AN EXTENDED DEBT SUSTAINABILITY ANALYSIS FRAMEWORK FOR LATIN AMERICAN ECONOMIES

2024

BANCO DE ESPAÑA
Eurosistema

Documentos Ocasionales
N.º 2412

Iván Kataryniuk, Raquel Lorenzo Alonso,
Enrique Martínez Casillas and Jacopo Timini

AN EXTENDED DEBT SUSTAINABILITY ANALYSIS FRAMEWORK FOR LATIN AMERICAN ECONOMIES

AN EXTENDED DEBT SUSTAINABILITY ANALYSIS FRAMEWORK FOR LATIN AMERICAN ECONOMIES (*)

Iván Kataryniuk

BANCO DE ESPAÑA

Raquel Lorenzo Alonso

EQUIPO ECONÓMICO

Enrique Martínez Casillas

BANCO DE ESPAÑA

Jacopo Timini

BANCO DE ESPAÑA

(*) The views expressed in this paper are those of the authors and do not necessarily represent the views of the Banco de España or the Eurosystem. This work was carried out during Raquel Lorenzo's time at the Banco de España and before she joined Equipo Económico. We are grateful to Carlos Thomas, Javier Vallés, Javier J. Pérez, Pablo Burriel and Juan Carlos Berganza for their comments.

Documentos Ocasionales. N.º 2412

May 2024

https://doi.org/10.53479/36539

ISSN: 1696-2230 (on-line edition)

Abstract

The COVID-19 pandemic marked a watershed for public finances in Latin America and around the world. Fiscal measures adopted in 2020 to cope with the health emergency were substantial and affected debt dynamics. While the situation partially reverted in the following years, public debt is still higher than its recent historical average for most countries in the region. In this context, the sustainability of public debt dynamics has taken on renewed importance. In this paper, we extend a standard Debt Sustainability Analysis (DSA) framework that considers significant features of Latin American economies – such as the existence of foreign currency denominated debt – by introducing an economic model that jointly determines future values of key macroeconomic variables. We then compute different scenarios for Brazil, Chile, Colombia, Mexico, and Peru, illustrating how fiscal and structural policy changes affect the dynamics of public debt.

Keywords: public debt, fiscal rules, structural reforms, Debt Sustainability Analysis (DSA), Latin America.

JEL classification: E62, H63, H68.

Resumen

La pandemia de COVID-19 marcó un punto de inflexión para las finanzas públicas en América Latina y el mundo. Las medidas fiscales adoptadas en 2020 para hacer frente a la emergencia sanitaria fueron numerosas y afectaron a la dinámica de la deuda. Si bien la situación se revirtió parcialmente en los años siguientes, la deuda pública sigue siendo superior a su promedio histórico reciente en la mayoría de los países de la región. En este contexto, la sostenibilidad de la dinámica de la deuda pública ha adquirido una renovada importancia. En este documento ampliamos un marco estándar de Análisis de Sostenibilidad de la Deuda (DSA, por sus siglas en inglés) que toma en consideración características significativas de las economías latinoamericanas —como la existencia de deuda denominada en moneda extranjera— mediante la introducción de un modelo económico que determina conjuntamente los valores futuros de variables macroeconómicas clave. A continuación calculamos diferentes escenarios para Brasil, Chile, Colombia, México y Perú que ilustran cómo los cambios de política fiscal y estructural afectan a la dinámica de la deuda pública.

Palabras clave: deuda pública, reglas fiscales, reformas estructurales, Análisis de Sostenibilidad de la Deuda (DSA), América Latina.

Códigos JEL: E62, H63, H68.

Índice

1 Introduction

The COVID-19 pandemic marked a watershed for public finances in Latin America and around the world. Fiscal measures adopted in 2020 to cope with the health emergency were sizeable and affected debt dynamics. While the situation partially reverted in the following years – as a result of the transitory nature of most public spending measures and the parallel increase in public revenues boosted by resumed economic growth – public debt is still higher than the average of the last two decades for most countries in the region (see Chart 1).

High levels of public debt, high interest rates, and enduring fiscal challenges pose a threat to fiscal sustainability.

However, most economies in the region rely on fiscal frameworks to keep public finances on a sustainable path. These frameworks incorporate one or more fiscal rules, such as budget, debt, or spending targets. Although these rules were temporarily suspended during the COVID-19 pandemic,[1] efforts are currently underway to reinstate them. Additionally, there have also been proposed parallel structural reforms – aimed e.g. at regulating product markets more efficiently, promoting international trade, or attracting quality foreign direct investment (Budina et al., 2023).

In this respect, one of the key tools used to monitor and assess fiscal sustainability in Latin America (and around the world) is the Debt Sustainability Analysis (DSA) framework. It provides an analytical framework that enables the projection of plausible future paths for public debt (see e.g. Alloza et al., 2020). To do this, a DSA framework is fed with multiple data series and forecasts for key macroeconomic variables, like GDP growth, inflation, interest rates, and the primary balance, to determine future public debt paths. Therefore, realistic forecasts are a key ingredient for DSA models. Often, these forecasts are acquired exogenously, meaning they are obtained using other toolkits[2] that involve a combination of quantitative and qualitative methods, and whose results are subsequently incorporated into the DSA framework. Consequently, the alternative scenarios constructed may not account for interactions among macroeconomic variables, such as the potential impact of fiscal policy changes on GDP growth.

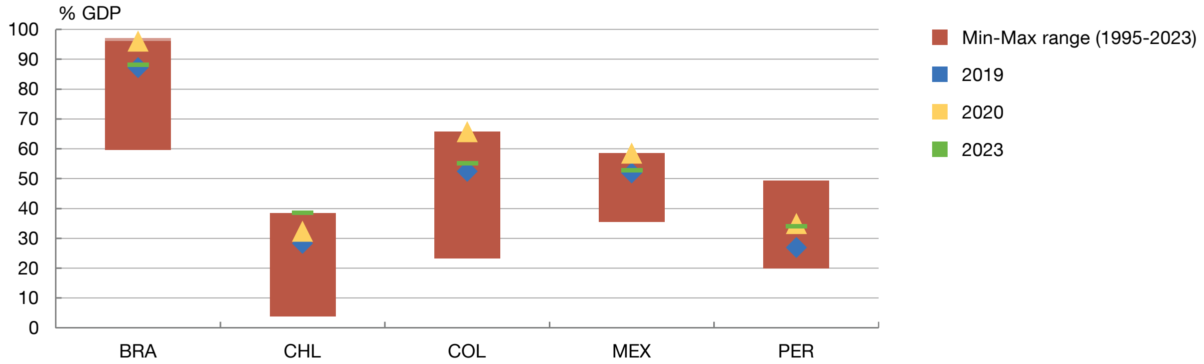
In this paper, we propose an extension to a standard Debt Sustainability Analysis (DSA) framework that takes into account important aspects of Latin American economies, such as the existence of foreign currency denominated debt.[3] This extension introduces an economic model that simultaneously determines future values of key macroeconomic

1 Most countries in the region used escape clauses, ad-hoc procedures, or adapted their fiscal targets.

2 For example, Andres-Escayola et al. (2021) describe how Bayesian vector autoregression (BVAR) models can be used to project GDP growth in Latin America.

3 It is important to consider this feature due to the varying exposure of countries to exchange rate risks associated with the rising costs of debt payments when local currencies depreciate. This exposure reflects the heterogeneous composition of their public debt (foreign and local currency denomination). Foreign currency denominated debt accounts for almost half of the total general government debt in some countries, whereas in others it is comparatively less significant, comprising only one twentieth of the total.

Chart 1
Gross public debt–selected Latin American countries



SOURCE: Authors' elaboration on IMF.
NOTE: General government public debt as percentage of country's GDP.

variables, and has two main implications. First, it ensures a consistent framework for generating all macroeconomic forecasts used in the DSA. Second, it captures the interactions among macroeconomic variables, enabling a theory-consistent propagation of shocks. Moreover, this economic model has the potential to rationalize other challenges that exist in standard DSA frameworks, such as accounting for the potential GDP impact of structural reforms. We then use the model to compute different scenarios for Brazil, Chile, Colombia, Mexico, and Peru, illustrating the incorporation of fiscal and structural policy changes in the model, and evaluating their effect on the dynamics of public debt.[4]

Our simulations show that adherence to fiscal rules can have large positive effects on the dynamics of public debt, especially for those countries projected to experience substantial fiscal deficits in the coming years. Our results also indicate that implementing structural reforms can contribute favorably to public debt dynamics through the potential GDP channel, resulting in higher rates of GDP growth and, ceteris paribus, lower debt-to-GDP ratios.

The remainder of the paper is organized as follows: Section 2 characterize the model; Section 3 describes the calibration of the key parameters; Section 4 discusses the simulation exercises; and Section 5 concludes.

4 In this paper, we adopt a deterministic approach to Debt Sustainability Analysis. This means that our framework provides debt simulations under a benchmark scenario, and a number of alternative scenarios in which shocks to key variables are implemented mostly based on a narrative approach. Alternatives exist mainly in the form of stochastic – i.e. probabilistic – Debt Sustainability Analysis (see Bouabdallah et al., 2017 for a revision of the literature, and Alloza et al., 2020 for an example of stochastic DSA).

2 The model

2.1 The dynamics of public debt

To describe and capture the dynamics of public debt, we adopt an existing state-of-the-art Debt Sustainability Analysis (DSA) framework that considers significant features of Latin American and emerging market economies – such as the existence of foreign currency denominated debt. In this sense, we closely mirror Acosta-Ormaechea and Martinez (2021) approach.[5]

More in detail, we follow the literature (e.g. Debrun et al., 2019; Burriel et al., 2022) and specify a standard equation to track the evolution of public debt over time of the form:

$$B_t = (1 + r_t)\, B_{(t-1)} - PB_t + DDA_t \tag{1}$$

where , the public debt at the end of period t, is equal to the stock of past obligations ($B_{(t-1)}$), and the corresponding interest payments ($r_t \times B_{(t-1)}$), the primary balance (PB_t) – defined as the difference between primary government revenues and expenditures, and the deficit-debt adjustment term (DDA_t) – a sort of residual term capturing all those components that do not fall into the primary balance category, also known as stock-flow adjustment. They often reflect government financial transactions (either issuance of debt to finance social security funds or the acquisition of equities), or the disposal of government financial assets to redeem existing debt, e.g. as a result of privatization measures (Kezbere and Maurer, 2018).

As suggested by Acosta-Ormaechea and Martinez (2021), it is possible to incorporate an additional layer to this basic debt dynamics framework: the currency denomination of debt, being either in local or foreign currency. This is particularly relevant for emerging markets and developing economies, where foreign currency denominated debt constitutes about half of the total outstanding government debt (IMF, 2020; IMF, 2022). In other words, and as explained in Acosta-Ormaechea and Martinez (2021), the total public debt coincides with the sum of public debt denominated in local currency and in foreign currency. This means:

$$B_t \equiv B_t^{lc} + e^{eop} B_t^{fc} \tag{2}$$

where $B_t^{lc} \leq B_t$ is the stock of public debt denominated in local currency, and $B_t^{fc} \leq B_t$ is the stock of public debt denominated in foreign currency. Implicitly, Equation 2 suggests that we express B_t in local currency (e^{eop} is the end-of-period exchange rate).

The existence of local and foreign currency has also implications for the interest

5 This approach has been already applied to analyze public debt dynamics in emerging markets. For example, Díaz Cruz (2023) exploits Acosta-Ormaechea and Martinez (2021) framework to elaborate scenarios for medium-term trajectories of public debt for several countries in Central America and the Caribbean.

payments and the deficit-debt adjustment term.

For the former, this means:

$$r_t B_{t-1} \equiv (r_t^{lc} B_{t-1}^{lc}) + (e_t^{avg} r_t^{fc} B_{t-1}^{fc}) \tag{3}$$

Indeed, the total sum devoted to interest payments ($r_t B_{t-1}$) can be decomposed into the interests generated on the share of debt denominated in local currency, $B^{lc}{}_{t-1}$, on which the country pays the nominal effective interest rate r_t^{lc}; and the interests generated on the share of debt denominated in foreign currency, B_{t-1}^{fc}, on which the country pays the nominal effective interest rate r_t^{fc}. It is often the case that $r_t^{fc} \neq r_t^{lc}$. The term e_t^{avg} is the average nominal exchange rate, and serves to denominate interest payments on foreign debt in local currency terms.[6] For the latter instead, this means that the deficit-debt adjustment term can be decomposed into two subcomponents, one identifying the "pure" debt creating flow – i.e. the part of the effect stemming directly from the financial transaction, DD_t; and another term, that in the spirit of Acosta-Ormaechea (2020), we call SF_t, identifying the stock-flow adjustment related to differences in the exchange rates used for converting debt stocks (end-of-period exchange rate) and debt flows (average exchange rate, used, e.g., for interest payments). Therefore:

$$DDA_t \equiv DD_t + SF_t \tag{4}$$

Exploiting the identities specified in Equation 2, Equation 3, and Equation 4, and substituting accordingly in the right hand side of Equation 1, we obtain:

$$B_t = (1+ r_t^{lc})B_{t-1}^{lc} + (e_t^{eop} + e_t^{avg}\, r_t^{fc})\, B_{t-1}^{fc} - PB_t + DD_t + SF_t \tag{5}$$

However, rather than debt nominal levels, researchers, policy-makers, and other relevant stakeholders tend to use an alternative metric: the debt-to-GDP ratio (e.g. Debrun et al., 2019; Buti and Gaspar, 2021). This is so because GDP constitutes a proxy for the ability of a country to generate value-added production, and the debt-to-GDP ratio therefore shows the size of debt commitments relative to its capacity to generate resources (either monetary or possible to monetize) for repaying debt obligations.

Indeed, again following Acosta-Ormaechea and Martinez (2021), it is possible to rethink the dynamics of public debt in terms of debt-to-GDP ratio, by dividing all terms of Equation 5 by nominal GDP (at time t, nominal GDP is identified by $P_t Y_t$) and rearranging as follows:

$$\frac{B_t}{P_t Y_t} = (1 + r_t^{lc}) \frac{B_{t-1}^{lc}}{P_{t-1} Y_{t-1}} \frac{P_{t-1} Y_{t-1}}{P_t Y_t} + \left(\frac{e_t^{eop}}{e_{t-1}^{eop}} + \frac{e_t^{avg}}{e_t^{eop}} \frac{e_t^{eop}}{e_{t-1}^{eop}} r_t^{fc} \right) \frac{e_{t-1}^{eop} B_{t-1}^{fc}}{P_{t-1} Y_{t-1}} \frac{P_{t-1} Y_{t-1}}{P_t Y_t} - \frac{PB_t}{P_t Y_t} + \frac{DD_t}{P_t Y_t} + \frac{SF_t}{P_t Y_t} \tag{6}$$

6 The different use of e_t^{eop} and e_t^{avg} comes from the established convention – derived from public finance manuals and based on rather intuitive grounds – of using end-of-period exchange rates to convert debt stocks from foreign to local currency (or the other way around), and average exchange rates to convert debt flows.

Equation (6) can be further transformed. First, by defining α_t as the share of public debt denominated in foreign currency ($\alpha_t = \frac{e^{eop} B_t^{fc}}{B_t}$), ε_t^{eop} as the change in the end-of-period exchange rate – i.e. appreciation or depreciation rate ($\varepsilon_t^{eop} = \frac{e_t^{eop}}{e_{t-1}^{eop}} - 1$); g_t as the real growth rate of the economy ($g_t = \frac{Y_t}{Y_{t-1}} - 1$); and π_t as the change in prices – i.e. an inflation rate indicator ($\pi_t = \frac{P_t}{P_{t-1}} - 1$). Additionally, r_t – the interest rate – can be characterized as the average of r_t^{lc} – the interest rate attached to the debt denominated in local currency – and r_t^{fc} – the interest rate attached to the debt denominated in foreign currency – weighted by the respective share of local and foreign currency debt on total public debt, i.e. $rt = (1 - \alpha_t)(1 + r_t^{lc}) + \alpha_t (1 + r_t^{fc}) - 1$. Second, by denoting variables identifying ratios in terms of GDP in lowercase. Third, by introducing dynamics – i.e. focusing on debt changes rather than levels. Once factoring in these issues, it is possible to finally rewrite it as follows:

$$b_t - b_{t-1} \frac{r_t - (1-g_t)\,\pi_{t-1}}{(1+g_t)(1+\pi_{t-1})} b_{t-1} + \frac{\varepsilon_t^{eop} + r_t^{fc}\left[(1+\varepsilon_t^{eop})\frac{e_t^{avg}}{e_t^{eop}} - 1\right]}{(1+g_t)(1+\pi_t)} \alpha_{t-1} b_{t-1} - \frac{g_t}{(1+g_t)(1+\pi_t)} b_{t-1} - pb_t + dd_t + sf_t \quad (7)$$

2.2 Behavioral linkages in debt projections

Projecting the evolution of public debt implies considering the dynamics of several macroeconomic variables and their response to different shocks. We follow recent developments in the literature (e.g. Warmedinger et al., 2015; Hernández de Cos et al., 2018; Burriel et al, 2022) and implement a series of stylized economic relationships,[7] by the means of a system of equations. These equations are a synthetic, backward-looking version of a standard New Keynesian model (Galí, 2015), in which aggregate demand, inflation, the fiscal balance and the exchange rate are jointly determined by shocks to macroeconomic fundamentals.

Our first behavioral equation corresponds to an Investment-Saving (IS) curve, linking real output growth to past output growth, potential output growth, the output gap, the fiscal stance, and the interest rate. Equation (8) collects these features as follows:

$$g_t = \rho g_{t-1} + (1 - \rho)\,\bar{g} + \beta \Delta def_t^{p,E} + \tau O_t + \vartheta (r_t^m - r_{t-1}^m) \quad (8)$$

Here, real output growth, g, responds to past output growth g_{t-1}, with elasticity ρ capturing the real output growth persistence; to real potential output growth, $\bar{g}$, with elasticity $1 - \rho$; as well as to the cyclical conditions of the economy – i.e the output gap – and fiscal and monetary policy. More in detail, the output gap is defined as $\frac{Y_t - \bar{Y}_t}{Y_t}$, where $Y_t = (1 + g_t)Y_{t-1}$ denotes the level of real output, and $\bar{Y}_t = (1 + \bar{g}_t)\bar{Y}_{t-1}$ that of potential real output. The output gap also affects the output growth rate, as in each period a fraction τ of the gap closes. Monetary policy is inserted as a change of the nominal (marginal) interest rate r_t^m, whose impact on real output growth is a function of the elasticity ϑ. Fiscal policy is inserted in model as a shock, $\Delta def_t^{p,E}$, whose impact on real output growth is mediated by a fiscal multiplier β, where the public deficit as a percentage of nominal GDP, $def_t = \frac{DEF_t}{Y_t}$, is defined as the sum of

7 For a general discussion of so-called Debt Sustainability Analysis (DSA) frameworks, see IMF (2022a), and the references quoted therein.

the structural public deficit, def_t^E (or as a percentage of potential GDP $def_{p,t}^E$), and the cyclical deficit, def_t^c

$$def_t \equiv def_t^{p,E} \frac{\overline{Y}_t}{Y_t} + def_t^C \quad (9)$$

where the cyclical deficit is defined as a proportion (elasticity, ϵ) of (the inverse) of the output gap, such that the public deficit increases proportionally during recessions $def_t^E \equiv -\epsilon O_t$

The second behavioral equation is a Phillips curve, which links the course of the inflation rate with the degree of slack in the economy, measured by the output gap adaptive inflation expectations.

$$\pi_t = E_t(\pi_{t+1}) + \theta O_t \quad (10)$$

In turn:

$$E_t(\pi_{t+1}) = \sigma\pi^0 + (1-\sigma)\frac{1}{4}(\pi_{t-1}) + \pi_{t-2} + \pi_{t-3} + \pi_{t-4}) + \theta O_t + \omega\varepsilon_t^{avg} \quad (11)$$

Equations (11) includes the medium-term inflation target, π^0, whose weight depends on σ – the anchoring of inflation to the inflation target; past values of inflation whose weight depends on $1-\sigma$; the output gap, O_t, whose effect on inflation depends on θ, and the exchange rate pass-through (to next-year inflation), being ω the inflation response to exchange rate and e_t the exchange rate.

The implicit interest rate r_t follows the following law of motion:

$$r_t = \delta r_{t-1} + (1-\delta)\, r_t^m \quad (12)$$

where δ is the interest rate persistence and r_t^m is the marginal interest rate. Given that in the model there are two types of debt denomination (local and foreign currency), we exploit the uncovered interest parity (UIP) theory – i.e. assuming open capital accounts, interest rate differentials are only determined by the expected change in exchange rates – and formulate Equation (13) as follows:

$$r_t^{m,lc} = r_t^{m,fc} + E_t(e_{t+1}) - e_t \quad (13)$$

where $r_t^{m,l,c}$ indicates the domestic marginal interest rate, and $r_t^{m,f,c}$ the foreign marginal interest rate (fixed), Ee_{t+1} and e_t are the expected exchange rate in t+1, and the current exchange rate respectively. This implies that given a foreign interest rate, changes to the local interest rate stem from the expected exchange rate. Assuming no changes in the foreign interest rate – or conceptualizing them as changes relative to the domestic rate – and assuming perfect foresight in exchange rates, Equation (13) can be reformulated as follows:

$$e_{t+1}^{avg} = e_{t+1}^{eop} = e_{t}^{eop} - (e_{t} \times \varphi \times \frac{\Delta(r_{t}^{m,lc} - r_{t}^{m,fc})}{100}) \qquad 14$$

where e_{t}^{eop} is the exchange rate of the year t. The parameter $\varphi \in (0,1)$ is an adjustment term for the pass-through of interest rate shocks to the exchange rate, measuring the degree of capital openness, such that under a fully open capital account $\varphi = 1$.

Our economic model therefore allows for the introduction of macroeconomic shocks to several variables, such as the primary balance, the interest rate, the exchange rate, GDP growth, and potental GDP, in a theory-consistent manner.

3 Calibration

Calibration requires finding a set of unique values for several common and country-specific parameters. In our case, this has largely been done by extracting estimates from the existing literature. In doing so, we take into account Favero et al. (2011) critique – showing the pervasiveness of country heterogeneity in the size and sign of fiscal policy effects – and use estimates obtained with region (Latin America) or – when solid evidence is available in favor of potential within-region heterogeneity – country-specific data.

First, the interest rate of the debt stock changes gradually and depends on the rollover frequency. The higher the rollover frequency, the higher the persistence of the interest rate. We calibrate the corresponding parameter δ using the average debt maturity at the country level.[8]

We obtain the parameter capturing the inflation expectations anchoring, σ, from Gondo and Yetman (2018). This parameter identifies how fast inflation tends to the inflation target, and it becomes larger with the time horizon as we can add more information to our expectations. This parameter varies across countries, from 0.6 in Colombia to 0.9 in Chile for a 12-month horizon. We obtain the parameter measuring the response of inflation to the output gap, θ, from Agénor and Bayraktar (2010) and Lanau et al. (2018), both indicating values around 0.1 for Latin America. We then set the exchange rate pass-through parameter, ω, at 0.05. This represents a mid-range value among those reviewed in the literature for Latin American countries. For example, Faruqee (2016) estimates the exchange rate pass-through to inflation after a 1 per cent increase in the nominal effective exchange rate for Latin American 5 (Brazil, Chile, Colombia, Mexico, and Peru) to be around 0.05 in recent years. Other studies indicate similar values (Cortes Espada, 2013; Albagli et al., 2015; Borensztein et al., 2016; Donayre and Panovska, 2016). This relatively low value reflects countries' commitment to inflation-targeting regimes and transparent decision-making processes (López-Villavicencio and Mignon, 2017). We then set the parameter ρ, capturing the persistence of output growth, to 0.17, in line with the IMF (2015) and Vianna (2016). The contemporaneous (or "short run") fiscal multiplier parameter β captures the impact of public spending on output growth. We follow IMF (2015), Garry and Rivas Valdivia (2017), and Carrière-Swallow et al. (2021) and set β=0.55. While the number falls outside (below) the average value range indicated by a recent meta-analysis (Hlavacek and Ismayilov, 2022), such difference reflects the fact that output effects of increases in government spending tend to be smaller in emerging markets and developing economies (Ilzetzki et al., 2013).

The output gap persistence parameter τ indicates the speed of the output convergence to its potential. We set it to 0.22, as estimated by Alberola et al. (2016) for a sample of Latin American countries. The cyclical component of the budget relative to the output gap – or in other words the elasticity of fiscal balance to output growth – corresponds to the parameter

8 It mirrors the average debt maturity assuming that a constant fraction of the outstanding debt matures in each period and is rolled over at the marginal interest rate.

Table 1
Calibration of the DSA common parameters

Parameter	Explanation	Value	Source
θ	Inflation response to the output gap	0.10	Agénor and Bayraktar (2010) and Lanau et al. (2018)
ω	Inflation response to exchange rate	0.05	Faruqee (2016), Cortes Espada, (2013), Albagli et al., (2015), Borensztein et al., (2016), Donayre and Panovska, (2016)
ρ	Output growth persistence	0.17	IMF (2015) and Vianna (2016)
β	Fiscal multiplier	0.55	IMF (2015), Garry and Rivas Valdivia (2017), and Carrière-Swallow et al. (2021)
τ	Output gap persistence	0.22	Alberola et al. (2016)
ε	Elasticity of fiscal balance to output growth	0.20	Martner Fanta (2000) and Alberola et al. (2016)
ϑ	Impact of interest rates on output growth	-0.10	Mallick and Sousa (2012)

Table 2
Calibration of the DSA country-specific parameters

Parameter	Explanation	Country					Source
		Brazil	Chile	Colombia	Mexico	Peru	
δ	Persistence of implicit interest rate	0.73	0.91	0.90	0.87	0.93	Own calculations
σ	Anchoring of inflation to inflation target	0.75	0.90	0.60	0.85	0.80	Gondo and Yetman (2018)
φ	Exchange rate response to interest rate shock (Chinn-Ito index)	0.16	0.70	0.42	0.70	1.00	Chinn and Ito (2006)

$\in$ in our model, which we set equal to 0.2 across Latin American countries following Martner Fanta (2000) and Alberola et al. (2016). Thus, the value of the cyclical balance would be ϵO_t. We also set the parameter identifying the interest rate impact on output growth, ϑ, equal to -0.1, as estimated by Mallick and Sousa (2012) for a sample of emerging countries.

We then calibrate the reaction of the exchange rate to a change in the interest rate– the parameter φ – exploiting the Chinn-Ito index (Chinn and Ito, 2006). Given that the Chinn-Ito index measures a country's capital account openness (based on the information reported in the Annual Report on Exchange Arrangements and Exchange Restrictions), we are assuming that the higher the financial openness, the stronger the reaction of the exchange rate to change in interest rates.

To avoid debt projections being dependent on data outliers – a problem similar to those mentioned by Álvarez and Odendahl (2022) and Carriero et al. (2022) for forecasting using Bayesian inference – materializing in the last year of data availability, we use the IMF World Economic Outlook forecasts as a source of information for the two first projection years.

Table 1 (common parameters) and Table 2 (country-specific parameters) summarize the information available for the entire set of key model parameters.

4 Simulation exercises

Our economic model allows for the introduction of macroeconomic shocks to several variables, such as the primary balance, the interest rate, the exchange rate, GDP growth, and potential GDP, in a theory-consistent manner.

In this section, we will focus on two shocks – the primary balance shock and the potential GDP shock – and compute different scenarios for Brazil, Chile, Colombia, Mexico, and Peru, illustrating how fiscal and structural policy changes can be incorporated in the model. Debt dynamics are data-driven up to 2024,[9] with simulations starting in 2025.[10]

Table 3 summarizes the key assumptions for the structural primary balance under three different scenarios. Chart 2 portrays public debt dynamics for Brazil, Chile, Colombia, Mexico, and Peru in any of these three different scenarios.

In the first scenario, we keep the structural primary balance fixed at 2023 levels.[11] This is to be interpreted as a simple scenario, depicting the dynamics of public debt would be in case structural primary balance levels would remain unchanged from 2023 levels. However, governments in Latin America already made fiscal plans for the coming years and projected their fiscal paths according to reforms already or about to be implemented, therefore it has not been built with the purpose of being a realistic scenario,

Table 3
Structural primary balance assumptions under different scenarios

Country	Scenario 1: Structural primary balance fixed at 2023 levels (%)	Scenario 2: Structural primary balance implied by fiscal rules (%)	Scenario 3: Scenario 2 + structural reforms
Brazil	-1,7	2025: +0.5% 2026 - onwards: +1.0%	Scenario 2 + converging to a 90% increase of potential GDP by 2028
Chile	-3.7	2025: -1.1% 2026 - onwards: -0.5%	
Colombia	+0.5	2025-2026: +0.2% 2027- onwards: +0.3%	
Mexico	+1.4	2025 - onwards: +1.5%	
Peru	-0.7	2025: 0.0% 2026: +0.5% 2027- onwards: +0.7%	

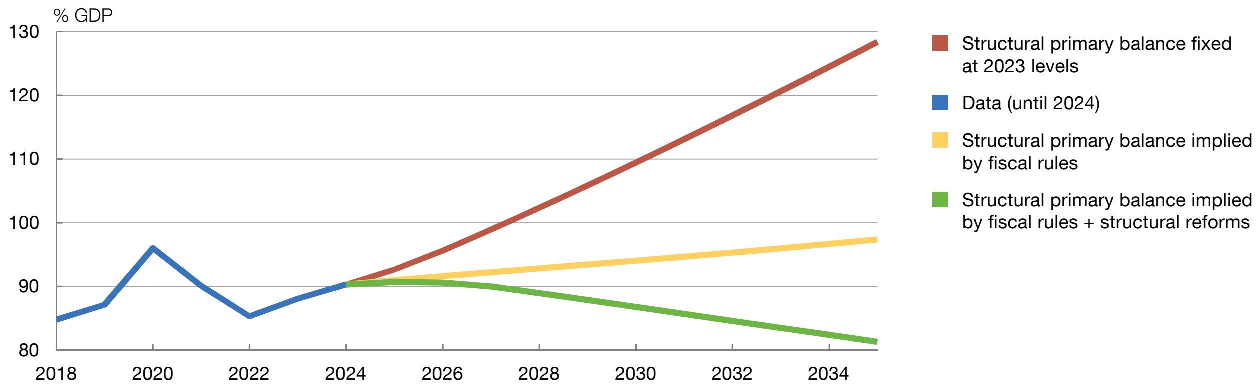
9 For years where there is no consolidated hard data yet, we rely on IMF forecasts.

10 It is important to stress that how to approach the construction of a reliable baseline scenario is outside the scope of this paper to construct a baseline scenario. Often, baseline scenarios rely on concepts such as "no policy change", i.e. incorporating all policies already enacted into the baseline scenario, and/or estimated paths for fiscal policy, for example by using IMF projections for the primary balance. For more details on how to approach the construction of a baseline scenario, see IMF (2022b).

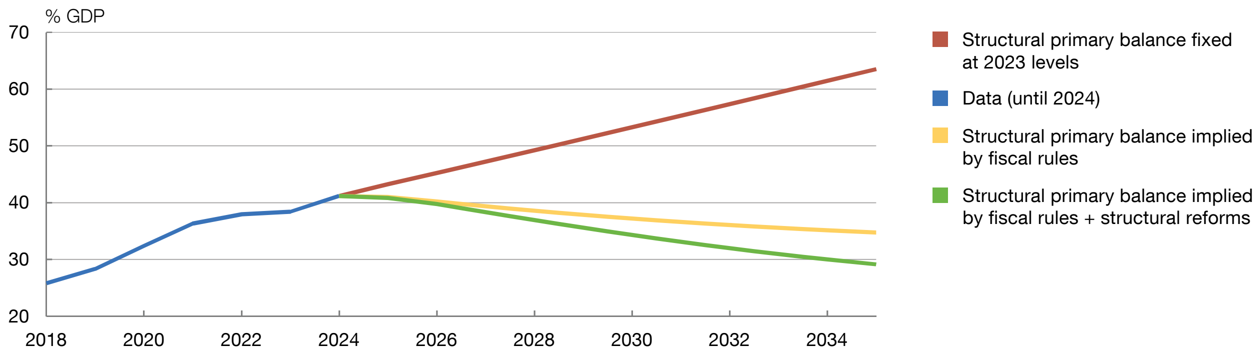
11 Forecasts for the 2023 structural primary balance are available in the IMF Fiscal Monitor (see IMF, 2023a).

Chart 2
Public debt dynamics under different assumptions

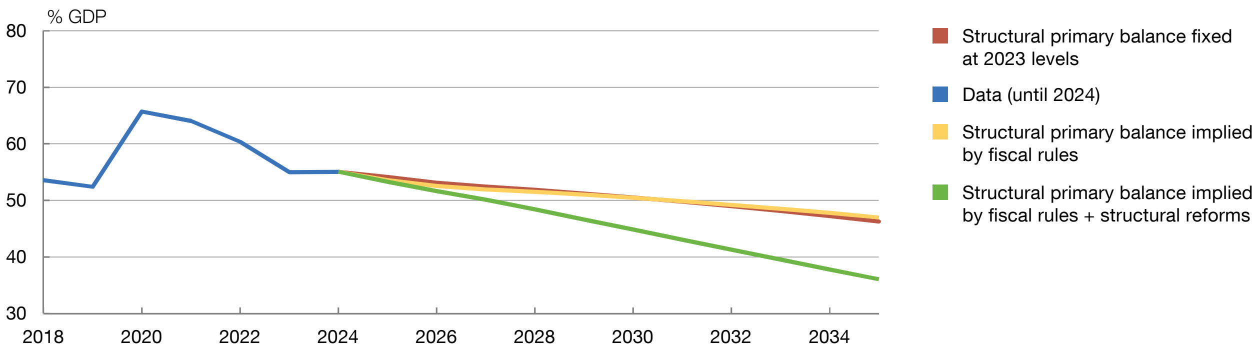
2.a Brasil



2.b Chile



2.c Colombia



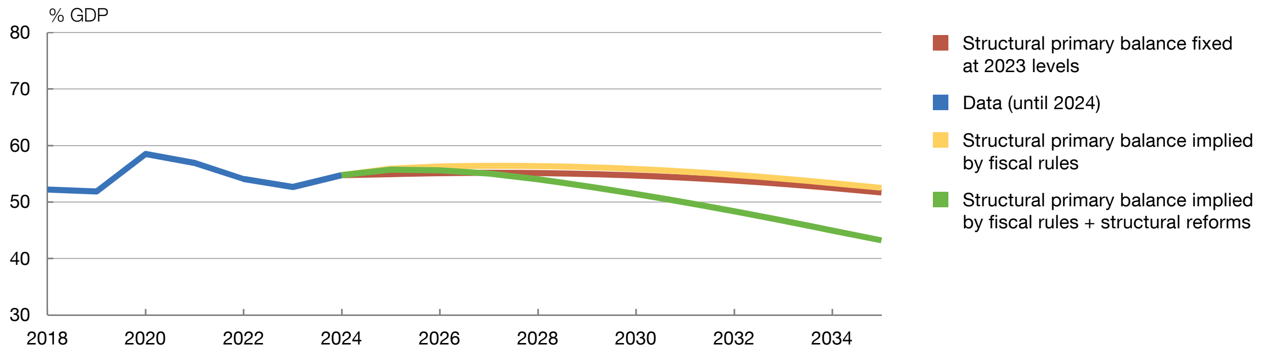
NOTE: See Table 3 and text for more details on the scenarios' assumptions.

but solely of being illustrational of the model potential. In this scenario, the public debt dynamics show an increasing trend for those countries expected to run structural primary deficits. Oppositely, those countries expected to run (large) surpluses, such as Mexico and Colombia, display downward trends in public debt dynamics. In Chart 2, the solid line depicts this scenario.

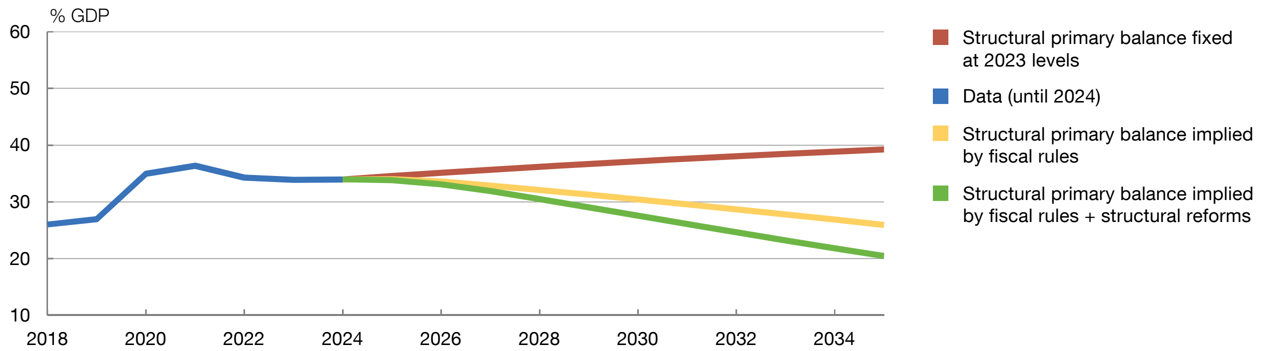
Chart 2

Public debt dynamics under different assumptions (cont'd)

2.d Mexico



2.e Peru



NOTE: See Table 3 and text for more details on the scenarios' assumptions.

In the second scenario, we insert the structural primary balance path implied by existing fiscal rules. Fiscal rules have been varying over time and are currently very heterogeneous across countries. Sometimes, these rules focus on different fiscal aspects: budget balance, expenditure, or debt levels.[12] Translating such rules into clear structural primary balance targets is not always straightforward. In certain cases, we calibrate the structural primary balance shock to reach specific primary balance targets (e.g. Brazil). In other cases, we derive the structural primary balance path from the corresponding multiannual fiscal framework. In most cases, in this scenario, debt dynamics are not steadily increasing, but converge towards equilibrium by the end of our projections horizon (2035). Again, in most cases, debt paths converge towards lower debt levels in 2035 with respect to Scenario 1, where we keep the structural primary balance fixed at 2023 levels. This is because the majority of countries in 2023 do not have yet converged towards structural

12 For a more detailed survey on the history, taxonomy, and functioning of fiscal rules, see, e.g., Berganza (2012), Arreaza et al. (2022), Gomez-Gonzalez et al. (2022), Ulloa-Suarez and Valencia (2022a), Ulloa-Suarez and Valencia (2022b), and Ardanaz et al. (2023).

primary balance levels implied by their fiscal rules, which are currently being phased in gradually following a hold period during the pandemic. In Chart 2, the dotted line depicts this scenario.

In the third scenario, we complement Scenario 2 by incorporating the adoption of priority structural reforms,[13] operationalized in the model as a 90% higher potential GDP by 2028 onwards. This value mirrors Bailliu and Hajzler (2016) estimates. In Figure 2, the dashed line depicts this scenario. It is possible to notice that the dashed line (Scenario 3) is always below the dotted line (Scenario 2): higher potential GDP implies higher GDP growth rates, and therefore – *ceteris paribus* – lower debt-to-GDP ratios.

13 Priority structural reforms may include easing product market regulations, boosting trade liberalization/facilitation, tackling climate change, or promoting digitalization. See IMF (2023b) for more details.

5 Conclusions

In this paper, we integrate an economic model that links and jointly determines future values of key macroeconomic variables – such as, e.g., GDP growth, inflation, interest rates, and the primary balance – to an existing state-of-the-art DSA framework that considers significant features of Latin American economies, including the existence of foreign currency denominated debt. We calibrate both common and country-specific parameters of the model by extracting estimates from the existing literature. The inclusion of our economic model in the DSA framework has two main implications. First, it provides a consistent framework for generating all macroeconomic forecasts used in the DSA. Second, it considers the interactions among macroeconomic variables. Therefore, when a shock is inserted in the model, it will propagate across variables in a theory-consistent manner.

Our simulations show the substantial beneficial impact that adherence to fiscal rules can have on public debt dynamics, particularly for countries projected to experience large fiscal deficits in the coming years. Furthermore, our results suggest that structural reforms can positively affect public debt dynamics through the potential GDP channel, leading to higher GDP growth rates and, ceteris paribus, lower debt-to-GDP ratios.

Looking forward, in order to better incorporate the growing concerns related to the policy challenges posed by climate change (Hansen, 2022; Mongelli et al., 2022), especially those concerning public debt sustainability (Beetsma et al., 2022; Gagliardi et al., 2022), the model could be expanded to include the nexus between climate change and economic policy in the behavioral linkages of debt projections.

References

Acosta Ormaechea, Santiago. (2020). "Public Debt Dynamics and Intra-Year Exchange Rate Fluctuations". IMF Working Papers, 2020/261, International Monetary Fund. https://doi.org/10.5089/9781513561585.001

Acosta Ormaechea, Santiago, and Leonardo Martinez. (2021). "A Guide and Tool for Projecting Public Debt and Fiscal Adjustment Paths with Local- and Foreign-Currency Debt". IMF Technical Notes and Manuals, 2021/005, International Monetary Fund. https://doi.org/10.5089/9781513577289.005

Agénor, Pierre-Richard, and Nihal Bayraktar. (2010). "Contracting models of the Phillips curve empirical estimates for middle-income countries". *Journal of Macroeconomics,* 32(2), pp. 555-570. https://doi.org/10.1016/j.jmacro.2009.09.002

Albagli, Elías, Alberto Naudon and Rodrigo Vergara. (2015). "Inflation Dynamics in LATAM: A Comparison with Global Trends and Implications for Monetary Policy". Economic Policy Papers, 58, Central Bank of Chile. https://ideas.repec.org/p/chb/bcchep/58.html

Alberola, Enrique, Iván Kataryniuk, Ángel Melguizo and René Orozco. (2016). "Fiscal policy and the cycle in Latin America: the role of financing conditions and fiscal rules". Working Papers, 1604, Banco de España. https://doi.org/10.2139/ssrn.2729709

Alloza, Mario, Javier Andrés, Javier J. Pérez and Juan A. Rojas. (2020). "Implicit public debt thresholds: An operational proposal". *Journal of Policy Modeling,* 42(6), pp. 1408-1424. https://doi.org/10.1016/j.jpolmod.2020.05.005

Álvarez, Luis J., and Florens Odendahl. (2022). "Data outliers and Bayesian VARs in the Euro Area". Working Papers, 2239, Banco de España. https://doi.org/10.53479/23552

Andres-Escayola, Erik, Juan Carlos Berganza, Rodolfo Campos and Luis Molina. (2021). "A BVAR toolkit to assess macrofinancial risks in Brazil and Mexico". Occasional Papers, 2114, Banco de España. https://repositorio.bde.es/handle/123456789/17051

Ardanaz, Martín, Carolina Ulloa-Suárez and Oscar Valencia. (2023). "Why Don't We Follow the Rules? Drivers of Compliance with Fiscal Policy Rules in Emerging Markets". IDB Working Paper Series, 1497, Inter-American Development Bank. https://doi.org/10.18235/0005165

Arreaza, Adriana, Pablo Sanguinetti, George Kopits, Juan Carlos Berganza, Klaus Schmidt-Hebbel, María Caridad Ortiz, Marco Antônio Freitas de Hollanda Cavalcanti, Monica Mora, Claudio Hamilton Matos dos Santos, Gustavo Bhering and Vinícius Augusto Lima de Almeida. (2022). *Reglas fiscales para la recuperación en América Latina: experiencias y principales lecciones.* CAF. https://scioteca.caf.com/handle/123456789/1905

Bailliu, Jeannine, and Christopher Hajzler. (2016). "Structural Reforms and Economic Growth in Emerging-Market Economies". *Bank of Canada Review* (Autumn), pp. 47-60. https://ideas.repec.org/a/bca/bcarev/v2016y2016iautumn16p47-60.html

Beetsma, Roel, Niels Thygesen, Janis Malzubris, Mateusz Szczurek, Laszlo Jankovics, Martin Larch, Mateja Gabrijelcic, Xavier Debrun, Matthias Busse and Massimo Bordignon. (2022). "Public finances and climate change in the post-pandemic era". Tech. rep., VoxEU.org. https://cepr.org/voxeu/columns/public-finances-and-climate-change-post-pandemic-era

Berganza, Juan Carlos. (2012). "Fiscal rules in Latin America: a survey". Occasional Papers, 1208, Banco de España. https://repositorio.bde.es/handle/123456789/6369

Borensztein, Eduardo, and Virginia Queijo Von Heideken. (2016). "Exchange Rate Pass-through in South America: An Overview". IDB Working Paper Series, 710, Inter-American Development Bank. https://doi.org/10.18235/0011752

Bouabdallah, Othman, Thomas Warmedinger, Cristina Checherita-Westphal, Francesco Drudi, Ralph Setzer, Roberta de Stefani and Andreas Westphal. (2017). "Debt sustainability analysis for euro area sovereigns: a methodological framework". Occasional Paper Series, 185, European Central Bank. https://www.ecb.europa.eu//pub/pdf/scpops/ecbop185.en.pdf

Budina, Nina, Christian H. Ebeke, Florence Jaumotte, Andrea Medici, Augustus J. Panton, Marina Mendes Tavares and Bella Yao. (2023). "Structural Reforms to Accelerate Growth, Ease Policy Trade-offs, and Support the Green Transition in Emerging Market and Developing Economies". IMF Staff Discussion Notes, 2023/007, International Monetary Fund. https://doi.org/10.5089/9798400250095.006

Burriel, Pablo, Iván Kataryniuk and Javier J. Pérez. (2022). "Computing the EU's SURE interest savings using an extended debt sustainability assessment tool". Occasional Papers, 2210, Banco de España. https://repositorio.bde.es/handle/123456789/21159

Buti, Marco, and Victor Gaspar. (2021). "Maastricht values". Tech. rep., VoxEU.org. https://cepr.org/voxeu/columns/maastricht-values

Carrière-Swallow, Yan, Antonio C. David and Daniel Leigh. (2021). "Macroeconomic Effects of Fiscal Consolidation in Emerging Economies: New Narrative Evidence from Latin America and the Caribbean". *Journal of Money, Credit and Banking,* 53(6), pp. 1313-1335. https://doi.org/10.1111/jmcb.12784

Carriero, Andrea, Todd E. Clark, Massimiliano Marcellino and Elmar Mertens. (2022). "Addressing COVID-19 outliers in BVARs with stochastic volatility". *Review of Economics and Statistics,* pp. 1-38. https://doi.org/10.1162/rest_a_01213

Chinn, Menzie D., and Hiro Ito. (2006). "What matters for financial development? Capital controls, institutions, and interactions". *Journal of Development Economics,* 81(1), pp. 163-192. https://doi.org/10.1016/j.jdeveco.2005.05.010

Cortés Espada, Josué Fernando. (2013). "Estimating the Exchange Rate Pass-Through to Prices in Mexico". *Monetaria,* 1(2), pp. 287-316. https://www.cemla.org/PDF/monetaria/PUB-MON-I-02.pdf

Debrun, Xavier, Jonathan D. Ostry, Tim Willems and Charles Wyplosz. (2019). "Public Debt Sustainability". Discussion Papers Series, 14010, CEPR. https://doi.org/10.1093/oso/9780198850823.003.0005

Delgado-Téllez, Mar, Esther Gordo, Iván Kataryniuk and Javier J. Pérez. (2022). "The decline in public investment: 'social dominance' or too-rigid fiscal rules?". *Applied Economics,* 54(10), pp. 1123-1136. https://doi.org/10.1080/00036846.2021.1990841

Díaz Cruz, Wilfredo. (2023). "Comprendiendo la trayectoria de la deuda pública en el mediano plazo para los países de la región CARD a través de la Herramienta de Dinámica de Deuda Pública". Notas Económicas, 145, Consejo Monetario Centroamericano. https://www.secmca.org/nota/comprendiendo-la-trayectoria-de-la-deuda-publica-en-el-med

Donayre, Luiggi, and Irina Panovska. (2016). "State-dependent exchange rate pass-through behavior". *Journal of International Money and Finance,* 64(C), pp. 170-195. https://doi.org/10.1016/j.jimonfin.2016.02.018

ECLAC. (2022). *Fiscal Panorama of Latin America and the Caribbean.* United Nations.

European Fiscal Board. (2023). "Assessment of the fiscal stance appropriate for the euro area in 2024". Tech. rep. https://www.consilium.europa.eu/media/65609/2023-06-21-efb-assessment-of-euro-area-fiscal-stance-final_0.pdf

Faruquee, Hamid. (2016). "Exchange Rate Pass-Through in Latin America". *Regional Economic Outlook. Western Hemisphere,* April. https://www.elibrary.imf.org/downloadpdf/book/9781498329996/ch004.pdf

Favero, Carlo, Francesco Giavazzi and Jacopo Perego. (2011). "Country Heterogeneity and the International Evidence on the Effects of Fiscal Policy". *IMF Economic Review,* 59(4), pp. 652-682. https://doi.org/10.1057/imfer.2011.25

Fournier, Jean-Marc. (2016). "The Positive Effect of Public Investment on Potential Growth". OECD Economics Department Working Papers, 1347, OECD Publishing. https://doi.org/10.1787/15e400d4-en

Gagliardi, Nicola, Pedro Arévalo and Stéphanie Pamies. (2022). "The Fiscal Impact of Extreme Weather and Climate Events Evidence for EU Countries". Discussion Papers, 168, Directorate General Economic and Financial Affairs (DG ECFIN), European Commission. https://economy-finance.ec.europa.eu/document/download/69d8a3f4-2a15-48a0-970d-92a7fb9d921b_en?filename=dp168_en.pdf

Galí, Jordi. (2015). *Monetary Policy, Inflation, and the Business Cycle: An Introduction to the New Keynesian Framework and Its Applications Second edition.* Princeton University Press. https://ideas.repec.org/b/pup/pbooks/10495.html

Garry, Stefanie, and Juan Carlos Rivas Valdivia. (2017). "An analysis of the contribution of public expenditure to economic growth and fiscal multipliers in Mexico, Central America and the Dominican Republic, 1990-2015". Estudios y Perspectivas – Sede Subregional de la CEPAL en México, 42062, CEPAL. https://hdl.handle.net/11362/42062

Gomez-Gonzalez, Jose E., Oscar M. Valencia and Gustavo A. Sánchez. (2022). "How fiscal rules can reduce sovereign debt default risk". *Emerging Markets Review,* 50(C). https://doi.org/10.1016/j.ememar.2021.100839

Gondo, Rocío. (2018). "Esquema de metas explícitas de inflación, credibilidad de la política monetaria y anclaje de las expectativas de inflación". *Moneda,* 174, pp. 9-12. https://www.bcrp.gob.pe/docs/Publicaciones/Revista-Moneda/moneda-174/moneda-174-02.pdf

Hansen, Lars Peter. (2022). "Central banking challenges posed by uncertain climate change and natural disasters". *Journal of Monetary Economics,* 125(C), pp. 1-15. https://doi.org/10.1016/j.jmoneco.2021.09.010

Hernández de Cos, Pablo, David López Rodríguez and Javier J. Pérez. (2018). "The challenges of public deleveraging". Occasional Papers, 1803, Banco de España. https://repositorio.bde.es/handle/123456789/6405

Hlavacek, Michal, and Ilgar Ismayilov. (2022). "Meta-analysis: Fiscal Multiplier". IES Working Papers, 7/2022, Institute of Economic Studies, Faculty of Social Sciences, Charles University in Prague. http://hdl.handle.net/10419/265193

Ilzetzki, Ethan, Enrique G. Mendoza and Carlos A. Végh. (2013). "How big (small?) are fiscal multipliers?". *Journal of Monetary Economics,* 60(2), pp. 239-254. https://doi.org/10.1016/j.jmoneco.2012.10.011

IMF. (2015). "2015 Article IV Consultation - Press Release; Staff Report; and Statement by the Executive Director for Spain". IMF Country Report, 15/232, International Monetary Fund. https://doi.org/10.5089/9781513543239.002

IMF. (2020). "Chapter 3. Emerging and Frontier Markets: Managing Volatile Portfolio Flows". En International Monetary Fund, *Global Financial Stability Report,* April, pp. 47-65. https://www.imf.org/-/media/Files/Publications/GFSR/2020/April/English/ch3.ashx

IMF. (2022a). "Making Debt Work for Development and Macroeconomic Stability". Policy Paper, 2022/019, International Monetary Fund. https://doi.org/10.5089/9798400208591.007

IMF. (2022b). "Staff Guidance Note on the Sovereign Risk and Debt Sustainability Framework for Market Access Countries". Policy Paper, 2022/039, International Monetary Fund. https://doi.org/10.5089/9798400216862.007

IMF. (2023a). "Fiscal Monitor". https://www.imf.org/external/datamapper/datasets/FM

IMF. (2023b). "G-20 Report on Strong, Sustainable, Balanced, and Inclusive Growth". https://www.imf.org/external/np/g20/110723.htm

Kezbere, Linda, and Henri Maurer. (2018). "Deficit-debt adjustment (DDA) analysis: an analytical tool to assess the consistency of government finance statistics". Statistics Paper Series, 29, European Central Bank. https://www.ecb.europa.eu//pub/pdf/scpsps/ecb.sp29.en.pdf

Lanau, Sergi, Adrian Robles and Frederik G. Toscani. (2018). "Explaining Inflation in Colombia: A Disaggregated Phillips Curve Approach". IMF Working Papers, 2018/106, International Monetary Fund. https://doi.org/10.5089/9781484354827.001

López-Villavicencio, Antonia, and Valérie Mignon. (2017). "Exchange rate pass-through in emerging countries: Do the inflation environment, monetary policy regime and central bank behavior matter?". *Journal of International Money and Finance,* 79(C), pp. 20-38. https://doi.org/10.1016/j.jimonfin.2017.09.004

Mallick, Sushanta K., and Ricardo M. Sousa. (2012). "Real Effects of Monetary Policy in Large Emerging Economies". *Macroeconomic Dynamics,* 16(S2), pp. 190-212. https://doi.org/10.1017/S1365100511000319

Martner Fanta, Ricardo. (2000). "Los estabilizadores fiscales automáticos". *Revista CEPAL,* 70, pp. 31-52. https://doi.org/10.18356/6bac5d0f-es

Parker, Miles. (2023). "How climate change affects potential output". *ECB Economic Bulletin,* 6/2023. https://www.ecb.europa.eu//pub/economic-bulletin/articles/2023/html/ecb.ebart202306_02~0535282388.en.html

Taylor, John B. (2000). "Low inflation, pass-through, and the pricing power of firms". *European Economic Review,* 44(7), pp. 1389-1408. https://doi.org/10.1016/S0014-2921(00)00037-4

Ulloa-Suarez, Carolina, and Oscar Valencia. (2022a). "Do governments stick to their announced fiscal rules". *Journal of Government and Economics,* 8(100058). https://doi.org/10.1016/j.jge.2023.100058

Ulloa-Suarez, Carolina, and Oscar Valencia. (2022b). "Numerical Compliance with Fiscal Rules in Latin America and the Caribbean". IDB Working Paper Series, 1345, Inter-American Development Bank. http://dx.doi.org/10.18235/0004445

Vianna, Andre C. (2016). "The impact of exports to China on Latin American growth". *Journal of Asian Economics,* 47(C), pp. 58-66. https://doi.org/10.1016/j.asieco.2016.10.002

Warmedinger, Thomas, Cristina Checherita-Westphal and Pablo Hernández de Cos. (2015). "Fiscal Multipliers and Beyond". *Hacienda Pública Española / Review of Public Economics,* 215(4), pp. 139-168. https://www.ief.es/docs/destacados/publicaciones/revistas/hpe/215_Art6.pdf

BANCO DE ESPAÑA PUBLICATIONS

OCCASIONAL PAPERS

2210 PABLO BURRIEL, IVÁN KATARYNIUK and JAVIER J. PÉREZ: Computing the EU's SURE interest savings using an extended debt sustainability assessment tool.

2211 LAURA ÁLVAREZ, ALBERTO FUERTES, LUIS MOLINA and EMILIO MUÑOZ DE LA PEÑA: Fund raising in the international capital markets in 2021. (There is a Spanish version of this edition with the same number).

2212 CARLOS SANZ: El peso del sector público en la economía: resumen de la literatura y aplicación al caso español.

2213 LEONOR DORMIDO, ISABEL GARRIDO, PILAR L'HOTELLERIE-FALLOIS and JAVIER SANTILLÁN: Climate change and sustainable growth: international initiatives and European policies. (There is a Spanish version of this edition with the same number).

2214 CARMEN SÁNCHEZ and JARA QUINTANERO: Las empresas *fintech:* panorama, retos e iniciativas.

2215 MARÍA ALONSO, EDUARDO GUTIÉRREZ, ENRIQUE MORAL-BENITO, DIANA POSADA, PATROCINIO TELLO-CASAS and CARLOS TRUCHARTE: In-person access to banking services in Spain: a comparison with other countries and other types of services. (There is a Spanish version of this edition with the same number).

2216 BEATRIZ GONZÁLEZ, ENRIQUE MORAL-BENITO and ISABEL SOLER: Schumpeter Meets Goldilocks: the Scarring Effects of Firm Destruction.

2217 MARIO ALLOZA, JÚLIA BRUNET, VICTOR FORTE-CAMPOS, ENRIQUE MORAL-BENITO and JAVIER J. PÉREZ: Government spending in Spain from a European perspective. (There is a Spanish version of this edition with the same number).

2218 PABLO AGUILAR, BEATRIZ GONZÁLEZ and SAMUEL HURTADO: Carbon tax sectoral (CATS) model: a sectoral model for energy transition stress test scenarios.

2219 ALEJANDRO MUÑOZ-JULVE and ROBERTO RAMOS: Estimation of the impact of changes in the period used to calculate the regulatory base on new retirement pension amounts. (There is a Spanish version of this edition with the same number).

2220 LUIS ÁNGEL MAZA: An estimation of the carbon footprint in Spanish credit institutions' business lending portfolio. (There is a Spanish version of this edition with the same number).

2221 SUSANA MORENO SÁNCHEZ: The EU-UK relationship: regulatory divergence and the level playing field.

2222 ANDRÉS ALONSO-ROBISCO and JOSÉ MANUEL CARBÓ: Inteligencia artificial y finanzas: una alianza estratégica.

2223 LUIS FERNÁNDEZ LAFUERZA, MATÍAS LAMAS, JAVIER MENCÍA, IRENE PABLOS and RAQUEL VEGAS: Analysis of the usability of capital buffers during the crisis precipitated by COVID-19. (There is a Spanish version of this edition with the same number).

2224 SONSOLES GALLEGO, ISABEL GARRIDO and IGNACIO HERNANDO: IMF precautionary facilities and their use in Latin America. (There is a Spanish version of this edition with the same number).

2301 LAURA HOSPIDO, CARLOS SANZ and ERNESTO VILLANUEVA: Air pollution: a review of its economic effects and policies to mitigate them.

2302 IRENE MONASTEROLO, MARÍA J. NIETO and EDO SCHETS: The good, the bad and the hot house world: conceptual underpinnings of the NGFS scenarios and suggestions for improvement.

2303 ADRIÁN LÓPEZ GONZÁLEZ: Inteligencia artificial aplicada al control de calidad en la producción de billetes.

2304 BELÉN AROCA MOYA: Conceptos, fundamentos y herramientas de neurociencia, y su aplicación al billete.

2305 MARÍA ALONSO, EDUARDO GUTIÉRREZ, ENRIQUE MORAL-BENITO, DIANA POSADA and PATROCINIO TELLO-CASAS: Un repaso de las diversas iniciativas desplegadas a nivel nacional e internacional para hacer frente a los riesgos de exclusión financiera.

2306 JOSÉ LUIS ROMERO UGARTE, ABEL SÁNCHEZ MARTÍN and CARLOS MARTÍN RODRÍGUEZ: Alternatives to the evolution of wholesale banking operations in the Eurosystem. (There is a Spanish version of this edition with the same number).

2307 HENRIQUE S. BASSO, OURANIA DIMAKOU and MYROSLAV PIDKUYKO: How inflation varies across Spanish households.

2308 LAURA CRESPO, NAJIBA EL AMRANI, CARLOS GENTO and ERNESTO VILLANUEVA: Heterogeneidad en el uso de los medios de pago y la banca *online:* un análisis a partir de la Encuesta Financiera de las Familias (2002-2020).

2309 HENRIQUE S. BASSO, OURANIA DIMAKOU and MYROSLAV PIDKUYKO: How consumption carbon emission intensity varies across Spanish households.

2310 IVÁN AUCIELLO-ESTÉVEZ, JOSEP PIJOAN-MAS, PAU ROLDAN-BLANCO and FEDERICO TAGLIATI: Dual labor markets in Spain: a firm-side perspective.

2311 CARLOS PÉREZ MONTES, JORGE E. GALÁN, MARÍA BRU, JULIO GÁLVEZ, ALBERTO GARCÍA, CARLOS GONZÁLEZ, SAMUEL HURTADO, NADIA LAVÍN, EDUARDO PÉREZ ASENJO and IRENE ROIBÁS: Systemic analysis framework for the impact of economic and financial risks (There is a Spanish version of this edition with the same number).

2312 SERGIO MAYORDOMO and IRENE ROIBÁS: The pass-through of market interest rates to bank interest rates. (There is a Spanish version of this edition with the same number).

2313 CARLOS PÉREZ MONTES, ALEJANDRO FERRER, LAURA ÁLVAREZ ROMÁN, HENRIQUE BASSO, BEATRIZ GONZÁLEZ LÓPEZ, GABRIEL JIMÉNEZ, PEDRO JAVIER MARTÍNEZ-VALERO, SERGIO MAYORDOMO, ÁLVARO MENÉNDEZ PUJADAS, LOLA MORALES, MYROSLAV PIDKUYKO and ÁNGEL VALENTÍN: Individual and sectoral analysis framework for the impact of economic and financial risks. (There is a Spanish version of this edition with the same number).

2314 PANA ALVES, CARMEN BROTO, MARÍA GIL and MATÍAS LAMAS: Risk and vulnerability indicators for the Spanish housing market.

2215 ANDRÉS AZQUETA-GAVALDÓN, MARINA DIAKONOVA, CORINNA GHIRELLI and JAVIER J. PÉREZ: Sources of economic policy uncertainty in the euro area: a ready-to-use database.

2316 FERNANDO GARCÍA MARTÍNEZ and MATÍAS PACCE: The Spanish electricity sector in the face of rising gas prices and the Goverment measures rolled out in response. (There is a Spanish version of this edition with the same number).

2317 ROBERTO BLANCO and SERGIO MAYORDOMO: Evidence on the impact of the public guarantee and direct aid schemes on Spanish firms during the covid-19 crisis. (There is a Spanish version of this edition with the same number).

2318 ISABEL GARRIDO and IRUNE SOLERA: Has the 2021 general SDR allocation been useful? For what and for whom?

2319 ROBERTO BLANCO, ELENA FERNÁNDEZ, MIGUEL GARCÍA-POSADA and SERGIO MAYORDOMO: An estimation of the default probabilities of Spanish non-financial corporations and their application to evaluate public policies.

2320 BANCO DE ESPAÑA: In-person access to banking services in Spain: 2023 Monitoring Report. (There is a Spanish version of this edition with the same number).

2321 EDUARDO AGUILAR GARCÍA, MARIO ALLOZA FRUTOS, TAMARA DE LA MATA, ENRIQUE MORAL-BENITO, IÑIGO PORTILLO PAMPIN and DAVID SARASA FLORES: Una primera caracterización de las empresas receptoras de fondos NGEU en España.

2401 ALEJANDRO MORALES, MANUEL ORTEGA, JOAQUÍN RIVERO and SUSANA SALA: How to identify all companies worldwide. Experience with the legal entity identifier (LEI). (There is a Spanish version of this edition with the same number).

2402 XAVIER SERRA and SONSOLES GALLEGO: An initial stocktake of the IMF's resilience and sustainability trust as a channel for using special drawing rights. (There is a Spanish version of this edition with the same number).

2403 PABLO HERNÁNDEZ DE COS: The role of macroprudential policy in the stabilisation of macro-financial fluctuations. Conference on Financial Stability/Banco de Portugal, Lisbon (Portugal), 2 October 2023.

2404 MORTEZA GHOMI, SAMUEL HURTADO and JOSÉ MANUEL MONTERO: Analysis of recent inflation dynamics in Spain. An approach based on the Blanchard and Bernanke (2023) model. (There is a Spanish version of this edition with the same number).

2405 PILUCA ALVARGONZÁLEZ, MARINA ASENSIO, CRISTINA BARCELÓ, OLYMPIA BOVER, LUCÍA COBREROS, LAURA CRESPO, NAJIBA EL AMRANI, SANDRA GARCÍA-URIBE, CARLOS GENTO, MARINA GÓMEZ, PALOMA URCELAY, ERNESTO VILLANUEVA and ELENA VOZMEDIANO: The Spanish Survey of Household Finances (EFF): description and methods of the 2020 wave.

2406 ANA GÓMEZ LOSCOS, MIGUEL ÁNGEL GONZÁLEZ SIMÓN and MATÍAS JOSÉ PACCE: Short-term real-time forecasting model for spanish GDP (Spain-STING): new specification and reassessment of its predictive power. (There is a Spanish version of this edition with the same number).

2407 OLYMPIA BOVER, LAURA CRESPO, SANDRA GARCÍA-URIBE, MARINA GÓMEZ-GARCÍA, PALOMA URCELAY and PILAR VELILLA: Micro and macro data on household wealth, income and expenditure: comparing the Spanish Survey of Household Finances (EFF) to other statistical sources.

2408 ÁNGEL ESTRADA and CARLOS PÉREZ MONTES: Un análisis de la evolución de la actividad bancaria en España tras el establecimiento del gravamen temporal de la ley 38/2022.

2409 PABLO A. AGUILAR, MARIO ALLOZA, JAMES COSTAIN, SAMUEL HURTADO and JAIME MARTÍNEZ-MARTÍN: The effect of the European Central Bank's asset purchase programmes on Spain's public finances. (There is a Spanish version of this edition with the same number).

2410 RICARDO BARAHONA and MARÍA RODRÍGUEZ-MORENO: Estimating the OIS term premium with analyst expectation surveys.

2411 JOSÉ MANUEL CARBÓ, HOSSEIN JAHANSHAHLOO and JOSÉ CARLOS PIQUERAS: Análisis de fuentes de datos para seguir la evolución de *Bitcoin.*

2412 IVÁN KATARYNIUK, RAQUEL LORENZO ALONSO, ENRIQUE MARTÍNEZ CASILLAS and JACOPO TIMINI: An extended Debt Sustainability Analysis framework for Latin American economies.