Fiscal R-Star: Fiscal-Monetary Tensions and Implications for Policy*

Marijn A. Bolhuis — IMF
Jakree Koosakul — IMF
Neil Shenai — IMF

March 2025

Abstract

Tensions between fiscal and monetary policies have become the focus of macroeconomic policy debates in recent years. Yet, there are few direct measures to quantify the degree of such tensions. This paper introduces the concept of "fiscal r-star," which is the real interest rate required to stabilize debt levels when the primary balance is set exogenously, output is growing at potential, and inflation is at target. Based on standard macroeconomic frameworks, we show analytically that the difference between the traditional monetary policy r-star and fiscal r-star—referred to as the "fiscal-monetary gap"— is a useful proxy for fiscal-monetary tensions. Computing the fiscal-monetary gap using 140 years of data from 16 advanced economies, fiscal-monetary tensions are currently at historic highs not seen since World War II. Moreover, larger fiscal-monetary gaps are associated with a range of adverse macroeconomic outcomes, including rising debt levels, higher inflation, exchange rate depreciations, financial repression, as well as elevated risks of future crises. Using the introduced framework, we show analytically how different policy levers can attenuate fiscal-monetary tensions, but provide some initial evidence on why implementation may be challenging today. In the absence of fiscal consolidation, policymakers may increasingly implement policies that undermine central bank independence and resort to financial repression to reduce tensions over time.

Keywords: Fiscal r-star; fiscal-monetary gap; fiscal-monetary interactions; fiscal dominance; inflation; fiscal consolidation; monetary policy; fiscal policy; policy space; financial repression; debt liquidation

JEL classification: E31, E42, E43, E44, E52, E58, E62, E63, F34, F41, N10

* The authors thank Julien Acalin, Serkan Arslanalp, Tohid Atashbar, Aqib Aslam, Suman Basu, Camila Casas, Jacopo Cimadomo, Cristina Checherita-Westphal, Sonali Das, Federico Diez, Vitor Gaspar, Rex Ghosh, Gita Gopinath, Anna Ilyina, Kenneth Kang, Jesper Linde, Deborah Lucas, Carlos Mulas Granados, Ceyla Pazarbasioglu, Juan Pessadore, Josef Platzer, Sergio Rodriguez, Andrew Rose, Misa Takebe, Rodrigo Valdes, James Yetman, Aleksandra Zdzienicka and seminar participants at the Asian Development Bank, Bank of Thailand, European Central Bank, Reserve Bank of Australia, and the International Monetary Fund for their helpful comments. They greatly appreciate the collegiality of Josef Platzer, Francesco Grigoli, and Robin Tietz for sharing their data, and thank Dan Zheng and Paula Arias for outstanding research assistance.

1 Introduction

The fault lines between monetary and fiscal policies have grown in recent years. The steep tightening of monetary policy to tame inflation during the COVID-19 pandemic and subsequent geopolitical conflicts has raised debt servicing costs of governments, increasing fiscal burdens.[1] At the same time, sustained fiscal deficits in response to recent economic shocks and longer-term structural issues have pushed debt in advanced economies (AEs) to record high levels (Figure 1).[2] In addition to raising concerns about fiscal sustainability, sustained deficits and potential fiscal loosening could in turn complicate monetary policy by adding to inflationary pressures. Policy tradeoffs can be even more difficult given present challenges, including the weak global growth outlook, rising geoeconomic fragmentation, and waning domestic political cohesion.

These developments have rekindled academic and policymakers' interest in fiscal-monetary tensions and their implications for macroeconomic stability. For example, some economists have highlighted the growing fiscal risks associated with rising expenditure pressures, higher-for-longer interest rates, and low growth (e.g., Gopinath, 2023a), while others similarly cited market expectations of higher real interest rates as portending more adverse interest-growth dynamics, with a concomitant reduction in fiscal space (e.g., Blanchard, 2023). [3] Facing low potential growth and high demands for additional spending on resilience-enhancing measures such as decarbonization and supply chain diversification, some economists have argued that central banks should give governments "space" to invest in these areas.[4]

Despite the growing attention placed on fiscal-monetary tensions, to the best of our knowledge, few measures exist that directly quantify the magnitude of such tensions. The lack of a clear measure of fiscal-monetary tensions makes it difficult to document how tensions have evolved and examine the implications of rising tensions for relevant macroeconomic outcomes. Our paper fills this gap in the literature by making the following contributions.

First, we provide motivating empirical evidence on the increasing degree of fiscal-monetary tensions over the past decade. To see why this is important, it is worth noting that even in an environment of elevated interest rates, fiscal-monetary tensions may not necessarily be high. This is because the fiscal authority can engage in 'passive' fiscal policy (Leeper, 1991) by undertaking fiscal consolidation in response to higher debt levels to ensure fiscal sustainability, thereby offsetting the adverse impact of higher interest rates on debt dynamics. Conversely, fiscal policy is 'active' when the fiscal authority does not increase the primary balance in response to

[1] There is also evidence of upward shifts in natural rates of interest in advanced economies after COVID. See, for example, Benigno et al. (2024), Fernandez-Villaverde et al. (2024), and Lubik et al. (2024).

[2] Including rising entitlement spending related to aging and funding the green transition and supply chain diversification (for more details, see Gopinath, 2023b).

[3] Disyatat and Borio (2021), Arslanalp and Eichengreen (2023) and Summers (2023) discuss similar issues, the latter with a focus on the United States.

[4] For example, Mario Draghi argued that governments needed sufficiently low borrowing costs to finance climate change investments and diversify supply supply chains (Reuters, 2024).

higher interest burdens. Higher borrowing costs are most likely to contribute to fiscal-monetary tensions under an active fiscal policy regime.

Previous studies have found mixed evidence regarding the activeness of fiscal policy. Focusing on earlier sample periods, Bohn (1998, 2005) showed empirically that fiscal policy in the United States was passive, while more recent studies found that even before the global financial crisis (GFC), AEs swung between periods of prudence (that is, passive fiscal policy) and profligacy (active fiscal policy) (e.g. Mauro et al., 2015). Based on an extended sample period that includes the GFC and the pandemic, we show that AEs' primary balances have indeed become more unresponsive to higher debt levels, especially after the pandemic. While some have argued that more favorable interest-growth differentials have made lower, and even negative, primary balances more sustainable (e.g., Blanchard, 2019), we document that primary balances have also failed to move closer to their debt-stabilizing levels since the GFC.

Our second contribution is introducing two related concepts to quantify the degree of fiscal-monetary tensions. These concepts are "fiscal r-star" and the "fiscal-monetary gap". Fiscal r-star is defined as the effective real interest rate on government debt that would achieve a stable ratio of debt-to-GDP for a given debt-to-GDP ratio, inflation target, trend real GDP growth, and a constant primary balance-to-GDP ratio (i.e. active fiscal policy).

Fiscal r-star bears resemblance to two related concepts in macroeconomics. First, it is similar in construction to the concept of the debt-stabilizing primary balance—a common measure of fiscal sustainability, defined as the level of primary balance-to-GDP ratio consistent with a stable debt-to-GDP ratio for a given debt-to-GDP ratio, trend real GDP growth, and constant effective real interest rate on government debt. In the context of active fiscal policy, we argue that fiscal r-star is a more relevant measure of fiscal sustainability since the primary balance does not adjust actively to ensure sustainability under an active policy regime, and the primary balance path can thus be viewed as exogenous. A higher fiscal r-star corresponds to greater fiscal sustainability: when fiscal r-star is above the current effective real interest rate on government debt, there is room for fiscal policy to run larger deficits. When fiscal r-star is lower, this room shrinks.

Fiscal r-star is also similar to the r-star concept in the context of monetary policy (henceforth referred to as "monetary r-star"), which dates back to Wicksell and is now commonly defined as the real interest rate at which real GDP growth is at potential (i.e. the output gap is closed) and inflation is stable and equal to the inflation target.[5] One attractive feature of fiscal r-star is that it is defined in the real interest rate space – i.e., the same space as monetary r-star – making quantitative comparisons between the two concepts possible. We define the difference between monetary r-star and fiscal r-stars as the "fiscal-monetary gap." By framing fiscal and monetary policy based on similar price-based measures, it is feasible to come up with a quantitative measure of tensions between the two policies.

Another attractive feature of our setup is that the fiscal-monetary gap is grounded in standard macroeconomic frameworks which analytically imply a set of policy tradeoffs. Combining fiscal r-star with standard IS and Phillips curves, we show how the fiscal-monetary gap serves as an intuitive summary statistic

[5] It is also related to the subsequently introduced concept of financial stability real interest rate (or r-double-star), which is defined as the real interest rate that ensures financial stability (Akinci et al., 2020).

for fiscal-monetary tensions. By definition, when monetary and fiscal r-stars are equal, such that the fiscal-monetary gap is zero, the fiscal and monetary authorities can simultaneously achieve their respective objectives of fiscal sustainability (defined as achieving a steady ratio of public debt to GDP) and price stability.[6] In contrast, when monetary r-star moves above fiscal r-star, a positive gap opens, which poses a set of policy trade-offs that we derive analytically.

A positive fiscal-monetary gap implies a combination of four different outcomes. First, if the monetary authority calibrates monetary policy to match monetary r-star, public debt dynamics become explosive for a given trajectory of the primary balance, debt stock target, and potential output. Second, the monetary authority may "budge" and keep its policy rate below monetary r-star for fiscal purposes. Such a policy could have benefits for fiscal sustainability by reducing the pace of debt accumulation but would put upward pressure on inflation. Third, fiscal policymakers could be tempted to lower borrowing costs by reducing the difference between the real effective interest rate on debt and the real policy rate. This can be done by shortening the effective maturity of outstanding debt or by engaging in various forms of financial repression to lower long-term government bond yields. Fourth, the fiscal policymaker could switch to a passive fiscal policy which would require a primary balance adjustment. Such fiscal consolidation could be pro-cyclical in the context of "higher-for-longer" policy rates and declining growth momentum.[7]

The framework thus provides empirically testable predictions about the effects of a rise in the fiscal-monetary gap on key macroeconomic outcomes. Hence, our third contribution consists of two empirical exercises in which we apply our framework to over 140 years of data from 16 AEs. First, we estimate fiscal r-star and fiscal-monetary gaps over the sample period, documenting the evolution of the degree of fiscal-monetary tensions over a relatively long period of modern history, covering World War I, the Great Depression, World War II, the Cold War, the Great Moderation, the GFC, and the pandemic and post-pandemic periods. Current estimates suggest that fiscal-monetary gaps are at highs last seen in the late 1950s, when AEs were dealing with the significant debt overhang from World War II. Based on a shorter sample, we also estimate the fiscal-monetary gap for emerging market economies (EMs) and find that the average gap tends to be relatively more stable in recent years.

Second, using local projections, we examine the implications of larger fiscal-monetary gaps for a set of macroeconomic outcomes. We show that larger gaps tend to be followed by a host of adverse macroeconomic outcomes, including rising debt levels, higher inflation, exchange rate depreciations, and lower bond returns. There is also evidence of financial repression, with lower real interest rates and higher inflation leading to the liquidation of public debt burdens. Additionally, countries with larger fiscal-monetary gaps are also found to subsequently experience elevated risks of future debt, currency, and housing crises. These empirical results support the predictions that follow from the paper's theoretical framework.

[6] That said, the fiscal authority can have other goals beyond debt stabilization that could increase fiscal-monetary tensions even absent a binding interest rate constraint vis-à-vis monetary r-star.

[7] For example, should growth momentum stall while inflation remains above central banks' targets, then central banks with a price stability mandate (e.g., the ECB and the Federal Reserve) may opt for a restrictive policy stance until a durable disinflation is achieved, even if such a stance further contributes to softer growth. Under these conditions, higher nominal and real interest rates may reduce fiscal space available given the potential for higher funding costs for fiscal authorities. This reduction in fiscal space could cause fiscal authorities to reduce the primary balance, in turn compounding reduced growth momentum, depending on the fiscal multiplier. See Leeper et al. (2010) on potential policy levers and rules in response to higher debt loads.

The rest of this paper proceeds as follows. The remainder of this section discusses our contributions to the literature. Section 2 motivates the paper's research questions and empirical strategy. Section 3 derives formally fiscal r-star and the fiscal-monetary gap and discusses their underlying intuition. Section 4 estimates fiscal r-star and the fiscal-monetary gap for 16 AEs using over 140 years of data. Section 5 analyzes historical developments in the fiscal-monetary gap and key macroeconomic outcomes using local projections. Section 6 estimates current levels of the fiscal-monetary gap for a sample of AEs and EMs. Section 7 explores the policy implications that follow from this analysis. Section 8 concludes.

Contributions to the literature. This paper is situated within two broad strands of literature. The first is the theoretical and empirical literature on the activeness of fiscal policy, including the related treatment of fiscal policy in existing theoretical models. The second is the theoretical and empirical literature on fiscal-monetary interactions and, to a lesser extent, financial repression.

Following the work of Leeper (1991), policy authority is deemed passive when it is limited by other active authorities and market prices. In Leeper's conception, fluctuations in fiscal policy generally lead to concomitant changes in monetary policy and prices, thus limiting the ability of the fiscal authority to actively target the output level over the medium and long term.[8] By contrast, active policies can pursue their objectives freely, without other policy levels and price signals binding their actions. In this respect, fiscal policy is typically deemed active if it is set *exogenously to prevailing debt levels*: that is, the primary balance does not always respond in a way that would promote debt sustainability in the short, and sometimes, medium term.

Most macroeconomic models, including standard New Keynesian models, tend to assume passive fiscal policy. In such models, government budgets and deficits are assumed to satisfy an inter-temporal solvency condition, or budget constraint, in the long run. The intuition is that given the real interest rate path set by monetary policy, prior accumulated fiscal deficits (i.e., the total sovereign debt stock) cannot be financed by Ponzi-like financing arrangements, such that the discounted net present value of future primary surpluses less seigniorage revenues is equal to or greater than the outstanding stock of debt (see Corsetti and Roubini, 1991). There is little scope for fiscal-monetary tensions in equilibrium, as any pressures on debt sustainability arising from contractionary monetary policy are assumed to be alleviated by adjustments in the primary balance, thereby satisfying intertemporal solvency. In general, tighter monetary policy leads the fiscal authority to adjust.

A strong characterization of active fiscal policy is the fiscal theory of the price level (FTPL). Under FTPL, as set forth by Woodford (1995) and Cochrane (2001, 2023), among others, the price level is determined by the value of real government debt, which is equal to the discounted present value of future primary surpluses.[9] As the expected fiscal path declines (i.e., moves further into deficit), it follows that either the fiscal authority will accumulate greater nominal and real debt for a given inflation target, or unexpected inflation will increase to maintain a constant level of real debt even as nominal debt increases in equilibrium.[10] Cochrane's analysis

[8] For more, see Leeper (1991) and Chung, Davig, and Leeper (2007). For an analysis of fiscal pro-cyclicality in the United States, see IMF (2023). For an accessible description of active and passive policy, see Haltom (2015).
[9] This key idea underpinning the FTPL dates back to at least Keynes (1923). See also Sargent et al. (2019).
[10] Cochrane (2018) argues that in the presence of long-term debt, higher interest rates lead to temporarily lower inflation because they lower the nominal value of long-term securities, necessitating a decline in the price level to keep the real value of debt stable.

was extended by Brunnermeier, Merkel, & Sannikov (2020), who proposed a model of the fiscal theory of the price level with a bubble term. In their model, the addition of a bubble term allows the fiscal authority to finance itself with debt that yields less than the economy's overall growth rate. In turn, the fiscal authority can roll over its existing debt stock into perpetuity without a subsequent rise in inflation while taking advantage of favorable interest-growth dynamics.

Previous empirical studies attempted to characterize fiscal policy under different policy settings. This literature dates to the work of Bohn (1998), who finds that higher debt levels lead to higher primary surpluses in the United States, illustrating that U.S. fiscal policy satisfied intertemporal solvency.[11] Mauro et al. (2015) extend this analysis to assess the history of fiscal profligacy using a panel of 55 countries over 200 years. These authors find that contrary to Bohn, AEs tended to swing between periods of prudence (where inter-temporal solvency was satisfied) and profligacy (where the budget constraint may not have been satisfied). More recently, Jiang et al. (2019, 2022) also find that the real returns on U.S. government debt fail to satisfy the budget constraint assumption, which suggests the U.S. fiscal authority pursued active fiscal policy.[12] Similarly, studying the fiscal history of the United Kingdom, Chen et al. (2022) also argue that reserve currency providers have latitude to calibrate fiscal policy that does not satisfy an inter-temporal solvency and in turn have more scope for discretionary fiscal policy.

This paper contributes to the above literatures on active fiscal policy and its treatment in macroeconomic models, both empirical and theoretically, in two respects. First, on the empirical front, this paper builds on the exercises of Bohn (1998) and Mauro et al. (2015) based on an extended sample period that includes the GFC and the pandemic. Especially during the pandemic, fiscal policy in AEs was significantly more active relative to earlier periods (see next section). The results hence corroborate the findings of Jiang et al. (2019, 2022) on the active nature of fiscal policy in the United States. Second, motivated by the paper's empirical findings, this paper presents a flexible framework based on standard New Keynesian macroeconomic blocs and accepted definitions of debt sustainability that allow for fiscal policy to be active. Using this framework, a new measure of fiscal sustainability—fiscal r-star—is derived. Under an active fiscal policy regime, the debt-stabilizing real interest serves as a better indicator of debt sustainability relative to the debt-stabilizing primary balance.

This paper also contributes to the growing literature on fiscal-monetary interactions. Earlier examples include Woodford (1998, 2001), who argues that fiscal sustainability is a requisite for price stability, and Chung, Davig, and Leeper (2007) and Davig and Leeper (2011), who use Markov switching models to study fiscal-monetary interactions under different policy combinations. In the wake of large-scale asset purchases by AE central banks after the GFC, authors such as Sims (2013) argued that fiscal-monetary interactions should be central to studies of inflation, monetary policy, and fiscal policy. Aizenman, Ahmed, and Jinjarak (2019) discuss fiscal dominance and analyze its impact on monetary and exchange rate frameworks, finding

[11] Mendoza and Ostry (2008) also find a robust positive conditional response of the primary balance to changes the debt stock for a panel emerging and AEs, although this positive reaction function diminishes at higher debt ratios. Ghosh et al. (2013) confirm the diminishing response for a group of AEs, dubbing this phenomenon "fiscal fatigue".

[12] Berndt, Lustig, and Yeltekin (2012) find that surprise shocks to government spending are financed by a mix of the reduction in the market value of U.S. government debt and future primary surpluses, which is consistent with the notion that unexpected inflation can be used to ease the government's budget constraint. Sims (2013) identifies several strands of FTPL, including related to fiscal dominance, central bank balance sheet-fiscal linkages, nominal and real debt levels, among others. See also Barro and Bianchi (2023) who apply the FTPL to an analysis of post-COVID surges in inflation and government spending.

evidence that policy rates tend to rise to counteract risk premia associated with higher debt loads. These concepts are further explored by several authors in the post-COVID context. For instance, based on a model that allows for changes in the monetary-fiscal mix, Bianchi and Melosi (2022) argued that the fiscal interventions in response to the pandemic affected the private sector's beliefs about the fiscal framework, causing an increase in inflation, which in turn required coordination between monetary and fiscal policies. Similarly, Bianchi, Faccini, & Melosi (2023) developed a general equilibrium model to show that debt-financed fiscal shocks contributed to persistent inflation in the aftermath of the pandemic.[13, 14]

We contribute to the literature on fiscal-monetary interactions in two ways. First, on the conceptual front, we introducte the fiscal-monetary gap as a summary statistic for fiscal-monetary tensions. In addition, by embedding active fiscal policy into a New Keynesian macroeconomic model, our framework allows for the study of fiscal-monetary interactions and their implications for key macroeconomic outcomes in a standard macroeconomic setting. We show analytically how a rise in fiscal-monetary tensions can have important implications for key macroeconomic outcomes and how different policy levers could be used to close the gap. Second, on the empirical front, we estimate of the fiscal r-star and fiscal-monetary gap for AEs based on over 140 years of data. In so doing, we document the evolution of fiscal-monetary interactions over a relatively long period of modern history. Beyond providing estimates of such tensions, we conduct additional analyses on the impact of a rise in the fiscal-monetary gap on key macroeconomic outcomes, which show that this framework's analytical predictions are indeed supported by the data.

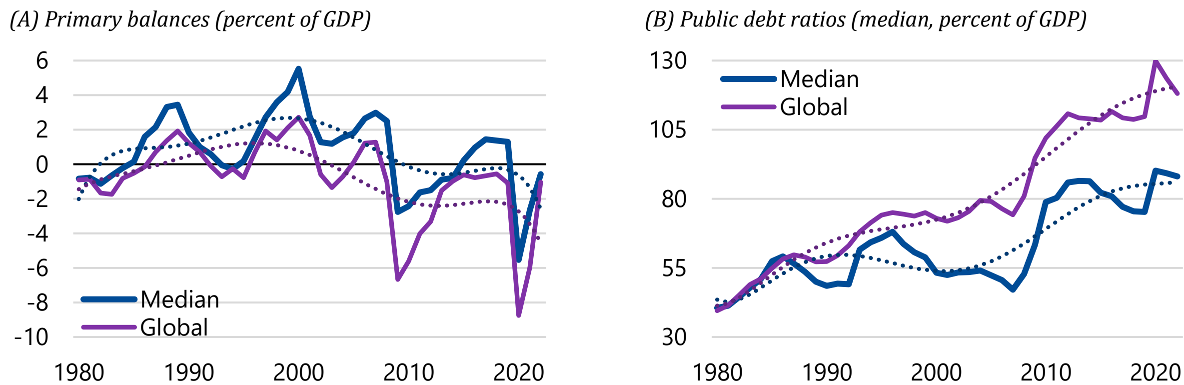
Finally, our paper also adds to the literature on financial repression as a mechanism to address fiscal-monetary tensions. Recent developments have rekindled interest in financial repression as a mechanism to reduce debt. Reinhart and Sbrancia (2015) introduce the concept of *debt liquidation*, which is the use of negative real interest rates via financial repression to reduce the real value of outstanding debt stocks. Jeanne (2023) notes the historic tendency of governments to rely on debt liquidation and financial repression, presenting a theory of optimal financial repression. Hall and Sargent (2022) compare monetary-fiscal responses during the COVID crisis and earlier U.S. wars, including the use of *de facto* financial repression.[15] This paper contributes to this literature by showing that during periods when the measured fiscal-monetary gap is large, bond market returns tend to decline, while debt liquidation increases. Seen in this light, financial repression is one option among of a menu of choices historically used by to policymakers when debt stocks are high and primary balance adjustments could be challenging to implement, especially in a low-growth and higher-for-longer interest rate environment.

[13] Additional examples include Caramp and Silva (2023), Chen et al. (2023), Martin (2020), Platzer and Peruffo (2022), Banerjee et al. (2023), Beyer et al. (2023), Arena et al. (2020), and Chen and Kemp (2023), as well as Schnabel (2022).

[14] Another body of work that gained prominence during the pandemic relates to the literature on so-called "modern monetary theory" (MMT) gained prominence by arguing that there are no financial limits to debt and deficits provided a country has its own monetary policy (such that it can print money to pay debt service due). See, for example, Kelton (2020) and Mitchell, Wray, and Watts (2019). For critiques of MMT, see Mankiw (2020).

[15] Acalin and Ball (2023) examine the roles of primary budget surpluses, surprise inflation, and pegged interest rates before the Fed-Treasury Accord of 1951.

Figure 1. Debt and Primary Balance Dynamics in Advanced Economies[1]



[1] Global variables are weighted by nominal GDP expressed in current USD. Trendlines are sixth-order polynomial.
Source: World Economic Outlook, Public Finances in Modern History, World Bank Development Indicators, and authors' calculations.

2 Motivation

This section empirically examines the degree to which fiscal policy in AEs has become more active in recent years. By conducting this analysis, we provide motivating evidence on growing fiscal-monetary tensions since the GFC.

The analytical starting point is the standard equation for debt accumulation. The existing stock of debt (d_{t-1}) must be repaid with interest (applied at effective rate i_t) at the end of the period.[16] The government budget constraint in period t is given by $G_t + (1 - i_t)D_{t-1} = T_t + D_t$, where G_t denotes nominal non-interest (or primary) expenditure and T_t denotes nominal tax revenues.[17] The change in a country's public debt-to-GDP ratio in a given year t (Δd_t) can be written as the law of motion of debt (equation (1)) below.

$$(\mathbf{1})\ \Delta d_t = \frac{r_t - g_t}{1 + \pi_t + g_t} d_{t-1} - pb_t.$$

Debt dynamics thus improve with an increase in the growth rate g_t, an increase in inflation π_t, or an increase

[16] By convention, a gross debt concept is used for debt sustainability equations. Potential mitigants of risks posed by higher gross public debt include gross government asset holdings (i.e., considering net debt). On the other hand, governments also face implicit liabilities such unfunded entitlements. Hence, this paper uses a gross government debt concept.

[17] For convenience, this paper assumes no non-tax revenues.

in the primary balance as a percentage of GDP, pb_t. They deteriorate when the effective real interest rate r_t increases.[18, 19]

The value of outstanding government debt can be expressed by a debt valuation equation in which the current debt stock is "backed" by the present value of future primary balances. If holders of government debt price bonds use a constant discount rate δ, debt is valued according to the following equation (2):

$$(\mathbf{2})\ d_{t-1}\frac{1+i_{t-1}}{1+\pi_t}=E_t\sum_{j=0}^{\infty}\frac{(1+g)^{j+1}}{(1+\delta)^j}\,pb_{t+j}+\lim_{T\to\infty}E_t\frac{(1+g)^{T+1}}{(1+\delta)^T}d_T,$$

which follows from rearranging and iterating over the budget constraint in equation (1), where real GDP is assumed to grow at a constant rate g. The first term on the righthand side of equation (2) is the present value of primary balances. The second term is a bubble term, which is usually assumed to be zero by invoking a private-sector transversality condition (Brunnermeier et al., 2020). When this equation is interpreted as an intertemporal solvency condition, the potential paths of primary balances are restricted to those that are consistent with the path of real interest rates and inflation in (2). Hence, standard New Keynesian frameworks, including DSGE models, assume that fiscal policy is passive: in the long term the fiscal authority adjusts the primary balance in response to the debt ratio.[20]

We assess the extent to which fiscal policy responds to public debt levels (and thus meets the aforementioned condition) through two regression exercises. First, following Bohn (1998) and Mauro et al. (2015), we assess the degree to which fiscal policy is implemented to stabilize debt levels by exploring systematic relationships between the primary balance and the debt ratio. We impose the following fiscal reaction function:

$$(\mathbf{3})\ pb_t=\rho_1 d_{t-1}+\alpha_1(Q_t-Q_t^*)+\epsilon_t,$$

where $Q_t-Q_t^*$ is the output gap.

The first test is to estimate ρ_1. Bohn (1998) argues if ρ_1 is significantly larger than $\frac{1+\bar{x}}{\bar{x}}$, where $\bar{x}$ is the interest-growth rate differential, then the debt ratio is stationary and mean-reverting. If the interest-growth rate

---

[18] The effective real interest rate is defined as $r_t \equiv i_t-\pi_t$. This assumes public debt consists of one-period bonds and that the stock of inherited debt must be repaid with interest at the end of the period. Revenues do not include interest income, and nominal GDP growth is assumed to be sufficiently low and there are no stock-flow adjustments. See Annex 1 for exact assumptions and derivation. For another assessment of how to assess debt sustainability via an intertemporal budget constraint, see Roubini (2001). It follows from the law of motion of debt that if r < g, then there is fiscal space to run primary deficits while still observing stable or declining debt-to-GDP ratios. For this argument applied to present-day debt dynamics in AEs, see Blanchard (2019). On the fiscal "growth dividend" provided by faster growth on debt-to-GDP ratios, see Bohn (2005).

[18] Decompositions of debt dynamics often use a residual stock-flow adjustment term, which includes potential discrepancies between actual public debt and recorded deficits (Weber, 2012). Traditionally, stock-flow adjustments include valuation effects through the impact of exchange rate changes on FX-denominated debt, recording effects (deficits are often recorded on an accrual basis while debt is a cash concept), and below-the-line financial transactions such as changes in government deposits, privatizations and realizations of contingent liabilities. Note that equation (1) does not include separate seigniorage income.

[20] The most obvious is to implement the fiscal stance that stabilizes the debt-to-GDP ratio taking monetary policy (and thus real interest rates) as given. For a full treatment of the characterization of optimal fiscal policy in response to monetary policy, see Benigno and Woodford (2003).

differential is zero, then this procedure simply testes whether $\rho_1 > 0$. For a detailed derivation of this condition, see Annex 1.

A key condition for Bohn's result is the stationarity of the real interest-growth differential in equation (1). More formally, this expression is given by the following: $\frac{r_t - g_t}{1+\pi_t+g_t}$. Since Bohn introduced this test, there have been secular declines in neutral real interest rates and potential growth rates, especially in AEs (see, for example, Rachel and Summers, 2019; IMF, 2023; Obstfeld, 2023). The ensuing change in the difference between real interest rates and real growth rates (i.e., $r_t - g_t$) creates additional fiscal space and greater debt-carrying capacity (Blanchard, 2019, 2023). In practice, policymakers often rely on comparisons between the actual primary surplus and the primary surplus required to stabilize the debt ratio (Mauro et al., 2015). In the medium term, it should be expected that the following version of the *debt-stabilizing primary balance* pb_t^{DS} is achieved to stabilize debt that is defined formally in equation (4), where pb_t^{DS} is the primary balance that stabilizes debt when the real interest rate equals the time-varying neutral rate r_t^* (monetary r-star), output grows at its current trend growth rate of potential output ($\bar{g}_t$) and inflation is at target ($\bar{\pi}$):

$$(\mathbf{4})\; pb_t^{DS} = \frac{r_t^* - \bar{g}_t}{1+\bar{\pi}+\bar{g}_t} d_{t-1}.$$

In the second exercise, we assess the activeness of fiscal policy using the following fiscal reaction function, represented below in in equation (5):

$$(\mathbf{5})\; pb_t = \rho_2 pb_t^{DS} + \alpha_2(Q_t - Q_t^*) + \epsilon_t.$$

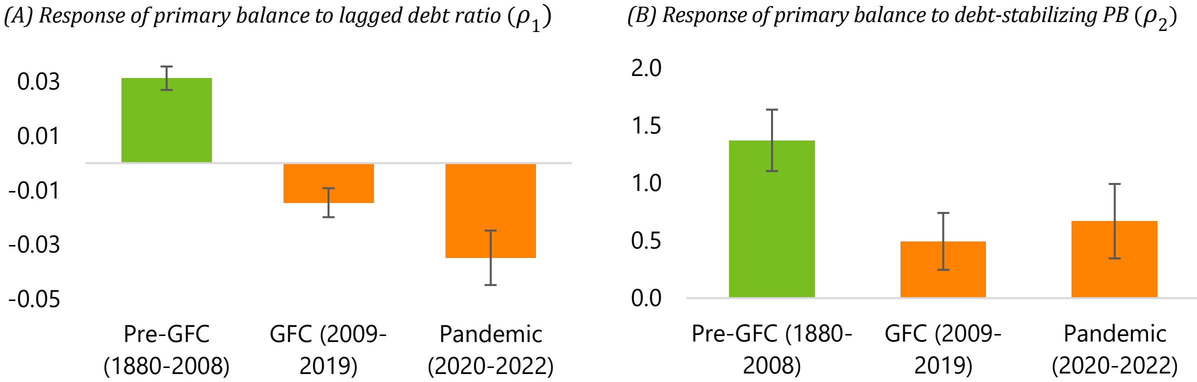
The second test for fiscal policy is whether the primary balance is expected to catch up with the debt-stabilizing primary balance, which occurs if coefficient ρ_2 is equal to one. If ρ_2 greater than one, then the debt ratio is stationary.[21]

Equations (3) and (5) are estimated using panel regressions that include time and country fixed effects. We use robust standard errors, clustered by year (see Annex 2 for further details). To examine the activeness of fiscal policy over time, the responsiveness of the primary balance in three different sub-periods is captured, namely 1) pre-global financial crisis (GFC) period (1880-2008), the post-GFC period (2009-2019), and the COVID pandemic (2020-2022).[22]

[21] The requirement that ρ_2 is greater than one has some similarities with the Taylor principle for monetary policy. Note that a fiscal policy that sets the primary balance equal to the debt-stabilizing primary balance such that $\rho_2 = 1$ does stabilize the debt ratio but does not guarantee that the debt ratio is stationary since it implies that the law of motion of debt has a unit root.

[22] Additional details are provided in Annex 1.

Figure 2. Responsiveness of Fiscal Policy to Debt and Debt-Stabilizing Primary Balances[1]



[1] Solid lines indicate statistical significance at 10 percent significance level, where robust standard errors are used, clustered by year.

Source: Public Finances in Modern History, Jordà, Schularick, and Taylor (2017), Platzer et al. (2023), authors' calculations.

Results indicate that fiscal policy in AEs has become more "active" since the GFC and especially during thepandemic. The estimates of ρ_1 and ρ_2 are plotted in Figure 2. Based on panel A, AEs' primary balances respond positively to the lagged debt ratio during the pre-GFC period, indicative of passive fiscal policy and consistent with the findings in Bohn (1998, 2005). This average response is economically and statistically significant, with a 1 percentage point higher debt ratio associated with a rise in the primary balance of 0.03 percentage points.[23] In contrast, the average response becomes negative but statistically insignificant during the GFC period, and negative *and* statistically significant during the pandemic. This negative response provides evidence that fiscal policy has become more active.[24]

This conclusion is further confirmed based on the estimates of ρ_2 from equation (5) in panel B. These estimates suggest that while the primary balance moved more than one for one with the debt-stabilizing primary balance during the pre-GFC period, such an endogenous response has become muted since the GFC. Both during the GFC and pandemic period, the response of the primary balance to the debt-stabilizing balance was significantly smaller than one. There are several potential drivers of the increasing unresponsiveness of the primary balance to both the lagged debt stock and changes in the debt-stabilizing primary balance, including discretionary spending pressures, waning social and political cohesion, as well as the lack of viable political coalitions willing to implement fiscal consolidation (e.g., Arslanalp and Eichengreen, 2023).

[23] This result is in line with the economic magnitude of the estimated coefficient in Bohn (1998), who estimates coefficients ranging from 0.03 to 0.05 for the United States on data from 1916 to 1995.

[24] In practice, primary balances tend to be highly autocorrelated, which raises a concern on whether this autocorrelation could affect the estimation results. We also conduct the exercise after including the lagged dependent variable, and find the results to be robust.

3 Defining Fiscal R-Star and the Fiscal-Monetary Gap

Motivated by the empirical evidence on increasingly active fiscal policy and potentially growing fiscal-monetary tensions, this section introduces the concepts of fiscal r-star and fiscal-monetary gap as a summary statistic for fiscal-monetary tensions. Using this framework, the implications of rising fiscal-monetary tensions as proxied by the fiscal-monetary gap on macroeconomic outcomes are assessed theoretically, including how such gaps can be closed via different policy levers. The following section tests these theoretical predictions, providing corroborating evidence.

Fiscal R-Star

Given the active nature of fiscal policy documented in the previous section, we start by taking the expected fiscal path as given and assume a constant primary balance-to-GDP ratio. This allows us to infer the implied real interest rate that would stabilize the debt-to-GDP ratio at a terminal debt ratio. More formally, we define fiscal r-star as the unobserved effective real interest rate that would achieve a stable ratio of public debt to GDP ($\bar{d}$) for a given inflation target ($\bar{\pi}$), expected constant path of the primary balance as a percentage of potential GDP ($\overline{pb}$) and the trend growth rate of potential output ($\bar{g}$) at a given time.[25] Rewriting equation (1) accordingly gives the following equation for fiscal r-star:

$$(\mathbf{6})\ r_f^* = \bar{g} + (1 + \bar{\pi} + \bar{g})\frac{\overline{pb}}{\bar{d}}.$$

From equation (6), it follows that fiscal r-star is a decreasing function of the target debt-to-GDP ratio, and an increasing function of the real growth rate, inflation target, and the primary balance.

Inserting this definition back into equation (1) gives the following debt accumulation equation as a function of fiscal r-star:

$$(\mathbf{7})\ \frac{\Delta d_t}{\bar{d}} = \frac{r_t - r_f^*}{1 + \bar{\pi} + \bar{g}} - \frac{pb_t - \overline{pb}}{\bar{d}}\ .$$

Equation (7) shows that fiscal r-star serves as a measure of fiscal sustainability. While fiscal r-star is above the average interest rate on government debt, there is room for fiscal policy to run larger deficits without increasing the debt ratio. When fiscal r-star is lower, the debt ratio grows unless the government engages in fiscal consolidation and raises the primary balance above $\overline{pb}$.

Fiscal r-star is a flexible concept that follows from the law of motion of debt and is not tied to any macroeconomic tradition. There are several interpretations of fiscal r-star depending on the macroeconomic

[25] Fiscal r-star includes the inflation target because it is relevant for the debt-stabilizing primary balance in standard definitions as most debt sustainability analyses use the nominal debt concept—a convention followed in this paper. The debt ratio used in this paper is the ratio of the nominal stock of accumulated debt relative to the current nominal flow of GDP. If the debt stock would be discounted relative to the real flow of GDP, the definition of fiscal r-star would change to $r_f^* = \bar{g} + \frac{\overline{pb}}{\bar{d}}$.

framework used to model output and inflation. In frameworks with an explicit role for money, fiscal r-star represents the real interest rate that keeps the growth of the money supply in line with the inflation target while also stabilizing the debt ratio. This definition follows from inserting fiscal r-star in the government budget constraint that includes money (e.g., Brunnermeier, Merkel, and Sannikov, 2020). If output is growing at potential and the primary balance is active at $\overline{pb}$, the law of motion of government liabilities relative to GDP collapses to the following equation:[26]

$$(\mathbf{8})\ \Delta d_t + \frac{\mu_t - \pi_t - \bar{g}}{1 + \pi_t + \bar{g}} \cdot m_{t-1} = \frac{(\pi_t - \bar{\pi})}{1 + \pi_t + \bar{g}} \cdot \overline{pb}$$

where μ_t is the growth rate of the nominal money stock and m_{t-1} is the ratio of the initial money stock to GDP. Provided velocity is constant in the equation of exchange, the central bank can set $\mu_t = \bar{\pi} + \bar{g}$ such that inflation is at target ($\pi_t = \bar{\pi}$) and the debt ratio is constant ($\Delta d_t = 0$). Fiscal-monetary tensions arise if the real interest rate is too low to ensure private sector spending is consistent with constant velocity.

Within the literature on the fiscal theory of the price level, fiscal r-star can also be interpreted as the real discount rate required for the private sector to absorb the current stock of government debt and stabilize inflation. Ruling out the bubble term and holding the primary balance fixed, equation (2) collapses to equation (9), such that the debt ratio and inflation are stable and at target if the discount rate equals the sum of the real interest rate and the inflation target (i.e., $\delta = r + \bar{\pi}$.):[27]

$$(\mathbf{9})\ d_{t-1}(1 + r_t) = \overline{pb} \cdot \frac{1 + \delta}{\delta - g}.$$

This equation implies the definition of fiscal r-star in equation (6). Fiscal-monetary tensions arise if the real interest rate is too low relative to the real discount rate to induce the private sector to absorb the growing stock of government debt.

When fiscal policy does not necessarily react to stabilize the debt ratio, fiscal r-star becomes a useful measure for fiscal-monetary tensions within standard frameworks with IS and Phillips curves. Assuming the dynamics of prices and output fall within the standard aggregate supply-aggregate demand frameworks and abstracting from cost-push shocks, inflation evolves according to the following equation:

$$(\mathbf{10})\ \Delta \pi_t = \Phi_t - \phi(r_t^P - r_m^*).$$

Equation (10) is obtained by combining the equations governing the IS and Phillips curves in standard New Keynesian models: ϕ is the sensitivity of inflation to changes in the real policy rate r_t^P, and, importantly, r_m^* is the natural rate of interest or conventional r-star, or the real interest rate at which output is at potential and

[26] In this case, the government budget constraint is $G_t + (1 + i_{t-1})D_{t-1} + (1 + i_{t-1})M_{t-1} = T_t + D_t + M_t$, and fiscal r-star is defined as $r_f^* = \bar{g} + (1 + \bar{\pi} + \bar{g})\frac{\overline{pb}}{\bar{d} + \bar{m}}$, where $\bar{m}$ is a given ratio of the nominal money stock to GDP.

[27] A bubble can be ruled out if the risk-free real rate is larger than the real growth rate. See Jiang et al. (2019) and Brunnermeier, Merkel, and Sannikov (2020) for a discussion. Note that going from (2) to (9) uses the approximation $\frac{1+i_{t-1}}{1+\pi_t} \approx r_t$.

inflation is at target.[28] To distinguish this real interest rate measure from fiscal r-star, this paper henceforth refers to this natural rate of interest as the *monetary* r-star.[29] Inflation expectations also matter for inflation dynamics in equation (10) through the term Φ_t, which reflects the deviation of expectations of future inflation from its past reading.[30]

The Fiscal-Monetary Gap

The fiscal-monetary gap is derived from combining fiscal r-star and the IS and Phillips curves. We define the *tension* between fiscal and monetary policy as a situation in which the stance of fiscal policy makes it more difficult for the central bank to stabilize inflation, or when the stance of monetary policy worsens the ability of the fiscal authority to stabilize the debt ratio. Combining equations (7) and (10), it is possible to see how the difference between r_m^* and r_f^* provides an intuitive quantitative indicator for tensions between monetary and fiscal policy. The difference between these terms $(r_m^* - r_f^*)$ is defined formally as the *fiscal-monetary gap* (equation (11)), where $\tau_t^* \equiv r_t - r_t^P$ is the spread between the real effective interest rate on government debt and the real policy rate:

$$(\mathbf{11})\ r_{m\,t}^* - r_{f\,t}^* = \frac{\Delta d_t}{\bar{d}}(1+\bar{\pi}+\bar{g}) + \frac{1}{\phi}(\Delta\pi_t - \Phi_t) + \frac{pb_t - \overline{pb}}{\bar{d}}(1+\bar{\pi}+\bar{g}) - \tau_t^*.$$

Equation (11) thus shows the policy tradeoffs faced by the monetary and fiscal authorities when the fiscal-monetary gap is positive. A larger fiscal-monetary gap indicates that one of four outcomes (or a combination of them) should occur. First, when neither the fiscal nor monetary authority changes its stance, debt will grow, as summarized in the first term. Second, if the monetary authority accommodates fiscal policy by lowering the monetary policy real interest rate for a given monetary r-star, inflation will rise above target (second term). Third, a positive fiscal-monetary gap can also be closed by fiscal consolidation, or when the primary balance is adjusted upwards as per the third term in equation (11). Fourth, the last term (τ_t^*) implies that the fiscal authority can lower the spread between the real effective interest rate on government debt and the real monetary policy rate. This reduction can be achieved through several operations, such as financial repression (where there are a mix of official and unofficial taxes on savings to help drive down government borrowing costs) or through changing the mix of debt issuance, such as by lowering the term premia of the debt stock by issuing shorter maturity debt.[31]

As flexible concepts, fiscal r-star and the fiscal-monetary gap can be incorporated in standard open economy models. For a small open economy for which monetary r-star is determined globally and thus set exogenously, and assuming basic interest rate parity conditions hold, then exchange rate dynamics amplify

[28] See Annex 1 for a derivation. Note that equation (10) implicitly assumes that the GDP deflator and consumer price index (CPI) are approximately equal.

[29] It is important to note that monetary r-star is not independent of fiscal dynamics. Rather, monetary r-star can depend on the overall balance and the debt level (see, for example, Rachel & Summers, 2019; Mian, Straub, & Sufi, 2022; Campos et al., 2024). The assumption of an exogenous monetary r-star is used for exposition and can be relaxed.

[30] Formally, $\Phi_t \equiv \beta E\pi_{t+1} - \pi_{t-1}$. If inflation expectations are fully adaptive (i.e., $\beta E\pi_{t+1} = \pi_{t-1}$) then (2) reflects an underlying accelerationist Phillips curve. If inflation expectations are fully anchored (i.e., $\beta E\pi_{t+1} = \bar{\pi}$) then Φ_t dampens inflation dynamics by pushing down inflation when it is above target.

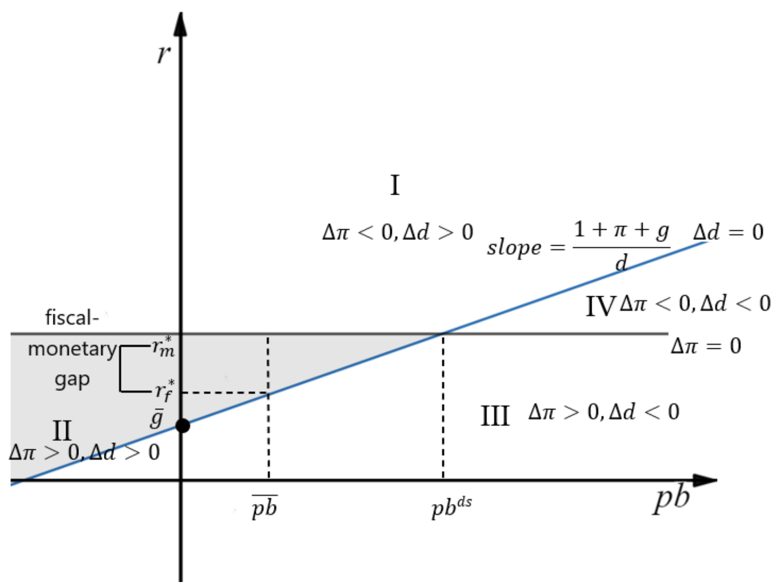
[31] In models with incomplete markets and other financial instruments, τ_t^* can also reflect sovereign risk premia, term premium of issuing longer dated obligations, liquidity premia, and external risk and currency premia.

the impact of a lower real policy rate on inflation (the second term in equation (11)). See Appendix A.3 for additional details, which also provides a derivation of fiscal r-star for governments that issues some of their debt in foreign currency.

Graphical representations and comparative statics

A different way to conceptualize the dynamics between fiscal and monetary r-stars, inflation, and debt is through a phase diagram. As shown in Figure 3, the diagram includes axes for the primary balance and real interest rates and consists of two schedules. The first schedule, derived from equation (7), is the balanced debt accumulation schedule, which consists of all the different combinations of primary balance and real interest rate such that the change in the debt-to-GDP ratio in each period is zero. This schedule can be thought of as depicting the debt-stabilizing real interest rate for a given level of the primary balance (i.e., fiscal r-star). It is upward sloping because as the primary balance increases, the corresponding fiscal r-star is higher. For simplicity, we assume that the real effective interest rate on government debt equals the real policy rate, such that $\tau_t^* = 0$. The second schedule, derived from equation (10) (i.e. from IS and Philips curves), represents the exogenously given real interest rate at which inflation is stable (monetary r-star). For simplicity, we assume that monetary r-star does not respond to changes in the primary balance, which results in the monetary r-star schedule being a flat line.[32]

Figure 3. Phase Diagram of Fiscal-Monetary Dynamics



Source: Authors.

[32] It is also possible to conceptualize this schedule as a negative function of the primary balance with asymptotic convexity as the primary balance declines (goes further into deficit). The intuition is that ever-larger primary deficits require equilibrium real interest rates to rise due both to their potentially stimulative and crowding out effect and due to the need for potentially higher risk premia required amid increasing fiscal risks, as proxied by larger primary deficits. See Rachel and Summers for an assessment of the impact of fiscal policy on monetary r-star. The main insights from our framework remain unchanged under this alternative assumption.

By construction, areas above (below) the fiscal r-star schedule correspond to all combinations of real interest rates and primary balances such that debt is rising (falling). Similarly, areas above (below) the monetary r-star schedule correspond to all levels of real interest rates and primary balances such that inflation is falling (rising). The phase diagram hence yields four areas that capture different inflation and debt dynamics based on different combinations of real interest rates and primary balances. Area I indicates combinations of the real interest rate and primary balance where inflation is falling while debt accumulation is positive. Area II shows combinations of the real interest rate and primary balance where both debt and inflation are growing. Area III depicts rising inflation and falling debt. And finally, in area IV, both inflation and debt are falling.

Different levels of the primary balance in turn determine the degree of fiscal-monetary tensions in the economy. A special case is when the fiscal authority sets the primary balance at the level that would stabilize the debt-to-GDP ratio (arising for example from a passive fiscal policy regime). In the phase diagram, this debt stabilizing primary balance level, pb^{ds}, is located at the intersection of two fiscal r-star and monetary r-star schedules. In turn, if the fiscal authority sets the level of primary balance greater than pb^{ds}, there would be little tensions between fiscal and monetary policies. This is because in such situations, fiscal r-star is greater than monetary r-star (that is, the fiscal-monetary gap is negative), which implies that the monetary authority can set the real interest rate anywhere below the fiscal r-star rate to ensure fiscal sustainability (to achieve falling debt), and either above or below the monetary r-star rate depending on the prevailing inflation rate (whether to engineer a rise or fall in inflation) to achieve price stability. In other words, through its choice of the real interest rate, the monetary authority could choose to operate either in region IV or region III to the right of pb^{ds}.

By contrast, if the fiscal authority sets the level of primary balance lower than pb^{ds} (which can be thought of as arising from an active fiscal regime), fiscal-monetary tensions would increase. In these situations, the fiscal-monetary gap is positive as the monetary star schedule is above the fiscal r-star schedule. For example, at the depicted level of primary balance $\overline{pb}$ in Figure 3, the fiscal-monetary gap is given by $r_m^* - r_f^*$. If the monetary authority sets the real interest rate between the two r-star rates, then both inflation and debt would be rising (Region II). If the monetary authority sets the real interest rate above monetary r-star (Region I to the left of pb_{ds}), inflation would be falling but debt would be rising even at a greater pace. Conversely, if the real interest rate is set below fiscal r-star (Region III to the left of pb_{ds}), inflation debt would fall but at the expense of rising inflation. In this respect, the choice of real interest rate set by the monetary authority involves important policy trade-offs, and the tensions between fiscal and monetary policies become more acute as the economy moves further to the left (i.e. as the primary balance decreases) on the phase diagram, where the locus of Region II grows.

The phase diagram can also help visualize shifts in overall debt and inflation dynamics arising from changes in the key parameters in the framework, which can explain how fiscal-monetary tensions evolve. Some comparative statics are presented in Figure 4 and described below:

- Should *monetary r-star increase exogenously* (Figure 4, panel A), for instance due to a change in global savings and investment schedules, the monetary r-star curve shifts upward, which would imply that for any given primary balance, the fiscal-monetary gap is larger. Rising neutral interest rates thus increase the trade-offs between stabilizing debt and achieving the inflation target.

- When *potential growth increases*, two effects occur, as shown in Figure 4, panel B. First, the y-intercept of the debt accumulation line rises, which can be thought of as the direct effect of faster real GDP growth making it easier to sustain larger primary balances without higher debt accumulation due to relatively more favorable interest-growth dynamics (i.e., r - g). At the y-intercept, with a primary balance of 0, then debt accumulation is simply the interest-growth differential, and the debt-stabilizing real interest rate equals the potential growth rate. The slope of the debt accumulation line also pivots leftward toward the y-axis due to a steeper slope caused by higher growth. The intuition of this pivot is that the elasticity of the primary balance with respect to borrowing costs goes down due to higher potential growth. Put differently, as the real interest rate increases, less of a change in the primary balance is required to stabilize debt when potential growth is higher. Overall, unless at very high deficits, an increase in potential growth improves the trade-off between stabilizing debt and achieving the inflation target.

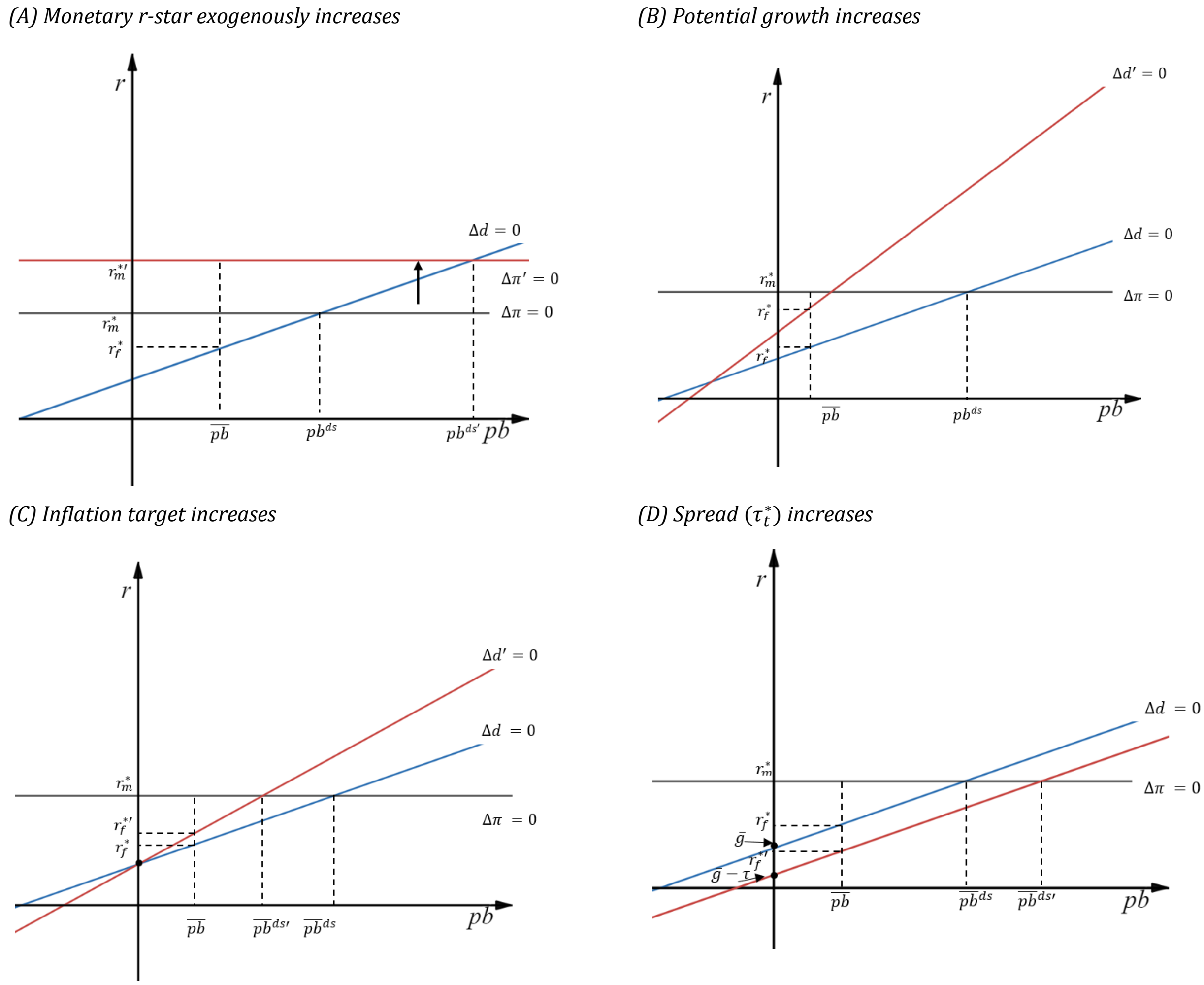
- An *increase in the inflation target* leads to a steeper fiscal r-star schedule (Figure 4, panel C). This arises because under a higher inflation target, less of a fiscal effort would be required to stabilize debt dynamics as inflation erodes some of the debt relative to GDP. For a given primary balance level, a higher inflation target would reduce fiscal-monetary tensions as long as the primary balance is positive.[33]
  - Lastly, an *increase in the spread between the real effective interest rate on government debt and the real policy rate* (τ_t^*) is presented in Figure 4, panel D. A rise in such a spread (from the baseline assumption of zero spread) increases the real interest rate on government debt relative to the real policy rate. Thus, it shifts the fiscal r-star schedule downward, such that, for a given primary balance level, a higher spread increases fiscal-monetary tensions. This is because a higher spread worsens debt dynamics while not improving the central bank's ability to maintain price stability.

From the above exercises in this subsection, it follows that fiscal-monetary tensions can be reduced by a combination of policy actions. First, the fiscal authority can undertake a primary balance adjustment (by increasing $\overline{pb}$), which would raise fiscal r-star (through moving along the fiscal r-star curve) and reduce the fiscal-monetary gap. Second, the fiscal authority can engage in debt management operations, such as shortening the weighted-average maturity of debt issuance when faced with an upward-sloping interest rate term structure. This would lower the effective cost of debt (thereby decreasing τ_t^*) and take advantage of differences in nominal interest rates across the term structure, though it could increase rollover risks. Third, both the fiscal and monetary authorities could engage in various forms of financial engineering and ultimately, financial repression, to decrease monetary r-star (or, more indirectly to decrease the spread τ_t^*). This can be done through macroprudential and capital flow measures designed to increase the captive pool of savings available to the fiscal authority than would otherwise be available at the fiscal authority's preferred

[33] Here, the government's financing needs are lower because its deficit is partly financed by collecting a higher "inflation tax." Over time, the scope for collecting this inflation tax is limited, since, when inflation rises, the private sector will reduce its real money holdings and there will be upward pressure on monetary r-star. For discussions of the impact of a higher inflation target on monetary policy space, see Leigh (2010), Blanchard, Dell'Ariccia, and Mauro (2010), Gagnon and Collins (2019), Blanchard (2022b), and Gagnon (2022).

borrowing cost.[34, 35] Finally, growth-enhancing structural reforms could reduce fiscal-monetary tensions by boosting potential growth (provided primary deficits are not too large), although this would depend also on the effects of higher growth on monetary r-star.[36]

Figure 4. Comparative Statics in Fiscal-Monetary Dynamics



Source: Authors.

[34] Reinhart, Kirkegaard, and Belen (2011) define financial repression as a situation in which a government uses macroprudential tools to generate directed lending from captive domestic audiences. Some tools of financial repression include interest rate caps, capital controls, moral suasion, and reserve and capital requirements. The potential use of financial repression is discussed further below in the context of how governments could deal with significant post-COVID debt overhangs.

[35] Equivalently, seen through the debt valuation equation in (6), financial repression would lower the real stochastic discount factor of holders of government debt such that the present value of primary balances is zero, but holders still value the debt. This is akin to generating a bubble term which represents a fiscal resource to the government. It can "mine the bubble" and never has to raise taxes to fully fund all government expenditures (Brunnermeier, Merkel, and Sannikov, 2020).

[36] From standard macroeconomic building blocks, monetary r-star is typically an increasing function of productivity growth (e.g., Laubach and Williams, 2003).

4 Estimation of Fiscal R-Star and the Fiscal-Monetary Gap

We now estimate fiscal r-star and the fiscal-monetary gap. Our sample consists of 16 AEs, including Australia, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom, and United States spanning more than 140 years of data between 1878 and 2020.

Data sources and methodology

As suggested by equation (6), calculating fiscal r-star requires estimating several parameters. These include the long-term (or cyclically adjusted) primary balance ($\overline{pb}$), growth rate of potential output ($\bar{g}$), the inflation target ($\bar{\pi}$), and the debt level target ($\bar{d}$). We rely on two main databases, namely the Jordà-Schularick-Taylor (JST) database, which provides the main macroeconomic data (Jordà, Schularick, and Taylor , 2017) complemented by fiscal data from the *Public Finances in Modern History* (PFMH) database (Mauro et al., 2015). To estimate the fiscal-monetary gap, an estimate of monetary r-star is required. The data source for monetary r-star is Platzer et al. (2023), who apply the Laubach and Williams (2003) methodology to estimate the natural rate of interest for our sample of countries using the JST database.

The baseline estimation of the different variables proceeds as follows. To obtain the long-term primary balance, a Hodrick-Prescott (HP) filter is applied to the primary balance series. For output growth, estimates provided by Platzer et al. (2023) are used to ensure consistency with their monetary r-star estimates. For the debt target, the five-year moving average of the public debt to GDP ratio is used.[37] For inflation expectations, an official inflation target is used where appliable. Where there is no official inflation target, the five-year moving average of the country's inflation is used.

A primary advantage of using the JST dataset based on simple filtering techniques to estimate these variables is the ability to document the evolution of the estimated fiscal r-star and the fiscal-monetary gap over a long period—over 140 years. This allows the analysis to cover several key historical episodes concerning debt sustainability, such the Great Depression and World War II. In section 6 an alternative approach in estimating these variables is explored—one based on expert forecasts of the underlying variables. The estimates from this alternative approach, based on more recent data, indicate that the results are robust to the two approaches used.

[37] An alternative method for choosing an appropriate level of terminal debt $\bar{d}$ is to assume constant real interest rate expenses as a share of GDP, as per Furman & Summers (2020), or to adopt a debt anchor that would calibrate a debt limit using an interest and revenue levels below a certain threshold (see, for example, Comelli et al., 2023).

Estimation results

The estimation results of fiscal r-star and the fiscal-monetary gap are presented in Figure 5. The results offer several insights. First, the average fiscal-monetary gap peaked during World War II amid war-era fiscal strains. Second, the average fiscal-monetary gap in 2020 is the highest measured since the late 1950s, when AEs were dealing with the significant debt overhang from World War II. The post-war boom and demobilization reduced the gap, which hit a historic low in the mid-1970s. Third, after historic lows in the 1970s, the gap remained low and relatively constant from the early 1980s through the mid-2000s, due primarily to the decline in monetary r-star after the early 1980s disinflation. Most notably is the upward trajectory of the fiscal-monetary gap since the mid-2000s.[38]

Overall, fiscal r-star is generally faster-moving and more volatile than monetary r-star, which follows from the definition of fiscal r-star: specifically, because fiscal r-star is a function of the primary balance, it is subject to policy discretion. By contrast, monetary r-star is a function of the supply and demand of savings and investment, which are relatively slower moving. To examine the influence of the underlying components on the evolution of fiscal r-star over the period, we conduct two exercises. First, we decompose the change in fiscal r-star over time through the following equation:

$$(\mathbf{12})\ r_{f,t}^{*} - \bar{r}_f^{*} = (\bar{g}_t - \bar{\bar{g}})\left(1 + \frac{\overline{\overline{pb}}}{\bar{d}}\right) + \left(\frac{\overline{pb_t}}{\overline{d_t}} - \frac{\overline{\overline{pb}}}{\bar{d}}\right)(1 + \bar{\pi} + \bar{\bar{g}}) + (\bar{g}_t - \bar{\bar{g}})\left(\frac{\overline{pb_t}}{\overline{d_t}} - \frac{\overline{\overline{pb}}}{\bar{d}}\right),$$

which captures the difference between global fiscal r-star (the average across countries for a given year) and its sample mean. The first term captures the impact of the change in the potential growth rate; the second term captures the impact of the change in the ratio of the primary balance and the debt level; and the last term captures their covariance.

The results of this exercise are plotted in Figure 6 and show that the decline in global fiscal r-star during the first half of the Twentieth Century coincided with significant spending needs associated with the two World Wars, with primary balances and debt accounting for most of this increase. From the early 1930s to late 1960s, trend growth positively contributed to the increase in fiscal r-star. Post-2000, the decline in global fiscal r-star was due both to declining potential growth and to deteriorating debt and primary balance dynamics, whereas fiscal policy (i.e., debt and deficits) was less of a drag on fiscal r-star from the early 1970s through the late 1990s.

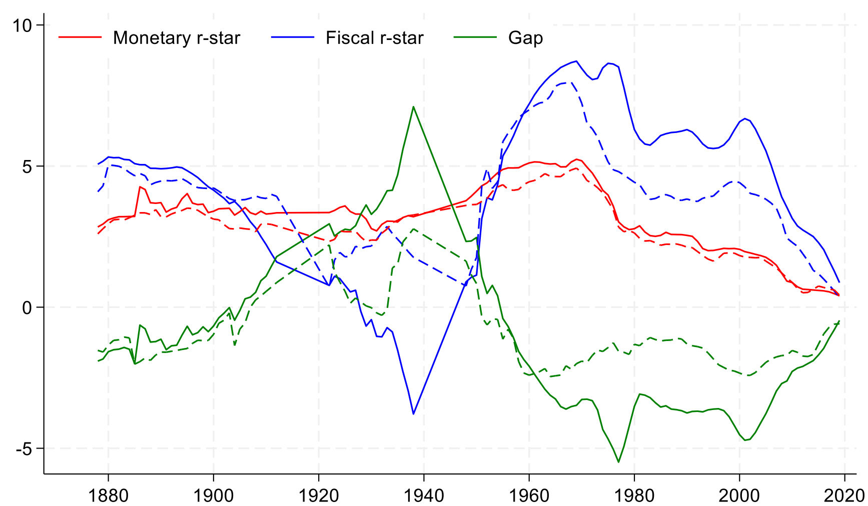
Second, to get a sense of the magnitude of the effects of different components, we regress our estimates of fiscal r-star and fiscal-monetary gap on their underlying components, considering specifications with and without country fixed effects. The regression results for the drivers of fiscal r-star are shown in Table 1. Results based on the full specification (column 8, which includes all components, including fixed effects) indicate that primary balance and potential growth are statistically significant drivers of fiscal r-star during the sample period, both displaying the expected positive sign. The coefficients are also economically

[38] Note that Figure 5 presents both means and medians. Although the medians show less volatility in the series due to fewer outliers being included in the sample, they show broadly similar overall trends.

significant. A one percentage point higher long-term primary balance is associated with a more than two percentage point higher fiscal r-star. A one percentage point higher trend growth rate is associated with a 1.2 to 1.4 percentage point higher fiscal r-star. Notably, the debt stock displays the expected negative sign, but is statistically insignificant, possibly due to potential collinearity with primary balance, although it is statistically significant in the standalone specification.

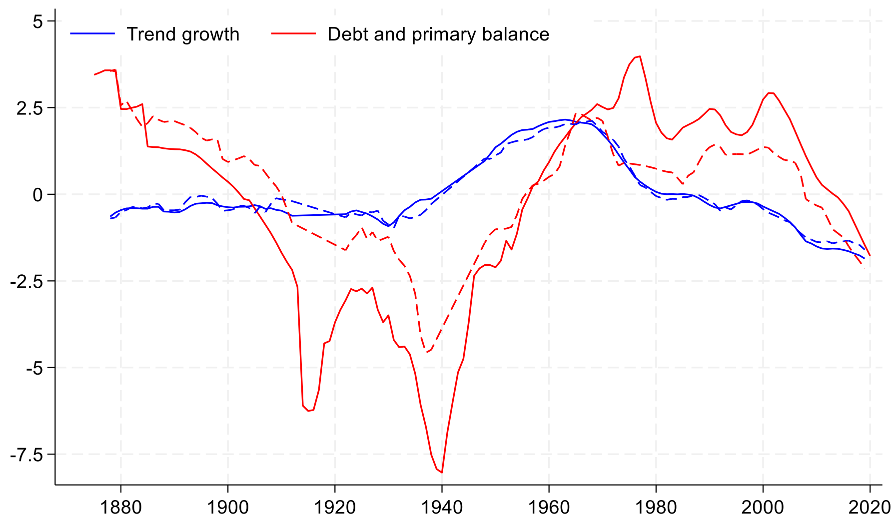
Interestingly, from additional results in columns 9 and 10, fiscal r-star and monetary r-stars show strong co-movement historically, with fiscal r-star increasing by 0.75 to 0.90 percentage points for a one percentage point higher monetary r-star. The results for the fiscal-monetary gap are shown in Table 2 and share broadly similar observations.

Figure 5. Historical Estimates of Fiscal R-Star and the Fiscal-Monetary Gap[1]



[1] Dashed lines represent medians of samples, while solid lines represent unweighted means.
Source: JST database (Jordà, Schularick, and Taylor, 2017) and authors' calculations.

Figure 6. Historical Decompositions of Fiscal R-Star Relative to Its Country Average[1]



[1] Dashed lines represent medians of samples, while solid lines represent unweighted means.
Source: JST database (Jordà, Schularick, and Taylor, 2017) and authors' calculations.

Table 1. Correlates of Fiscal R-Star[1]

	(1) r_f^*	(2) r_f^*	(3) r_f^*	(4) r_f^*	(5) r_f^*	(6) r_f^*	(7) r_f^*	(8) r_f^*	(9) r_f^*	(10) r_f^*
$\overline{d}$	-0.040***	-0.024					-0.018	-0.012		
	(0.013)	(0.018)					(0.013)	(0.012)		
$\overline{pb}$			2.22***	2.13***			2.24***	2.19***		
			(0.33)	(0.39)			(0.31)	(0.37)		
$\overline{g}$					1.41***	1.22**	1.24***	1.20***		
					(0.39)	(0.42)	(0.20)	(0.18)		
r_m^*									0.75***	0.90***
									(0.22)	(0.27)
R^2	0.05	0.27	0.57	0.64	0.09	0.31	0.67	0.71	0.06	0.31
Country FE	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES

[1] OLS regressions of fiscal r-star on drivers for full JST sample (1700 observations), with and without fixed effects. Robust standard errors in parentheses, clustered at country level. All variables winsorized at 1 percent tails.
*** p<0.01, ** p<0.05, * p<0.1

Table 2. Correlates of the Fiscal-Monetary Gap[1]

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	$r_m^* - r_f^*$	$r_m^* - r_f^*$	$r_m^* - r_f^*$	$r_m^* - r_f^*$	$r_m^* - r_f^*$	$r_m^* - r_f^*$	$r_m^* - r_f^*$	$r_m^* - r_f^*$	$r_m^* - r_f^*$	$r_m^* - r_f^*$
$\bar{d}$	0.018	-0.013					0.014	-0.0076		
	(0.012)	(0.012)					(0.014)	(0.015)		
$\overline{pb}$			-2.18***	-2.056***			-2.18***	-2.05***		
			(0.34)	(0.39)			(0.34)	(0.40)		
$\bar{g}$					-0.32	-0.12	-0.21	-0.34*		
					(0.32)	(0.36)	(0.18)	(0.18)		
r_m^*									0.28	0.12
									(0.20)	(0.25)
R^2	0.01	0.28	0.58	0.66	0.005	0.28	0.59	0.66	0.009	0.28
Country FE	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES

[1] OLS regressions of fiscal-monetary gap on drivers for full JST sample (1700 observations), with and without fixed effects. Robust standard errors in parentheses, clustered at country level. All variables winsorized at 1 percent tails.
*** p<0.01, ** p<0.05, * p<0.1

5 Fiscal-Monetary Tensions and Macroeconomic Outcomes

To explore the impact of changes in fiscal-monetary tensions on key macroeconomic outcomes, we estimate local projections (Jorda, 2005) under the following specification:

$$y_{i,t+h} - y_{i,t-1} = \beta^h gap_{i,t} + \alpha_i^h + \sum_{k=1}^{3} \delta_k^h y_{i,t-k} + \boldsymbol{\Gamma^h X_{i,t}} + u_{i,t+h},$$

where for country i and horizon (in years) h, $y_{i,t+h}$ is the response of an outcome variable relative to its initial value $y_{i,t-1}$ with respect to the initial level of the fiscal-monetary gap; $gap_{i,t}$ is the fiscal monetary gap; α_i^h is an intercept that captures a country-specific fixed effect which accounts for time-invariant factors driving changes in the outcome variable, and $\boldsymbol{X_{i,t}}$ is a set of control variables.

We consider a variety of outcome variables, including macroeconomic outcomes, asset prices, and measures of the probability of crisis. Broadly motivated by our discussion in Section 4, the set of macroeconomic outcomes includes changes in the debt-to-GDP ratio, inflation, exchange rate movements relative to the USD and commodity basket, cumulative fiscal consolidation, and debt liquidation, which is a measure of financial repression following Reinhart and Sbrancia (2015).[39] For asset prices, we consider real bond, equity, housing, and cash returns. We are interested in the probability of several types of crises, including debt (external, domestic, and total), inflation, currency, systemic, bond, equity, housing, economic recession, whose definitions are included in the notes of Table 9.

Two sets of control variables are considered. The first set includes three lags of the outcome variable. The second set includes lags of the debt level, business cycle variables (i.e., trend output growth and inflation), policy variables (the primary balance and real policy rate) and monetary r-star. Including monetary r-star ensures that the impact of the fiscal-monetary gap rather than the interest rate environment generally is captured. Robust standard errors with respect to heteroskedasticity, cross-sectional correlation, and serial correlation across years are used (Driscoll and Kraay, 1998).

β^h is the coefficient of interest. It measures the elasticity between fiscal-monetary gaps and subsequent outcomes. Put differently, it summarizes the predictive power of the fiscal-monetary gap for outcomes at different time horizons. By focusing on the dynamic impulse responses to changes in fiscal-monetary gaps, the estimates potentially capture possible feedback effects between policy and outcomes. While it can be argued that variation in fiscal-monetary gaps does not generally result from exogenous shocks, the use of local projections and the inclusion of fixed effects addresses endogeneity concerns with regard to reverse causality and time-invariant factors.

The estimated impulse responses for selected macroeconomic outcomes are shown in Figure 7. The results show that a rise in the fiscal-monetary gap is associated with a host of adverse macroeconomic outcomes, including a rising debt ratio, higher price level, exchange rate depreciation, and financial repression. More

[39] Debt liquidation can be thought of as the change in the debt ratio that results from the real interest rate being below monetary r-star and inflation being above target.

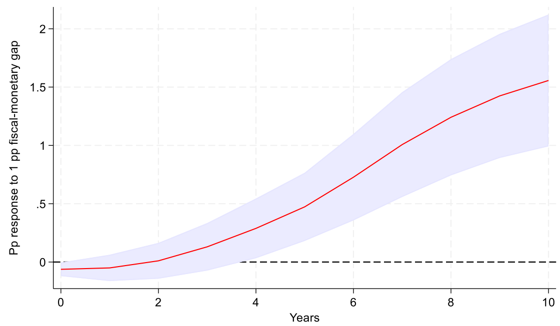
specifically, when the fiscal-monetary gap is one percentage point higher, the debt ratio (Panel A) and price level (Panel B) rise by an additional 1.5 percentage points after ten years. Furthermore, a one percentage point higher fiscal-monetary gap predicts a cumulative excess nominal depreciation relative to the U.S. dollar (Panel C) and relative to a commodity basket (Panel D) by around 2 percent and 1.5 percent after ten years, respectively.[40] Such a rise also appears to be subsequently associated with fiscal consolidation (Panel E), although the effect is economically small at 0.02 cumulative percentage points after ten years. Finally, a higher fiscal-monetary gap also predicts more liquidation of government debt, a symptom of financial repression. A 1 percentage point higher fiscal-monetary gap is associated with an additional cumulative liquidation of government debt by 0.6 percentage points ten years later.

A rise in the fiscal-monetary gap is also found to predict movements in asset prices and occurrences of economic crises. As shown in Figure 8, a one percentage point increase in fiscal-monetary gap is associated with 2 and 1 percentage points lower real returns on bonds (Panel A) and real cash (Panel D) after ten years, respectively, which is consistent with the results regarding the greater propensity to engage in debt liquidation. Real housing returns (Panel C) fall initially but are relatively unchanged after ten years, the impulses for real equity returns (Panel B) are not statistically significant. As shown in Figure 9, a rise is the fiscal-monetary gap is also associated with a higher probability of several types of economic crises, although the magnitudes of the impulses are moderate, with a one percentage point increase being associated with higher probabilities of crises by around between 0.7 and 1.8 percentage points.

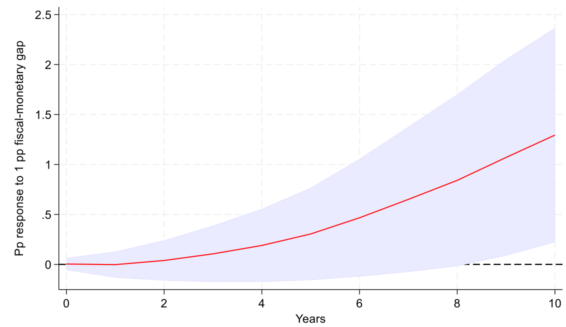
[40] Fiscal r-star and the fiscal-monetary gap are presented in a closed economy setting. It is possible to extend its treatment in an open economy setting as described in Appendix A.3.

Figure 7. Shocks to the Fiscal-Monetary Gap and Macroeconomic Indicators

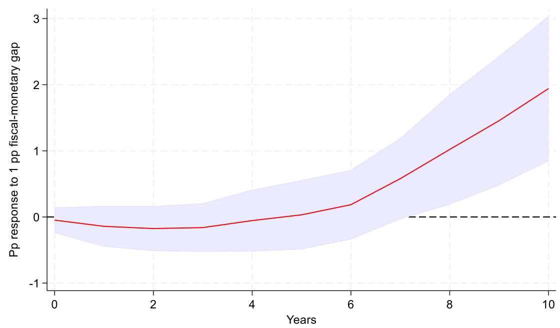
(A) Expected change in the debt ratio



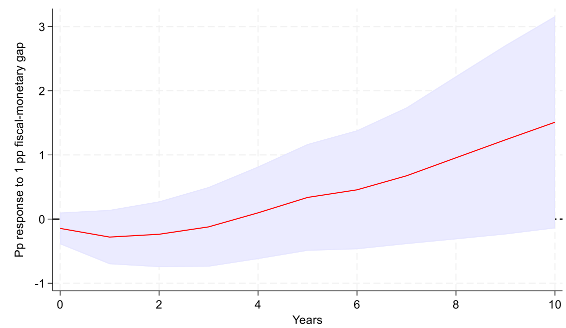
(B) Expected change in the price level



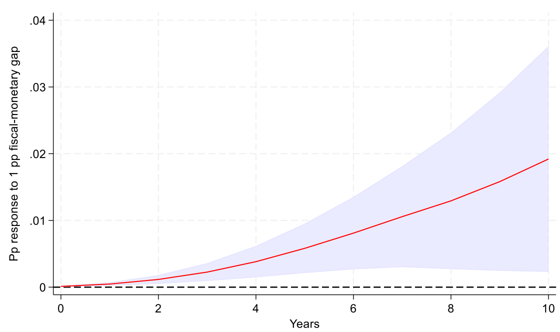
(C) Cumulative nominal depreciation relative to USD[1]



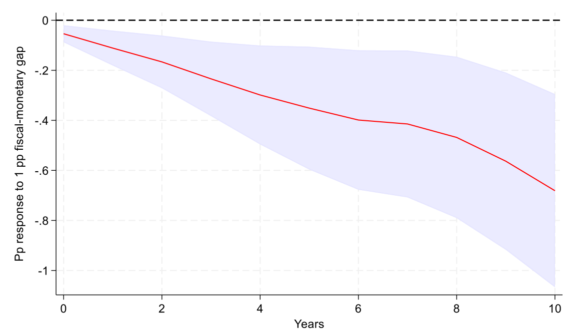
(D) Cumulative depreciation relative to commodity basket[2]



(E) Cumulative fiscal consolidation[3]



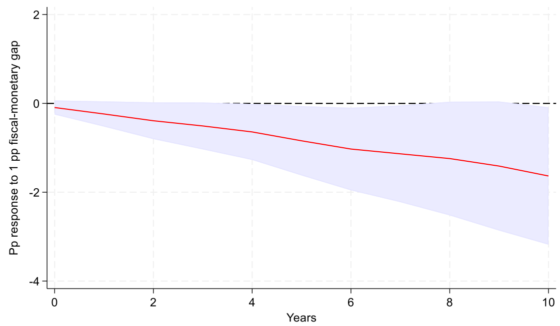
(F) Cumulative debt liquidation



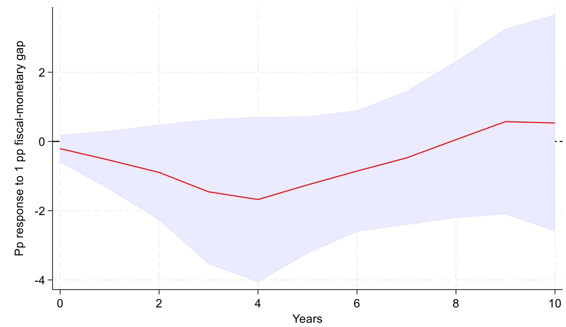
[1] USA not included in sample. Units expressed in foreign currency units per 1 unit USD.
[2] Units expressed in foreign currency unit per 1 unit of basket, equal weighed 27 commodities, including beef, hides, lamb, pork, coal, petroleum, barley, corn, rice, rye, wheat, copper, lead, nickel, steel, tin, zin, gold, silver, cocoa, coffee, cotton, palm oil, sugar, tea, tobacco, wool.
[3] Measured as the cumulative sum of the primary balance.
Source: Authors' calculations

Figure 8. Shocks to the Fiscal-Monetary Gap and Asset Prices[1]

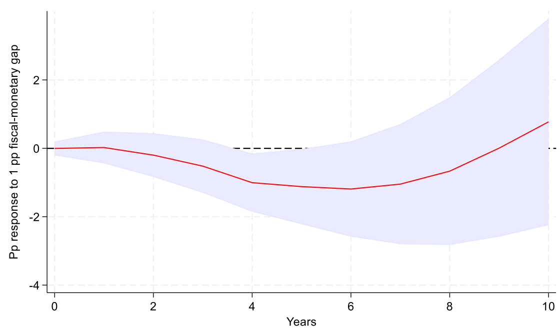
(A) Real bond returns



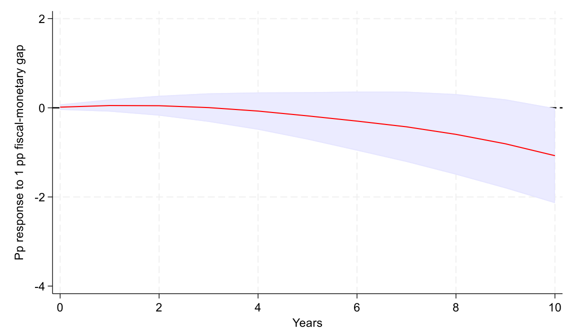
(B) Real equity returns



(C) Real housing returns



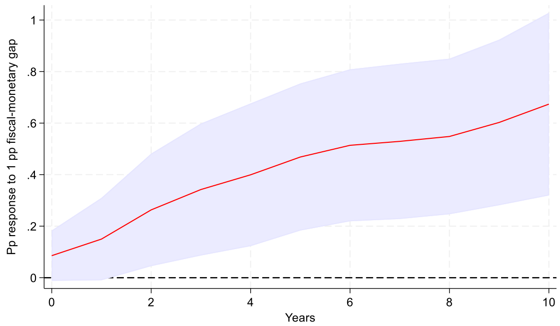
(D) Real cash returns



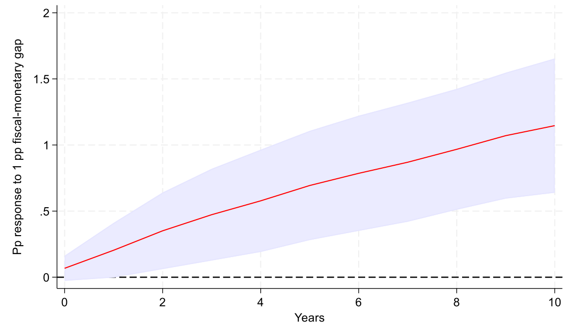
[1] Expected change in returns due to a 1 percentage point increase in the fiscal-monetary gap.
Source: Authors' calculations

Figure 9. Shocks to the Fiscal-Monetary Gap and Changes to the Probability of Crises[1]

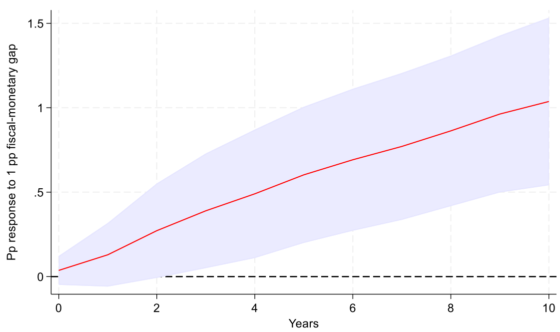
(A) Cumulative probability of external debt crisis[2]



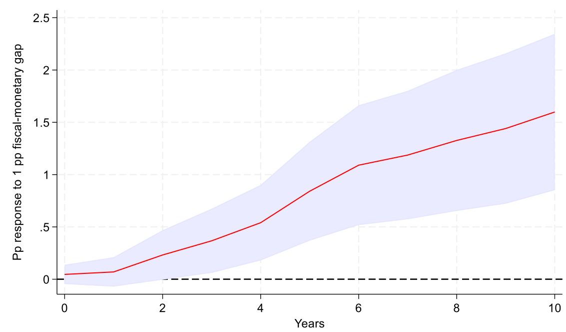
(B) Cumulative probability of domestic debt crisis[3]



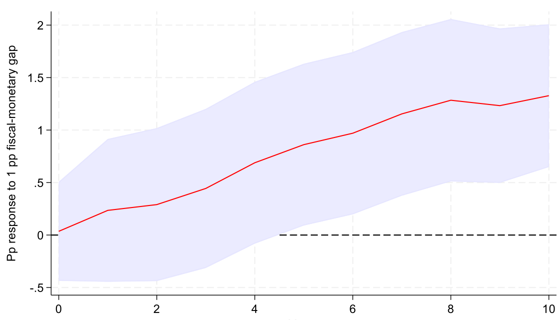
(C) Cumulative probability of any debt crisis[4]



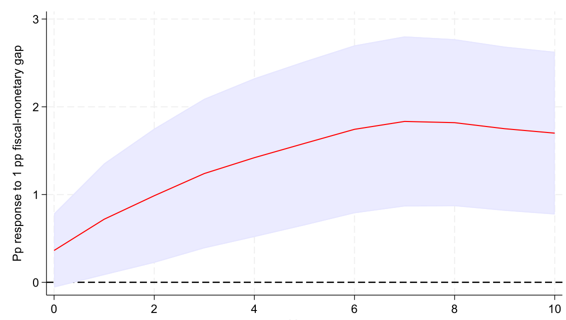
(D) Cumulative probability of inflation crisis[5]



(E) Cumulative probability of currency crisis[6]



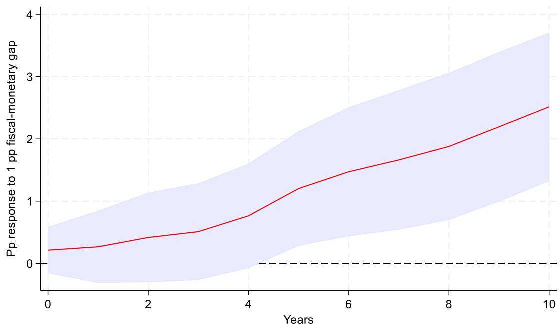
(F) Cumulative probability of systemic crisis[7]



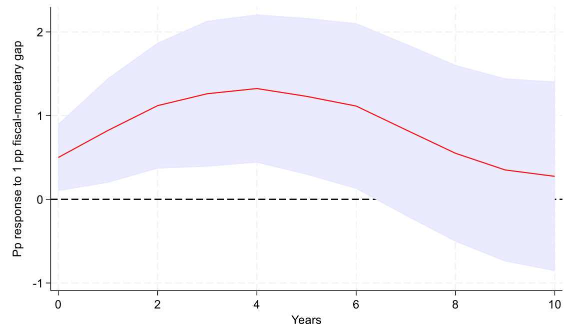
[1] Expected difference in cumulative probability of crisis within time window due to a 1 p.p. increase in the fiscal-monetary gap.
[2,3,4] Debt crisis if either in domestic or external default according to data by Carmen Reinhart.
[5,6,7] Definitions from same dataset. A systemic crisis is defined following Caprio et al. (2005), who characterize modern systemic crises as "those episodes where there are bank runs, a significant share of non-performing assets, bank liquidations, and large-scale policy intervention to support banks" (Reinhart and Rogoff, 2014).
Source: Authors' calculations

Figure 9. Shocks to the Fiscal-Monetary Gap and Changes to the Probability of Crises (cont.)

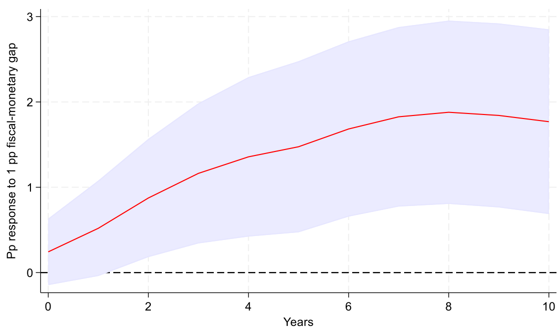
(G) Cumulative probability of bond crisis[1]



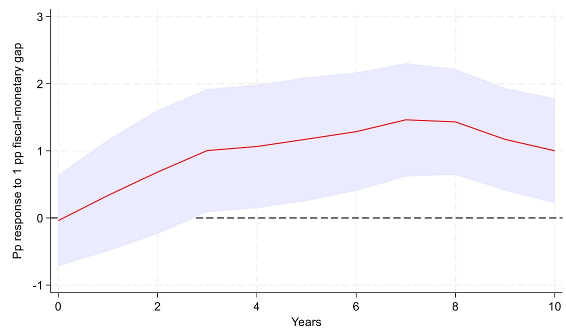
(H) Cumulative probability of stock market crisis[2]



(I) Cumulative probability of housing crisis[3]



(J) Cumulative probability of recession[4]



[1, 2, 3] Crisis if real asset returns are less than negative 10 percent in a given year within the time window.
[4] Recession if real GDP falls in a given year.
Source: Authors' calculations

6 Current Estimates of Fiscal R-Star and the Fiscal-Monetary Gap

In this section, we present forward-looking and more recent estimates of fiscal r-star and the fiscal-monetary gap, utilizing data from the IMF's World Economic Outlook (WEO) dataset between 2014 and 2023 (in contrast to the JST dataset which is available until 2020). The WEO database contains information on the *n*-year ahead projections of key macroeconomic variables through 2023. The underlying assumption is that these projections serve as reasonable approximations of their long-term trends. An advantage of this approach relative to that employed in Section 5 is the focus on the forward-looking aspect of the underlying macroeconomic variables. In addition, the WEO dataset includes a broader sample of countries—in addition to the 16 AEs considered in the previous section, the sample is expanded to include 37 EMEs in this section. Finally, being model-free, this approach is robust to the end-point problem inherent in filtering techniques used to estimate potential output and monetary r-star in Section 2. Given the focus on the endpoints (that is, estimates of the relevant variables in the recent years) in this section, this aspect could yield more reliable estimates for the recent data points relative to the estimates in Section 4.

The estimation proceeds as follows. For each year in the sample, 5-year ahead projections of GDP growth, government primary balance, and debt level are used to capture $\bar{g}$, $\overline{pb}$, and $\bar{d}$, respectively. To estimate monetary r-star, the 5-year ahead projections of the policy rate minus $\bar{\pi}$ is used. For countries that lack an official inflation target, the inflation target ($\bar{\pi}$) is measured in the same manner; otherwise, the explicit inflation target is used. One potential issue underlying the WEO dataset is the possibility of forecast errors in the 5-year projections. Given this issue, we also present estimates after correcting for historical forecast errors for potential growth, primary balances, and debt levels. This is done by first computing the yearly forecast error for each country as the difference between the WEO forecast 5 years before and the realized value for each year, taking the country-specific average of these errors across the years, and then adding this average forecast error back to the 5-year ahead forecast for each of the mentioned variable.

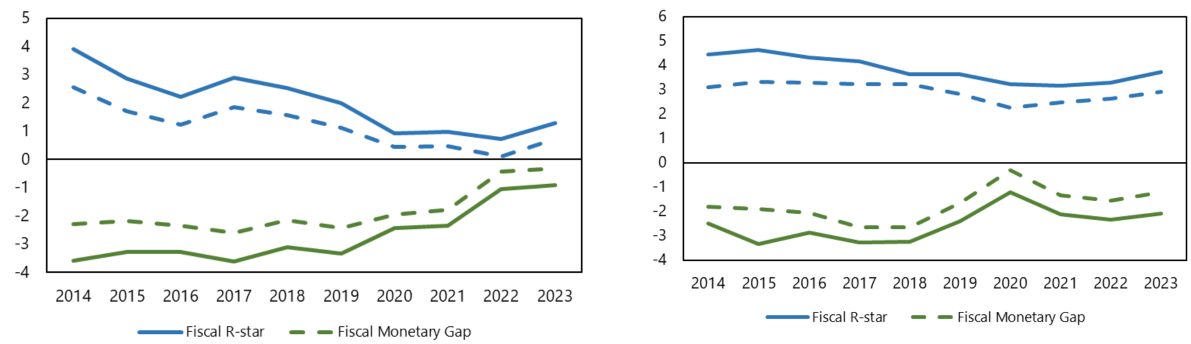
Results for AEs and EMs are shown in panels A and B of Figure 10, respectively. The baseline estimates (not correct for forecast errors) are shown through the solid lines. For AEs, fiscal r-star appears to have declined significantly over the past decade, from around 4 percent in 2014 to around 1 percent in 2023. This has resulted in a corresponding rise in the fiscal-monetary gap to a historic high level of around -1 percent in 2023. Inspecting the evolution of fiscal r-star's components over the same period (as shown in Panel A of Figure 11), such a decline in fiscal r-star appears to have been driven by a combination of lower potential GDP growth, higher terminal debt, and most importantly the declining primary balance, especially during the COVID-19 pandemic.

For EMs, the trends in fiscal r-star and the fiscal-monetary gap are more stable. The decline in fiscal r-star has been more gradual, driven by a moderate fall in potential GDP growth and the inflation target, and a moderate post-Covid increase in terminal debt. With a relatively stable monetary r-star, the fiscal-monetary gap for EMs has increased at a more measured pace.

After adjusting for forecast errors (as shown through the dashed lines in Figure 10), the recent estimates for the fiscal r-star are even lower for both AEs and EMs, resulting in even larger estimates for the fiscal-monetary gap.

Figure 10. Recent Estimates of Fiscal R-Star and the Fiscal-Monetary Gap (AEs and EMs) (percent)[1]

(A) Fiscal R-Star and the Fiscal-Monetary Gap (AEs) *(B) Fiscal R-Star and the Fiscal-Monetary Gap (EMs)*

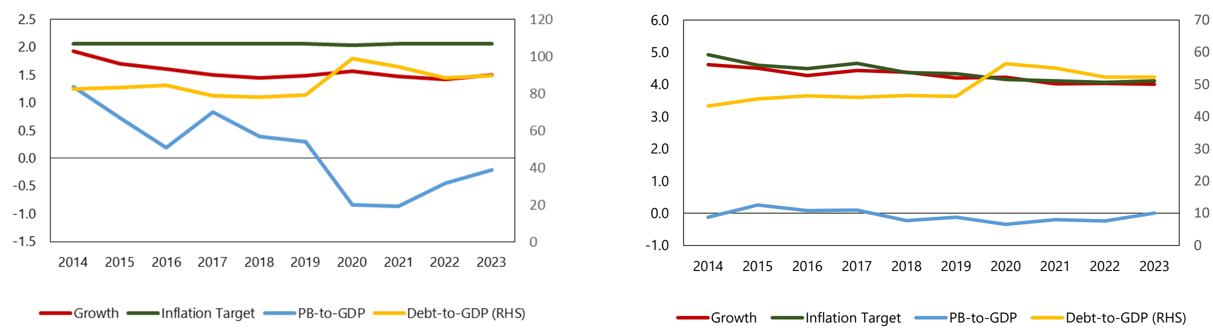


[1] Solid lines represent baseline estimates, while dashed lines represent estimates after correcting for historical forecast errors over the sample period for nominal GDP growth, primary balances, and debt levels.

Source: Authors' calculations

Figure 11. Evolution of Components of Fiscal R-Star (AEs and EMs) (percent)

(A) AE (percent) *(B) EM (percent)*



Source: Authors' calculations

7 Policy Implications and Conclusions

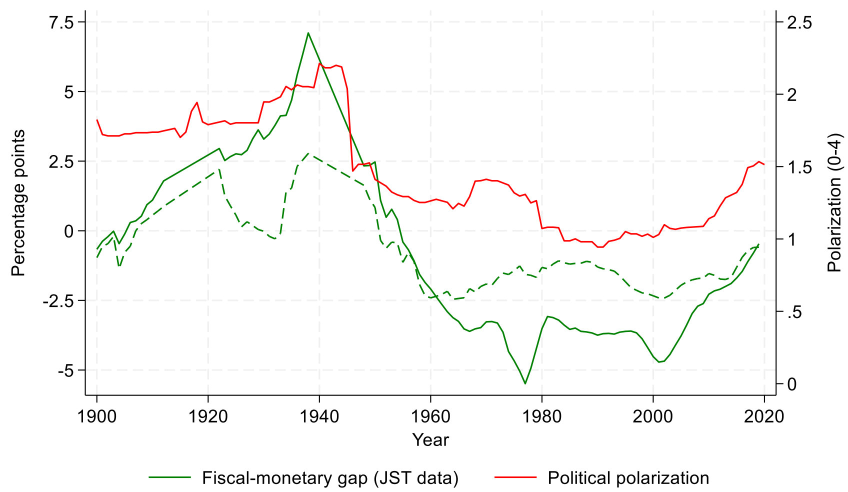
With our estimates pointing to fiscal-monetary tensions in AEs being currently at historical highs, our empirical analysis would indicate that should current fiscal trajectories remain unchanged—and absent an exogenous decline in monetary r-star—undesirable economic consequences may ensue. To avoid these adverse potential outcomes, different policy levers could be used in a preemptive manner, as discussed in Section 3 through the lens of our analytical framework. This section discusses policy implications, potential challenges associated with some of these policy actions, including fiscal adjustment, monetary accommodation, and financial repression, and concludes with some avenues for future research that follow from this paper.

First, as discussed by several authors (for example, Alesina, et al., 1998; Price, 2010; and Arslanalp, Eichengreen, and Henry, 2024) political economy considerations could play an important role in affecting countries' willingness to undergo fiscal consolidation and hence improve the trajectory of their debt dynamics via fiscal effort. This paper's framework can be used to consider different scenarios for fiscal and monetary policy and help determine the appropriate policy mix given uncertainty (see Annex 4). Arslanalp, Eichengreen, and Henry (2024), for example, find that Jamaica's debt reduction was achieved via a series of fiscal responsibility mechanisms and consensus-building exercises, enabled by a reduction in political polarization that enabled trust-building and fair burden sharing. Arslanalp et al.'s case study of Jamaica's sustained debt reduction could be relevant to the current period given Jamaica's then high inherited debt and unfavorable interest-growth dynamics. It is currently unclear, however, whether advanced economies have the requisite social cohesion necessary to achieving a politically sustainable fiscal consolidation plan.[41]

Adding to this literature, we find that there is indeed co-movement between fiscal-monetary tensions and political polarization. Specifically, as shown in Figure 13, which plots the fiscal-monetary gap alongside a measure of political polarization provided in the *Varieties of Democracy* database, the degrees of fiscal-monetary tensions and political polarization in the common sample of AEs have historically moved together, with both currently reaching highs not seen since the 1940s-50s. This co-movement is explained by a potential two-way relationship explored in the literature. Specifically, as societies become more polarized, implementing the fiscal adjustments required to reduce the fiscal-monetary gap may become more challenging (Roubini and Sachs, 1989a,b; Alesina and Tabellini, 1990; Alesina and Drazen, 1991), which leads to greater tensions over time as debt and interest burdens accumulate. The pressures posed by fiscal-monetary tensions may in turn feed back into polarization (Gabriel, Klein, and Pessoa, 2023; Hübscher, Sattler, and Wagner, 2023).

[41] See also Balasundharam et al. (2023) for a stock taking on difficulties of achieving successful fiscal consolidations.

Figure 13. Political Polarization and the Fiscal-Monetary Gap[1]



[1] Sample includes Australia, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom, and United States

Source: Varieties of Democracy Dataset (version 13) and authors' calculations. Political polarization is measured via a survey-based approach, whereby survey respondents in each country are asked questions to elicit the degree to which society has separated into distinct, antagonistic political camps based on the likelihood of disparate groups to engage in friendly interactions with non-likeminded parties.

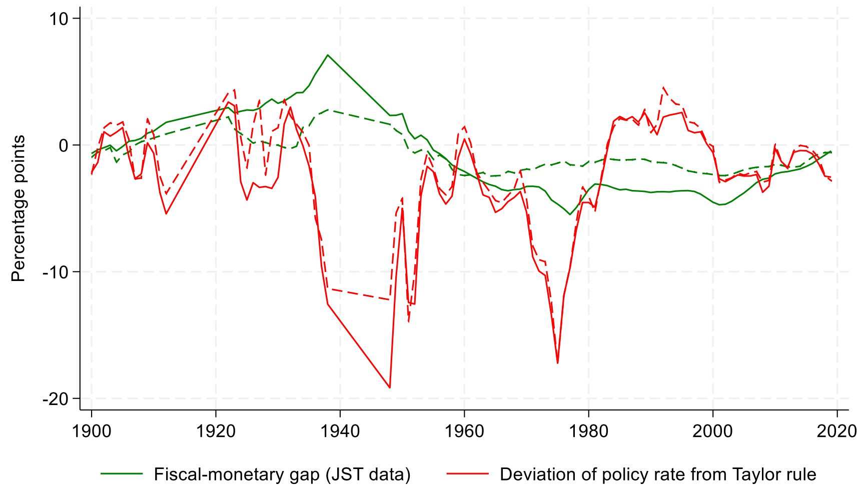
Second, since monetary policy accommodation could reduce fiscal-monetary tensions, central banks may face greater pressures to accommodate fiscal policy going forward. Monetary accommodation was historically associated with periods of higher fiscal-monetary tensions. In some cases, this arrangement was explicit, such as during World War II (Romero, 2013). Estimating standard Taylor rules (Taylor, 1993) using the JST database, we find that episodes of heightened fiscal-monetary tensions historically indeed coincide with periods in which the monetary policy rate deviated below the interest rates given by Taylor rules.[42] More specifically, as shown in Figure 14, policy rates appear to be low relative to Taylor rule levels in the 1930s-1950s, when fiscal-monetary gaps were at historic highs.[43]

Central bank institutional independence should continue to be safeguarded to prevent fiscal authorities from undermining the central bank's ability to play an active role in stabilizing inflation. Such independence can also have fiscal dividends (see Gopinath, 2022): when inflation expectations are well-anchored, inflation risk premia on government debt would be reduced, thereby enhancing fiscal sustainability. Also, de-anchoring of inflation expectations resulting from overly accommodative monetary policy could subsequently necessitate even tighter monetary policy that increase fiscal-monetary tensions even more.

[42] Following Hofmann and Bodanova (2012), we set the nominal policy rate in the Taylor (1993) rule as $i_t^P = r_{m,t}^* + 1.5(\pi_t - \bar{\pi}) + 0.5(Q_t - Q_t^*)$, where the last variable is the output gap. All variables are expressed in percent or percentage points.

[43] Similarly, Hofmann and Bogdanova (2012) discuss the "Great Deviation", in which policy rates were below levels given by the Taylor Rule for AEs in the period following the Global Financial Crisis. This period coincided with a rise in fiscal-monetary gaps across AEs.

Figure 14. The Fiscal-Monetary Gap and Deviations of Policy Rates from Equilibrium Rates



[1] Sample includes Australia, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom, and United States

Source: JST database.

Third, financial repression (both de facto and de jure) has historically been used to lower fiscal financing costs, but similar measures today would be challenging. Historically, countries have resorted to using financial repression during episodes of large fiscal-monetary gaps, particularly when fiscal pressures (e.g., due to wars and other exogenous shocks) are acute. That said, policymakers should be mindful of the adverse spillovers of financial repression, including to households, firms, and capital formation. On a practical level, the strength of organized financial interests that would lobby against financial repression (due to suppressed returns) and global capital mobility (making it more difficult for authorities to "lock in" capital) could reduce the potential efficacy of financial repression (Arslanalp and Eichengreen, 2023). Still, if fiscal-monetary tensions remain elevated into the medium term, while political cohesion and social consensus to achieve fiscal consolidations is lacking, then financial repression may increasingly become a preferred tool of choice of countries facing heightened tensions.

Open financial accounts can exacerbate fiscal-monetary tensions and trigger nonlinearities when domestic real interest rates diverge from foreign real interest rates. If policymakers in an open economy accommodate active fiscal policy and allow substantially large interest rate differentials to exist, capital outflows could trigger a real exchange rate depreciation, further pushing up the debt ratio through exchange rate valuation effects, lowering fiscal r-star and further increasing the fiscal-monetary gap. The market's perception of the additional risk associated with investing in foreign assets (alternatively, the additional compensation demanded by investors to hold foreign assets) could push up the country's risk premium. This premium is influenced by active fiscal policy, adversely impacting investors' perceptions about the riskiness of a country's institutions (e.g., central bank independence), including through fears of fiscal dominance.

Some policy actions available in a closed economy become less effective in an open economy setting, which could tempt policymakers to revert to other nonconventional tools. Accommodative monetary policy cannot fully offset a higher interest burden if a large share of debt is denominated in foreign currency. Similarly, the impact of surprise inflation on the debt ratio is smaller if it is offset by a nominal currency depreciation that pushes up the stock of FX-denominated debt. Forcing domestic savers to hold government debt through financial repression is less effective if a larger share of the debt stock is held by nonresidents or if domestic savers can substitute foreign assets for domestic assets. Therefore, as policy actions focused on domestic actors become less effective, policymakers could be tempted to resort to policies that distort capital flows, including foreign exchange intervention (FXI) and capital flow measures (CFMs).

The paper opens several avenues of theoretical research related to fiscal-monetary interactions. Further work can attempt to refine the fiscal r-star framework by incorporating the concept into existing micro-founded macroeconomic models to better account for the potential endogeneity of monetary r-star to an economy's fiscal stance. One potential avenue could be building a DSGE model calibrated to a representative advanced economy with active fiscal policy to examine how shocks to the fiscal-monetary gap impact macroeconomic aggregates. It would be possible to build a model with an exogenous primary balance path, from which a Wicksellian r-star (determined by the market-clearing real interest rate of savings and investment) could be computed. This market-clearing interest rate with active fiscal policy could be compared to the shadow fiscal r-star that would stabilize the debt path. Deriving an open economy version of the fiscal r-star and fiscal-monetary gap framework, including by building on the insights in Appendix A.3, would further refine this paper's theoretical framework. Finally, future work can explore the interactions between all three interest rate anchors – that is, monetary r-star, fiscal r-star, and financial r-star (Akinci et al., 2020) – to consider the sustainability of the overall fiscal-monetary-financial policy mix. This will in turn allow policymakers to develop granular policy advice based on holistic assessments of fiscal-monetary-financial space, informed by both theory and country-specific circumstances.

The paper's empirical work can also be refined and extended. One important avenue of future research is on the empirical determinants of fiscal r-star and fiscal-monetary gaps, especially from a structural perspective, by examining the relevance of factors such as aging populations and rising dependency ratios, political polarization, among others. Building on Section 8, more work can be done to analyze the relationship between fiscal-monetary gaps, deviations from rules-based monetary policy frameworks, and potential infringements on central bank independence. Subsequent research can also examine the role of financial repression in dealing with periods of elevated fiscal-monetary tensions. Relatedly, the results of this paper can be used to develop a proxy for financial repression.[44] Finally, future research can attempt to add granularity to the analysis of the association of the fiscal-monetary gap with key macroeconomic outcomes, including by decomposing changes in the gap into changes in monetary r-star and changes in fiscal r-star separately.

[44] The proxy could be computed using the following equation: (monetary r-star – actual policy rate)/(monetary r-star – fiscal r-star). The intuition is that when the policy rate is closer to fiscal r-star amid a higher monetary r-star, this would imply that the central bank prioritizes debt sustainability. This work could build on the work of Reinhart and Sbrancia (2015) as well as Acalin and Ball (2023).

References

Acalin, J., & Ball, L. M. (2023). *Did the US really grow out of its World War II debt?* (No. w31577). National Bureau of Economic Research.

Aizenman, J., Ahmed, R., and Jinjarak, Y. 2019. "Inflation and Exchange Rate Targeting Challenges Under Fiscal Dominance," *NBER Working Papers* no. 25996.

Akinci, Ozge, Gianluca Benigno, Marco Del Negro, Albert Queralto. 2020., "The Financial (In)Stability Real Interest Rate, R**." *FRB of New York Staff Report* No. 946, Rev. May 2023.

Alesina, A., & Drazen, A. (1991). Why are stabilizations delayed?. *The American Economic Review*, *81*, 1170-1188.

Alesina, A., & Tabellini, G. (1990). A positive theory of fiscal deficits and government debt. *The review of economic studies*, *57*(3), 403-414.

Arena, Marco, Gabriel Di Bella, Alfredo Cuevas, Borja Gracia, Vina Nguyen, and Alex Pienkowski. 2020. "It Is Only Natural: Europe's Low Interest Rates (Trajectory and Drivers)," IMF Working Papers 2020/116.

Arslanalp, Serkan and Barry Eichengreen. 2023. "Living with High Public Debt."

Arslanalp, Serkan, Barry Eichengreen, and Peter Blair Henry. 2024. "Sustained Debt Reduction: The Jamaica Exception," *Brookings Papers on Economic Activity*.

Balasundharam, Vybhavi, Olivier Basdevant, Dalmacio Benicio, Andrew Ceber, Yujin Kim, Luca Mazzone, Hoda Selim, and Yongzheng Yang. 2023. "Fiscal Consolidation: Taking Stock of Success Factors, Impact, and Design," IMF Working Papers 2023/063.

Bannerjee, Ryan, Valerie Boctor, Aaron Mehrotra, and Fabrizio Zampolli. 2023. "Fiscal deficits and inflation risks: the role of fiscal and monetary regimes."

Barro, Robert J. and Francesco Bianchi. 2023. "Fiscal Influences on Inflation in OECD Countries, 2020-2022," *NBER Working Paper* no. 31828.

Benigno, P., & Woodford, M. (2003). Optimal monetary and fiscal policy: A linear-quadratic approach. *NBER macroeconomics annual*, *18*, 271-333.

Benigno, Gianluca, Boris Hofmann, Galo Nuño, Damiano Sandri. 2024. "Quo vadis, r*? The natural rate of interest after the pandemic." *BIS Quarterly Review*.

Berndt, Antje, Hanno Lustig, and Şevin Yeltekin. 2012. "How Does the US Government Finance Fiscal Shocks?" *American Economic Journal: Macroeconomics*, 4 (1): 69-104.

Beyer et. al. 2023. “Shared Problem, Shared Solution: Benefits from Fiscal-Monetary Interactions in the Euro Area,” *IMF Working Paper* 23, no. 149.

Bianchi, Francesco, Renato Faccini, & Leonardo Melosi. 2023. “A Fiscal Theory of Persistent Inflation,” *Quarterly Journal of Economics* 138, no. 4, pp. 2127-2179.

Bianchi, Francesco and Leonardo Melosi. 2022. “Inflation as a fiscal limit,” Federal Reserve Bank of Chicago Working Paper, No. 2022-37.

Blanchard, O., Dell’Ariccia, Giovanni, & Mauro, P. (2010). Rethinking Macroeconomic Policy. *Journal of Money, Credit and Banking*, *42*, 199-215.

Blanchard, O. (2019). Public debt and low interest rates. *American Economic Review*, *109*(4), 1197-1229.

Blanchard, Olivier. 2022a. *Fiscal Policy under Low Interest Rates*. Cambridge: MIT Press.

Blanchard, Olivier. 2022b. *It is time to revisit the 2% inflation target.* Financial Times.

Blanchard, Olivier. 2023. *If markets are right about long real rates, public debt ratios will increase for some time. We must make sure that they do not explode.* Washington, DC: Peterson Institute for International Economics.

Bohn, Henning. 1998. "The “Behavior of U.S. Public Debt and Deficits,” *The Quarterly Journal of Economics* 113, no. 3, pp. 949-963.

Bohn, Henning. 2005. “The Sustainability of Fiscal Policy in the United States,” CESIFO Working Paper No. 1446.

Brunnermeier, M. K., Merkel, S. A., & Sannikov, Y. 2020. *The fiscal theory of price level with a bubble* (No. w27116). National Bureau of Economic Research.

Campos, R. G., Fernández-Villaverde, J., Nuno, G., & Paz, P. (2024). Navigating by Falling Stars: Monetary Policy with Fiscally-driven Natural Rates.

Caprio, Gerald, Daniela Klingebiel, Luc Laeven, and Guillermo Noguera. 2005. “Banking Crisis Database.” In Systemic Financial Crises: Containment and Resolution, edited by Patrick Honohan and Luc Laeven, 307– 40. Cambridge: Cambridge University Press.

Caramp, Nicolas and Dejanir H. Silva. 2023. “Fiscal policy and the monetary transmission mechanism,” *Review of Economic Dynamics* 51, pp. 716-746.

Carrera, Claudia Martínez and Rodrigo Vergara. 2012. “Fiscal Sustainability: The Impact of Real Exchange Rate Shocks on Debt Valuation, Interest Rates, and GDP Growth,” *World Development* 40, no. 9.

Chen, Jiaqian, Era Dabla-Norris, Carlos Goncalves, Zoltan Jakab, and Jesper Lindé. 2023. "Can Fiscal Consolidation help Central Banks' Fight Inflation?" IMF Working Paper 23/260.

Chen, Ruo and Esti Kemp. 2023. "Putting Out the *NBFi*re: Lessons from the UK's Liability-Driven Investment (LDI) Crisis," IMF Working Papers 2023/210.

Chen, Zefeng and Jiang, Zhengyang and Lustig, Hanno N. and Van Nieuwerburgh, Stijn and Xiaolan, Mindy Z., Exorbitant Privilege Gained and Lost: Fiscal Implications (April 28, 2022).

Chung, Hess, Troy Davig, and Eric M. Leeper. 2007. "Monetary and Fiscal Policy Switching," *Journal of Money, Credit and Banking* 39, no. 4, pp. 809-842.

Cochrane, John H. 2001. "Long-Term Debt and Optimal Policy in the Fiscal Theory of the Price Level." *Econometrica*, 69 (1): pp. 69-116

Cochrane, J. H. (2018). Stepping on a rake: The fiscal theory of monetary policy. *European Economic Review*, *101*, 354-375.

Cochrane, John H. 2023. *The Fiscal Theory of the Price Level*. Princeton: Princeton University Press.

Comelli, Fabio, Peter Kovacs, Jimena Montoya, and Arthur Sode. 2023. "Navigating Fiscal Challenges in Sub-Saharan Africa: Resilient Strategies and Credible Anchors in Turbulent Waters." *IMF Departmental Papers* 2023/007.

Corsetti, Giancarlo and Nouriel Roubini. 1991. "Fiscal Deficits, Public Debt, and Government Solvency: Evidence from OECD Countries." *Journal of the Japanese and International Economies* 5, pp. 354-380.

Davig, Troy and Eric M. Leeper. 2011. "Monetary-fiscal policy interactions and fiscal stimulus." *European Economic Review* 55, pp. 211-227.

Disyatat, Piti and Claudio Borio. 2021. "Monetary and fiscal policies: In search of a corridor of stability." *VoxEU*.

Driscoll, J. C., & Kraay, A. C. (1998). Consistent covariance matrix estimation with spatially dependent panel data. *Review of economics and statistics*, *80*(4), 549-560.

Fernández-Villaverde, Jesús, Joël Marbet, Galo Nuño and Omar Rachedi. 2024. "Monetary policy strategy and the natural rate," *VoxEU.*

Furman, Jason, and Lawrence H. Summers. 2020. "A Reconsideration of Fiscal Policy in the Era of Low Interest Rates."

Gabriel, R. D., Klein, M., & Pessoa, A. S. (2023). The political costs of austerity. *Review of Economics and Statistics*, 1-45.

Gagnon, Joseph E. 2022. *To keep unemployment low, central banks should plan to raise inflation target.* Washington, DC: Peterson Institute for International Economics.

Gagnon, Joseph E., and Christopher G. Collins. 2019. *The Case for Raising the Inflation Target Is Stronger than You Think.* Washington, DC: Peterson Institute for International Economics.

Galí, J. (2020). Uncovered interest parity, forward guidance and the exchange rate. *Journal of Money, Credit and Banking*, *52*(S2), 465-496.

Ghosh, A. R., Kim, J. I., Mendoza, E. G., Ostry, J. D., & Qureshi, M. S. (2013). Fiscal fatigue, fiscal space and debt sustainability in advanced economies. *The Economic Journal*, *123*(566), F4-F30.

Gopinath, Gita. 2022. "How Will the Pandemic and War Shape Future Monetary Policy?." Federal Reserve Bank of Kansas City. Jackson Hole, Wyoming.

Gopinath, Gita. 2023a. "The temptation to finance all spending through debt must be resisted," *Financial Times*.

Gopinath, Gita. 2023b. "Gita Gopinath's Introductory Remarks for the Conference 'Fiscal Policy in an Era of High Debt'. Washington, DC.

Hall, George J. and Thomas J. Sargent. 2022. "Financing Big US Federal Expenditures Surges: COVID-19 and Earlier US Wars."

Hofmann, Boris and Bilyana Bogdanova. 2012. "Taylor rules and monetary policy: a global 'Great Deviation'?" *BIS Quarterly Review*.

Hübscher, E., Sattler, T., & Wagner, M. (2023). Does austerity cause polarization?. *British Journal of Political Science*, *53*(4), 1170-1188.

IMF. 2023. United States 2023 Article IV Consultation, Washington, DC.

Jeanne, Olivier. 2023. "'Whatever It Takes': Government Default Versus Financial Repression."

Jiang, Z., Lustig, H., Van Nieuwerburgh, S., & Xiaolan, M. Z. (2019). *The US public debt valuation puzzle* (No. w26583). National Bureau of Economic Research.

Jiang, Z., Lustig, H., Van Nieuwerburgh, S., & Xiaolan, M. Z. (2022). *Measuring US fiscal capacity using discounted cash flow analysis* (No. w29902). National Bureau of Economic Research.

Jordà, Ò. (2005). Estimation and inference of impulse responses by local projections. *American economic review*, *95*(1), 161-182.

Jordà, Òscar, Moritz Schularick, and Alan M. Taylor. 2017. “Macrofinancial History and the New Business Cycle Facts.” in *NBER Macroeconomics Annual 2016*, volume 31, edited by Martin Eichenbaum and Jonathan A. Parker. Chicago: University of Chicago Press.

Kelton, Stephanie. 2020. *The Deficit Myth: Modern Monetary Theory and the Birth of the People's Economy*, New York: Public Affairs.

Keynes, J. M. (1923). *A tract on monetary reform*. Cosimo Classics.

Laubach, Thomas and John C. Williams. 2003. “Measuring the Natural Rate of Interest,” *Review of Economics and Statistics* 85, no.4 (November), pp. 1063-70.

Leeper, Eric M.. 1991. “Equilibria under ‘active’ and ‘passive’ monetary and fiscal policies,” *Journal of Monetary Economics* 27, pp. 129-147.

Leeper, Eric M., Michael Plante, and Nora Traum. 2010. “Dynamics of fiscal financing in the United States,” *Journal of Econometrics* 156, pp. 304-321.

Lubik, Thomas A., Brennan Merone and Nathan Robino. 2024. “Stargazing: Estimating r* in Other Countries,” *Federal Reserve Bank of Richmond Economic Brief.*

Mendoza, E. G., & Ostry, J. D. (2008). International evidence on fiscal solvency: Is fiscal policy “responsible”?. *Journal of Monetary Economics,* 55(6), 1081-1093.

Renee Haltom. 2015. “Interview: Eric Leeper,” *Econ Focus*, Federal Reserve Bank of Richmond.

Leigh, D. (2010). Monetary policy and the lost decade: Lessons from Japan. *Journal of Money, Credit and Banking*, *42*(5), 833-857.

Mankiw, N. Gregory. 2020. “A Skeptics Guide to Modern Monetary Theory,” *NBER Working Papers* no. 26650.

Martin, Fernando M. “Fiscal Dominance,” *Federal Reserve Bank of St. Louis Working Paper* 2020-040.

Mauro, P., Romeu, R., Binder, A., & Zaman, A. (2015). A modern history of fiscal prudence and profligacy. *Journal of Monetary Economics*, *76*, 55-70.

Mian, Atif. R., Ludwig Straub, & Amir Sufi. 2022. *A Goldilocks Theory of Fiscal Deficits* (No. w29707). National Bureau of Economic Research.

Mitchell, William, L. Randall Wray, and Martin Watts. 2019. *Macroeconomics*, London: Red Globe Press.

Platzer, J., Grigoli, M. F., & Tietz, R. (2023). *Low for (Very) Long? A Long-Run Perspective on r* across Advanced Economies*. International Monetary Fund.

Platzer, Josef and Marcel Peruffo. 2022. "Secular Drivers of the Natural Rate of Interest in the United States: A Quantitative Evaluation," *IMF Working Papers* no. 22/30.

Rachel, Lukasz and Lawrence H. Summers. 2019. "On Falling Neutral Real Rates, Fiscal Policy, and the Risk of Secular Stagnation," *Brookings Papers on Economic Activity*.

Reinhart, C. M., & Rogoff, K. S. (2014). Recovery from financial crises: Evidence from 100 episodes. *American Economic Review*, *104*(5), 50-55.

Reinhart, Carmen M. and M. Belen Sbrancia. 2015. "The Liquidation of Governmetn Debt," *IMF Working Papers* no. 15/7.

Reinhart, Carmen M, Jacob F. Kirkegaard, and M. Belen Sbrancia. 2011. "Financial repression Redux." *Finance & Development*.

Reuters. 2024. "Ex ECB chief says central banks should give governments space to invest." Reuters.com, February 15, 2024.

Romero, Jessie. 2013. "The Treasury-Fed Accord," *Federal Reserve History*, published by the Federal Reserve Bank of Richmond.

Roubini, N., & Sachs, J. (1989a). Government spending and budget deficits in the industrial countries. *Economic policy*, *4*(8), 99-132.

Roubini, N., & Sachs, J. D. (1989b). Political and economic determinants of budget deficits in the industrial democracies. *European Economic Review*, *33*(5), 903-933.

Sargent, T. J., Hall, G., Ellison, M., Scott, A., James, H., Dabla-Norris, E., ... & Gaspar, V. (2019). Two Decades of Walking on a Tightrope: Public Debt Management in France during the Interwar Period. In *Debt and Entanglements Between the Wars*. International Monetary Fund.

Schnabel, Isabel. 2022. "Finding the right mix: monetary-fiscal interaction at times of high inflation." Keynote speech at the Bank of England Watchers' Conference.

Sims, Christopher. 2013. "Paper Money," *American Economic Review* 103, no. 2, pp. 563-584.

Summers, Lawrence. 2023. "Fiscal stimulus and stability after the response to COVID," Speech delivered at conference on "Rethinking fiscal policy—global perspectives," an event sponsored by the Peterson Institute for International Economics, Washington, D.C.

Taylor, John. 1993. "Discretion versus policy rules in practice." *Carnegie-Rochester Conference Series on Public Policy* 39, pp. 195-214.

Varieties of Democracy dataset. Coppedge, Michael, John Gerring, et al. v13" Varieties of Democracy (V-Dem) Project.

Weber, A. (2012). *Stock-flow adjustments and fiscal transparency: A cross-country comparison*. International Monetary Fund.

Woodford, M. (1995, December). Price-level determinacy without control of a monetary aggregate. In *Carnegie-Rochester conference series on public policy* (Vol. 43, pp. 1-46). North-Holland.

Woodford, M. (1998). Control of the public debt: a requirement for price stability?. In *The Debt Burden and its Consequences for Monetary Policy: Proceedings of a Conference held by the International Economic Association at the Deutsche Bundesbank, Frankfurt, Germany* (pp. 117-158). London: Palgrave Macmillan UK.

Woodford, Michael. 2001. "Fiscal Requirements for Price Stability," *NBER Working Papers*. No. 8072.

Appendix

A.1 Derivations

Bohn's test for passive fiscal policy

Test 1. First, it will be helpful to define the interest-growth differential as

$$(\mathbf{A.1})\ \Gamma_t \equiv \frac{r_t - g_t}{1 + \pi_t + g_t}$$

Inserting the fiscal reaction function in equation (3) into the law of motion of debt in equation (1) and rearranging gives

$$(\mathbf{A.2})\ d_t = [\Gamma_t + (1 - \rho_1)] \cdot d_{t-1} - \alpha_1(Q_t - Q_t^*) - \epsilon_t$$

Since $Q_t - Q_t^*$ and ϵ_t are assumed to be stationary, the debt ratio is stationary if (i) Γ_k is stationary and (ii) $\rho_1 > E[\Gamma_t]$. In this case, the debt ratio is expected to converge to zero.

Test 2. It follows from the previous condition for stationarity of the debt ratio that if the permanent component of the interest-growth differential changes during the sample period, test 1 loses its potency for gauging whether fiscal policy sets the primary balance to stabilize the path of the debt ratio.

$$(\mathbf{A.3})\ \overline{\Gamma}_t \equiv \frac{r_t^* - \bar{g}_t}{1 + \bar{\pi} + \bar{g}_t}$$

Inserting the fiscal reaction function in equation (5) into the law of motion of debt, and rearranging gives

$$(\mathbf{A.4})\ d_t = [\Gamma_t + (1 - \rho_2 \cdot \overline{\Gamma}_t)] \cdot d_{t-1} - \alpha_1(Q_t - Q_t^*) - \epsilon_t$$

It follows that the debt ratio is stationary if (i) $E[\Gamma_t] = \overline{\Gamma}_t$ and positive, and (ii) $\rho_2 > 1$. Again, if this is the case, the debt ratio is expected to converge to zero.

Fiscal R-Star

Fiscal r-star is derived algebraically below. We can rewrite the law of motion using the difference between revenues and primary expenditure, as per equation (A.5):

$$(\mathbf{A.5})\ D_t = (1 + i_{t-1})D_{t-1} - PB_t$$

where $PB_t \equiv T_t - G_t$ is the primary balance. Dividing both sides by nominal GDP yields equation (A.6):

$$(\mathbf{A.6})\ d_t = \frac{1 + i_{t-1}}{(1+\pi_t)(1+g_t)} d_{t-1} - pb_t$$

where small letters denote variables relative to nominal GDP. π_t and g_t are the growth rates of the GDP deflator and real GDP. We define the real interest rate on government debt as the difference between the nominal interest rate and the inflation rate, i.e., $r_t \equiv\ i_{t-1} - \pi_t$. The change in the debt-to-GDP ratio can be written as in equation (A.7) as:

$$(\mathbf{A.7})\ \Delta d_t = \frac{r_t - g_t}{1 + \pi_t + g_t} d_{t-1} - pb_t + o_t$$

where o_t is a convenient residual term which approximates zero for sufficiently low growth rates of nominal GDP.[45]

Fiscal r-star is the real interest rate that stabilizes debt-to-GDP at level $\bar{d}$ when output grows at potential rate $\bar{g}$, inflation is at target $\bar{\pi}$ and the fiscal authority runs the primary balance $\overline{pb}$. It's derived by inserting these variables into equation (A.8) and setting $\Delta d_t = 0$:

$$(\mathbf{A.8})\ r_f^* = \bar{g} + (1 + \bar{\pi} + \bar{g}) \frac{\overline{pb}}{\bar{d}}\ .$$

The Fiscal-Monetary Gap

The fiscal-monetary gap is derived algebraically below. Inserting equation (A.8) into equation (A.7) gives the following:

$$(\mathbf{A.9})\ \Delta d_t = \frac{r_t - g_t}{(\pi_t - \bar{\pi}) + (g_t - \bar{g}) + \left(r_f^* - \bar{g}\right)\bar{d}/\overline{pb}} d_{t-1} - pb_t$$

Using $g_t = \bar{g}$, $d_{t-1} = \bar{d}$ and $(\pi_t - \bar{\pi})\frac{\overline{pb}}{\bar{d}} \approx 0$, this simplifies to

$$(\mathbf{A.10})\ \Delta d_t = \frac{r_t - \bar{g}}{r_f^* - \bar{g}} \overline{pb} - pb_t$$

Adding and subtracting $r_f^* \overline{pb}$, rearranging, using the definition of fiscal r-star in the denominator, and dividing by $\bar{d}$ gives equation (A.11).

$$(\mathbf{A.11})\ \frac{\Delta d_t}{\bar{d}} = \frac{r_t - r_f^*}{1 + \bar{\pi} + \bar{g}} - \frac{pb_t - \overline{pb}}{\bar{d}}$$

Finally, using $\tau_t \equiv r_t - r_t^P$ and inserting equation (10) and rearranging gives the fiscal-monetary gap as in equation (11).

[45] Specifically, $o_t = (\frac{r_t - g_t - \pi_t g_t}{1 + \pi_t + g_t - \pi_t g_t} - \frac{r_t - g_t}{1 + \pi_t + g_t}) d_{t-1}$.

A.2 Panel Regressions on Fiscal Responsiveness

Two panel regression exercises are conducted in Section 3 to assess the extent to which fiscal policy responds to public debt levels. The first exercise, which follows the fiscal function in equation (3), involves estimating the following panel regression, as set forth in equation (A.1):

$$(\mathbf{A.1})\ pb_{i,t} = \rho_1 \cdot d_{i,t-1} + \omega_1 \cdot otherperiod_t \cdot d_{i,t-1} + \alpha_1 \cdot Q\_gap_{i,t} + \delta_t + \beta_i + \epsilon_{i,t},$$

where $Q\_gap_{i,t} \equiv Q_{i,t} - Q^*_{i,t}$, the variables $pb_{i,t}$, $d_{i,t-1}$, $Q_{i,t}$ and $Q^*_{i,t}$ are defined in the same manner as in Section 3 for country i in year t, and δ_t and β_i are time and country fixed effects, respectively. To capture the difference in the responsiveness of $pb_{i,t}$ to $d_{i,t-1}$ across three sub-periods (pre-GFC, GFC, and the COVID pandemic), three separate regressions were run. While the full sample period (1880-2022) in all the three regressions was included, the above specification introduces a time dummy $otherperiod_t$ which equals 1 if the year t does not fall within the period of interest, and 0 otherwise.[46] Under the above specification, ρ_1 can thus be interpreted as the responsiveness of fiscal policy during the sub-period of interest.

The second exercise, which follows the fiscal function in equation (5), then involves estimating the following panel regression:

$$(\mathbf{A.2})\ pb_{i,t} = \rho_2 \cdot pb^{DS}_{i,t} + \omega_2 \cdot otherperiod_t \cdot pb^{DS}_{i,t} + \alpha_2 \cdot Q\_gap_{i,t} + \delta_t + \beta_i + \epsilon_{i,t},$$

where $pb^{DS}_{i,t}$ is the debt-stabilizing primary balance defined in the same manner as in Section 3 for country i in year t. Again, three separate regressions are run for the three sub-periods, with the dummy variable allowing for ρ_2 to be interpreted as the responsiveness of fiscal policy during the sub-period of interest.

Both regressions use the following sample and data sources. The sample of 16 AEs is the same as that used in Section 4. Data on primary balances and debt levels are obtained from the Public Finance in Modern History database (Mauro et al., 2015). To construct $pb^{DS}_{i,t}$, trend growth and monetary r-star data are obtained from Platzer et al. (2013), respectively. For the debt stabilizing balance, we set inflation at 2 percent for all countries. The full regression results are presented in the table below.

[46] More specifically, for the pre-GFC, GFC, and Covid regressions, the dummy variable $otherperiod_t$ equals 1 if the years fall within 2009-2022, 1880-2008 and 2020-2022 and 1880-2019, respectively.

Annex Table 1. Responsiveness of Fiscal Policy to Debt and Debt-Stabilizing Primary Balances

	Response to Debt Levels			Response to Debt-Stabilizing PB		
	(1)	(2)	(3)	(4)	(5)	(6)
	pre-GFC	GFC	COVID	pre-GFC	GFC	COVID
Lagged Debt Level	0.031***	-0.015***	-0.035***			
	(0.003)	(0.003)	(0.006)			
Lagged Debt Level * Other Period	-0.053***	0.041***	0.058***			
	(0.006)	(0.006)	(0.007)			
Output Gap	0.014	0.018	0.013			
	(0.019)	(0.020)	(0.020)			
Debt-Stabilizing Primary Balance (DSPB)				1.37***	0.49***	0.67***
				(0.16)	(0.15)	(0.20)
DSPB * Other Period				-0.86	0.75***	0.46*
				(0.21)	(0.21)	(0.24)
Output Gap				0.005	0.004	0.005
				(0.019)	(0.020)	(0.020)
Time FEs	Yes	Yes	Yes	Yes	Yes	Yes
Country FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1796	1796	1796	1796	1796	1796
R-squared	0.40	0.37	0.37	0.36	0.36	0.36

Note: Panel regressions of countries' primary balances on selected regressors. Robust standard errors, clustered by year, are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Source: Authors' calculations

A.3 Open Economy Extension

Open economy version of the framework. A parsimonious Mundell-Fleming version of the fiscal r-star and fiscal-monetary gap models would include the following equation for inflation (equation (A.1)), where $q_t - q^*$ is the country's real exchange rate gap. A positive value indicates a real depreciation. η is the elasticity of inflation with respect to this gap, reflecting both the impact of expenditure switching on the output gap and imported inflation in the Phillips curve.:

$$(\mathbf{A.1})\ \Delta\pi_t = \Phi_t - \phi(r_t^P - r_m^*) + \eta(q_t - q^*)\ ;$$

Using the "real" version of uncovered interest parity gives $q_t - q^* = (-)(r_t^P - r_m^*)$ (Gali, 2020). This implies that in this open economy, the impact of holding the real policy rate below monetary r-star is amplified through the exchange rate channel:

$$(\mathbf{A.2})\ \Delta\pi_t = \Phi_t - (\phi + \eta)(r_t^P - r_m^*)\ ;$$

Foreign-currency-denominated debt. Whereas most AEs issue debt in their own currency and, in many cases, are reserve currency providers, many EMEs issue debt in foreign currency in addition to local currency. Exchange rate depreciations can thus adversely impact fiscal sustainability by raising the real value of external debt service.[47] These effects are reflected in the law of motion of debt below (equation (A.3)) which includes explicit reference to the share of foreign currency debt α_{t-1}, the foreign currency real interest rate r_t^f, and the growth rate of the real exchange rate Δq_t:

$$(\mathbf{A.3})\ \Delta d_t = \frac{\alpha_{t-1} r_t^f + (1 - \alpha_{t-1}) r_t^d - g_t + \alpha_{t-1}\Delta q_t (1 + r_t^f)}{1 + g_t} d_{t-1} - pb_t$$

In this case, fiscal r-star is a function of the share of FX-denominated debt and the foreign interest rate as per equation (A.3) where α is the long run value the share of foreign currency debt and $\zeta \equiv \frac{1}{1-\alpha}$:

$$(\mathbf{A.3})\ \ r_f^* = \zeta\bar{g} + \zeta(1 + \bar{g})\frac{\overline{pb}}{\bar{d}} - \zeta\alpha r^f,$$

Thus, the open economy fiscal r-star is decreasing in the foreign interest rate, where the debt ratio can only be stable if the higher costs of foreign currency debt are offset by a lower interest rate on domestic debt. The importance of the foreign interest rate is greater for countries with higher shares of foreign currency debt. Note that when the share of foreign currency debt is zero, equation (A.3) collapses to the equation of fiscal r-star in the main text.[48]

---

[47] On the impact of exchange rates and debt sustainability, see Carrera & Vergara (2012).

[48] Subject to an approximation term, which leads to differences in the denominator of the first term of the debt accumulation equations.

A.4 Calibrating the Fiscal-Monetary Policy Mix

This paper's concepts can provide a framework for thinking about the appropriate policy mix. In general, policymaking implicitly requires an ex-ante assessment of the likely trajectory of fiscal and monetary r-stars, from which adjustment paths can be chosen. Calibrating fiscal policy requires an implicit assessment of the likely trajectory of monetary r-star. If monetary r-star is expected to remain lower-for-longer, then the necessity of a large, upfront fiscal adjustment to restore sustainability may be mitigated. By contrast, if monetary r-star is expected to be higher-for-longer, then fiscal adjustment may be needed depending on the trend of primary balances and the existing debt stock.

Juxtaposing these scenarios of lower- and higher-for-longer monetary r-star and different combinations of fiscal r-star yields a matrix of different adjustment scenarios. Using this framework, while being mindful of the potential adverse effects of a protracted period of elevated fiscal-monetary tensions, can help policymakers assess the relatively likelihood of different fiscal and monetary r-star scenarios, in turn guiding the need for adjustment (see Annex Figure 1).

Annex Figure 1. Managing Policy Given Potential Fiscal and Monetary R-Star Dynamics[1]

Fiscal r-star \ ***Monetary r-star***	*Lower-for-longer*	*Higher-for-longer*
Low	**I.** Weak fiscal adjustment; backloaded	**II.** Strong fiscal adjustment; front-loaded[1]
High	**III.** No adjustment needed	**IV.** Potential fiscal adjustment needed

[1] In quadrant II, there could be a temptation to resort to financial repression to engineer a reduction in the fiscal-monetary gap without a concomitant fiscal adjustment. As explained in Section 5, historically large fiscal-monetary gaps were accompanied by combination of rising debt levels, higher inflation, financial repression, and lower real asset returns, with elevated risks of crises.
Source: Authors.