IDB WORKING PAPER SERIES Nº IDB-WP-1187

A Fiscal Rule to Achieve Debt Sustainability in Colombia

María Angélica Arbeláez
Miguel Benítez
Roberto Steiner
Oscar Valencia

Inter-American Development Bank
Department of Research and Chief Economist

February 2021

A Fiscal Rule to Achieve Debt Sustainability in Colombia

María Angélica Arbeláez*
Miguel Benítez*
Roberto Steiner**
Oscar Valencia***

* Fedesarrollo
** Banco de la República
*** Inter-American Development Bank

February 2021

Cataloging-in-Publication data provided by the
Inter-American Development Bank
Felipe Herrera Library

A fiscal rule to achieve debt sustainability in Colombia / María Angélica Arbeláez, Miguel Benítez, Roberto Steiner, Oscar Valencia.
p. cm. — (IDB Working Paper Series ; 1187)
Includes bibliographic references.
1. Fiscal policy-Colombia-Econometric models. 2. Public investments-Colombia-Econometric models. 3. Debts, Public-Colombia-Econometric models. 4. Budget-Colombia-Econometric models. I. Arbeláez, María Angélica. II. Benítez, Miguel. III. Steiner, Roberto. IV. Valencia, Oscar. V. Inter-American Development Bank. Department of Research and Chief Economist. VI. Series.
IDB-WP-1187

http://www.iadb.org

Abstract[*]

In order to enhance fiscal sustainability and regain "investment grade" credit rating, in 2011 Colombia implemented a fiscal rule (FR) on the Central Government's structural balance. Investment grade was rapidly attained, and FR targets were complied with, until 2019. Using the Synthetic Control Method, we provide evidence that the FR promoted fiscal discipline. Nevertheless, public debt has increased continuously and is now expected to exceed 60 percent of GDP, in large part driven by the pandemic. We argue that the FR should be reformed so as to incorporate a debt anchor. Using a regime change model and the IMF's buffer risk methodology, we show that the prudent debt level should not exceed 48 percent of GDP and that in order to achieve this in the medium term, a policy mix increasing revenues to 17.8 percent of GDP (from 15.5 percent during 2016-2019) and reducing primary expenditure to 15 percent (from 16 percent during 2016-2019) is required. FR's performance would also benefit from changes in its institutional design.

JEL classifications: E37, E62, H42, H30, H60
Key words: Fiscal rules, Public debt, Synthetic control method, Debt anchor

[*] This paper is part of the Latin American and Caribbean Research Network project on "Fiscal Rules and the Behavior of Public Investment in Latin America and the Caribbean" sponsored by the IDB's Research Department and undertaken under the technical coordination of Alejandro Izquierdo, Eduardo Cavallo, Martín Ardanaz, Teresa Ter-Minassian and Carlos Végh, whose comments we greatly appreciate, as well as those from Luis Fernando Mejía. We received able research assistance from Sebastián Higuera and Sebastián Bernal. Corresponding author: María Angélica Arbeláez at marbelaez@fedesarrollo.org.co. Opinions expressed in this paper do not represent the views of Banco de la República or its Board of Directors, nor the views of the IADB or its Board of Directors. When this project began, Steiner was at Fedesarrollo.

1 Introduction

During the period 1980-1995, the indebtedness of Colombia's Central Government (CG) remained low and stable in comparison to that of other countries in the region. The increase in the debt burden in the second half of the 1990s became a source of concern, giving rise to important institutional reforms, first to sub-national government finances and in 2011 to the establishment of a fiscal rule (FR) for the CG. In contrast to what was expected when the FR was established, CG indebtedness has risen significantly; the debt-to-GDP ratio hovers around 50 percent, having doubled in the last decade, and is expected to exceed 60 percent in 2020 as a consequence of the COVID-19 crisis. On the other hand, CG investment was dynamic until 2014, after which it has declined, coinciding with the decline in oil prices.

The possibility of reforming the FR is now openly discussed. The main topic of concern is the rise in the debt burden, with many analysts taking issue with a rule that targets the structural balance, with no anchor on the debt level (see Escobar, 2019 and Clavijo, 2016). Another topic being raised is the need to strengthen the independence and technical capabilities of the FR's consultative committee and to incorporate explicit and transparent escape clauses in order to prevent the use of discretionary measures that compromise credibility, as might have happened recently when the fiscal stance was relaxed in order to absorb the Venezuelan migration shock (Perry, 2019).

In that vein, this paper assesses the functioning of the FR with an emphasis on compliance and analyzes the factors that have influenced debt dynamics. Through different quantitative exercises, we explore alternative scenarios of the FR with debt anchor. Our main goal is to provide technically grounded recommendations in order to improve the current FR framework and ensure future compliance.

The paper is organized as follows. After this introduction, the second section describes the historical evolution of fiscal frameworks aimed at pursuing fiscal sustainability at the subnational and national levels and explains in detail the current FR, focusing on compliance, debt dynamics, public investment performance and budgetary and tax restrictions. The third section presents several quantitative approaches, seeking to i) evaluate the current FR, using the Synthetic Control method; ii) estimate a prudent debt anchor, using a the regime-change approach and the IMF's buffer-risk methodology; and iii) simulate fiscal balances and debt trajectories for the next decade,

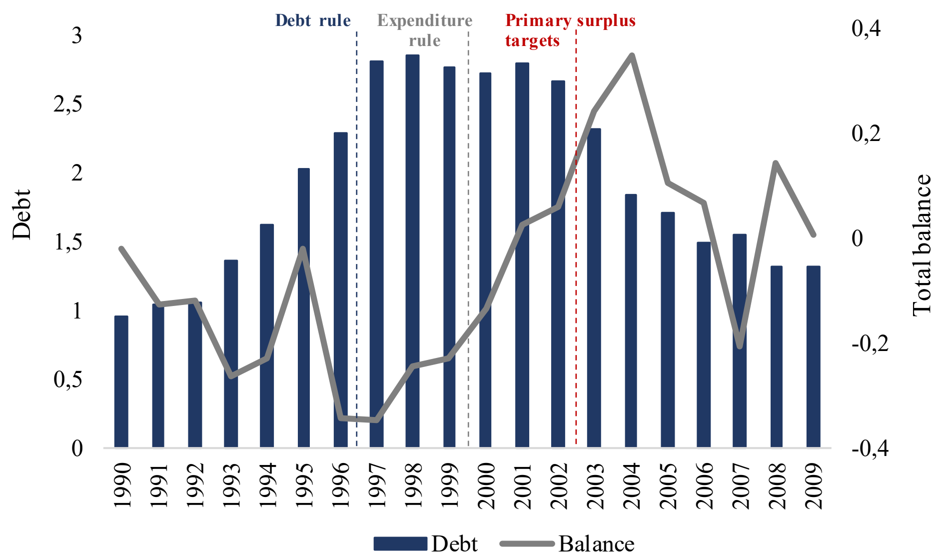
consistent with accomplishing medium-term debt targets, conditioned on different growth scenarios and additional expenditure in the short-term related with the COVID-19 emergency. To this end, we use a Neo-Keynesian General Equilibrium Model. The fourth section provides conclusions and policy recommendations.

2 The Road Leading to a Fiscal Rule for the Central Government

2.1 Rules at the Sub-National Level

Fiscal rules were first implemented for sub-national governments in response to the significant rise in their indebtedness during the 1990s (Figure 1), a result of the decentralization process derived from the 1991 Constitution. The 1997 so-called "Ley de Semáforos" ("Traffic light law") stipulated that their indebtedness could not exceed their payment capacity. It introduced liquidity-based and solvency-based metrics, and established ceilings on them. This was complemented with Law 549 of 1999 dealing with pension liabilities and Law 550 allowing subnational governments to enter into debt-restructuring agreements. Subsequently, Law 617 of 2000 restricted current expenditure growth—establishing limits according to population—and stipulated that current expenditure must be financed solely out of current income. It also developed a bailout plan in case of financial difficulties. Finally, in 2003 the "Ley de Responsabilidad y Transparencia Fiscal" mandated sub-national entities to include in their budget fiscal targets that ensure debt sustainability, limited the pledging of future revenues ("vigencias futuras") and restricted CG bailouts.

Figure 1. Subnational Total Fiscal Balance and Debt (% of GDP)



Source: Authors' calculations based on Contraloría and Banco de la República.

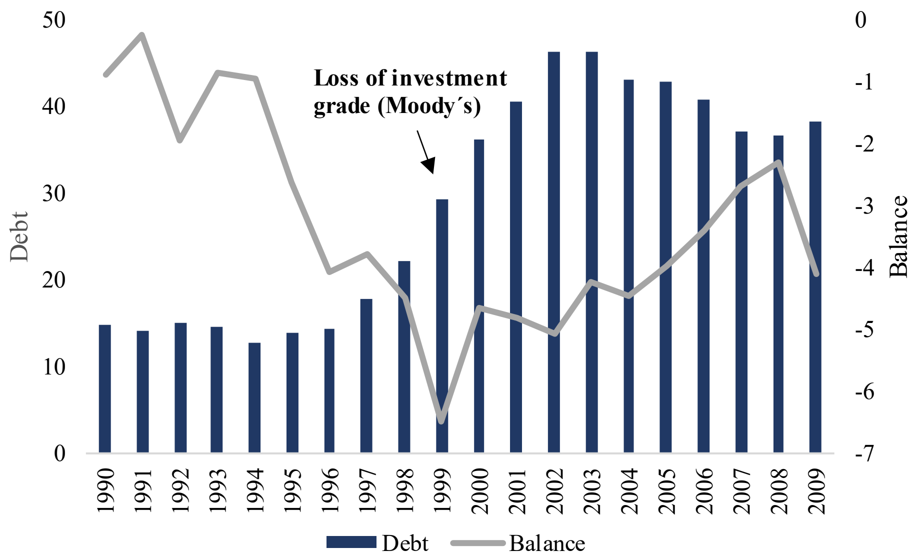
This set of rules placed subnational governments' finances on a sound footing and contributed to reducing indebtedness (Alonso et al., 2006 and Chamorro and Urrea, 2016). Their current debt level is low (under 2 percent of GDP), even below the average for OECD countries (OECD, 2016).

2.2 Rules for the Central Government

At the CG level, the debt burden soared in the second half of the 1990s, and Colombia lost its "investment grade" rating in 1999 (Figure 2). Regulations began to be drawn up with the 2003 "Ley de Responsabilidad y Transparencia Fiscal" which called for the CG to Congress a "Marco Fiscal de Mediano Plazo" (Medium Term Fiscal Framework, MFMP) which must contain an analysis of the economic situation, a 10-year projection of key macro indicators and an estimation of fiscal balances. Although this instrument is useful in guiding public finances, by itself it is insufficient for ensuring sustainability, given that it does not establish mandatory targets for the primary balance.[1]

[1] Moreover, establishing mandatory targets for the primary balance may not ensure debt sustainability if the growth rate and the cost of debt deviate significantly from the values projected when establishing the primary balance target.

Figure 2. CG Fiscal Balance and Gross Debt (% of GDP)



Source: Authors' calculations based on MHCP data.

In 2007 the Uribe administration convened a commission of experts to provide guidance on fiscal sustainability and the management of the ensuing oil boom. The commission recommended establishing a FR for the next five years (Botero et al., 2007). Along the same lines, in 2008 the central bank proposed a rule for the CG consisting of targets for the primary structural balance with the purpose of facilitating a countercyclical fiscal policy stance (Lozano et al., 2008). Towards the end of the Uribe administration in 2010, the government formally proposed the adoption of a FR for the structural primary balance, aimed at i) recovering the investment grade credit rating, ii) achieving a sustainable level of public debt, and iii) a allowing a counter-cyclical fiscal policy stance.

2.3 The 2011 Fiscal Rule

At the beginning of the Santos administration (2011) the FR was approved by Congress, with some differences compared to rules previously discussed. The rule targets the *structural balance* defined as the difference between total income and total expenditure, excluding the cyclical components of GDP and of oil revenues and any countercyclical expenditure (equations 1-3).[2]

[2] The FR stipulates that the government may implement a countercyclical expenditure plan if the difference between potential GDP growth and effective growth is greater than 2 percentage points. Countercyclical expenditure cannot

$$Structural\ balance_t = Total\ balance_t - \boldsymbol{Cyclical\ balance_t} \qquad (1)$$

$$Structural\ balance_t = (Total\ income_t - Total\ expenditure_t) - (\boldsymbol{Cyclical\ income_t} - \boldsymbol{Cyclical\ expenditure_t}) \qquad (2)$$

$$Structural\ balance_t = (Total\ income_t - \boldsymbol{Cyclical\ income_t}) - (Total\ expenditure_t - \boldsymbol{Cyclical\ expenditure_t}) \qquad (3)$$

This type of rule, common in countries where macroeconomic volatility is strongly associated with commodity exports (IMF, 2018a), seeks to reduce procyclicality of fiscal policy and facilitate macro stabilization. Its effectiveness largely hinges on the quality of assumptions regarding potential GDP growth and long-term commodity prices.

Along with the rule, the "Comité Consultivo de la Regla Fiscal (CCRF)" (Fiscal Rule Advisory Committee) was established. It reviews the methodology and definition of basic parameters required for the operation of the rule; it additionally opines on the compliance report that the Government must submit to Congress and on the temporary suspension of the rule in the event of extraordinary events that compromise macroeconomic stability.[3] The CCRF's opinions are not binding.

The FR was incorporated in budgetary operations and works as follows:

- In the first quarter of the year, the MHCP presents to the CCRF the methodology and estimation of potential growth, output gap and long-term oil prices with which the structural and total balances are estimated. It also presents for the CCRF's validation a report on compliance with the FR for the previous year. In case of non-compliance, the report must explain the reasons for the breach.[4]
- In June, the MHCP submits to Congress the compliance report—validated by the CCRF—along with the MFMP and a fiscal strategy that sets expenditure

surpass 20 percent of the output gap, and once GDP growth converges with long-term growth, this expenditure must be dismantled over a two-year period.

[3] The CCRF consists of nine members: three deans of economics departments; four members of research centers and reputed consultants; and the two presidents of the economic affairs commissions of both chambers of Congress. Terms are for three years, extendable once. There are two external advisory groups, one for potential growth, one for long-term oil prices. All technical support staff is from the MHCP. It is important to highlight that in 2020 Decree 370 modified certain institutional aspects strengthening the CCRF's autonomy, by, for example, staggering the appointment of its members in such a way that a single government cannot appoint them all.

[4] Since the FR was incorporated, the compliance report has always been validated by the CCRF.

ceilings consistent with the FR targets. This expenditure ceiling is binding only for the following year.

- On this basis, the Fiscal Policy Council (CONFIS)[5] allocates the budget between investment and current expenditure. While the MHCP allocates current expenditure among ministries and other entities through the "Marco de Gasto de Mediano Plazo" (MGMP), the National Planning Department (DNP) allocates investment among sectors/entities.[6] The latter must have been included in the "Plan Nacional de Desarrollo" (PND), which each administration presents to Congress at the beginning of its four-year term in office.
- Based on the MFMP, the MGMP and the POAI, in July the MHCP submits to Congress the annual budget. The total amount must be approved by September 15, and the detailed composition by end November. Budget execution begins on January 1 of the following year.

2.3.1 Compliance with the Fiscal Rule

The FR law established a yearly declining path for the CG's structural deficit. Starting from a 2.6 percent of GDP deficit in 2012, it called for a structural deficit of 2.3 percent of GDP or less in 2014, 1.9 percent or less in 2018 and of 1 percent or less in 2022. As of 2022, the deficit could not exceed 1 percent of GDP. Although not part of the FR, the documents supporting the 2011 law envisioned a continuous decline in debt in the absence of shocks, from 34 percent of GDP in 2012 to 25 percent in 2023.

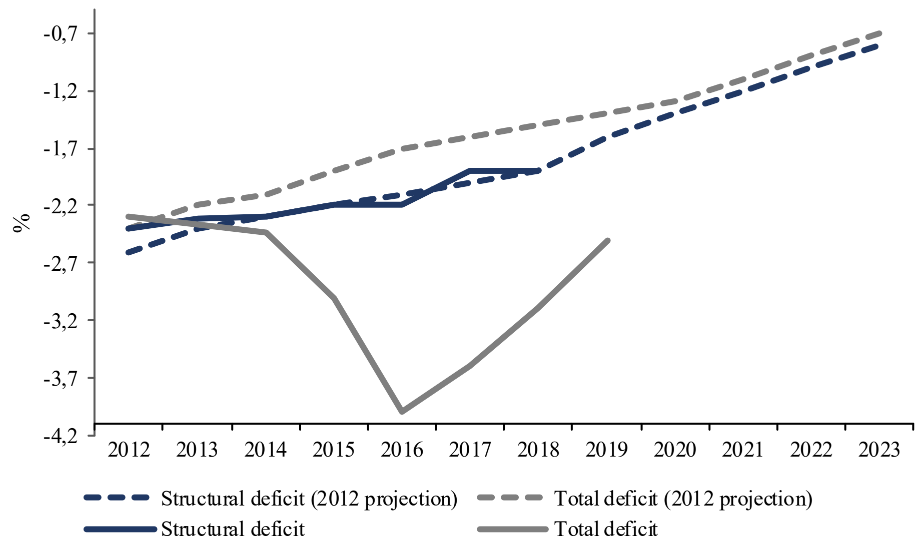
Both the deficit and the public debt burden have increased substantially

Although until 2019 structural deficit targets were complied with every year and investment grade was regained in 2011, original expectations regarding the overall fiscal balance and the debt burden have not been met. When the rule was first implemented, it was envisioned that every year until 2023 the structural deficit would be larger than the total deficit (i.e., the cyclical component would

[5] Chaired by the Minister of Finance and consisting of DNP, Customs and Taxes, and a representative of the President.
[6] To this end, the *"Plan Operativo Anual de Inversiones"* (POAI)—the investment planning tool that seeks to prioritize the projects that will be incorporated in the budget—is also prepared.

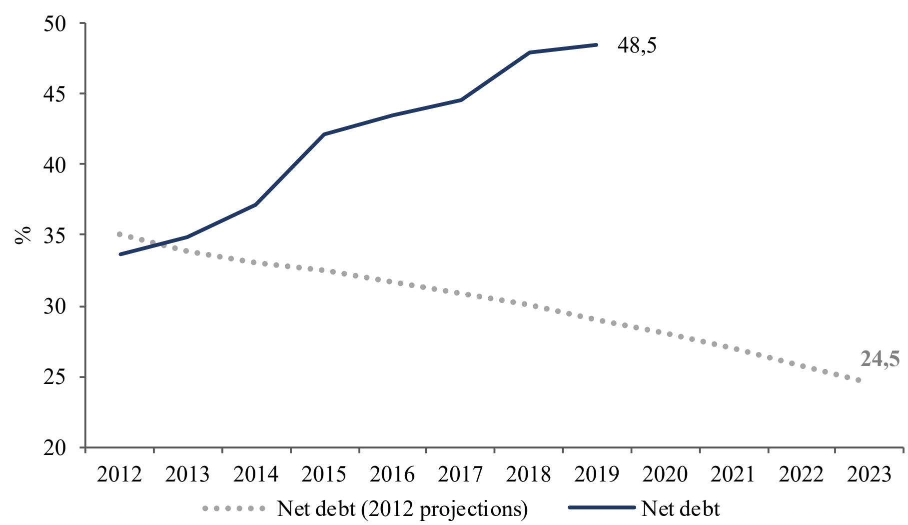
call for fiscal restraint). Unfortunately, assumptions regarding oil prices did not materialize (Figure 3). As a result, CG net debt has continuously increased, reaching 48.5 percent of GDP in 2019, in stark contrast with the outlook envisioned in 2012 (Figure 4).

Figure 3. Structural and Total Deficits and Their Original Projections (% of GDP)



Source: Authors' calculations based on MHCP and MFMP data (2012-2018).

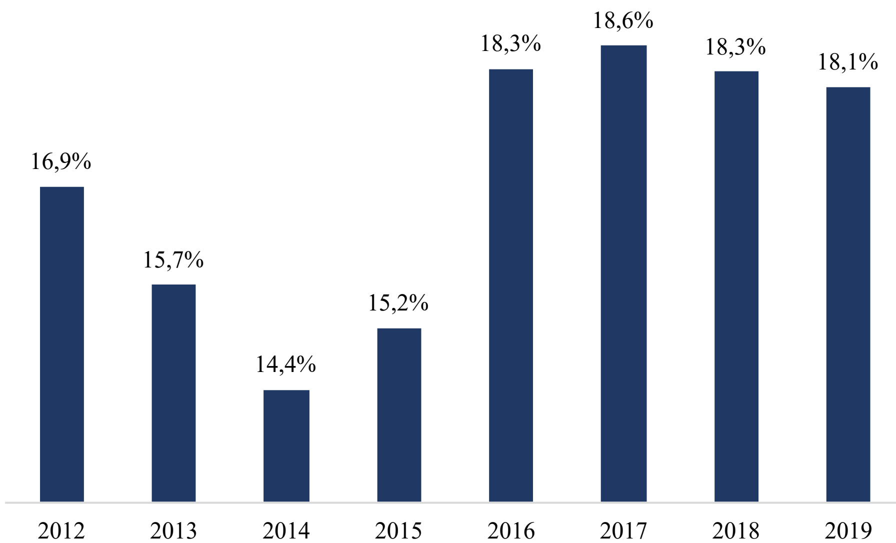
Figure 4. Net Debt (% of GDP)



Source: Authors' calculations based on MHCP and MFMP data (2012-2018).

Due to the increase in the debt burden and the decline in revenue,[7] debt affordability (i.e., the share of debt service to fiscal revenues) has worsened, rising from 12 percent in 2014 to 17 percent in 2018 (Figure 5).

Figure 5. Debt Affordability
(debt service as a percentage of tax revenue)

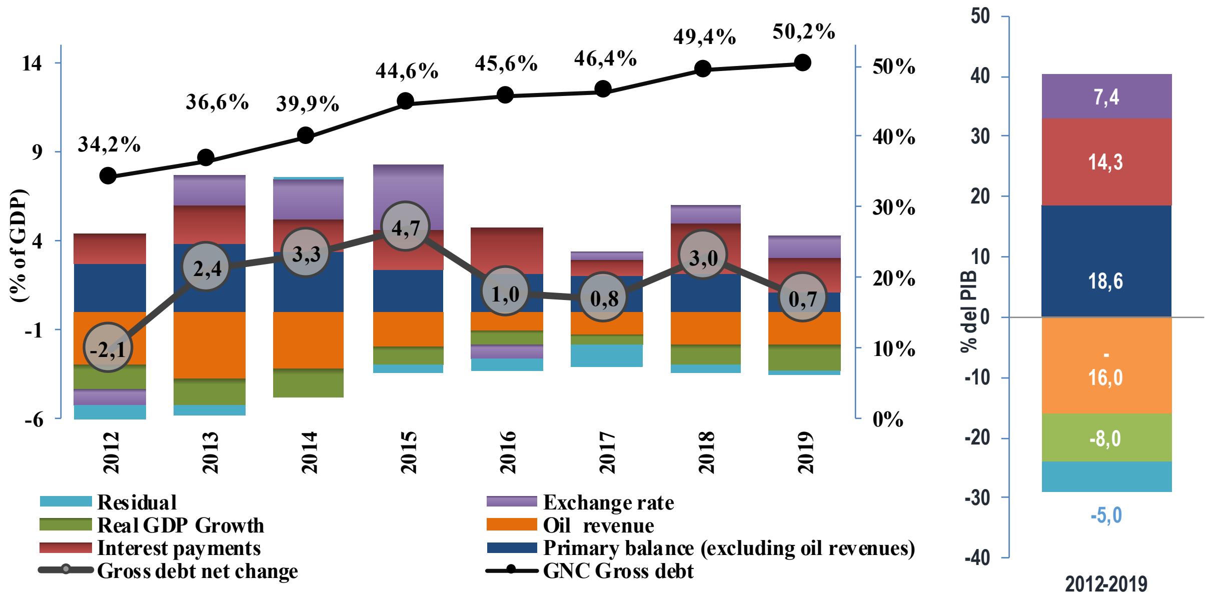


Source: Authors' calculations based on MHCP.

In Figure 6 we report the results of an exercise that decomposes the change in the debt burden into its main components during the period in which the FR has been in operation. It can be seen that during the first years (2012-2014), oil revenues and economic growth contributed to a decline in debt, while the persistence of high non-oil primary deficits, interest payments and currency depreciation increased debt.[8] During the period after the collapse in oil prices (2014-2016), the increase in debt was explained by significant currency depreciation, a fall in oil revenues and the persistence of high non-primary deficits. In recent years (2017-2019) the dynamics have been different, with the increase in debt explained mainly by higher interest payments.[9]

[7] As a result of the collapse in oil prices, CG revenue declined from 17 percent of GDP in 2013 to 14.8% in 2016.
[8] We decompose the primary deficit between its oil and non-oil components, in order to pinpoint oil revenue's contribution to the primary deficit and to debt. The sum of both components (oil revenues and non-oil primary deficit) is the net contribution of the primary deficit to the change in debt.
[9] These estimation follows the methodology presented in Valencia et al. (2018), with similar findings.

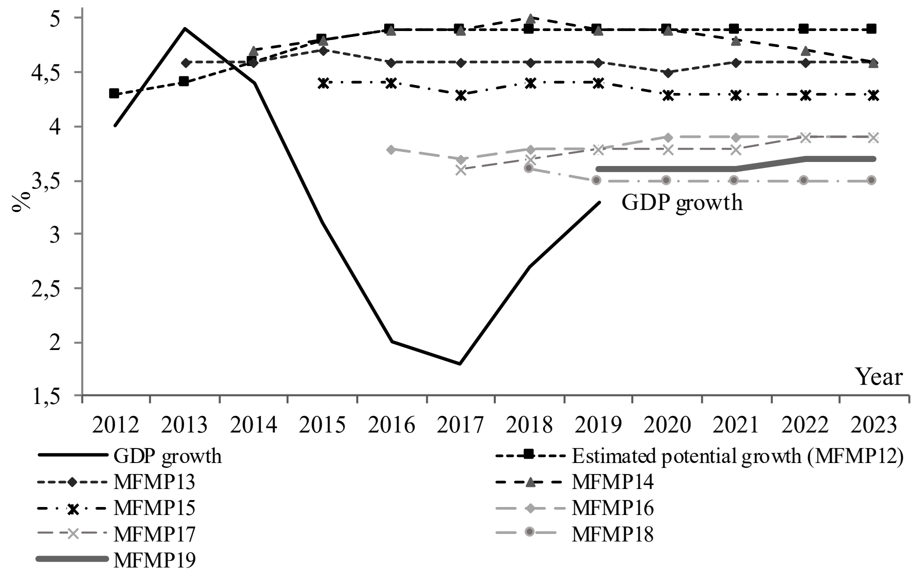
Figure 6. Decomposition of Debt-to-GDP Ratio Growth



Source: Authors' calculations based on MHCP.

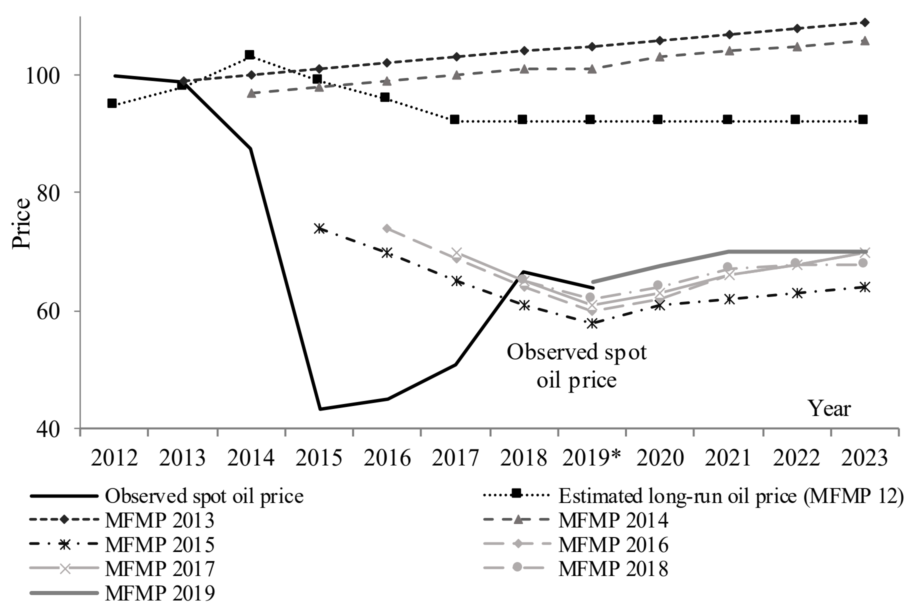
Despite this increase in the debt burden and the persistent of high non-oil primary deficits, FR´s targets have been accomplished every year. This development has been the result of incorporating assumptions regarding potential growth and long-run oil prices that ex post proved to be very optimistic. Indeed, Figure 7 shows that, except for 2013, growth turned to be well below potential growth projections in all MFMP between 2012 and 2018. In the same vein, the envisioned long-run oil price consistently exceeded "spot" prices. Although every year the long-run price was corrected, the revised price assumptions later proved to be too optimistic (Figure 8).

Figure 7. GDP Growth and Potential GDP Growth Assumptions



Source: Authors' calculations based on MHCP and MFMP data (2012-2018).

Figure 8. Evolution of "Spot" and Long-Run Oil Prices



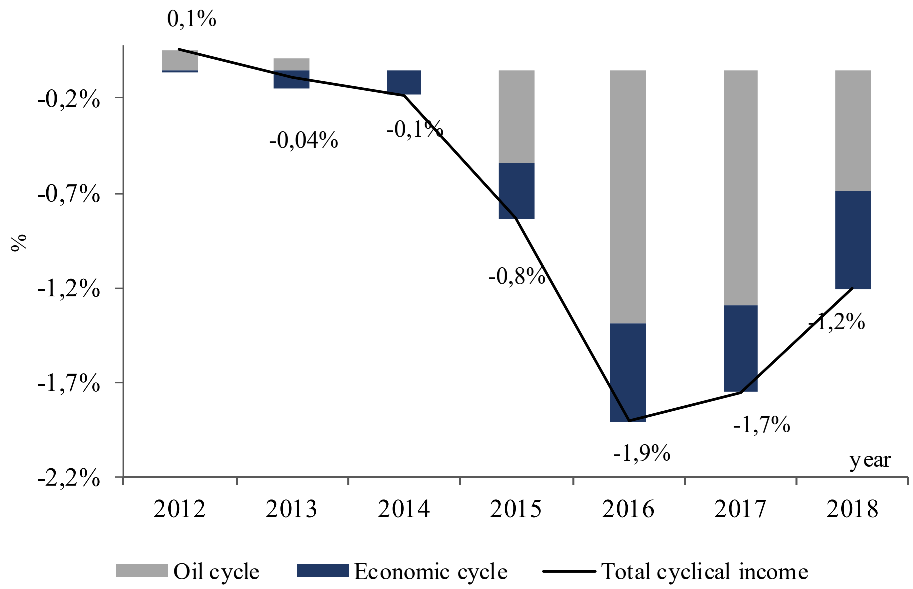
Source: Authors' calculations based on MHCP and MFMP data (2012-2018).

On account of the oil shock and the long-term oil prices and long-term growth assumptions used, a significant cyclical fiscal imbalance ensued which, as shown in Figure 9, reached almost 2

percent of GDP in 2016. According to interviews conducted with former CCRF members, the flexibility in the estimation of the cyclical components of the rule might have been facilitated by the CCRF not having its own technical staff.

Figure 9. Cyclical Income

(% of GDP)



Source: Authors' calculations based on Fiscal Rule Compliance Reports (2012-2018).

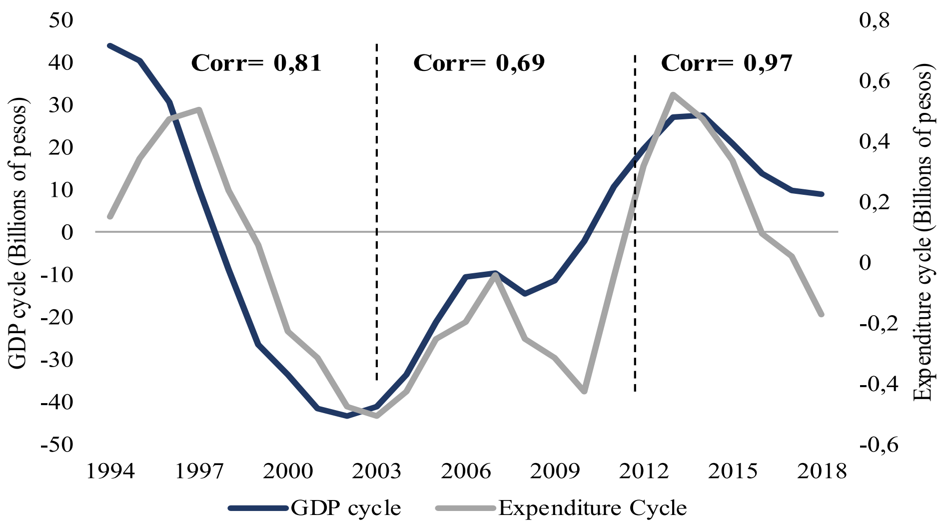
In addition, the absence of well-designed escape clause contributed to these results and made it difficult to accommodate, in a more transparent manner, exceptional and successive shocks—including the 2014 oil shock and the recent Venezuelan migration—with a well-defined plan specifying the fiscal measures that would allow for the return to the rule's goals in the medium term.

On the other hand, fiscal policy continued to be procyclical after the implementation of the FR (Figure 10).[10] This was due to the rapid growth in expenditure during the first years after the FR was implemented (2012-2014), financed to a great extent with the oil-boom revenues. Having saved only a small fraction of the oil windfall, it was not feasible to expand public expenditure

[10] These results are consistent with more sophisticated exercises, including those in Zapata and Vallejo (2019).

once the economy slowed down in 2015. In fact, the increase in indebtedness during 2015-2019 did not expand public expenditure, but rather prevented it from declining even more.

Figure 10. Fiscal Policy Procyclicality



Source: Authors' calculations based on MHCP data.
Note: Cyclical components and the trend were decomposed using the Hodrick-Prescott Filter.

In spite of the fact that having complied with the FR's structural balance targets did not prevent debt from increasing and did not diminish the procyclicality of fiscal policy, complying with the FR's structural balance targets has become an important tool to guide fiscal matters—as is argued by Escobar (2019)—and has facilitated dialogue between finance ministers and different stakeholders on issues such as tax reforms and budget approvals, somehow constraining higher expenditure aspirations. Therefore, it can be hypothesized that, in the absence of the FR, deficits and public debt would almost certainly had been even higher, a question that we address in the quantitative analysis below.

2.3.2 Budget Inflexibility and Weak Tax Collection: Structural Fiscal Constraints

The discussions regarding the adoption of a fiscal rule stressed the need for it to be accompanied by institutional reforms aimed at making public current spending more flexible. Unfortunately, not only do high levels of budgetary inflexibility remain, but increasing tax collections has also proven to be very difficult. Consequently, when a negative economic shock strikes, the government either

uses the room under the structural target to run a larger nominal deficit or, if it does not wish to increase debt, cuts investment spending.

Budget inflexibility

CG expenditure is highly inflexible, and that inflexibility has increased in the last decade. Namely, 96 percent of current expenditure (or 88 percent of total expenditure) is inflexible, up from 94 percent (or 84 percent of total expenditures) in 2007 (Table 1). This is explained by several factors: i) CG transfers to territorial entities through the "Sistema General de Participaciones" (SGP) to the tune of 3.8 percent of GDP;[11] ii) transfers to the public pension system, which hover around 3.5 percent of GDP; iii) interest payments, which represent about 2.5 percent of GDP; iv) personal services, which refers especially to public employees' salaries and represent around 2.3 percent of GDP; and v) other transfers, which represent 3.8 percent of GDP, and whose main components are transfers to special funds (about 1.4 percent) and, since 2013, payments by the CG to fund programs previously financed with parafiscal contributions (1.1 percent), namely the "Instituto de Bienestar Familiar" (ICBF) and the "Servicio Nacional de Aprendizaje" (SENA).

Table 1. Central Government Expenditure Inflexibility (% of GDP)

Component	2005-2009	2010-2014	2015-2018
Total expenditure	17.8	18.1	18.8
Current expenditure	16.0	15.4	16.6
Inflexible current expenditure	15.2	14.6	15.9
SGP	4.1	4.0	3.8
Pensions	3.5	3.4	3.5
Other transfers	2.4	2.6	3.8
Debt service	3.1	2.4	2.5
Personal services	2.1	2.2	2.3

Source: Authors' calculations based on MHCP.

[11] A percentage—established in the Constitution—of average current income of the last four years. It is worth noting that the way the SGP is designed provides few incentives for subnational governments to generate their own revenues (fiscal laziness).

Public investment performance

Historically, on account of the lack of flexibility regarding current expenditure, public investment has been highly procyclical to revenue (Zapata and Vallejo, 2019). Following the collapse of oil prices, which reduced CG revenue by around 2 percentage points of GDP between 2013 and 2016, investment declined from 3 percent of GDP in 2015 to 1.5 percent in 2018, while current expenditure actually increased. The implementation of the fiscal rule in itself does not seem to have affected public investment. In fact, investment increased during the first years of the rule (from 2.4 percent in 2011 to 3.2 percent in 2013), and its contraction in 2015 coincides with the decline in CG revenue after the oil shock. Moreover, it can be hypothesized that in the absence of a fiscal rule, public investment would have inevitably contracted. In the next section we provide some evidence in favor of this hypothesis (Table 2).

Table 2. CG Revenues and Expenditure (% GDP)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Current expenditure	15.3	16.7	15.1	14.8	15.1	15.9	16.2	16.1	16.4	16.8	16.9	16.5
Investment expenditure	2.2	2.2	2.1	2.4	2.8	3.2	3.0	3.0	2.3	2.1	1.5	1.8
Fiscal revenues	15.6	15.3	13.8	15.2	16.1	16.9	16.7	16.1	14.9	15.6	15.3	16.2

Source: Authors' calculations based on MHCP data.

It is important to note, however, that several institutional developments have been introduced in order to protect, as far as possible, public investment and the provision of public goods in the context of the abovementioned constrains on CG investment. In Box 1 we briefly illustrate four relevant cases.

Box 1. Some Institutional Measures to Protect Public Investment|

Privatization of Ecopetrol (2007)

In 1999 Colombia entered a program with the IMF, one of whose pillars was to reduce the fiscal deficit. In the absence of current expenditure flexibility, the program could jeopardize Ecopetrol's investment prospects, as it was 100 percent state-owned and an integral part of the non-financial public sector. Having agreed that restricting Ecopetrol's investment capacity would be a mistake, several alternatives were considered, and the government's request to

exclude Ecopetrol from the fiscal accounts had a constructive reply from the IMF. Namely, this would be possible if two conditions were met: i) Ecopetrol ceased to be the sector's regulator; and ii) a stake in the company were sold to the private sector. In 2003, the "Agencia Nacional de Hidrocarburos" was created as a regulatory entity, and in 2007 around 8.5 percent of the company was sold. These changes, in the context of the commodities price-boom, allowed Ecopetrol's investment to increase from 0.5 percent of GDP in 2004 to 4.9 percent in 2014.

Public-private partnerships (2012)

In 2012 public-private partnerships (PPPs) were established, allowing public infrastructure projects to be carried out by the private sector via concessions. Public roads could be built, maintained and operated by private agents who would receive as compensation tolls and public resources in order to guarantee a certain return on their investment. Public resources would be provided via CG "Vigencias Futuras" (revenue pledges) which, as long as they remain within certain limits, are not considered debt, although they certainly reduce future fiscal space. As a result, the execution of ambitious infrastructure projects was to a large extent safeguarded from the adjustment that was called for once oil prices collapsed.

Royalties

Royalties constitute an economic compensation paid by companies to the State for exploiting a non-renewable natural resource. The current royalties' system allocates the vast majority of resources to investment funds (on average 75 percent during 2012-2018) and a smaller amount to saving funds (20 percent). At the subnational level investment—which is to a great extend supported by royalties—rose sharply between 2010-2014, representing more than 50 percent of total public investment.

Divestiture of ISAGEN

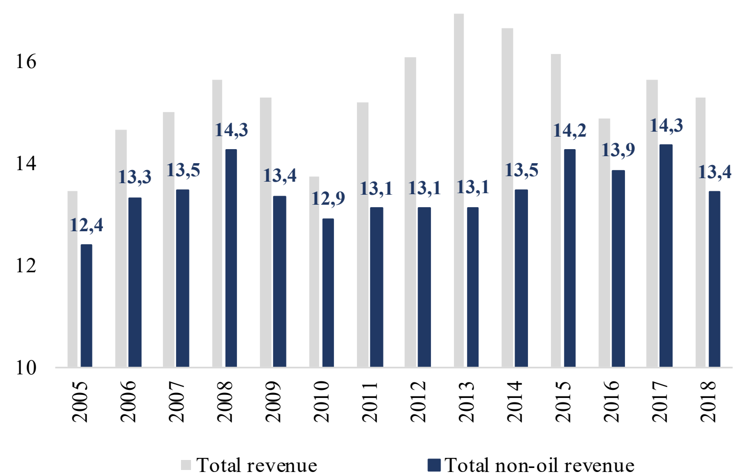
Of the $USD 2.1 billion that the State received from the 2016 privatization of ISAGEN—a major power generating concern—10 percent went to territorial entities in the company's area of influence, while the remaining 90 percent went to a public investment fund—*Fondo Nacional para el Desarrollo de la Infraestructura"* (FONDES)—whose main purpose is to finance a huge upgrade in transportation infrastructure.

Weak tax collection

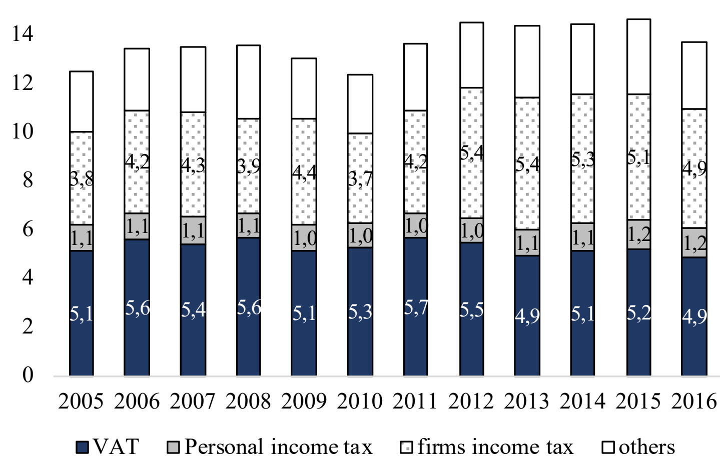
For several decades, various technical missions—i.e., the "Bases para una reforma tributaria estructural" (2006), the "Comisión de Expertos Para la Equidad y la Competitividad Tributaria" in 2015 and the "Comisión del Gasto y la Inversión Pública" in 2017—have highlighted the need to increase tax collections. Unfortunately, and despite 11 tax reforms carried out in the last 20 years, tax revenues (excluding those from oil) are today similar to those in 2006 and well below the average for Latin America (Figure 11a). This has mainly been driven by the stagnation of VAT and personal income tax collections (Figure 11b).

Figure 11. Tax Revenues (% of GDP)

a) CG total Revenue



b) Tax revenue by components



Source: Authors' calculations based on a) MHCP, Fedesarrollo (2019a), Toro et al. (2015) and b) ECLAC (2019).

Whenever attempts have been made to increase VAT collection, reduce exemptions, or expand the personal income tax base, governments have encountered major obstacles in Congress. The persistent inability to increase tax collections is mainly due to political economy issues, in particular i) the influence that powerful economic interests exert in Congress in order to obtain exemptions or lower levels of taxation;[12] and ii) a low willingness of parties and political movements—regardless of their ideology—to increase the tax burden of the middle class, a development best understood in the context of the median voter theorem (see Box 2).

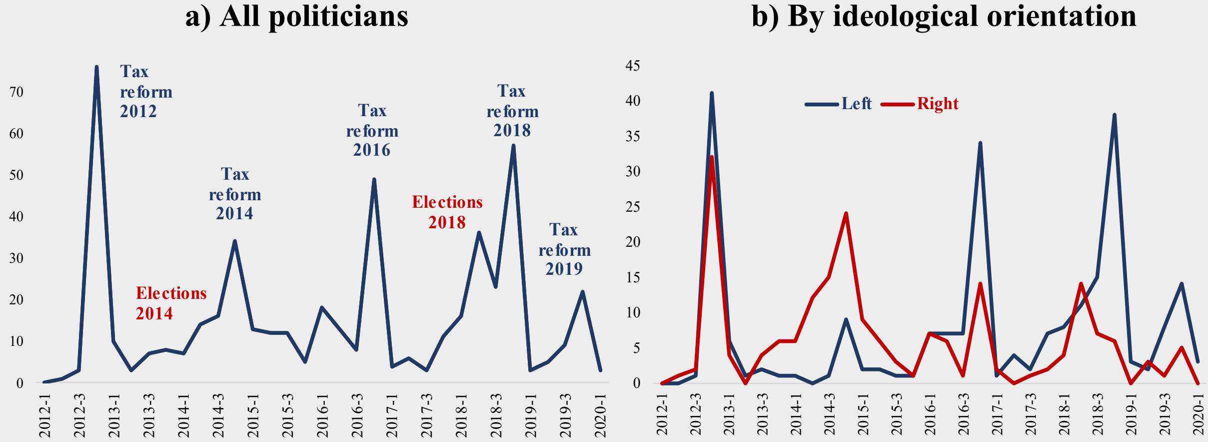
Box 2. Political Economy of Taxation: The Median Voter Approach

The median voter theorem predicts that political parties will adopt the political programs located closest to the preferences of the median vote. By doing so, they minimize the distance to the preferences of the population and, therefore, maximize the support received. It is possible to state that nowadays the median voter in Colombia is the middle class. According to Latinobarómetro, in 2018 some 39 percent of the Colombian population considered themselves as belonging to the middle-income class, and 76 percent to the expanded middle-income class (lower-middle, middle, and upper-middle). By contrast, 23 percent of the population considered themselves as belonging to the "low-income class" and 2 percent to the "upper-income class." Such a situation is similar throughout Latin America.

Whenever tax reforms are discussed - and to a lesser extent when there are elections - politicians adapt their messages and public appearances present themselves as the true defenders of the middle class. Figure 12a shows that the number of tweets by the main political leaders mentioning the term "middle class" increases substantially in the quarters when tax reforms are under consideration. Interestingly, Figure 12b shows that this occurs regardless of political orientation.

[12] This problem is documented in Salazar (2013) and Oliviera et al. (2009)

Figure 12. Politicians' Tweets Related to the Middle Class (2012-2020)



Source: Authors' calculations using Twitter data.
Note: Politicians considered: Álvaro Uribe, Gustavo Petro, Jorge Robledo, Iván Duque, Claudia López, Oscar Iván Zuluaga, Juan Manuel Santos, Maria Fernanda Cabal, Humberto de la Calle, German Vargas, Roy Barreras, David Barguil and Ernesto Macías.

Regarding 2016 and 2018 tax reforms, a large part of the messages were aimed at criticizing i) the reduction of the income level required to pay personal income taxes; ii) the increase in the VAT rate from 16 percent to 19 percent (in 2016); and iii) the proposal to extend the VAT to the basic consumption basket (in 2018), arguing that this measure affected the middle class. This occurred despite the fact that the proportion of people who pay income tax is extremely low –around 4 percent of the labor force in 2018, compared to 10 percent on average in Latin America (ECLAC, 2019). Also, while it certainly makes sense for the poor not to pay VAT on their basic consumption basket, the proposal that this benefit should not be extended to the rest of society was challenged on the grounds that removing the exemption would hurt the middle class.

What has been discussed up to now allows us to draw several conclusions regarding the performance of the FR and CG fiscal sustainability. Despite initial projections, the debt-to-GDP ratio has doubled in the last decade. This has been due to the collapse of oil prices in 2014 and to the wide cyclical fiscal space that resulted from considering such shock as mostly temporary, while to a large extent having considered as permanent the boom that preceded the downturn. The central issues to consider regarding the FR's performance can be summarized as follows:

1. Key inputs to the FR, namely the long-run price of oil and the long-run rate of growth, have proven to be consistently over-optimistic, and this feature might have been facilitated by the CCRF not having its own technical staff.
2. The rule has not had clear and well-defined escape clauses, leading to discretionary decisions, conceivably undermining its credibility.
3. Public investment has declined since the 2014 oil shock, although several measures have been taken to somewhat safeguard investment, including the provision of infrastructure investment by the private sector.
4. The challenging fiscal situation highlights the need for reforms making public expenditure more flexible and increasing tax revenue, thereby protecting public investment.
5. Since targets on the structural balance have not been sufficient to guarantee debt sustainability, improvements in the design of the rule should be considered in such a way that it incorporates some type of anchor in the level of indebtedness.

Notwithstanding the above considerations, it could well have been the case that matters would have evolved in a more negative manner had the FR not been in place. This is a matter that we seek to address below, undertaking a synthetic control exercise. Also, we will discuss alternative designs and possible modifications for the FR, consistent with both achieving fiscal sustainability in the medium term and safeguarding public investment.

3 Quantitative Analysis

Several quantitative exercises are presented in the next two sections. The first section provides a retrospective evaluation of the FR seeking to assess its effect on public debt and public investment using the Synthetic Control Method. In the second section we identify the tolerable debt limit in Colombia and subsequently calibrate a debt anchor consistent with stabilizing debt in the medium term. In addition, we simulate deficit, expenditure and revenue trajectories required for accomplishing the medium-term debt target.

3.1 Fiscal Rule Evaluation: The Synthetic Control Approach

In this section, we use the synthetic control method to approximate the effect that the FR could have had on debt and on public investment. To do this, we build a counterfactual (synthetic Colombia) that will allow us to reproduce the trajectories that debt and investment would have had if in an economy as similar as possible to Colombia if the fiscal rule had not been implemented.

Following Abadie et al. (2019), we suppose that there are $J+1$ countries, and that Colombia implemented a FR in year T'. Let Y_{it} be the dependent variable (for example, the debt-to-GDP ratio or public investment) for countries $i = 1, \dots, J+1$ and years $t = 1, \dots, T$.

Then, we can define

$$Y_{it} = Y_{it}^{N} + \alpha_{it} D_{it} \tag{4}$$

where Y_{it}^{N} is the debt-to-GDP ratio for country i in t, in absence of a FR; α_{it} is the FR effect for i in t and D_{it} is a dummy variable that equals 1 if country i has a FR in the year t and 0 otherwise. It can be observed that Y_{it}=Y_{it}^{N} for $i = 2, \dots, J+1$ for all t, and for $i = 1$ in $t \epsilon \{1, \dots, T'\}$. On the other hand, Y_{1t}^{N} is an unobservable variable for $\mathrm{t} \epsilon \{\mathrm{T}' + 1, \dots, \mathrm{T}\}$ (when the FR is in place).

Therefore, in order to estimate the trajectory of Colombia in the absence of a fiscal rule, it is necessary to approximate $Y_{1t}^{N}$to a synthetic unit named "synthetic Colombia" that we define as the weighted average of the countries in the donor pool ($i = 2, \dots, J+1$)

$$\hat{Y}_{1t}^{N} = \sum_{i=2}^{J+1} W_i Y_{it} \tag{5}$$

where W_i is the vector that minimizes the distance between the treated unit (Colombia) and the linear combination of countries in the donor pool, in terms of a set of predictor variables that are correlated with public debt and are averaged over a for several years before the implementation of the FR. In this way, if W is maximized, Y_{1t}^{N} approaches Y_{1t} during the pre-treatment period and therefore, reproduces the behavior of the debt in the absence of FR in the post-treatment period.

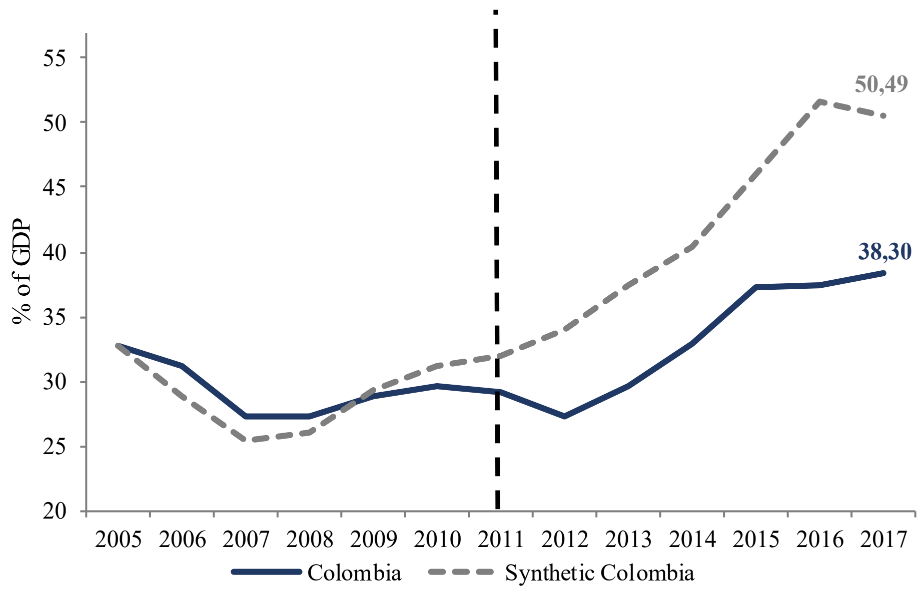
3.1.1 Synthetic Control for the Debt-to-GDP Ratio

To undertake the synthetic control model to estimate the FR's impact on CG indebtedness, we considered the 174 countries included in the IMF's Public Debt Database, among which we identified 59 that as of 2017 had not implemented any fiscal rule in their CG finances. We confined

the comparison group to countries with certain similarity to Colombia in terms of income and export orientation.[13]

Figure 13 shows the estimated effect of the FR on the debt-to-GDP ratio. It follows that in absence of a FR, Colombian indebtedness would have been 12 percentage points higher than the level observed in 2017.[14] This result is consistent with Escobar (2019), according to whom the FR has been a useful tool for the Minister of Finance to guide public finances and constrain larger public spending aspirations by government agencies and Ministries and has facilitated the approval of tax reforms in Congress.[15]

Figure 12. Plausible Debt-to-GDP Trajectory in the Absence of a FR



Source: Authors' calculations based on IMF data.

[13] The procedure carried out to select countries, variables and weights is described in Appendix A

[14] Debt-to-GDP ratio values in the figure are lower than the official ones published by the Ministry of Finance. This occurs because the IMF debt series measures only the Budgetary CG debt, thus excluding extra-budgetary entities.

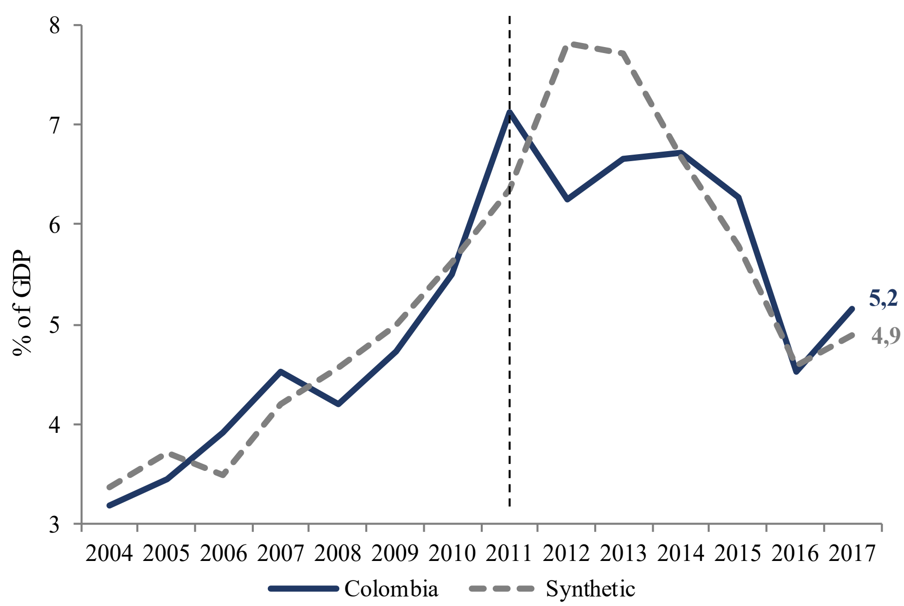
[15] Following Abadie et al. (2010), we conducted placebo tests as a robustness check for our results, and we present them in Appendix B.

3.1.2 *Synthetic Control for Public Investment (% of GDP)*

Public investment data used to carry out this exercise correspond to General Government (GG) investment, since it has not been possible to obtain investment data from the CG for a sufficiently large number of countries.[16]

Results of the estimation are shown in Figure 14, suggesting that in the absence of the FR public investment in 2017 would have reached 4.9 percent of GDP, very similar to the levels actually observed (5.1 percent).[17] In that sense, there would be no evidence to support the claim that implementation of the FR constrained public investment. Rather, its contraction after 2014 seems to have been related with the end of the commodity prices boom and the persistence of procyclical behavior of public investment.

Figure 13. Plausible Public Investment Trajectory in the Absence of FR (% of GDP)



Source: Authors' calculations based on IMF data.

[16] The results of this exercise should be taken with caution insofar as the fiscal rule examined applies to the CG, while investment corresponds to the GG. In fact, investment of sub-national entities has increased since the royalty reform in 2012 and compensated the contraction of CG investment after the oil price shock in 2015.

[17] The procedure carried out to select countries, variables and weights used to build the synthetic unit are found in Appendix C.

3.2 Calibration Exercise of the Fiscal Rule for the Structural Balance with a Gross Public Debt Anchor

Expenditure inflexibility and a low level of revenues began to take their toll on the CG when oil prices plummeted in 2014, taking debt from 37 percent of GDP in 2014 to 50 percent in 2018. These constraints become even more critical in the context of the COVID-19 crisis, with gross debt projected to exceed 60 percent of GDP in 2020 as a result of i) the large exchange rate depreciation; ii) the sharp decline in growth, which reduces tax revenues and increase the debt-to-GDP ratio; and iii) the additional expenditure associated with health and social assistance.

On June 13, 2020 the CCRF unanimously agreed—correctly so in our opinion—to suspend the fiscal rule for 2020 and 2021. Although this is a sensible option in the short term, it does not prevent debt from increasing, and it is therefore essential to carry out institutional reforms that guarantee medium term fiscal sustainability.

A priority within those institutional changes is to anchor the fiscal rule to a debt target. Recent literature recommends this type of alternative as it facilitates the recovery of the link between fiscal flows and changes in stocks (IMF, 2018b). This is the purpose of the following quantitative exercises, where we anchor the current fiscal rule to a prudent level of debt and present simulations of the main fiscal variables in the medium term so as to achieve the debt target.

To do this, we follow the following steps. First, we estimate a prudent level of debt in the medium term using two methodologies: (a) based on a regime-change approach, we analyze debt's past behavior in order to detect periods in which debt dynamics became unstable; (b) based on a neoclassical production function that incorporates complementarity between public and private investment (the IMF's buffer-risk methodology), we calculate the debt level that maximizes economic growth and estimate a prudent level that ensures that under different shocks debt will likely not exceed the resulting debt ceiling. Second, we use a Neo-Keynesian general equilibrium model in which we anchor the fiscal rule on the structural balance to reach the estimated prudent level of debt in the medium term. We simulate for the medium term the main fiscal variables consistent with meeting the estimated prudent debt target and conditioned to different scenarios of economic growth and public expenditure associated with the COVID-19 emergency.

3.2.1 Debt Anchor Estimation

Prudent level of debt: Regime-change approach

Debt dynamics have a non-linear behavior; there are periods and critical levels in which debt can follow an explosive and unstable trend. Hence, detecting debt levels where debt dynamics change their regime—i.e., become unstable—allows us to detect the prudent level around which debt should be maintained. For the case of Colombia, we use the smooth transition regime change model presented by Granger and Teräsvirta (1993), whose fundamental assumption is that regime changes are mainly generated by a transition variable (z_i), which passes through the critical value or threshold (th) and whose occurrence depends on the weights assigned to the regimes. We will refer to this critical value as the prudent debt level.

For this particular study, regimes are defined by two possible states (S_t^j)—where j could be L (stable) or H (unstable)—defined by the level of the endogenous variable debt-to-GDP ratio (d_t). The probability of occurrence of the unstable (H) state is defined by:

$$Pr(S_t^H) = G(z_t; \gamma, th) \qquad (6)$$

where γ represents the speed or smoothness parameter of adjustment, and $G(\cdot)$ represents the transition function between both states –bounded between 0 and 1— and which changes smoothly as z_t grows. This transition function takes the form of a first order logistic function or LSTAR:

$$G^{LSTAR}(z_t; \gamma, th) = \left(1 + \exp\left(-\gamma(z_t - th)\right)\right)^{-1}, \gamma > 0 \qquad (7)$$

Therefore, the LSTAR model can be represented in the following way as an extension of an Auto-Regressive (AR) model of order p that allows changes in the parameters of the model depending on the value of the exogenous transition variable (z_t):

$$d_t = \boldsymbol{X_t} + G^{LSTAR}(z_t; \gamma, th)\boldsymbol{X_t} + \epsilon_t \ (8)$$

where $\boldsymbol{X_t} = (\phi_0, \phi_1 d_{t-1}, \phi_2 d_{t-2}, \dots, \phi_p d_{t-p})$ is a vector of lagged debt values d_t with their respective coefficients (ϕ) and ϵ_t represents the error term, which must be white noise with constant variance and asymptotically normal distribution.

The results show that there is a statistically significant threshold of around 46 percent of GDP (Table 3), which was reached during the 1999 crisis and surpassed in 2017, after the collapse of the oil price in 2014 (Figure 15). We will define this value (th) as *prudent debt level # 1.*

Table 3. LSTAR Estimation for Prudent Debt-to-GDP Ratio

	Coefficient	Standard Error.	t-value	Pr(>|z|)	
Const. ϕ_0^L	2.268	1.052	2.156	0.031	*
ϕ_1^L	1.683	0.128	13.104	0.000	***
ϕ_2^L	-0.737	0.125	-5.897	0.000	***
Const. ϕ_0^H	-80.109	32.325	-2.478	0.013	*
ϕ_1^H	-2.321	1.071	-2.167	0.030	*
ϕ_2^H	4.176	1.067	3.914	0.000	***
γ	33.534	15.38	-2.180	0.030	*
Threshold (th)	46.038	0.061	751.509	0.000	***

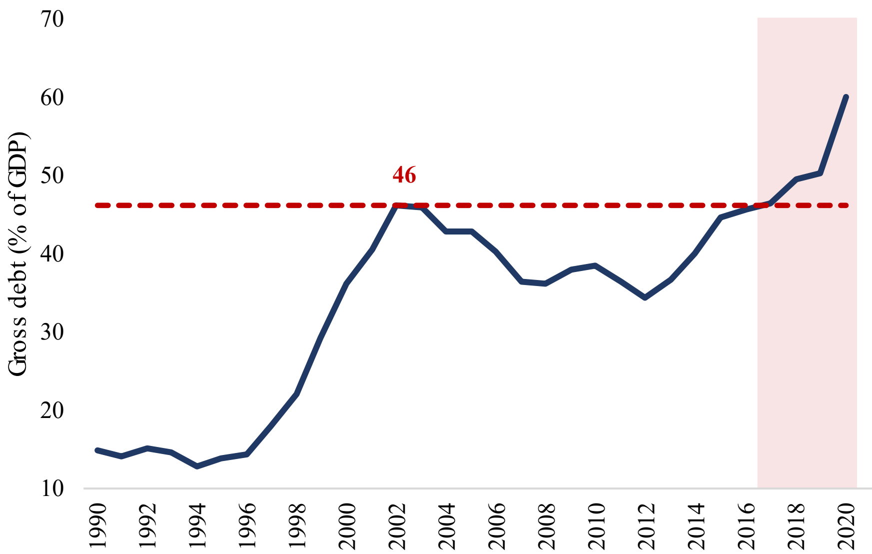
*Signif: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1*

L: Regime 1 – Stable debt

H: Regime 2 – Unstable debt

Source: Authors' calculation.s

Figure 14. Prudent Debt-to-GDP Ratio



Source: Authors' calculations.

Prudent level of debt: Buffer against future risk (IMF approach)

This approach seeks to estimate the debt level that allows hedging against risks that may arise from the volatility of key variables such as the interest rate (domestic and foreign), exchange rate, oil price and economic growth. This methodology has two stages: first, following Checherita et al.

(2014), we estimate a *maximum debt ceiling*, consistent with Colombia's growth conditions and second, a prudent level of debt (*debt's prudent level # 2)* consistent with not exceeding the *maximum debt ceiling*, under conditions of stress of key variables.

Maximum debt ceiling

Assuming that public investment is financed through indebtedness, the idea is to gauge the level of debt that maximizes the public capital stock and, therefore, economic growth. We start from a production function denoted by:

$$Y_t = \left(L_t^{\beta} K_t^{1-\beta}\right)^{1-\alpha} K_{gt}^{\alpha} \qquad (9)$$

where Y_t represents output, L_t labor, K_t, the private capital stock, and $K_{g,t}$ the public capital stock.

After reorganizing, we obtain

$$Y_t = (L_t^{\epsilon} K_t^{1-\alpha})^{1-\alpha} \left(\frac{K_g}{K_t}\right)^{\alpha} \qquad (10)$$

where

$$\epsilon = \beta(1-\alpha) \qquad (11)$$

In the steady-state, public capital grows at a constant rate denoted by $\Delta K_g = x\, K_g$, where x is also the growth rate of output, consumption, and private capital.

After maximizing x, we obtain d^*, the value of the debt-to-GDP ratio that maximizes growth—i.e., the *maximum debt ceiling*.

$$d^* = \left(\frac{\alpha}{(1-\alpha)^2}\right)^{1-\alpha} \qquad (12)$$

We estimate (9) using data from the IMF´s Investment and Capital Stock Database for the period 1990-2017.[18] We present 3 OLS and DOLS estimation models (Table 4) and we recover the values for α and d^*. Using the average of the three results, we found that the value of debt that maximizes public investment and growth—*the maximum debt ceiling*—is, on average, 63.5 percent of GDP.

[18] Based on Frankel and Romer (1999) and Dollar and Kraay (2004), we include the trade-to-GDP ratio as a control on account of it being an important driver of growth.

Table 4. Maximum Debt Limit Estimation

	OLS	OLS	DOLS
Variables	Ln (Y/K)	Ln (Y/K)	Ln (Y/K)
Ln(Kg/K)	0.301***	0.272***	0.260***
	(0.0353)	(0.0949)	(0.0320)
Ln(L/K)	0.372***	-0.215***	0.331***
	(0.0476)	(0.0232)	(0.0347)
Trade/GDP	0.00294	-0.00142	0.00629***
	(0.00269)	(0.00459)	(0.00221)
Δ Ln(Kg/K)			-0.663***
			(0.122)
Δ.Ln(L/K)			0.863***
			(0.155)
Constant	4.747***		4.296***
	(0.330)		(0.254)
Obs.	58	58	58
R-Squared	0.761	0.991	0.853
Maximum debt			
Alpha	0.301	0.272	0.26
D*	71.3%	61.5%	57.6%
D* average		**63.5%**	

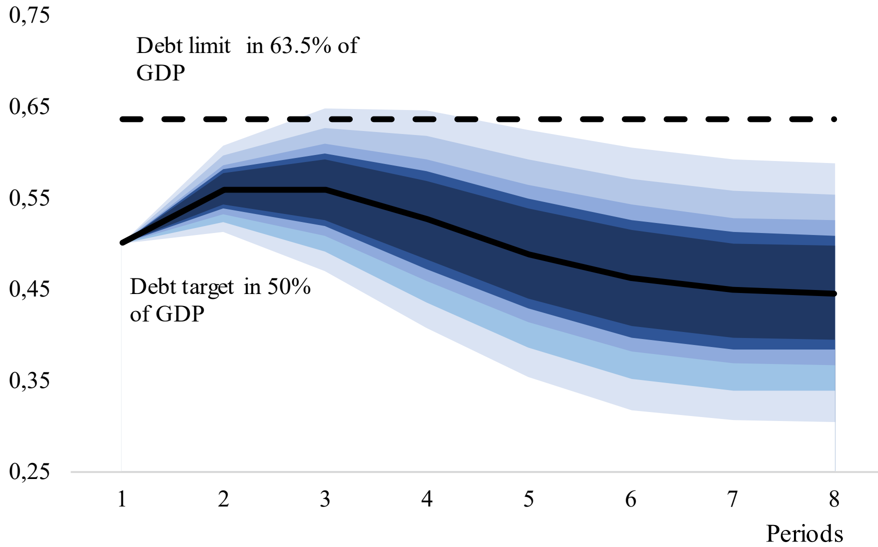
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' calculations based on IMF and MHCP data.

From these results and following IMF (2018b), we proceed to estimate *prudent debt level #2*, one that ensures that under different shocks[19] CG debt will likely not exceed the maximum debt ceiling at a 10 percent tolerance criterion. As is shown in Figure 16, *prudent debt level #2* should not exceed 50 percent of GDP.

[19] Forecasts and shocks were estimated from a VAR model and the respective matrix of variances and covariances of the errors. By definition, shocks that have not occurred in the past are not considered, the pandemic being one of them. Variables in the VAR estimation are foreign and domestic interest rate, growth rate, inflation, primary balance, and spot oil prices.

Figure 15. Prudent Level of Debt



Source: Authors' estimations based on WEO-FMI data.

As can be seen, *estimated prudent debt level´s # 1 and #2* are similar (50 percent and 46 percent). We take their average as a point of reference for establishing a *debt anchor* ($\bar{\bar{d}}$) of 48 percent of GDP in the medium term. This finding is consistent with the average debt-to-GDP ratio observed between 2017-2018 in countries with the same credit rating as Colombia (54 percent in Fitch and S&P and 45 percent in Moody's),[20] and is slightly lower than other debt threshold estimations. For instance, Marney and Ramsey (2020) estimated a prudent level around 60 percent; Lozano and Julio (2019), under a fiscal fatigue approach, estimated a maximum tolerable CG debt for Colombia in 52.4 percent, and Mendoza and Oviedo (2007) found a debt ceiling of around 55 percent under a fiscal solvency approach.

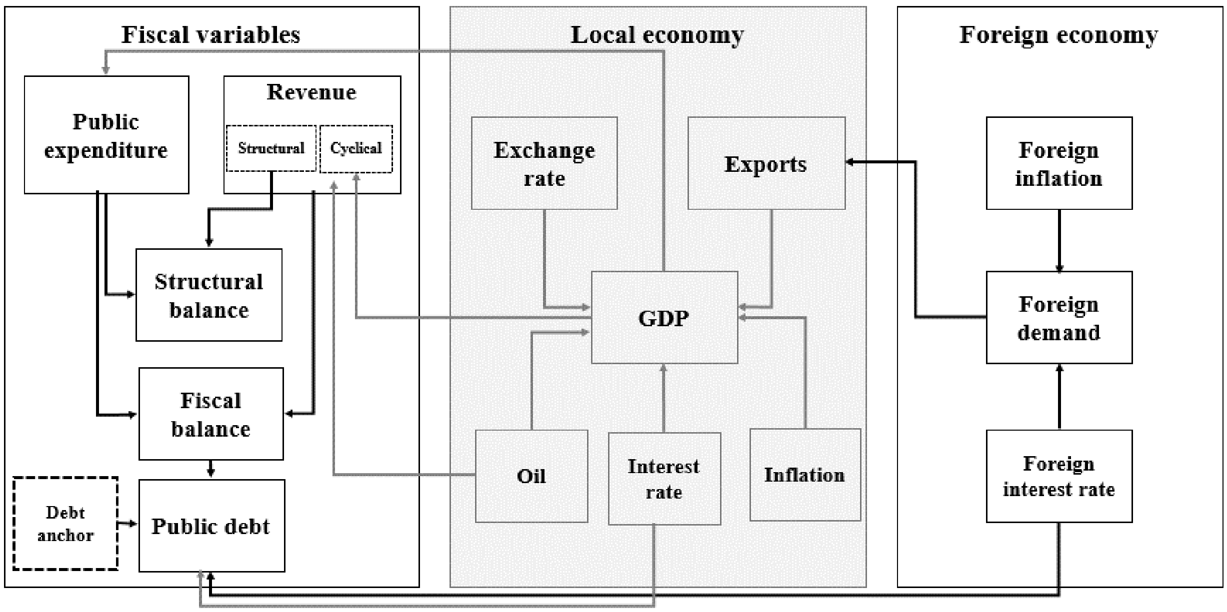
3.2.2 Calibration of a Debt Anchor

Given the previous results and using a Neo-Keynesian general equilibrium model built by Valencia and Angarita (2020), we proceed to simulate the total and structural deficit trajectories required to achieve a *debt anchor* of 48 percent of GDP in the medium term, taking into account the COVID-19 shock and conditioning the simulation on different growth scenarios.

[20] Authors' calculations based on IMF data.

Figure 17 summarizes the main components of the model for a small open economy with a domestic and a foreign market. The model includes a fiscal module that incorporates a structural balance rule and a debt anchor. Both the domestic market and the fiscal balance are oil dependent.

Figure 16. Structure of the Valencia and Angarita (2020) Model



Source: Valencia and Angarita (2020).

Since the fiscal rule is defined in terms of output gaps and fiscal variables, it is convenient to represent the model in gaps (denoted by ^). The micro-foundation of the model makes it possible to represent the demand for goods and services through a forward looking IS curve as follows:

$$\hat{y}_t = E_t[\hat{y}_{t+1}] - \gamma_1(E_t[\hat{g}_{t+1}] - \hat{g}_t) - \gamma_2(\hat{\imath}_t - E_t[\pi_{t+1}] - \rho) + \gamma_3(E_t[\hat{\delta}_{t+1}] - \hat{\delta}_t) + \varepsilon_t^{\hat{y}} \quad (13)$$

where $E_t[\bullet]$ denotes expectations, g_t government expenditure, i_t the nominal interest rate, π_t the rate of inflation, ρ a time preference parameter, δ_t the exchange rate and $\varepsilon_t^{\hat{y}}$ demand shocks. Importantly, equation (13) captures the contemporary impact of fiscal impulses, although it includes a medium-term countercyclical adjustment $(E_t[\hat{g}_{t+1}] - \hat{g}_t)$.[21] The other components are standard: expectations of the output gap $E_t[\hat{y}_{t+1}]$, a negative relationship between the output gap

[21] This means that any fiscal impulse made in t must be compensated with an adjustment in the future.

and the expected real interest rate $(\hat{\imath}_t - E_t[\pi_{t+1}] - \rho)$ and a positive relationship with expected currency depreciation $\left(E_t\left[\hat{\delta}_{t+1}\right] - \hat{\delta}_t\right)$.

On the supply side, firms act in monopolistic competition, use only labor for simplicity, and have sticky prices. In terms of gaps, the behavior of prices implies the resulting Neo Keynesian Philips curve:

$$\pi_t = \beta E_t[\pi_{t+1}] + \kappa\left[\phi_1\hat{y}_t + \phi_2\hat{y}_t^* + \phi_3\hat{\delta}_t + \frac{\tau_{ss}}{1-\tau_{ss}}\hat{\tau}_t - (1+\phi_4)\varepsilon_t\right] \quad (14)$$

where $E_t[\pi_{t+1}]$ are inflation expectations with $\beta < 1$, $\hat{y}_t^*$ is the foreign output gap, $\hat{\tau}_t$ the tax gap, $(\frac{\tau_{ss}}{1-\tau_{ss}})$ a tax distortion and $(1+\phi_4)\varepsilon_t$ a supply shock. Importantly, in equilibrium, direct taxes affect price formation through the labor cost channel. Additionally, note that the response of prices to changes in the tax gap $(\hat{\tau}_t)$ depends on the degree of tax distortion $(\frac{\tau_{ss}}{1-\tau_{ss}})$.

The fiscal module considers a fiscal rule that establishes yearly targets on the structural balance. The structural balance is calculated according to the IMF's methodology. Structural revenues and expenses (denoted by τ_t^s and g_t^s) can be expressed as:

$$\frac{\tau_t^s}{\tau_t} = \left(\frac{y_t^P}{y_t}\right)^{\eta}; \frac{g_t^s}{g_t} = \left(\frac{y_t^P}{y_t}\right)^{\varphi} \quad (15)$$

where y_t^P is potential output, and η and φ are the structural expenditure and revenue elasticities[22] to the ratio $\frac{y_t^P}{y_t}$. We can define the structural balance as follows:

$$sb_t = \frac{SB_t}{y_t} = \frac{\tau_t^s}{y_t} - \frac{g_t^s}{Y_t^P} = \left[\frac{\tau_t}{Y_t}\left(\frac{y_t^P}{y_t}\right)^{\eta}\right] - \left[\frac{g_t}{y_t}\left(\frac{y_t^P}{y_t}\right)^{\varphi}\right] \quad (16)$$

which, in terms of the output gap would be

$$sb_t = \frac{\tau_t}{y_t}(1+\hat{y}_t)^{1-\eta} - \frac{g_t}{y_t}(1+\hat{y}_t)^{1-\varphi} \quad (17)$$

The structural balance is calculated with information on the output gap, elasticities and revenue and expenditure for each year as a percentage of GDP.

[22] τ includes total tax revenues (oil and non-oil). It is very difficult to measure oil's structural component due to the non-linear nature of oil prices. Best practices recommend excluding the oil component from the structural balance to avoid transferring its price volatility to the fiscal accounts (López-Murphy and Villafuerte, 2010).

Fiscal balances anchored to the prudent level of debt

Debt convergence towards the *debt anchor* ($\bar{\bar{d}}$) is achieved through *short-term debt targets* ($\bar{d}_t$) determined by the following autoregressive process:

$$\bar{d}_t = c_1\bar{\bar{d}} + (1 - c_1)d_{t-1} + \epsilon_t^{\bar{d}} \qquad (18)$$

where c_1 measures the speed of adjustment of debt towards the *debt anchor*. The advantage of this expression is that it is always easily estimated and provides a guide on how to reach the *debt anchor*.

The determination of the fiscal balance consistent with a debt anchor is a problem the policymaker solves by minimizing i) the difference between the total balance (b_t) and the structural balance (sb_t) and ii) between observed debt (d_t) and the short-term debt target ($\bar{d}_t$). In this sense, the policymaker chooses the fiscal balance and debt paths in such a way that they close the structural balance and debt gaps, subject to its budget constraint (equation 20):[23]

$$\min_{\{b_t, d_t\}_{t=0}^{T}} E_t\left[\sum_{t=0}^{T} \beta_{gov}^t \left[\frac{f_1}{2}(b_t - sb_t)^2 + \frac{f_2}{2}\left(d_t - \bar{d}_t\right)^2\right]\right] \qquad (19)$$

$$(1 + \theta_t)d_t = d_{t-1} - b_t \qquad (20)$$

$$d_0 \text{ as given}$$

$$\lim_{t \to T} b_t = \bar{\bar{sb}} \qquad (21)$$

$$\lim_{t \to T} d_t = \bar{\bar{d}} \qquad (22)$$

where f_1& f_2 are the weights given by the policymaker to each gap, $\beta_{gov} < 1$ is the government's discount factor and $\bar{\bar{sb}}$ is the medium-term structural balance consistent with the *debt anchor*. The Euler condition of the optimization problem is:

$$(sb_t - b_t) = \frac{1}{1+\theta_t}\left[\beta_{gov}\, E_t(sb_{t+1} - b_{t+1}) + \frac{f_2}{f_1}(\bar{d}_t - d_t)\right] \qquad (23)$$

---

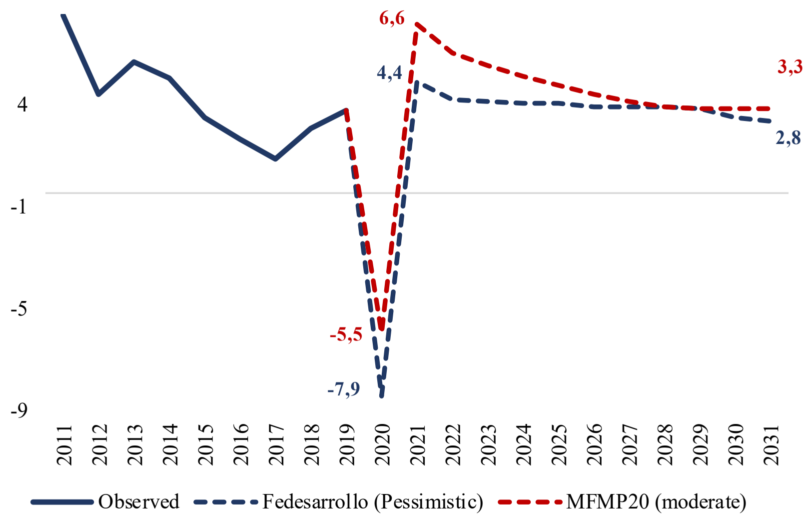
[23] The Government's restriction is expressed in terms of the total balance and debt, as follows: $d_t = \left[\alpha^d \frac{1+r_t}{1+\theta_t} + (1-\alpha^d)\frac{1+r_t^*}{1+\theta_t}\right] d_{t-1} - (\tau_t - g_t)$, where r_t is the domestic real interest rate, r_t^* is the foreign real interest rate, τ_t is tax revenue, g_t is government expenditure, α^d the share of domestic currency debt and θ_t the economic growth rate. Now define $1+\bar{r}_t = \alpha^d(1 + r_t) + (1-\alpha^d)(1 + r_t^*)$; the budget constraint is collapsed to $d_t = \left[\frac{1+\bar{r}_t}{1+\theta_t}\right] d_{t-1} - (\tau_t - g_t)$. The balance is defined as $b_t = (\tau_t - g_t - \bar{r}_t d_{t-1})$. Therefore, the budget constraint can be expressed as equation (20).

Equation (23) shows that, in equilibrium, the gap between the total and the structural balance should be equal to the expected value of the same gap in the future plus the difference between current debt and the *debt anchor.* The fiscal adjustment consistent with debt deleveraging is consistent with a path that gradually generates countercyclical adjustments in fiscal balances. For example, if the fiscal balance gap is positive in t, it must be compensated with a reduction in future fiscal balance gaps in order to reduce the debt gap. If at the same time the debt gap is very large, the government must generate intertemporal cyclical savings to achieve the adjustment towards the *debt anchor*. This means that keeping the balance gap positive today implies a future fiscal adjustment. In equilibrium, equations (18-23) determine the path for debt and the fiscal and structural balances.

This model was calibrated for Colombia[24] using Bayesian techniques.[25] Given the uncertainty regarding the future path of key economic variables due to the pandemic, conditional simulations are made for different growth scenarios in order to analyze medium term dynamics of fiscal variables. In particular, two growth scenarios were considered for the following years (Figure 18). In the first, from Fedesarrollo, output is expected to contract by 7.9 percent in 2020, followed by a 3.5 percent rebound in 2021. The second scenario, envisioned by the government in the MFMP 2020, anticipates a contraction of 5.5 percent in 2020 and a 6.6 percent rebound in 2021.

[24] Data for 2000-2019 was obtained from MHCP, DANE, WB, and Banco de la República.
[25] The estimated parameters are summarized in Appendix D.

Figure 17. Economic Growth Scenarios



Source: Fedesarrollo

Our model differs from the traditional Colombian FR rule in two respects. The first is that the structural balance is endogenously determined by economic variables and should not necessarily be decreasing. This is justified by the fact that different shocks have persistently affected the potential level of output and therefore the structural balance. The recent episode of the pandemic is an obvious case in point. There is a growing literature on how COVID-19 can have implications for productivity, value chains and rates of return on capital, thus having long-term consequences for economic activity (see Dieppe, 2020; Guerrieri et al., 2020; Jordà et al., 2020; and Bodenstein et al., 2020).

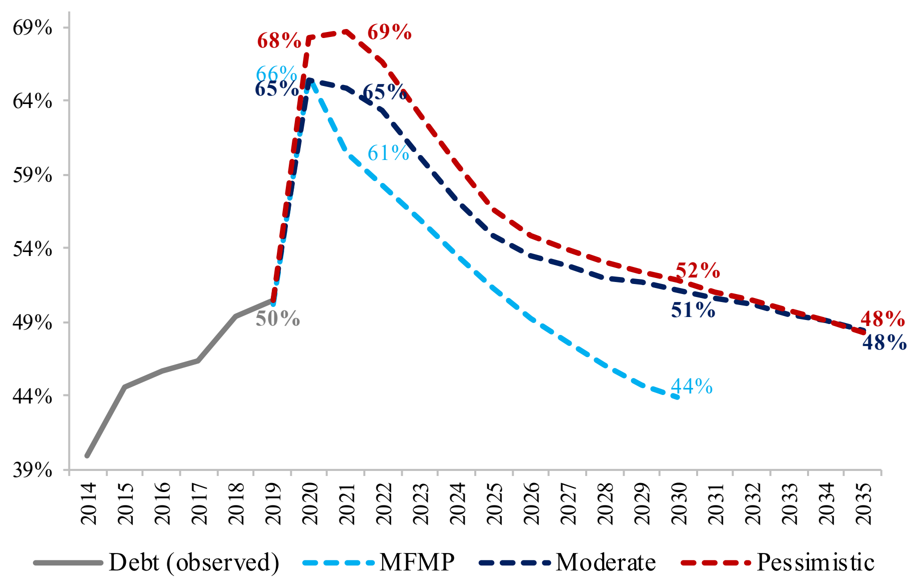
In fact, Fedesarrollo's growth assumption envisions a decline in potential growth, from 3.4 percent to 3 percent, due to COVID-19. The endogenous specification of the structural deficit allows us to capture the implications that the decline in potential growth would have on the structural balance. In this case, the contraction in potential output translates into a substantial drop in structural revenues.

The second aspect is the rule that we simulate is anchored to converge to a long-term prudent debt level of 48 percent consistent with a long-term structural deficit of 1 percent of GDP. This allows us a similar response scenario for the fiscal paths to achieve this objective.

Below we present the simulations of the main fiscal variables in the medium term, anchoring the fiscal rule to a medium-term debt target of 48 percent of GDP. We analyze two

scenarios with different assumptions regarding economic growth (moderate and pessimistic). Figure 19 shows the debt-to-GDP ratio forecasts consistent with a medium-term debt target of 48 percent of GDP. As can be seen, our model manages to replicate the debt increase forecasted for 2020 under all specifications of the FR. However, we forecast higher debt levels in the following years, in contrast to MHCP projections.[26] In the short term, gross debt levels could reach 69 percent of GDP and would converge towards a level of 48 percent of GDP in 2035. Of course, this is conditional on growth dynamics.

Figure 18. Debt Simulations (2020-2035)
(% of GDP)



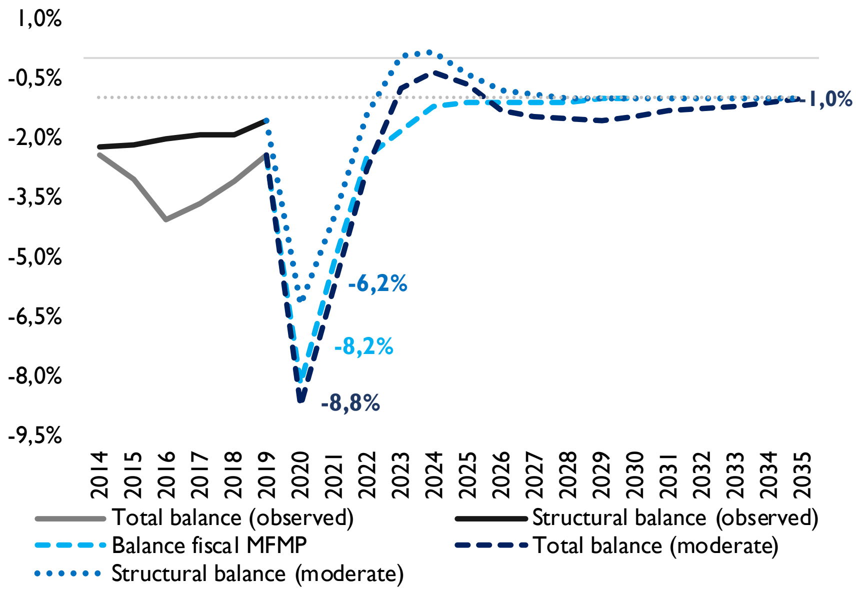
Source: Authors' calculations.

Figure 20 shows the evolution of the structural and total deficit. Under both growth scenarios, the model predicts a deficit between 8.8-9 percent of GDP for 2020. It can also be seen that the structural deficit would increase to 6 and 7 percent of GDP in 2020 and should be gradually adjusted, in order to converge to 1 percent, consistent with the medium-term *debt anchor*.

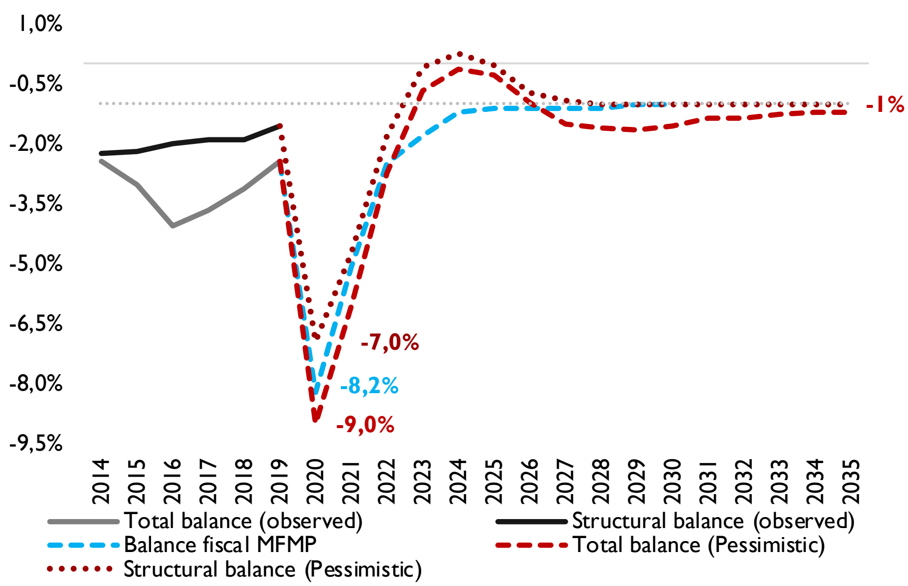
[26] It is important to bear in mind that these discrepancies are in part due to the fact that MFMP20's scenario envisions the privatization of several public assets in 2021 for 1.1 percent of GDP.

Figure 19. Deficit Forecasts
(% of GDP)

a) Moderate growth scenario



b) Pessimistic growth scenario

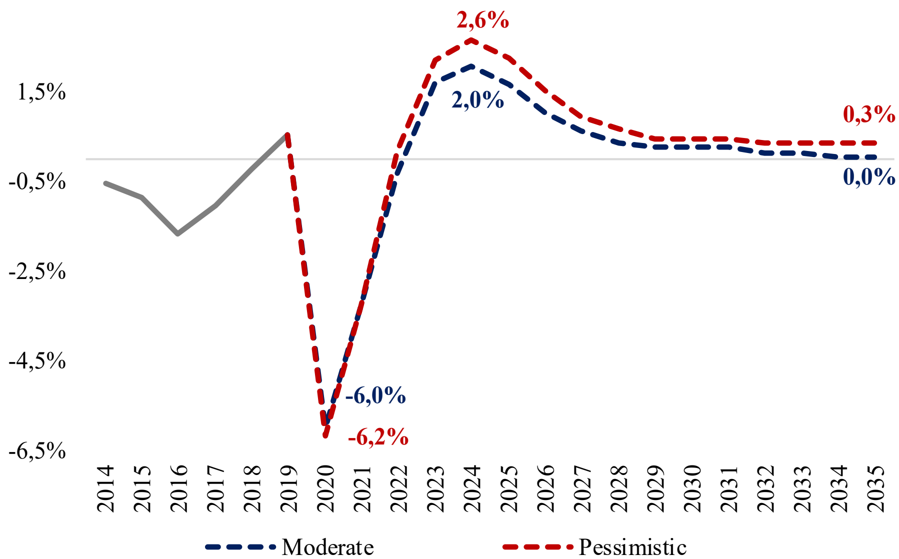


Source: Authors' calculations.

Importantly, the simulations suggest that the primary balance should be positive beginning in 2022, generating fiscal savings that in 2024 will reach 2.4 percent of GDP and would be on

average 0.7 percent of GDP between 2022 and 2035. In the medium term, the primary balance should be stabilized around 0.3 percent, consistent with the debt target (Figure 21).

Figure 20. Primary Balance Forecasts



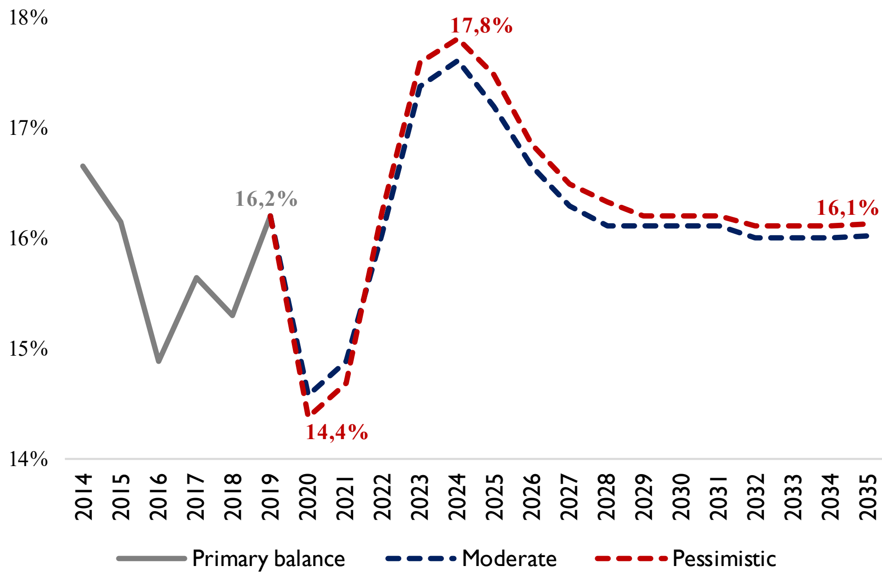
Source: Authors' calculations.

Figure 22 shows the CG's expenditure and revenue trajectories for the next decade that are required to achieve the debt target of 48 percent of GDP. Tax revenues are expected to fall to 14 percent of GDP in 2020-2021 due to the crisis. In the medium term a significant increase is required, leading to a tax collection level of 17.8 percent of GDP, which is consistent with MFMP projections. However, this is not enough; primary expenditure will reach around 20 percent of GDP in 2020 and must be reduced to 15 percent of GDP in the medium term in order to achieve the debt target. In this sense, it is of utmost importance that the increases in emergency expenditure does not become permanent and, above all, that there be an improvement in the quality of spending, delivering a multiplier effect that improves the growth path.[27]

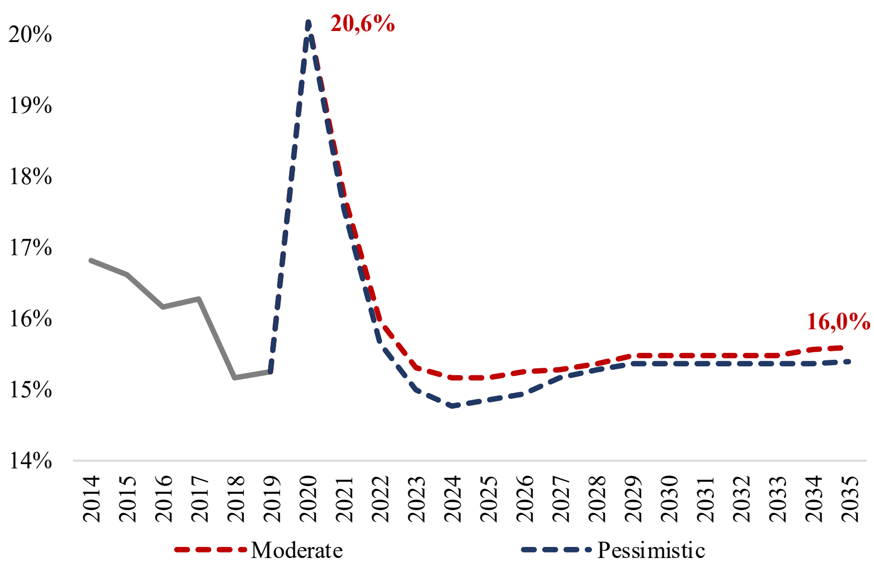
[27] It is worth remembering that these projections do not consider the possibility of privatizing state assets, which, although it does not reduce deficits, reduces the need to finance those assets exclusively through debt.

Figure 21. Revenues and Primary Expenditure Forecasts (2020-2035) (% of GDP)

a) Revenues



b) Primary expenditure



Source: Authors' calculations.

4. Conclusions and Policy Recommendations

Our main findings can be summarized as follows:

Despite complying with the structural balance targets established in the FR law, public debt has increased significantly since the rule was established, in sharp contrast to what was envisioned in 2011. After the oil price shock and in a context of large currency depreciation, the debt increase was also explained by consistently having allowed for a fiscal cyclical adjustment that every year except one delivered a total deficit that was larger, and sometimes much larger, than the structural deficit. In this process, the long-run price of oil and the long-run rate of GDP growth suggested by the government and validated by the CCRF proved to have been consistently optimistic. CCRF's lack of its own independent technical staff might have played a role in these developments.

Notwithstanding the rise in debt, the synthetic control exercise suggest that had the FR not been in place, the rise in the debt burden would probably have been even higher. In any event, a key purpose of having introduced a FR, namely reducing the procyclicality of fiscal policy, has not been achieved. Furthermore, given the inflexibility of current spending, central government investment has been highly procyclical and was sharply cut after the oil shock. Nevertheless, the synthetic control exercise suggests, that regardless of the FR, investment would have declined. Also, it is important to highlight that the lack of clearly defined escape clauses has brought about discretionary measures—prominently additional fiscal space in 2019 to accommodate the costs associated with massive migration from Venezuela—that potentially undermine the credibility of the rule.

One of the main purposes of establishing a FR was to permit Colombia to recover Colombia an investment grade rating from credit rating agencies. This objective, which was achieved early on, is now in jeopardy. The continuous rise in debt since the FR's inception has now been coupled with a sharp increase in debt on account of the fiscal implications of the COVID-19 pandemic. Public debt is now projected to exceed 60 percent of GDP in 2020 and 70 percent in 2021. In that context, the suspension of the fiscal rule in 2020 may be the perfect opportunity to reform key issues of the FR in order to restore fiscal sustainability in the medium term.

Based on these findings, we offer the following policy recommendations:

It is essential to modify the FR so that it incorporates a debt anchor. Our estimations indicate that this level should not exceed 48 percent in the medium term. Debt reduction must be a priority to avoid a crowding-out effect on economic growth.

In order to pursue this ambitious objective while at the same time aiming to protect public investment, essential components of the reform effort include allowing for greater flexibility in current spending and enhancing tax collections. In addition, spending related to COVID-19 needs to be transitory, and in the future the policy mix should involve a reduction in spending and increases in revenues. These objectives could be achieved by, among other measures, improving spending efficiency and allocation and reducing tax-related expenditure.

Ideally, the CCRF should have its own technical staff, and the FR should incorporate explicit and transparent escape clauses for exceptional situations. For instance, in the escape clauses the trigger to temporarily abandon the rules must be clearly defined and should include correction mechanisms.

References

Abadie, A., A. Diamond and J. Hainmueller. 2010. "Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California's Tobacco Control Program." *Journal of the American Statistical Association* 105(490): 493-505.

Abadie, A. et al. 2019. "Using Synthetic Controls: Feasibility, Data Requirements, and Methodological Aspects." *Journal of Economic Literature.* Forthcoming.

Alonso, G. et al. 2006. "La Economía Colombiana: Situación Actual Frente a los Noventa y Sus Perspectivas." Bogota, Colombia: Banco de la República, Grupo Macroeconómico. Available at: https://www.banrep.gov.co/sites/default/files/publicaciones/pdfs/borra429.pdf

Barro, R.J. 1990. "Government Spending in a Simple Model of Endogeneous Growth." *Journal of Political Economy* 98(5, Part 2): S103-S125.

Bernal, R. et al. 2017. *Comisión del Gasto y la Inversión Pública: Informe Final*. Bogota, Colombia: Fedesarro. Available at: https://www.fedesarrollo.org.co/sites/default/files/LIB2017COMISION.pdf

Bird, R.M., J.M. Poterba and J. Slemrod, editors. 2006. *Bases para una Reforma Tributaria Estructural en Colombia*. Bogota, Colombia: Fedesarrollo.

Bodenstein, M., G. Corsetti and L. Guerrieri. 2020. "Social Distancing and Supply Disruptions in a Pandemic." Finance and Economics Discussion Series 2020-031. Washington, DC, United States: Board of Governors of the Federal Reserve System.

Bonilla, R. et al. 2015. *Comisión de Expertos para la Equidad y la Competitividad Tributaria.* Bogota, Colombia: Fedesarrollo.

Botero, R., et al. 2007. "Comisión Independiente de Gasto Público." Bogota, Colombia: Fedesarrollo. Available at: https://www.repository.fedesarrollo.org.co/handle/11445/1612.

Clavijo, S. 2016. "Anomalías de la Regla Fiscal y Trayectoria de Endeudamiento." En: Comentario económico del día, Centro de Estudios Económicos de la Asociación Nacional de Instituciones Financieras (ANIF). Bogota, Colombia: ANIF.

Corficolombiana. 2019. *Contra la Corriente. ¿Hasta Cuándo?* Perspectivas Económicas Corficolombiana: Proyecciones 2020. Bogota, Colombia: Corficolombiana. Available at: https://investigaciones.corficolombiana.com/documents/38211/0/informe%20anual.pdf/3e743415-9e81-c5f0-81db-0095d35ea7bc

Chamorro, R.A., and A.F. Urrea. 2016. “Incidencia de las Reglas Fiscales en la Sostenibilidad de la Deuda Pública Territorial en Colombia.” *Cuadernos de Economía* 35(67): 207-251.

Checherita-Westphal, C., A. Hughes Hallett and P. Rother. 2014. “Fiscal Sustainability Using Growth-Maximizing Debt Targets.” *Applied Economics* 46(6): 638–647.

Dieppe, A., editor. 2020. Global Productivity. Trends, Drivers and Policies. Washington, DC, United States: World Bank. Available at: https://www.worldbank.org/en/research/publication/global-productivity

Dollar, D., and A. Kraay. 2004. “Trade, Growth, and Poverty.” *Economic Journal* 114: 22-49.

Economic Commission for Latin America and the Caribbean (ECLAC). 2019. *Revenue Statistics in Latin America and the Caribbean 1990-2017.* Santiago, Chile: ECLAC. Available at: https://repositorio.cepal.org/handle/11362/44526

Escobar, A. 2019. “La Regla Fiscal de Colombia: Antecedentes, Desempeño y Perspectivas.” In: A. Barreix and L.F. Corrales, editors. *Reglas Fiscales Resilientes en América Latina*. Washington, DC, United States: Inter-American Development Bank.

Fedesarrollo. 2019. “Prospectiva Económica.” Octubre 2019. Capítulos 1 y 2. Bogota, Colombia: Fedesarrollo. Available at: https://www.repository.fedesarrollo.org.co/handle/11445/3841

Frankel, J., and D. Romer. 1999. “Does Trade Cause Growth?” *American Economic Review* 89(3): 379–399.

Granger, C.W.J., and T. Teräsvirta. 1993. *Modeling Nonlinear Economic Relationships*. Oxford, United Kingdom: Oxford University Press.

Guerrieri, V. et al. 2020. “Macroeconomic Implications of COVID-19: Can Negative Supply Shocks Cause Demand Shortages?” NBER Working Paper 26918. Cambridge, United States: National Bureau of Economic Research.

IMF. 2018a. “Fiscal Policy: How to Select Fiscal Rules, A Primer.” How-To Notes. Washington, DC, United States: International Monetary Fund, Fiscal Affairs Department. Available at: https://www.imf.org/en/Publications/Fiscal-Affairs-Department-How-To-Notes/Issues/2018/03/15/How-to-Select-Fiscal-Rules-A-Primer-45552

IMF. 2018b. “Fiscal Policy: How to Calibrate Fiscal Rules, A Primer. How-To Notes. Washington, DC, United States: International Monetary Fund, Fiscal Affairs Department. Available at:

https://www.imf.org/en/Publications/Fiscal-Affairs-Department-How-To-Notes/Issues/2018/03/15/How-to-Calibrate-Fiscal-Rules-A-Primer-45551

Jordà, Ò., S.R. Singh and A.M. Taylor. 2020. "Longer-Run Economic Consequences of Pandemics." NBER Working Paper 26934. Cambridge, United States: National Bureau of Economic Research.

López-Murphy, P. and M. Villafuerte. 2010. "Fiscal Policy in Oil Producing Countries during the Recent Oil Price Cycle." IMF Working Paper 10/28. Washington, DC, United States: International Monetary Fund.

Lozano, I. et al. 2008. "Regla Fiscal Cuantitativa para Consolidar y Blindar las Finanzas Públicas de Colombia." Borradores de Economía 505. Bogota, Colombia: Banco de la República. Available at: https://doi.org/10.32468/be.505

Lozano, I., and J.M. Julio. 2019. "Límite de la Deuda Pública y Espacio Fiscal: Análisis para Colombia y Otros Mercados Emergentes." *Borradores de Economía* 1076. Bogota, Colombia: Banco de la República. Available at: https://doi.org/10.32468/be.1076

Marney, K., and B. Ramsey. 2020. "Colombia: Debt Limits and the Fiscal Rule 2.0 Debate." New York, United States: J.P. Morgan, Economic Research.

Mendoza, E.G., and P.M. Oviedo. 2007. "Public Debt, Fiscal Solvency and Macroeconomic Uncertainty in Latin America: The Cases of Brazil, Colombia, Costa Rica, and Mexico." NBER Working Paper 10637. Cambridge, United States: National Bureau of Economic Research.

Organisation for Economic Co-operation and Development (OECD). 2016. "Making the Most of Public Investment in Colombia: Working Effectively across Levels of Government." OECD Multi-level Governance Studies. Paris, France: OECD Publishing. Available at: http://dx.doi.org/10.1787/9789264265288-en.

Olivera, M., M. Pachón and G.E. Perry. 2010. "The Political Economy of Fiscal Reform: The Case of Colombia, 1986-2006." Working Paper IDB-WP-181. Washington, DC, United States: Inter-American Development Bank.

Perry, G. 2019. *Decidí Contarlo. Conversaciones sobre Cincuenta Años de Economía y Política en Colombia*. Bogota, Colombia: Editorial Debate.

Salazar, N. 2013. "Political Economy of Tax Reforms: The Case of Colombia." Woodrow Wilson Center Update on the Americas. Washington, DC, United States: Wilson Center, Latin America Program. Available at: https://www.wilsoncenter.org/sites/default/files/media/documents/publication/SalazarTaxReformColombia.pdf

Toro, J. et al. 2015. "El Choque Petrolero y sus Implicaciones en la Economía Colombiana." Borradores de Economía 906. Bogota, Colombia: Banco de la República.

Valencia, O. et al. 2018. "Análisis de Sostenibilidad de la Deuda Bruta del Gobierno Central 2018-2029." Notas Fiscales. Bogota, Colombia: Ministerio de Hacienda y Crédito Público, Centro de Estudios Fiscales. Available at: http://www.urf.gov.co/webcenter/ShowProperty?nodeId=%2FConexionContent%2FWCC_CLUSTER-070586%2F%2FidcPrimaryFile&revision=latestreleased

Valencia, O., and G.H. Angarita. 2020. "Assessing the Fiscal Impact of COVID-19 in LAC." Bogota, Colombia: Ministerio de Hacienda y Crédito Público. Mimeographed document.

Zapata, S., and F. Vallejo. 2019. "Prociclicidad Sectorial del Gasto y el Producto en Colombia." Notas Fiscales. Bogota, Colombia: Ministerio de Hacienda y Crédito Público, Centro de Estudios Fiscales. Available at: http://www.urf.gov.co/webcenter/ShowProperty?nodeId=%2FConexionContent%2FWCC_CLUSTER-115856%2F%2FidcPrimaryFile&revision=latestreleased

Appendices

A. Construction of "Synthetic Colombia" for the Debt-to-GDP Ratio

Of the 50 countries that did not implement any fiscal rule at the central level, nine were excluded because of lack of data. For the remaining 41—which became our donor pool—we collected a large number of possible predictive variables from 2004 to 2017: i) GDP and GDP per-capita (PPP), ii) CG fiscal deficit, iii) population size,[28] iv) real interest rate,[29] v) GG public investment; vi) Terms of trade index for commodities, and vii) Human capital index.[30]

Using 27 countries,[31] we estimated the model and built "synthetic Colombia." Countries and weights are listed in Table 5, excluding those whose weights are 0.[32] Following Abadie et al. (2010), we excluded from the analysis those countries whose Mean Squared Prediction Error (MSPE)[33] were high compared to Colombia,[34] since it is not suitable to compare effects from models poorly adjusted (high MSPE) with those best adjusted, like the one for Colombia, whose MSPE is low (1.7).

Table 5. Countries Used to Build Synthetic Colombia (debt)

Country	Weight
Bangladesh	0,081
Guatemala	0,035
Kazakhstan	0,206
Mozambique	0,124
South Africa	0,515
Zimbabwe	0,039

Source: Authors' calculations.

[28] Measured in population (millions).
[29] Measured as the inflation-adjusted lending interest rate.
[30] The terms of trade index was taken from the IMF. Data on population and real interest rate was obtained from the World Bank, and the human capital index from PWT9.1. The remaining variables were taken from the World Economic Outlook (WEO). Philippine debt data were obtained from official sources.
[31] We eliminated the 23 least similar countries compared to Colombia both in the pre-treatment period and during 2014 and 2015, bearing in mind that during this period Colombia's terms of trade fell sharply due to the oil shock.
[32] The countries used to build the counterfactual share certain similarities with Colombia. It is observed that the majority are exporters of primary goods (Bangladesh, Guatemala, and Zimbabwe) and some in particular, of minerals and oil (Kazakhstan, Guatemala and South Africa).
[33] The MSPE averages the difference between the behavior of the observed debt and the synthetic debt for the pre-treatment period.
[34] More than 3 times the MSPE of Colombia.

Predictor variables that best adjusted the behavior of the synthetic unit to that of Colombia in the pre-treatment period are presented in Table 6. In the estimation, these variables were averaged for the period 2000-2011. [35] It can be seen that the averages of the predictor variables for Colombia and the synthetic are for the most part very similar.

Table 6. Predictor Balance (2007-2011)

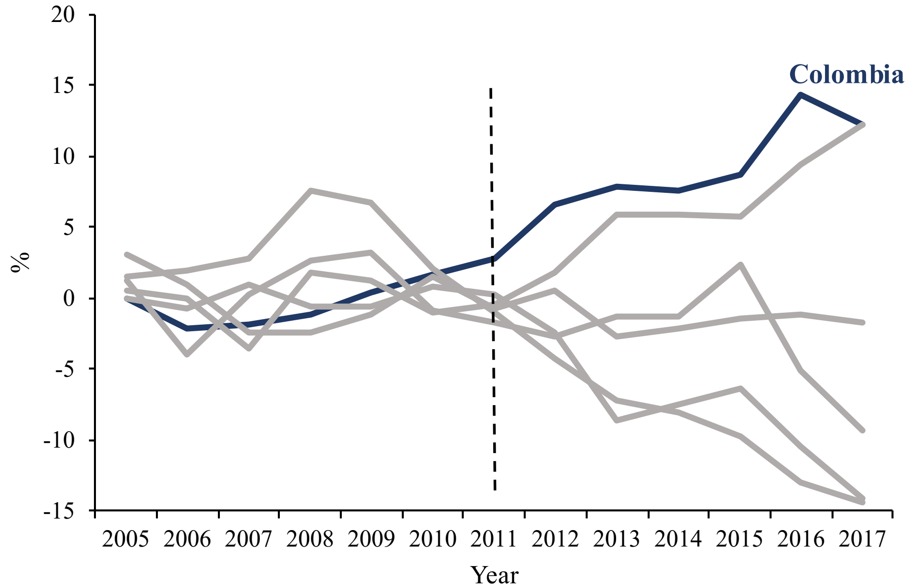
	Colombia	Synthetic
Lagged debt-to-GDP	30.33	34.66
Per capita GDP	9,631	9,629
Population	43.15	43.14
Terms of Trade	97.48	97.48
Human Capital Index	2.28	2.28
Fiscal deficit	-3.24	-0.35

B. Placebo Tests: Difference between the Estimated and Observed Debt-to-GDP Ratio for Every Country in the Donor Pool

As a robustness check and in order to assess the statistical significance of the results, we carried out different placebo tests, which consist of estimating the synthetic control method in each of the countries in the donor pool, as if they had adopted a fiscal rule in the same year as Colombia. Since the countries did not implement an FR, the estimated effect should be null or at least smaller than the effect estimated for Colombia. Otherwise, it could be suspected that the effect estimated for Colombia could be simply the result of the mathematical procedure used. The estimated effect for Colombia is one of the highest, which allows us to conclude that the FR effect on debt seems to be significant (Figure 23).

[35] Except fiscal deficit, averaged from 2004 to 2011.

Figure 22. Placebo Tests: Difference between the Observed Debt and the Estimated Effect



C. Construction of "Synthetic Colombia" for Public Investment (% of GDP)

We start with the same donor pool—50 countries which have not implemented FRs on their central government finances—as well as from the same vector of possible predictor variables used to undertake the previous exercise, including an institutional quality variable from Transparency International.[36] Then, we keep in the donor pool only 29 countries: emerging economies, commodity exporters and Latin American countries.[37] Table 7 shows the countries used to build the counterfactual and their weights. Table 8 summarized the predictor balance, that best adjusted the behavior of the synthetic unit to that of Colombia.

[36] This index (ranging from 0 to 10) measures the perception by experts and entrepreneurs of the level of corruption of public institutions. A higher score means that corruption is more successfully controlled.

[37] We use JP Morgan's EMBI classification to determine the countries belonging to "emerging economies." For commodity-exporting countries, we followed the classification of the IMF used in the World Commodity Exporters Database.

Table 7. Countries Used to Build Synthetic Colombia (investment)

Country	Weight
Algeria	0,001
Azerbaijan	0,151
Bangladesh	0,194
Guatemala	0,001
Haiti	0,277
Oman	0,011
South Africa	0,228
Ukraine	0,001
Zambia	0,135

Table 8. Predictor Balance (investment)

	Colombia	Synthetic
Public investment (2007-2011)	4,6	4,6
Growth (2005-2011)	4,9	6,0
population (log) (2005-2011)	3,8	3,2
Terms of trade (2007-2010)	99,2	99,1
Terms of trade (2013-2015)	99,2	99,3
Real interest rate (2004-2011)	7,6	7,6
GG revenue (2005-2011)	18,4	18,4
Transparency (2008-2011)	3,6	2,8

D. Elasticities Estimated for the Valencia and Angarita (2020) Model

Parameter	Definition	Calibration	Estimation	
			Prior	*Posterior*
	Fiscal parameters			
f_2	Economic cycle share in fiscal balance		0.80	0.76
f_3	Debt gap share in fiscal balance		0.80	0.81
μ_1	Autoregressive parameter in structural balance	0.30		
μ_2	GDP gap share in structural balance		0.10	0.06
ϑ	Share of the difference between debt and debt target in debt gap	0,50		
ξ^d	Share of public debt in national currency	0.65		
ρ_1^J	Autoregressive parameter in fiscal revenue		0.80	0.67
ρ_2^J	GDP gap share in fiscal revenue		0.55	0.57
ρ_1^g	Autoregressive parameter in public expenditure		0.80	0.73
ρ_2^g	GDP gap share in public expenditure	0.30		
	Macroeconomic parameters			
θ	Forward looking parameter in the IS curve		0.20	0.13
$\frac{\theta\gamma}{\sigma} + \alpha\gamma$	Exchange rate share in the IS curve		0.40	0.37
γ	Autoregressive parameter in IS curve		0.70	0.61
$(1-\theta)$	Public expenditure share in IS curve		0.14	0.21
κ	Forward looking parameter in the Phillips curve		0.23	0.27
$\theta\sigma_\gamma$	GDP gap share in the Phillip's curve		0.20	0.21
$\alpha\gamma\sigma_\gamma$	Exchange rate gap share in the Phillips curve		0.10	0.09
α_z	Autoregressive parameter in economic growth		0.40	0.36
ζ	Autoregressive parameter in debt target		0.20	0.20
σ_{y*}	Autoregressive parameter in foreign IS curve		0.20	0.22
α_1^*	Autoregressive parameter in the foreign Phillips curve		0.20	0.13
α_2^*	Foreign GDP gap share in the foreign Phillips curve		0.15	0.02
α_1	Autoregressive parameter in Taylor rule		0.15	0.23
α_2	Inflation gap share in Taylor rule	0.90		
α_3	GDP gap share in Taylor rule	0.30		
υ_1	Autoregressive parameter in nominal interest rate		0.15	0.31