budget in the previous year.[61] The windfall is now lower (13 minus 10.75) and one quarter goes to the budget for additional spending (0.56 = 1/4 *2.25), while three quarters go to savings (1.69 = ¾* 2.25). Cumulatively, spending is higher by 1.31 (= 0.75 + 0.56) relative to the pre-shock baseline of 10. And the NFA stock increases to 33.94, up by 1.69 compared to the previous year (1.69 is the fiscal surplus). The revenue going to the budget is 11.31 (=10.75+0.56) and the nominal NFA is 33.94 (=32.25 + 1.69), maintaining the NFACR at 3. Thereafter, the nominal NFA converges gradually to 39 after 35 periods.

The table below show that the mechanism converges very slowly. In this example, it takes two decades for the NFA to get back to 39. But this method should not be used in a mechanical way. The table shows that most of the transition is achieved in the first years.[62] Thus, the ¼-¾ allocation principle between spending and saving windfalls should be applied in the initial years; but, after a while, when spending has already increased significantly, the country could make an ad hoc adjustment (for instance, spending has already increased by 2.77 in year 10 and could be adjusted by another 0.23 to 3 in a single year). Overall, the essence of the argument is that it is possible and desirable to engineer a gradual accumulation of the buffer after a positive shock (rather than an abrupt one).

Table A1. Policy Response to a Positive Revenue Windfall

year	1	2	3	4	5	6	7	8	9	10	11	12	...	20
Budget revenue baseline (1)	10.0	10.0	10.8	11.3	11.7	12.1	12.3	12.5	12.6	12.7	12.8	12.8	...	13.0
Actual revenue (2)	10.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	...	13.0
Revenue windfall = (2) - (1)	0.0	3.0	2.3	1.7	1.3	0.9	0.7	0.5	0.4	0.3	0.2	0.2	...	0.0
Three quarters of windfall is saved	0.0	2.3	1.7	1.3	0.9	0.7	0.5	0.4	0.3	0.2	0.2	0.1	...	0.0
One quarter of windfall is spent in the budget (3)	0.0	0.8	0.6	0.4	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.0	...	0.0
Revenue used to fund annual budget (= spending) = (1) + (3) = (4)	10.0	10.8	11.3	11.7	12.1	12.3	12.5	12.6	12.7	12.8	12.8	12.9	...	13.0
Fiscal balance = (2) - (4) = (5)	0.0	2.3	1.7	1.3	0.9	0.7	0.5	0.4	0.3	0.2	0.2	0.1	...	0.0
NFA (nominal; end of period) = NFA previous year + (5) = (6)	30.0	32.3	33.9	35.2	36.2	36.9	37.4	37.8	38.1	38.3	38.5	38.6	...	39.0
NFACR = (6)/(4)	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**	**...**	**3.0**

[61] In this example, the budget revenue baseline in each year is assumed to be equal to the revenue used to fund the budget in the previous year.

[62] In the main text, Figure 11 shows the transition path during the first 12 years (using the same assumptions as in this Appendix), and the NFA is almost equal to 39 in year 12.

Appendix 4. Debt Rule Calibration for Commodity Producers: A Case Study

As discussed in Section VI, the anchor can be either a floor on financial assets or a ceiling on debt depending on country circumstances. In this appendix, we focus on the calibration of the debt ceiling by integrating key commodity producers' features into the IMF debt calibration toolkit (IMF 2018a). As a case study, we perform an illustrative calibration exercise to identify a prudent debt anchor for Colombia, a country moderately dependent on oil revenue.

The standard calibration exercise consists of three main steps. First, we assume a debt limit (that is the threshold beyond which a debt distress is likely to occur with high probability) of 80 percent of GDP, taking into account the debt carrying capacity of Colombia and the IMF Debt Sustainability Framework for market access countries. Secondly, we estimate the required safety margin to ensure that there is sufficient borrowing space between the debt anchor and the debt limit to respond to shocks. This step involves stochastic simulations to gauge the potential impact of macroeconomic and fiscal shocks on debt over the medium-term. We start by estimating the joint distribution of macroeconomic and fiscal shocks experienced by Colombia using data on real GDP growth, real effective interest rates, real exchange rates, terms of trade gaps, and external loan disbursements for the period 1990-2020. These shocks are then used to perform simulations of future debt trajectories over a 8-year horizon using a system of simultaneous equations formed by the debt accumulation equation and a fiscal reaction function in which the level of the primary balance responds to realizations of macroeconomic variables, including past debt. Finally, the debt trajectories are summarized in a fan chart, which allows to set the debt anchor and calculate the probability that public debt would remain below the maximum debt limit in the medium-term. Figure A1, Panel A displays the fan chart in the baseline with the default 2018 parameterization, including a 5 percent risk tolerance. It shows that, without accounting for the specificities of resource-rich countries, a debt-to-GDP ratio of around 70 percent would be considered a safe debt anchor for Colombia.

Next, we integrate some new features specific to commodity producers to calibrate the debt anchor. Three main changes are made to the 2018 framework (IMF 2018a) to make it more pertinent for commodity producers:

- First, the 2018 framework computes the terms of trade gaps using the overall goods and service terms of trade. We now use a commodity-based terms of trade, which is more relevant for commodity exporters (Gruss and Kebhaj 2019).
- Second, the 2018 methodology assumes a symmetric reaction of primary balance to terms of trade gaps. Our analysis differentiates between the effects of negative and positive terms of trade gaps to account for the non-linearity in the response of primary balances to terms of trade shocks. For instance, primary balances often improve (deteriorate) during commodity price booms (busts). But the improvement during booms is usually less significant than the deterioration in fiscal balances when prices crash due the procyclicality of government spending which leads to overspending in good times.
- Third, the 2018 toolkit relied on the estimation of fiscal reaction functions for a global sample of emerging markets. In our analysis, the sample focuses solely on commodity producers to improve the representativeness of the fiscal policy response. Countries that are heavily dependent on resource

revenue (like Saudi Arabia, Azerbaijan) for which a financial asset buffer is more appropriate are also excluded from the sample.[1] The list of countries is presented in Table A2.

Table A2: List of countries and Parameterization	
List of Countries	**Parameters Calibration**
Algeria, Angola, Bolivia, Botswana, Burkina Faso, Cameroon, Central African Republic, Chad, Colombia, Republic of Congo, Cote d'Ivoire, Democratic Republic of the Congo, Ecuador, Gabon, Ghana, Guinea, Guyana, Indonesia, Iran, Liberia, Mali, Mauritania, Mexico, Mongolia, Mozambique, Niger, Nigeria, Papua New Guinea, Peru, Russian Federation, Sierra Leone, South Africa, Sudan, Yemen, Zambia, Zimbabwe	<table><tr><td>**Parameters**</td><td>**Values**</td></tr><tr><td>Last year debt to GDP ratio (%)</td><td>65.7</td></tr><tr><td>Debt limit (% of GDP)</td><td>80</td></tr><tr><td>Risk Tolerance (%)</td><td>5</td></tr><tr><td>Average historical growth rate (% of GDP)</td><td>3.2</td></tr><tr><td>Average historical primary balance (% of GDP)</td><td>0.38</td></tr></table>

We estimate the fiscal reaction function below following standard specifications in the literature (Baum and others 2017, IMF 2018, Goncalves, and Perrelli, 2022) using data mainly from the World Economic Outlook database, and the International Debt Data Statistics.

$$pb_{it} = \alpha_i + \rho pb_{it-1} + \beta_1 P_{it} totgap_{it} + \beta_2 (1 - P_{it}) totgap_{it} + \theta d_{t-1} + \varphi X_{it} + \varepsilon_{it} \ldots$$

where pb is the primary balance to GDP ratio, $totgap$ is the deviation of terms of trade (based on the commodity terms of trade series constructed by Gruss and Kebhaj (2019)) from trend,[2] P_{it} is an indicator variable for positive terms of trade gaps, d_{t-1} is the debt to GDP ratio in the preceding year, α_i are country-fixed effects, and X_{it} is a set of control variables including the public and publicly-guaranteed external disbursements. The results are presented in Table A3. The estimated coefficients are used in the debt calibration toolkit to estimate the debt anchor for Colombia.

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[1] Any economy where resource revenue accounts for more than 50 percent of general government revenue in 2020 is excluded from the estimation.

[2] Both gaps are constructed using the filter proposed by Hamilton (2017).

Table A3: Estimation of Fiscal Reaction Functions

	Primary balance
Lag of primary balance to GDP ratio	0.359***
	(0.0510)
Lag of debt to GDP ratio	0.0160***
	(0.00465)
Negative output gap	0.0904**
	(0.0339)
Negative terms of trade gap	0.119*
	(0.0621)
Postive terms of trade gap	0.299***
	(0.0479)
External disbursement	-0.159*
	(0.0927)
Constant	-0.948**
	(0.459)
Observations	851
R-squared	0.321
Number of ifscode	37
Number of groups	
Robust standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Figure A1, Panel B shows that accounting for the specific features of commodity producers affects significantly the estimated prudent debt level. The debt anchor is revised downward to around 55 percent of GDP. This result implies that, to comfortably withstand repeated negative shocks, like those experienced in the past, without endangering fiscal sustainability, Colombia would have to keep an additional buffer of around 15 percent of GDP compared to the default calibration for which specific risks related to oil revenue are not considered.

Figure A1: Effect of Tailoring the Calibration of the Debt Anchor to Commodity Producers

A. Default Toolkit

B. Accounting for Commodity Revenue Risks
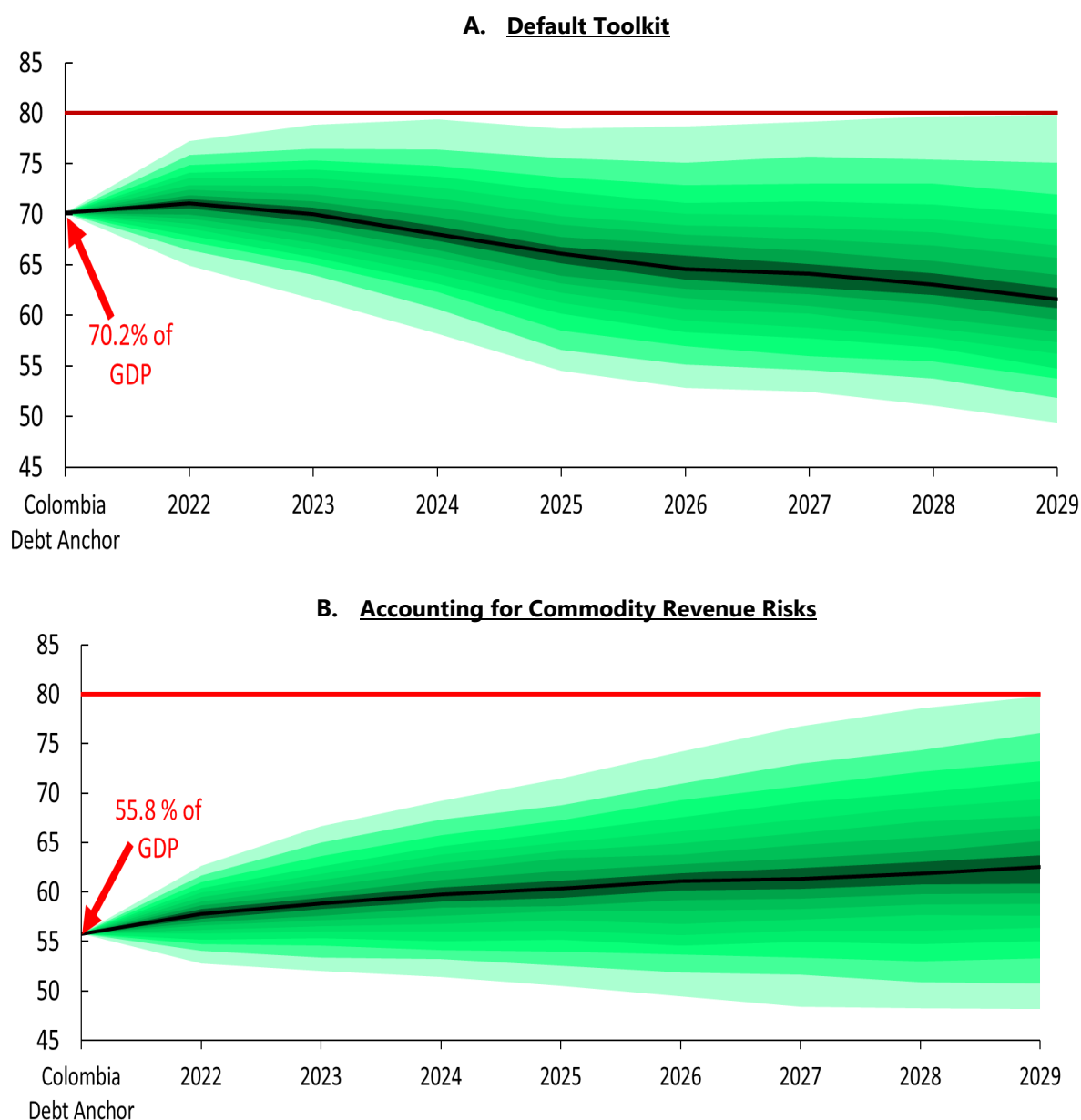
Source: authors' estimates.
Note: The calibration used a tailored version of the FAD (2018) debt calibration toolkit for Emerging Economies.

References

Alfaro, Laura, and Fabio Kanczuk. 2009. "Optimal reserve management and sovereign debt." Journal of International Economics. Volume 77, Issue 1, February 2009, Pages 23-36

Arezki, Rabah and Kareem Ismail. 2013. Boom–bust cycle, asymmetrical fiscal response and the Arezki, R. and K. Ismail. 2013. Boom–bust cycle, asymmetrical fiscal response and the Dutch disease. Journal of Development Economics 101(2013), pp 256-267.

Asatryan, Z., C. Castellón, and T. Stratmann. 2018. Balanced budget rules and fiscal outcomes: Evidence from historical constitutions, Journal of Public Economics, Volume 167, November 2018, Pages 105-119.

Badinger, H. and W. H. Reuter, The case for fiscal rules, Economic Modelling, Volume 60, 2017, Pages 334-343.

Bauer, A. and D. Mihalyi. 2015. Why Weren't Governments Better Prepared for the Commodity Price Crash? Natural Resource Government Institute's blogs.

Baunsgaard, T., M. Villafuerte, M. Poplawski-Ribeiro, and C. Richmond. 2012. "Fiscal Frameworks for Resource Rich Developing Countries." IMF Staff Discussion Note 12/04, International Monetary Fund, Washington, DC.

Bornhorst, F., A. Fedelino, J. Gottschalk, and G. Dobrescu. 2011. "When and How to Adjust Beyond the Business Cycle—A Guide to Structural Fiscal Balances." IMF Technical Notes and Manuals 2011/02, International Monetary Fund, Washington, DC.

Bova, E., P. Medas, and T. Poghosyan. 2016. "Resource Revenue Volatility and Macroeconomic Stability in Resource-rich Countries: The Role of Fiscal Policy", IMF working paper 16/36, International Monetary Fund, Washington, DC.

Burret, H. and J. Schnellenbach. 2013. "Implementation of the Fiscal Compact in the Euro Area Member States." Working Paper 08/2013, German Council of Economic Experts.

Caputo, R. and R. Valdés (2016) A fiscal vaccine against the Dutch disease, Applied Economics Letters, 23:1, 68-73.

Carpantier, J.F. and W. N. Vermeulen, 2021, Success and failures of SWFs: On the macroeconomic performance, time-varying objectives and first liquidations of Sovereign Wealth Funds," LIDAM Discussion Paper, IRES 2021/06.

Caselli, F., H. Davoodi, C. Goncalves, G.H. Hong, A. Lagerborg, P. Medas, A. Minh Nguyen, and J. Yoo. 2022. "The Return to Fiscal Rules." IMF Staff Discussion Note, International Monetary Fund, Washington, DC.

Caselli, F., J. Reynaud. 2020. Do fiscal rules cause better fiscal balances? A new instrumental variable strategy, European Journal of Political Economy, Volume 63, 2020.

Céspedes, L., and A. Velasco. 2014. "Was This Time Different? Fiscal Policy in Commodity Republics." Journal of Development Economics 106 (January): 92–106.

Coutinho, L., D. Georgiou, M. Heracleous, A. Michaelides, S. Tsani. 2022. Limiting Fiscal Procyclicality: Evidence from Resource-Dependent Countries. Economic Modelling Volume 106, January 2022, 105700.

Crain, M. and J. Devlin. 2003. "Nonrenewable Resource Funds: A Red Herring for Fiscal Stability?", Paper presented at the annual meeting of the American Political Science Association, Philadelphia, PA, 27 August (2003).

Davis, J., R. Ossowski, J. Daniel, and S. Barnett. 2001. "Stabilization and Savings Funds for Nonrenewable Resources: Experience and Fiscal Policy Implications", IMF occasional paper 205, International Monetary Fund, Washington, DC.

Davoodi, H., P. Elger, A. Fotiou, D. Garcia-Macia, A. Lagerborg, R. Lam, and S. Pillai. 2022. "Fiscal Rules Dataset: 1985-2021", International Monetary Fund, Washington.

Davoodi, H., P. Elger, A. Fotiou, D. Garcia-Macia, X. Han, A. Lagerborg, W. R. Lam, and P. Medas. 2022. Fiscal Rules and Fiscal Councils Recent Trends and Performance during the COVID-19 Pandemic, IMF WP/22/11, ", International Monetary Fund, Washington, D.C.

Dudine, P., W. R. Lam, and E. Ture. 2019. Colombia: Establishing a debt anchor and updating the fiscal rule, Technical Report, August 2019. International Monetary Fund, Washington, D.C.

Ebrahim Zadeh, C. 2003. "Back to Basics - Dutch Disease: Too much wealth managed unwisely" Finance and Development.

El Badawi, I., R. Soto and H. Youssef. 2018. Sovereign Wealth Funds and Macroeconomic Stabilization in the Home Country. Working paper No 1175, Economic Research Forum.

Engel, E. and R Valdes. 2000. "Optimal Fiscal Strategy for Oil Exporting Countries." IMF Working Paper WP/00/118.

Escolano, J. 2010. "A Practical Guide to Public Debt Dynamics, Fiscal Sustainability, and Cyclical Adjustment of Budgetary Aggregates." IMF Technical Notes and Manuals 2010/02, International Monetary Fund, Washington, DC.

European Commission. 2012. "Communication from the Commission. Common Principles on National Fiscal Correction Mechanisms." COM(2012) 342.

European Commission. 2017. "Report From The Commission presented under Article 8 of the Treaty on Stability, Coordination and Governance in the Economic and Monetary Union." C(2017) 1201.

Eyraud, L, X Debrun, A Hodge, V Lledó, and C Pattillo. 2018. "Second-Generation Fiscal Rules: Balancing Simplicity, Flexibility, and Enforceability", IMF Staff Discussion Notes 18/04.

Eyraud, L. and A. Weber. 2013. "The Challenge of debt Reduction during Fiscal Consolidation." IMF Working Paper WP/13/67.

Fuentes, J. R., K. Schmidt-Hebbel, and Raimundo Soto. 2021. Fiscal rule and public investment in Chile / J. Rodrigo Fuentes, Working Paper Series 1189, Inter-American Development Bank.

Gbohoui, W, and P. Medas. 2020. "Fiscal Rules, Escape Clauses, and Large Shocks." Special Series on Fiscal Policies to Respond to COVID-19.

Gruss, B. and S. Kebhaj, 2019, "Commodity Terms of Trade: A New Database." IMF Working Paper 2019/021.

Heinemann, F., M.D. Moessinger, and M. Yeter. 2018. Do fiscal rules constrain fiscal policy? A meta-regression-analysis European Journal of Political Economy, 51 (2018), pp. 69-92

IMF. 2012a. "Macroeconomic Policy Frameworks for Resource Rich Developing Countries." IMF Policy Paper available at https://www.imf.org/external/np/pp/ eng/2012/082412.pdf

IMF. 2012b. "Macroeconomic Policy Frameworks for Resource Rich Developing Countries—Background Paper 2." IMF Policy Paper and supplements available at https://www.imf.org/en/Publications/Policy-Papers/Issues/2016/12/31/Macroeconomic-Policy-Frameworks-for-Resource-Rich-Developing-Countries-PP4698

IMF. 2015. Fiscal Monitor: The Commodities Roller Coaster. International Monetary Fund, Washington, DC, October.

IMF. 2017. "Regional Economic Outlook for Sub-Saharan Africa, October 2017, Chapter 2."

IMF. 2018a. "How to Calibrate Fiscal Rules? A Primer." FAD How-To Note 8, International Monetary Fund, Washington, DC.

IMF. 2018b. "How to Select Fiscal Rules? A Primer." FAD How-To Note 9, International Monetary Fund, Washington, DC.

IMF. 2019. Fiscal Monitor: Curbing Corruption. International Monetary Fund, Washington, DC, April.

IMF. 2021. "How to Design a Fiscal Strategy in a Resource-Rich Country." FAD How-To Note 21/01, International Monetary Fund, Washington, DC.

International Energy Agency. 2023. "Oil 2023. Analysis and Forecast to 2028."

Koh, W. 2017. Fiscal Policy in Oil-Exporting Countries: The Roles of Oil Funds and Institutional Quality (August 2017). Review of Development Economics, Vol. 21, Issue 3, pp. 567-590, 2017

Larch, M., M. Buisse, and L. Jankovics. 2021. "Enforcement of Fiscal Riles: Lessons from the Fiscal Compact." ZEW Discussion Paper No. 21-085 | 11/2021.

Larraín, F., L. A Ricci, K. Schmidt-Hebbel, H. González, M. Hadzi-Vaskov, and A. Pérez. 2019. Enhancing Chile's Fiscal Framework: Lessons from Domestic and International Experience. International Monetary Fund, Washington, D.C.

Lledo, V., M. Sasson, and S. Acevedo. 2019. Enhancing Ecuador's Fiscal Framework: Lessons from Second-Generation Rule-Based Systems. Unpublished Working Paper, International Monetary Fund, Washington, DC.

Lledó, V., S. Yoon, X. Fang, S. Mbaye, and Y. Kim. 2017. "Fiscal Rules at a Glance." 2015 IMF Fiscal Rules Database Background Note, International Monetary Fund, Washington, DC. http://www.imf.org/external/datamapper/FiscalRules/map/map.htm

Mihalyi, D. and L. Fernández. 2018. "How Did Fiscal Rules Hold Up in the Commodity Price Crash?" Natural Resource Governance Institute.

OECD. 2019. "Budgeting and Public Expenditures in OECD Countries 2019. Poland Country Profile."

Ossowski, R., M. Villafuerte, P. Medas, and T. Thomas. 2008. "The Role of Fiscal Institutions in Managing the Oil Revenue Boom." IMF Occasional Paper 260, International Monetary Fund, Washington.

Ossowski, R. 2013. Fiscal Rules and Resource Funds in Nonrenewable Resource Exporting Countries: International Experience. Discussion Paper No. IDB-DP-290. Inter-American Development Bank.

Ossowski, R., and H. Halland. 2016. Fiscal Management in Resource-Rich Countries: Essentials for Economists, Public Finance Professionals, and Policy Makers. World Bank Studies. Washington, DC: World Bank.

Pieschacon, A. 2012. The value of fiscal discipline for oil-exporting countries. Journal of Monetary Economics, 59(3), 250–268.

Santos, A. and A. M. Werner. 2015. Peru: Staying the Course of Economic Success. International Monetary Fund, Washington, DC.

Schmidt-Hebbel, K. and R. Soto. 2018. "Fiscal Rules and Fiscal Performance: World Evidence, Documentos de Trabajo 517, Instituto de Economia. Pontificia Universidad Católica de Chile.

Sugawara, N. 2014. "From Volatility to Stability in Expenditure: Stabilization Funds in Resource-rich Countries," IMF working paper 14/43, International Monetary Fund, Washington, DC.

Villafuerte, M., P. Lopez-Murphy, and R. Ossowski. 2010. "Riding the Roller Coaster: Fiscal Policies of Nonrenewable Resource Exporters in Latin America and the Caribbean." IMF Working Paper WP/10/251. International Monetary Fund, Washington, DC.

Villafuerte, M. and P. Lopez-Murphy. 2010. Fiscal Policy in Oil Producing Countries During the Recent Oil Price Cycle. IMF WP/10/28. International Monetary Fund, Washington, DC.

Villafuerte, M. 2015. "Fiscal Policy Management and Sovereign Wealth Funds." In Sovereign Funds: Fiscal Framework, Governance, and Investment, edited by Ana Maria Jul and Donghyun Park. London: Central Banking Publications.