

WP/20/52

IMF Working Paper

$r-g < 0$: Can We Sleep More Soundly?

by Paolo Mauro and Jing Zhou

I N T E R N A T I O N A L M O N E T A R Y F U N D

IMF Working Paper

Fiscal Affairs Department

$r-g < 0$: Can We Sleep More Soundly*

Prepared by Paolo Mauro and Jing Zhou

March 2020

IMF Working Papers describe research in progress by the author(s) and are published to elicit comments and to encourage debate. The views expressed in IMF Working Papers are those of the author(s) and do not necessarily represent the views of the IMF, its Executive Board, or IMF management.

Abstract

Contrary to the traditional assumption of interest rates on government debt exceeding economic growth, negative interest-growth differentials have become prevalent since the global financial crisis. As these differentials are a key determinant of public debt dynamics, can we sleep more soundly, despite high government debts? Our paper undertakes an empirical analysis of interest-growth differentials, using the largest historical database on average effective government borrowing costs for 55 countries over up to 200 years. We document that negative differentials have occurred more often than not, in both advanced and emerging economies, and have often persisted for long historical stretches. Moreover, differentials are no higher prior to sovereign defaults than in normal times. Marginal (rather than average) government borrowing costs often rise abruptly and sharply, but just prior to default. Based on these results, our answer is: not really.

JEL Classification Numbers: E43, E62, H63

Keywords: interest-growth differentials, public debt

Author's E-Mail Address: pmauro@imf.org, jzhou@imf.org

* We gratefully acknowledge helpful suggestions by Philip Barrett, Olivier Blanchard, Julio Escolano, Jean-Marc Fournier, Vitor Gaspar, Ethan Ilzetzki, Catherine Pattillo, Andrea Presbitero, Kenneth Rogoff, and participants in the IMF's 2019 Annual Research Conference. We thank S. Ali Abbas and Kunxiang Diao for sharing the external public debt data.

Contents

1	Introduction	3
2	The Data	5
3	Interest-Growth Differentials: Empirical Regularities	6
3.1	The Prevalence of Negative Interest-Growth Differentials in History	6
3.2	The Divergence between Advanced and Emerging Economies (1975–95)	8
3.3	The Role of Financial Repression and Inflation in Interest-Growth Differentials	9
4	Interest-Growth Differentials, Fiscal Variables, and Sovereign Defaults	12
4.1	Interest-Growth Differentials and the Fiscal Stance	12
4.2	Interest-Growth Differentials in the Run-up to Default Episodes	14
4.3	Marginal Rates in the Run-up to Default Episodes	16
5	Conclusion	17
A	Data Appendix	27
A.1	Fiscal Variables	27
A.2	GDP	28
A.3	Other Financial Variables	28
B	Identify Financial Repression Years	29

1 Introduction

Standard economic models assume that the interest rate is higher than the growth rate of the economy. In applications to countries' public finances, if economic growth exceeds the cost of government borrowing, the government can just roll over its debt, and the debt-to-GDP ratio will decline without the need to increase taxes. Economists have recently started rethinking whether the assumption of a positive interest-growth differential is sufficiently grounded in empirical experience, and what the implications of relaxing such assumptions would be. In his 2019 American Economic Association presidential address, Olivier Blanchard reminded us that the interest-growth differential for government debt has often been negative in the United States. Moreover, differentials have been negative, on average, in a majority of advanced economies since the Global Financial Crisis (GFC) that began in 2008, and they have remained negative even in advanced economies whose economic growth has returned to a healthy pace. Policymakers need to weigh such negative differentials against the background of higher public debts than prior to the global financial crisis.¹ In this paper, we provide evidence on the prevalence of negative differentials over the past two centuries in 55 advanced and emerging economies. We also show that differentials in country-years preceding defaults on public debts are no higher than usual, suggesting that interest-growth differentials have no predictive power for government defaults—at least not until it is too late for policies to take corrective actions.

The prevalence of high debt levels and low interest-growth differentials suggests several interrelated questions. First, are the recent low interest-growth differentials unique from a historical perspective? Second, are there any prominent drivers of changes in such differentials? Third, what is the empirical association between interest-growth differentials and sovereign defaults? Can low interest-growth differentials be viewed as strengthening debt sustainability?

In this paper, we address these questions empirically. We begin by assembling data on interest-growth differentials. In previous studies, the best sources of interest-growth differentials are based on marginal borrowing rates from [Jordà, Schularick and Taylor \(2017\)](#) for advanced economies data or author-collected bond-specific data such as [Reinhart and Sbrancia \(2015\)](#). We construct a larger dataset that contains the public finances, average government borrowing costs, and economic growth for 55 advanced and emerging countries over up to 200 years, drawing primarily on [Mauro et al. \(2015\)](#) who had used similar data to analyze the determinants of countries' primary fiscal

¹Public debts have increased substantially around the world since the outset of the GFC. At end-2018, debt-to-GDP ratios exceeded 100 percent for the advanced economies (the highest since WWII), 50 percent for emerging markets (a level not seen since the early 1980s), and 45 percent for the low-income countries (compared with 30 percent pre-GFC). Rising indebtedness has engendered concerns regarding debt sustainability. Primary deficits are projected to rise in the advanced economies as a result of aging populations, and in emerging and low-income countries as a result of the need to invest in human and physical capital. Policymakers need to assess whether low or negative interest-growth differentials will be enough to offset such fiscal pressures and ensuing risks.

surpluses. These data refer to the average effective cost of servicing debt (the ratio of the interest bill to government debt), which is the appropriate measure for standard debt dynamics accounting equations.² For a somewhat smaller sample, we also use marginal borrowing rates. These react faster to changes in market perceptions, but are an imperfect proxy for future effective interest rates. Whenever possible, we take account of the role of exchange rate depreciation in the de facto cost of borrowing in foreign currency, although this portion of the analysis is constrained by the limited availability of data on the share of foreign currency public debt in total public debt.

We document five empirical regularities. First, negative interest-growth differentials occur for prolonged periods in history in both advanced and emerging economies. Second, the often-held view that differentials are more likely negative in emerging than in advanced economies stems largely from the period between the first oil shock of 1973–74 and the mid-1990s: during that time, the advanced economies liberalized their capital markets and sought to curb inflation by allowing interest rates to rise faster than inflation, whereas the emerging economies continued to use financial repression against the background of high inflation. Prior to the 1980s, the advanced economies engaged in financial repression too, and by the mid-1990s, many emerging economies had also liberalized their financial markets. Third, the fiscal stance is somewhat more expansionary, on average, when interest-growth differentials are low: when differentials decline, the primary fiscal deficit increases but not nearly enough to fully compensate. Fourth, differentials computed using the average effective interest rate on government borrowing are essentially useless to predict government defaults. Fifth, marginal interest rates (on new government borrowing or on the secondary market) often rise sharply and abruptly but only a few months ahead of defaults.

To sum up, can we sleep more soundly as a result of low differentials? For those who lose sleep over possible debt crises, the answer is: perhaps a little, but not really. History teaches us that many crises have occurred after years of low differentials, and that market expectations can turn quickly and abruptly, shutting countries out of financial markets in a matter of a few months.

Related Literature This paper intends to contribute to three strands of literature. First, several studies have analyzed interest-growth differentials for either limited country samples or short sample periods—for instance, [Ball, Elmendorf and Mankiw \(1995\)](#) and [Mehrotra and Sergeyev \(2019\)](#) on the U.S., [Jordà et al. \(2019\)](#) and [Schmelzing \(2019\)](#) on advanced economies, [Escolano, Shabunina and Woo \(2017\)](#) on advanced and emerging economies, and [Turner and Spinelli \(2011\)](#) on OECD economies since the 1980s.³ Some of these studies ([Turner and Spinelli \(2011\)](#), [Escolano, Shabunina and Woo \(2017\)](#), [Kozłowski, Veldkamp and Venkateswaran \(2019\)](#), [Rachel and Summers \(2019\)](#))

²Based on the government flow budget constraint $d_t - d_{t-1} = \frac{1+r_t}{1+g_t} \cdot d_{t-1} + pd_t \approx (r_t - g_t)d_{t-1} + pd_t$, where d is the public debt as share of GDP, pd is the primary deficit as share of GDP, g is the nominal growth rate, and r is the average effective interest rate on the public debt. For more details see, for instance, [Escolano \(2010\)](#).

³Our paper focuses on the interest rate for government borrowing, not on the (usually higher) return on capital, which relates to a different literature on dynamic efficiency (e.g., [Abel et al. \(1989\)](#)) or prospects for future inequality (e.g., [Piketty \(2014\)](#)).

investigate the reasons for negative interest-growth differentials or low interest rates on “safe” government bonds—such as financial repression, global saving glut, secular stagnation, significant tail risks, etc., whereas others take negative interest-growth differentials as given and analyze their implications for debt sustainability and fiscal policies (Barrett (2018), Blanchard (2019), Mehrotra and Sergeyev (2019)). This paper extends the empirical analysis by drawing on a rich historical cross-country dataset, giving us a broader perspective on some of the factors underlying variation in interest-growth differentials.

Second, this paper is related to the studies on financial repression and debt sustainability, which gauge the effects of financial repression on debt servicing costs (Giovannini and De Melo (1991), Reinhart and Sbrancia (2015), Reinhart, Kirkegaard and Sbrancia (2011)) or establish the optimal financial repression given sovereign default risks (Chari, DAVIS and Kehoe (forthcoming)). Building on these studies, our paper employs new ways to systematically date financial repression—including de jure measures of financial repression and de facto measures based on deviations from uncovered interest rate parity. Utilizing these identified country-year pairs where financial repression prevails, this paper provides better estimates of the impact of financial repression on government borrowing costs.

Third, this paper is linked to the studies on debt sustainability and sovereign defaults. Previous work has documented that marginal borrowing costs (interest rates spreads) often spike in the run-up to sovereign defaults (for example, Arellano (2008), Broner, Lorenzoni and Schmukler (2013), Abbas, Pienkowski and Rogoff (2019)), typically drawing on data beginning in the 1980s. Our new long time series allows us to compare the behavior of marginal and average effective rates since the late 1800s. We find that interest-growth differentials can be negative for prolonged periods followed by sudden spikes in marginal borrowing costs that often culminate in defaults.

The remainder of the paper is organized as follows. Section 2 describes the data. Section 3 reports stylized facts on the prevalence of negative interest-growth differentials in long-run historical data, notes that the divergence between advanced and emerging countries is largely confined to 1975–95, and shows that financial repression and inflation account for the divergence. Section 4 explores the potential association between sovereign defaults and the differences between effective (or marginal) interest rates and economic growth. Section 5 concludes.

2 The Data

This paper draws on a dataset consisting of fiscal variables for 55 countries over up to 200 years (Mauro et al. (2015), updated to 2018)—to our knowledge, the most comprehensive dataset currently available for both fiscal flows (including the interest bill) and stocks. We augment these data with information on money market rates, sovereign defaults, and financial market reforms. Full data

sources are reported in Appendix A. Our final dataset consists of a cross-country panel over long time periods for interest payments, public debt stocks, gross domestic products, external public debts, fiscal balances, money market rates, exchange rates, sovereign default indicators, and policy-based variables on the level of liberalization in financial markets.

The key variable—the interest-growth differential—is constructed as the difference between the effective interest rate and the nominal growth rate. The effective interest rate contains two parts: one is the ratio between the interest bill and the average of the current and previous years’ public debt stocks, and the other is the depreciation adjustment.⁴ For countries that issue public debt in foreign currencies, exchange rate depreciation is an important factor driving changes in public debt, as emphasized by studies on “original sin” (such as [Eichengreen, Hausmann and Panizza \(2003\)](#)). We include the depreciation adjustment whenever the necessary data on foreign-currency public debt is available—for emerging economies, this means from 1970s as the earliest. For the final sample, we exclude domestic and external sovereign default years (where the intertemporal government budget constraint does not apply), hyperinflation (greater than 100%), and extreme exchange rate collapse (top 1 percentile depreciation of the whole sample).

3 Interest-Growth Differentials: Empirical Regularities

We begin by exploring the stylized facts of interest-growth differentials, considering the evolution of interest-growth differentials in different time periods and country groups.

3.1 The Prevalence of Negative Interest-Growth Differentials in History

On average, interest-growth differentials are negative for both advanced and emerging economies.⁵ The differentials are approximately negative 2.5 percentage points for advanced economies on average, and negative 6.5 percentage points for emerging economies. Across time, differentials are more negative post-WII than Pre-WII, and more negative pre-GFC than post-GFC. Across countries, emerging economies show lower differentials than advanced economies, although as will be shown below this difference stems largely from 1975–1995. The medians for both country groups are less negative than the means (Figure 1), indicating that tail events of very negative differentials are

⁴The formula for the differentials is $\tilde{r}_t - g_t = r_t + \alpha_{t-1} \cdot s_t - g_t$. α_{t-1} denotes the last period’s share of external public debt in total public debt and s_t is the depreciation (against the U.S. dollar) compared with the last period. r_t is the average interest rate on public debt, and g_t is the nominal growth rate. Detailed derivation can be found in [Escolano, Shabunina and Woo \(2017\)](#), for instance.

⁵The classification of advanced and emerging economies is based on the present day definition from the IMF’s World Economic Outlook. We use these country groups for illustration as customary, fully recognizing that the distinction between advanced and emerging economies is not static throughout: for instance, Australia and Canada were clearly emerging economies in the pre-WWI period.

more common than higher positive ones. For the low and high ends of the distribution, the most negative differentials are associated with high growth (post-war, for instance), and the most positive ones come from large depreciation.

Table 1: Summary Statistics: Interest-Growth Differentials by Time Periods

	Full sample		Pre-WWII		Post-WWII		Post-1980		Post-GFC	
	AE	EM	AE	EM	AE	EM	AE	EM	AE	EM
Mean	-2.4	-6.6	0.3	2.0	-3.1	-7.6	0.1	-5.5	0.5	-2.9
Median	-1.3	-4.8	0.8	2.4	-1.7	-5.3	0.5	-3.9	-0.0	-2.2
Standard Deviation	9.1	14.3	8.5	10.4	8.0	14.4	6.2	12.3	3.8	7.4
N	2789	1468	1009	146	1579	1273	906	867	239	306

Note: This table presents the summary statistics of interest-growth differentials by time periods. AE and EM refer to advanced economies and emerging market economies, respectively. Pre-WWII period is from 1800–1938, excluding WWI observations. Post-WWII period is from 1950–2018. Post-GFC (global financial crisis) refers to 2009–2018.

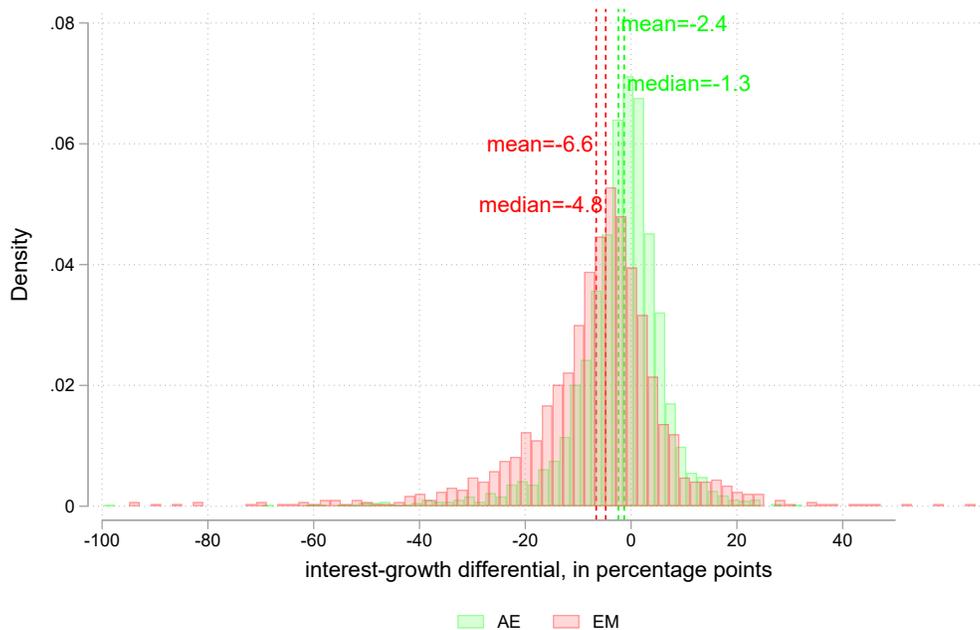
Negative interest-growth differentials have occurred more frequently than not over the past two centuries for both advanced and emerging economies, though the frequency of negative interest-growth differentials varies across countries. Figure 2 presents the share of years in which the differential was negative, for each of the 55 countries in our sample. Although negative interest-growth differentials are the norm—occurring more than half of the time for both advanced and emerging economies, the frequency of negative differentials of emerging economies is about 15 percentage points larger than the advanced economies.

3.2 The Divergence between Advanced and Emerging Economies (1975–95)

Interest-growth differentials for country groups vary considerably over time. Average differentials are strongly negative during the two world wars and in the period between WWII and the first oil shock. Indeed, advanced and emerging economy average differentials move closely with each other until around 1975 (Figure 3). From 1975 to 1995, the differentials diverge between the two country groups, and the average gap widens to 20 percentage points at its peak. The gap narrows in the late 1990s, as emerging economies’ differentials shrink, and it becomes insignificant in the late 2010s. After 1995, the divergence between advanced and emerging economies emerges again around 2005. However, it is partly due to emerging economies reintroducing financial repression (for instance, Argentina, Indonesia, Thailand, and Venezuela), which will be shown in the next section to be an important factor driving the divergence.

This divergence is jointly driven by the gap in inflation rates between the two country groups and the different responses of their nominal interest rates to inflation. As an accounting identity, interest-growth differentials can be decomposed into the differentials of nominal interest rates,

Figure 1: Distribution of Interest-Growth Differentials



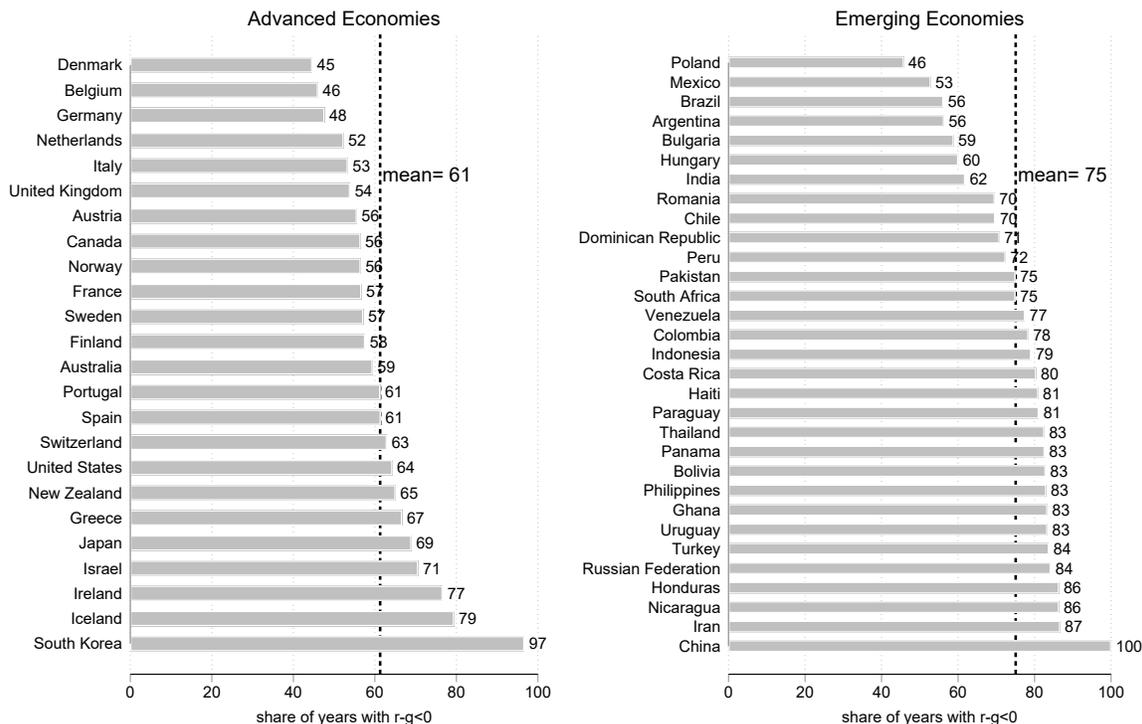
Note: This chart plots the whole distribution of interest-growth differentials for advanced economies and emerging economies for all the observations (2789 for advanced economies, and 1468 for emerging economies). The vertical lines indicate means and medians, as denoted in the chart.

inflation, real growth, and depreciation adjustment. Assessing each component separately, the gap across country groups is largely accounted for by differences in inflation during 1975–95, whereas differences in interest rates, real growth, and depreciation adjustment are small (Figure 3). In other words, nominal interest rates rose significantly less in response to inflation in the emerging economies than in the advanced economies.

3.3 The Role of Financial Repression and Inflation in Interest-Growth Differentials

To understand the post-WWII episode and the divergence in differentials between advanced and emerging economies during 1975 to 1995 requires analyzing inflation as well as financial repression, which creates and maintains a captive domestic audience that facilitated directing credit to the government (such as interest rate controls, capital controls, reserve requirements, and government ownership of banks, etc.). In this section, we focus on that 1975–95 divergence episode because many policymakers seem to view emerging economies as more prone to negative differentials than advanced economies. Understanding this episode helps to reconfirm that negative differentials are not the sole confine of emerging economies.

Figure 2: Share of Years (in percent) with Negative Interest-Growth Differentials, by Country



Note: This chart plots the share of years with negative interest-growth differentials for each country. The sample period with available data depends on the country. The full sample is from 1800 to 2018 for advanced economies and 1865 to 2018 for emerging economies. The dashed vertical line indicates the mean share across countries in each group.

Financial repression, in combination with inflation, reduces the cost of debt in significant periods in history. In their study on 12 advanced economies, [Reinhart and Sbrancia \(2015\)](#) find that the savings of annual debt interest payments amounted to up to 5 percent. On a sample of 24 countries, [Giovannini and De Melo \(1991\)](#) estimate that the annual revenue gain from financial repression can be as large as 5 percent of GDP in several countries. This effect is also supported by a comparison of the interest-growth differentials between advanced economies and emerging economies. As shown in Figure 3, before the early 1970s, the two country groups move along with each other, and the gap between their interest-growth differentials is virtually nil. The more negative differentials in emerging than in advanced economies is a phenomenon of 1975–95, a period in which the advanced economies liberalized their capital markets, allowing interest rates to rise faster than inflation, whereas the emerging economies continued to use financial repression to constrain the rise in nominal interest rates against the background of increasing inflation. Prior to the mid-1970s, the advanced economies engaged in financial repression too. By the mid-1990s, many emerging economies had also liberalized their financial markets.

To assess the role of financial repression systematically, we begin by identifying the financial

repression and liberalization years, based on both de jure measures from [Abiad, Detragiache and Tressel \(2008\)](#) and de facto measures as the structural breaks in the UIP deviations (see Appendix B for more details). Utilizing the identified liberalization years, as a first look, we examine whether financial repression has constrained interest-growth differentials. Essentially, we estimate the gap between the interest-growth differentials before and after financial market liberalization using the following local projection specification on a 5-year horizon:

$$(r - g)_{it+j} = \beta_j D_{it} + \gamma D_{it-1} + \Gamma \mathbf{X}_{it} + \alpha_i + \epsilon_{it} \quad (1)$$

where $j = 1, \dots, 5$, indicating the number of years after financial liberalization. D^{it} denote dummies for whether financial repression is liberalized in country i in year t or not, and \mathbf{X} include the real interest rate (for serial correlation), real growth (for business cycle conditions), the change in public debt and initial public debt (for fiscal conditions), as well as commodity prices and Moody’s BAA spreads (for global shocks and risks).

Financial repression years are indeed associated with significantly lower differentials, by 2 to 6 percentage points depending on the type of financial liberalization and the length of post-liberalization time. We explore different types of financial repression—interest controls, capital controls, and credit controls—and the de facto measure based on structural breaks in UIP deviations. As presented in Figure 4, several features stand out. First, the liberalization’s effect takes time to be reflected in an increase in interest-growth differentials. For instance, none of the liberalization shows impacts on interest-growth differentials contemporaneously. For interest rate controls and credit controls liberalizations, differentials do not increase until two years later, and at least one year for capital control liberalization and de facto liberalization measure. Second, the effects are long-lasting and remain significant after five years. Third, the de jure and the de facto measures arrive at similar results in the estimates’ magnitudes.

Having established that financial repression constrains interest-growth differentials, we further explore the channel through which financial repression operates. Based on the previous results that the divergence between advanced and emerging economies mainly arises from emerging economies’ high inflation and their subdued interest rate response to high inflation, we are particularly interested in how financial repression suppresses the response of interest rates to inflation. To this end, we augment the last section’s specification by adding the interaction term of financial repression and expected inflation.⁶

$$y_{it} = \beta_0 FR_{it} + \beta_1 FR_{it} \times \pi_{it}^e + \Gamma \mathbf{X}_{it} + \alpha_i + \epsilon_{it} \quad (2)$$

As financial repression mostly affects interest rates, we explore its impact not only on interest-growth differentials but also, in separate regressions, on effective, long-term domestic, and short-term

⁶Financial repression constrains the response of interest rate to expected inflation; however, the response of the interest rate to unexpected inflation does not depend on whether financial repression is present.

domestic interest rates. These different dependent variables are denoted by y_{it} .⁷ We utilize the continuous financial repression indexes from [Abiad, Detragiache and Tressel \(2008\)](#) and the Chinn-Ito index, denoted by FR . The control variables \mathbf{X} are the same as before. As contemporaneous inflation is a mismeasured proxy for expected inflation, we use lagged inflation as its instrument.⁸

In general, financial repression significantly suppresses nominal interest rate and constrains its response to expected inflation, leading to low differentials (Table 2). Financial repression reduces nominal interest rates and differentials significantly: a one standard deviation deterioration in the financial regulation index is associated with a decrease in nominal interest rates and differentials by about 3 percentage points. These estimates also align with the literature. For instance, using a dynamic panel setting for a sample of 128 countries over 1999–2008, [Escolano, Shabunina and Woo \(2017\)](#) estimate the coefficient on the Chinn-Ito capital control index to be around 4. Moreover, the responses of interest rates to expected inflation are muted by financial repression: associated with an expected 1 percentage point inflation increase, the rise in effective rates is 0.4 percentage points lower for the most financial-repressed country (based on mean Chinn-Ito index) than for the least one. Among different types of interest rates, the role of financial repression is most prominent in long-term domestic interest rates, because financial repression constrains long-term domestic interest rates by a greater extent than both effective rates, which contain external interest rates, or short-term rates, which may not be high enough to be affected.

Based on our estimates, the effective interest rate gap between advanced and emerging economies would have been reduced by 1.8 percentage points (out of 3.9 percentage points), on average, if emerging countries aligned with the median level of advanced economies’ financial repression (measured by the financial reform index), thus allowing interest rates to change freely in response to economic fluctuations and move toward the level of advanced economies.⁹

To sum up, negative interest-growth differentials are a common occurrence in countries at all levels of economic development. The presumption—common in policy circles—that negative differentials are a phenomenon associated with emerging economies seems to be driven by the experience of 1975–95 and does not stand up to scrutiny when considering longer historical periods.

⁷Long-term rate is the 10-year treasury bill rate, and short-term rate is the 3-month treasury bill rate. For the few countries whose 10-year rates are not available, 5-year or 2-year rates are used instead.

⁸Lagged inflation can serve as a valid instrument for expected inflation ([McCallum \(1976\)](#)): under the assumption of rational expectations, realized inflation π_t is equal to the sum of expected inflation π_t^e and a white noise u_t . Therefore, π_{t-1} is correlated with π_t^e and uncorrelated with u_t .

⁹One caveat is that our experiment here only aligns financial repression conditions between the two country groups—the other factors, including inflation and fiscal variables, stay the same. Therefore, the 1.8 percentage points represents the partial effects of financial liberalization in emerging countries as if they resemble advanced economies, controlling for any general-equilibrium effects stemming from financial liberalization.

Table 2: Impact of Financial Repression on Interest-Growth Differentials

	financial regulation index				capital controls index			
	$r - g$	effective rate (r)	long-term rate	short-term rate	$r - g$	effective rate (r)	long-term rate	short-term rate
financial repression	-12.916** (5.88)	-13.306** (6.16)	-7.515** (2.48)	0.684 (2.14)	-3.660* (2.19)	-4.327* (2.27)	-5.570* (2.88)	-0.363 (2.17)
financial repression × inflation	-0.128 (0.31)	0.170 (0.36)	-0.678** (0.31)	-1.094*** (0.21)	-0.421* (0.24)	-0.399* (0.21)	-0.244* (0.13)	-0.424* (0.22)
inflation	0.755** (0.36)	1.759*** (0.40)	1.176*** (0.19)	0.598** (0.19)	0.590*** (0.16)	1.434*** (0.19)	1.338*** (0.23)	1.404*** (0.23)
lag real interest rate	1.041*** (0.11)	1.035*** (0.13)	0.354*** (0.09)	0.319*** (0.08)	1.053*** (0.11)	1.021*** (0.10)	0.404*** (0.07)	0.622*** (0.14)
real growth	-0.702** (0.22)	0.571** (0.22)	0.490*** (0.13)	0.259** (0.13)	-0.911*** (0.11)	0.226* (0.12)	0.175 (0.12)	0.181 (0.13)
change in public debt	0.306** (0.13)	-0.035 (0.13)	0.316*** (0.06)	0.131 (0.09)	0.335** (0.10)	-0.009 (0.09)	0.224*** (0.06)	0.101 (0.09)
lag public debt	-0.014 (0.02)	-0.013 (0.02)	0.046** (0.01)	0.036** (0.01)	0.031** (0.01)	0.015 (0.01)	0.038** (0.01)	0.046*** (0.01)
global risk	0.338 (0.23)	0.491** (0.23)	0.402*** (0.09)	0.432*** (0.10)	-0.264** (0.13)	-0.140 (0.11)	0.256** (0.13)	0.094 (0.17)
non-fuel commodity price	-0.053** (0.02)	-0.045** (0.02)	0.003 (0.01)	-0.013 (0.01)	-0.057*** (0.01)	-0.038** (0.01)	-0.026*** (0.01)	-0.060** (0.02)
fuel commodity price	-0.021 (0.03)	0.003 (0.03)	-0.343* (0.20)	-0.009 (0.01)	-0.033** (0.01)	-0.004 (0.02)	-0.067** (0.03)	-0.033 (0.02)
N	1254	1254	837	893	2025	2025	1303	1416
Wald-stat (first stage)	18.74	18.74	31.74	5.819	71.22	71.22	20.05	29.68

Note: This table presents panel regressions of financial repression, inflation, and their interaction term while controlling for macro, fiscal, and global variables. Financial repression is measured by the financial regulation index and Chinn-Ito index, see text for more details. Standard errors are clustered at country level.

4 Interest-Growth Differentials, Fiscal Variables, and Sovereign Defaults

Having reviewed the stylized facts on the levels of, and variation in, interest-growth differentials, we now turn to analyzing their implications for government debt sustainability. As changes in the public debt ratio are determined by both interest-growth differentials (multiplied by the debt ratio) and the primary fiscal balance, it is important to consider not only these two items separately, but also the extent to which they move together: in principle, a decline in differentials could be more than offset by an increase in the primary fiscal deficit. Therefore, in this section, we explore the empirical association between differentials and fiscal variables, before turning to an analysis of whether interest-growth differentials or fiscal variables are significantly different in the run up to sovereign defaults compared with normal times.

4.1 Interest-Growth Differentials and the Fiscal Stance

Considering the whole sample, interest-growth differentials are (marginally) negatively associated with the primary fiscal balance, with a correlation coefficient of -0.03 (Table 3). (This is the median across countries of the country-specific correlation coefficients.) On the basis of this simple correlation, there is tentative evidence that policymakers respond to declining differentials with a slight expansion of primary fiscal deficits, but almost certainly not enough to fully offset the favorable impact of lower differentials. Even so, it is worth exploring these potential relationships somewhat further. The correlation of the primary fiscal balance is significantly positive with economic growth, reflecting the well-known positive association between fiscal revenues and economic growth; the correlation of the primary fiscal balance and interest rates is weaker, albeit positive, perhaps as governments tighten fiscal policies when borrowing costs are higher.

The association between the differentials and the cyclically-adjusted fiscal balance¹⁰ is positive and significant, with a correlation coefficient of 0.15 (0.14 with the real interest rate, suggesting a policy response to borrowing costs, and -0.03 with real growth, suggesting slightly counter-cyclical fiscal policies).¹¹ Two caveats are in order when interpreting these correlations: first, the sample consists of countries at different levels of economic development and financial integration in international capital markets over long historical periods; second, cyclical adjustment of fiscal variables is difficult in the presence of changes in trend economic growth—an especially relevant consideration for emerging economies.

Table 3: Correlations between Interest-Growth Differentials and Fiscal Stance

	primary balance	cyclically-adjusted primary balance
$r - g$	-0.03	0.15
real r	0.03	0.14
real g	0.09	-0.03

Note: This table reports the median (across countries) of the country-specific correlations between interest-growth differentials and primary balances. The sample contains 55 countries and 4257 observations.

To see whether the correlation with real growth or real interest rate drives the overall correlation between differentials and cyclically-adjusted primary balance, we decompose the correlation as follows:

$$\text{corr}(pb^{ca}, r - g) = \text{corr}(pb^{ca}, r) \cdot \frac{\sigma_r}{\sigma_{r-g}} - \text{corr}(pb^{ca}, g) \cdot \frac{\sigma_g}{\sigma_{r-g}}$$

¹⁰The cyclically-adjusted primary balance is calculated as: $pb^{ca} = pb - e\alpha$, where pb denotes primary balance, pb^{ca} denotes cyclically-adjusted primary balance, e denotes spending, all as share of GDP. α denotes the nominal output gap. In other words, we assume the revenue elasticity to be one and the spending elasticity to be zero, in line with the estimates in Girouard and André (2005). Even so, cyclical adjustment must be interpreted cautiously, especially for emerging economies, because the business cycle fluctuations in emerging economies are primarily driven by shocks in trend economic growth (Aguiar and Gopinath (2007)).

¹¹Here we abstract from the depreciation adjustment as its correlation with the differentials is found to be negligible.

The overall correlation is the difference between the correlations of each component adjusted by the standard deviation (denoted by σ) ratios. As reported in Table 4, the real interest rate plays the dominant role in the overall correlation, showing both higher correlation with cyclically-adjusted primary balance and higher standard deviation relative to that of interest-growth differentials. Advanced economies have a higher correlation than the emerging economies between the real interest rate and the cyclically-adjusted primary balance, which indicates that fiscal expansions in advanced economies when real interest rates are low exceeds those of emerging economies.

Table 4: Decomposing the Correlations between Interest-Growth Differentials and Fiscal Stance

	$corr(pb^{ca}, r - g)$	$corr(pb^{ca}, r)$	$\frac{\sigma_r}{\sigma_{r-g}}$	$corr(pb^{ca}, g)$	$\frac{\sigma_g}{\sigma_{r-g}}$
Full sample	0.19	0.21	0.88	-0.03	0.45
Advanced Economies	0.22	0.25	0.87	-0.03	0.50
Emerging Economies	0.14	0.15	0.89	-0.02	0.36

Note: This table decomposes the correlations between interest-growth differentials and cyclically-adjusted primary balance, and the mean of the country-specific correlations are reported. See the main text for details on the decomposition. The sample contains 55 countries and 4257 observations.

To explore the conditional relationship between interest-growth differentials and the primary balance, we estimate the fiscal response function following studies such as [Bohn \(2008\)](#) and [Mauro et al. \(2015\)](#) to include the role of interest-growth differentials. The regression is specified as

$$pb_{it} = \beta_1 d_{it-1} + \beta_2 (r - g)_{it} + \beta_3 d_{it-1} \times (r - g)_{it} + \Gamma \mathbf{X}_{it} + \alpha_i + \epsilon_{it} \quad (3)$$

where pb denotes the primary balance and d is the public debt, both as a share of GDP. and \mathbf{X} includes the real output gap, the real public spending gap, and commodity prices, varying in different specifications.¹²

The primary fiscal balance is tighter when interest-growth differentials are higher, with the magnitude of tightening increasing with initial debt level (Table 5). We first replicate [Bohn \(2008\)](#), and the results align with the literature—a 10 percent increase in the debt-to-GDP ratio is associated with a 0.1 percent of GDP primary balance tightening. With interest-growth differentials included, we find that the coefficient of the interaction between debt and differentials is significantly positive; however, the magnitude is not high enough to offset the direct impact of differentials on debt servicing cost. Considering, for instance, a country with a 100% debt-to-GDP ratio, a 100 basis points decrease in differentials is associated with an expansion in the primary fiscal balance by 0.1 percent of GDP, far less than the beneficial impact on the debt ratio (1 percent of GDP) that stems through the accounting relationship from the lower differential times the debt ratio. In other words, taking these

¹²The real output gap and public spending gap are the HP-filtered cyclical components of the logarithm real GDP and logarithm real public spending, representing the percent deviation from their trends, respectively. Real public spending is the nominal spending deflated by GDP deflator.

empirical associations at face value, policymakers would seem to respond to lower differentials by expanding the primary fiscal deficit, but not nearly enough to offset the direct, beneficial impact of lower differentials on the debt ratio.

Table 5: Primary Balance Response Functions and Interest-Growth Differentials

	(1)	(2)	(3)	(4)	(5)	(6)
lag public debt	0.010*	0.010*		0.012**	0.011**	0.011**
	(0.01)	(0.01)		(0.01)	(0.01)	(0.01)
lag public debt $\times (r - g)$			0.001**	0.001**	0.001**	0.001**
			(0.00)	(0.00)	(0.00)	(0.00)
$r - g$				-0.003	-0.000	-0.000
				(0.01)	(0.01)	(0.01)
real output gap		0.076			0.117**	0.118**
		(0.05)			(0.05)	(0.05)
real spending gap		-0.100***			-0.103***	-0.103***
		(0.02)			(0.02)	(0.02)
non-fuel commodity price						0.001
						(0.00)
fuel commodity price						-0.005
						(0.01)
N	4007	4007	4007	4007	4007	4007
R^2	0.008	0.111	0.014	0.024	0.133	0.133

Note: This table presents panel regressions of primary balance (as share of GDP) response functions. Column (1) and (2) are the baseline fiscal response functions in the literature. Column (3) to (6) augment fiscal response functions with lagged public debt, $r - g$, and interaction term, in various forms. Standard errors are clustered at country level, also allowing for cross-sectional dependence.

4.2 Interest-Growth Differentials in the Run-up to Default Episodes

Having explored whether the impact of changes in interest-growth differentials on debt dynamics can be attenuated by fiscal responses, we now analyze whether unfavorable differentials are associated with sovereign defaults. We focus on whether differentials are higher in the run-up to defaults than in “normal times”, using an approach similar to [Gourinchas and Obstfeld \(2012\)](#). We define “normal times” as all years except: (i) those when the country is in default, (ii) the three years after the completion of debt restructuring, or (iii) the five years prior to default. The estimated equation is as follows:

$$y_{it} = \sum_{j=1}^5 \beta_j D_{it}^j + \lambda_t + \alpha_i + \epsilon_{it} \quad (4)$$

where D_{it}^j denotes j years before default. Besides the country fixed effects as in [Gourinchas and Obstfeld \(2012\)](#), we also include year fixed effects to control for any global factors that may affect interest-growth differentials, such as shocks to global risk aversion. The estimates of β_1, \dots, β_5 are

presented in Figure 5.

Interest-growth differentials in the run-up to default do not significantly differ from those in normal times. Although there is an increase toward the onset of default, it is not significant. This pattern holds in all of the full sample, the post-war, advanced economies, and emerging economies subsamples. Further decomposition of interest-growth differentials into components shows that real economic growth is significantly lower than usual the year prior to default, and that a growth deceleration is visible—while not significant—in the years prior to defaults. Real interest rates are somewhat lower than usual, albeit not significantly.¹³ On balance, we cannot reject that interest-growth differentials are the same as in normal times.

Sovereign defaults in emerging countries are often just preceded or accompanied by large depreciation, which could boost the debt ratio. To take account of this effect, we assess the differences in depreciation adjustment between the run-up to default and normal times in the same specification as before. The results (Figure 5) show that depreciations are, on average, 20 percent larger in the year prior to default compared with normal times. This leads to higher depreciation adjustment, 8.8 percentage points one year prior to default, significant at the 90% level. However, zooming into the months preceding default reveals that visibly large depreciations—albeit insignificant—do not show up until a few months prior to default.

Turning

in the year before default. Specifically, in the year prior to default, the primary fiscal balance is about 1 percent of GDP lower than in normal times, even after teasing out the cyclical component. In the meantime, public debt is 16 percent higher, as share of GDP. These results suggest that interest-growth differentials do not help to predict defaults, whereas primary deficits and public debt ratios seem to have some predictive power. These results are confirmed by [Moreno Badia et al. \(2020\)](#), who reach the same conclusion using a machine learning method in the context of an early warning system for fiscal crises, based on a large sample of countries and more than 100 variables over a shorter sample period.

4.3 Marginal Rates in the Run-up to Default Episodes

The marginal interest rate responds faster than the average effective rate to changes in market participants' sentiments. There is abundant evidence documenting the increase of marginal rates in the run-up to defaults. For instance, in the cases of Greece, Argentina, Dominican Republic, etc. (Figure 6), marginal rates skyrocketed in the run-up to default.¹⁴ A similar pattern is observed in

¹³Inflation is calculated using the GDP deflator, and the (ex-post) real interest rate is the nominal rate adjusted for this period's inflation.

¹⁴The marginal rates are calculated as 10-year treasury bond yields for Greece and EMBI spread plus the U.S. 10-year treasury yields for emerging markets.

more distant default episodes such as Uruguay in 1876 and Greece in 1894 (Figure 7).

Averaging across all default episodes, marginal rates in the run-up to defaults exceed those in normal times by about 2 percentage points, and the differences are statistically significant (Figure 8). This pattern holds for marginal rates measured on both domestic currency borrowing and foreign currency borrowing, and it is slightly more pronounced on the foreign currency portion.

Although the marginal rate increases significantly preceding sovereign defaults, it does not give much time for policy makers to react. Unpacking the year before default into months (Figure 9), sizable gaps emerge about six months before default, and they keep growing as default approaches. However, the increases are not robustly significant until two months prior to default. Therefore, marginal rates do not buy much time for corrective policy measures to take place.

To recall, the average effective interest rate is the relevant rate to determine debt dynamics. The marginal rate, which measures the borrowing cost for new issuance, reflects market sentiments more quickly but is an imperfect proxy for future developments in the average effective interest rate. The marginal rates are only relevant for debt dynamics when changes in sentiments are sustained for a long time and such changes affect the whole maturity structure of the debt. The marginal rate is, more importantly, a reflection of whether investors are willing to roll over the debt. Increases in the marginal rate are the mirror image of a default triggered by a change in market sentiment, which is in turn hard to predict. Fiscal variables such as debts and deficits have some predictive power, but average effective interest-growth differentials do not.

5 Conclusion

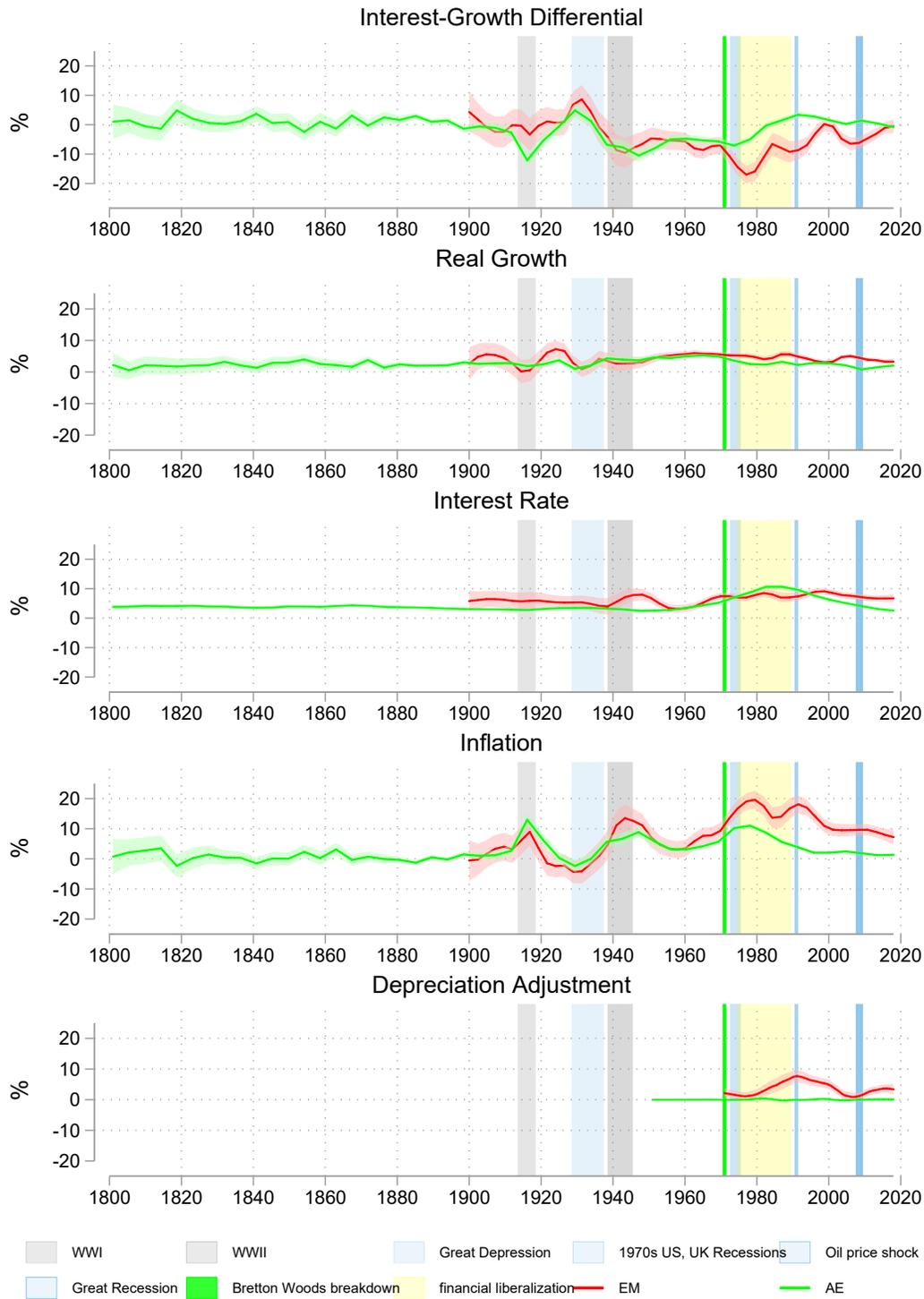
Our empirical analysis of interest-growth differentials and their role in public finance is relevant from the standpoint of economic models, which usually assume that the interest rate exceeds the rate of growth of the economy. It is also relevant from perspective of policymaking, especially against the backdrop of two features of the post-GFC setting: the prevalence of low and often negative interest-growth differentials and high public debt ratios. We find that the negative differentials experienced today are not unprecedented—on the contrary, they prevail in the history of both advanced and emerging economies. Negative differentials are, if anything, the norm rather than the exception during the past two centuries. Moreover, low differentials based on average effective interest rates are not associated with lower frequency of sovereign defaults, whereas fiscal deficits and debts seem to have some (albeit limited) predictive power for sovereign defaults.

In view of these findings, can we sleep more soundly given low differentials? Based on the findings reported in this paper, our answer is: not really. Sovereign default histories demonstrate that after prolonged periods of low differentials based on average effective interest rates, marginal borrowing

costs can rise suddenly and sharply, shutting countries out of financial markets at short notice.

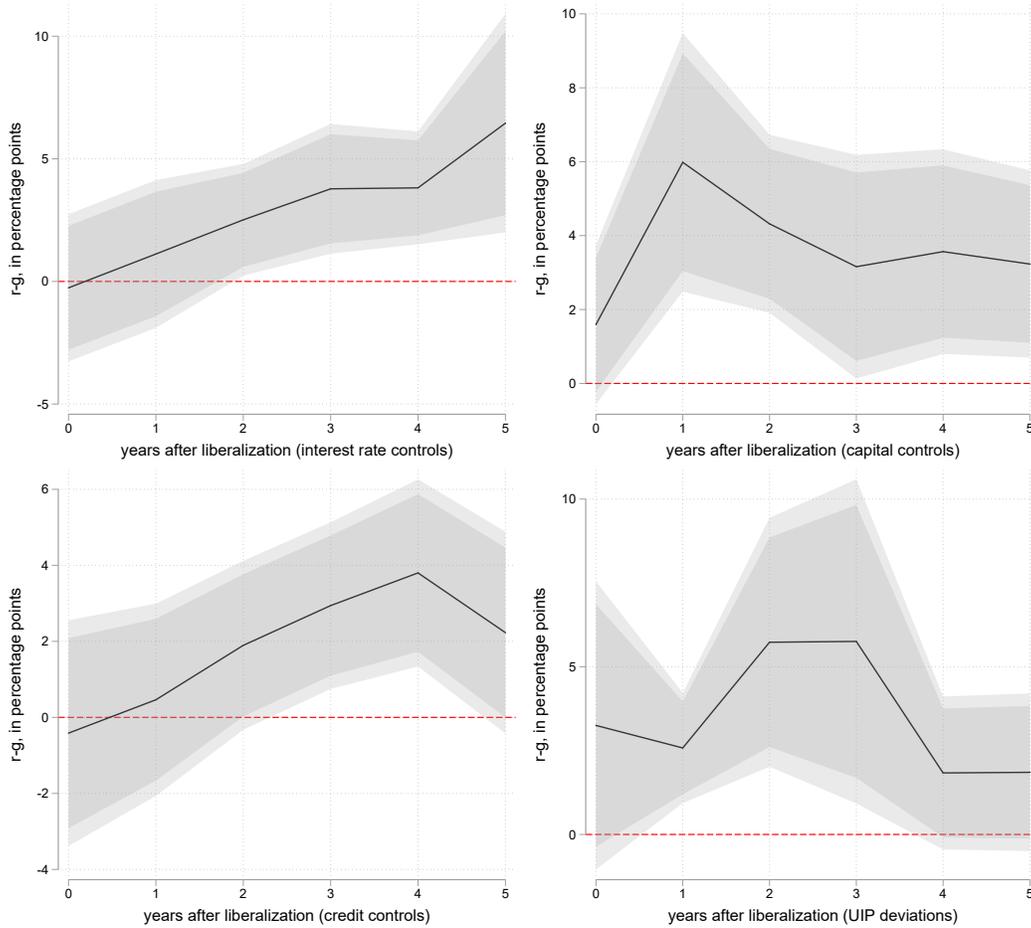
Our paper has abstracted from analyzing a full set of exogenous contributors to interest-growth differentials. A more complete analysis would require taking into consideration the reasons why interest-growth differentials are currently so low, as pointed out, for example, by [Garín et al. \(2019\)](#). Our objective has been to caution that negative differentials do not necessarily reduce the likelihood of government defaults in the years ahead. Only with further reflection on the factors underlying the low differentials, as well as prospects for the primary fiscal balance, will we be able to make fully informed judgments on an appropriate stance of policies.

Figure 3: The Divergence Between Advanced and Emerging Economies



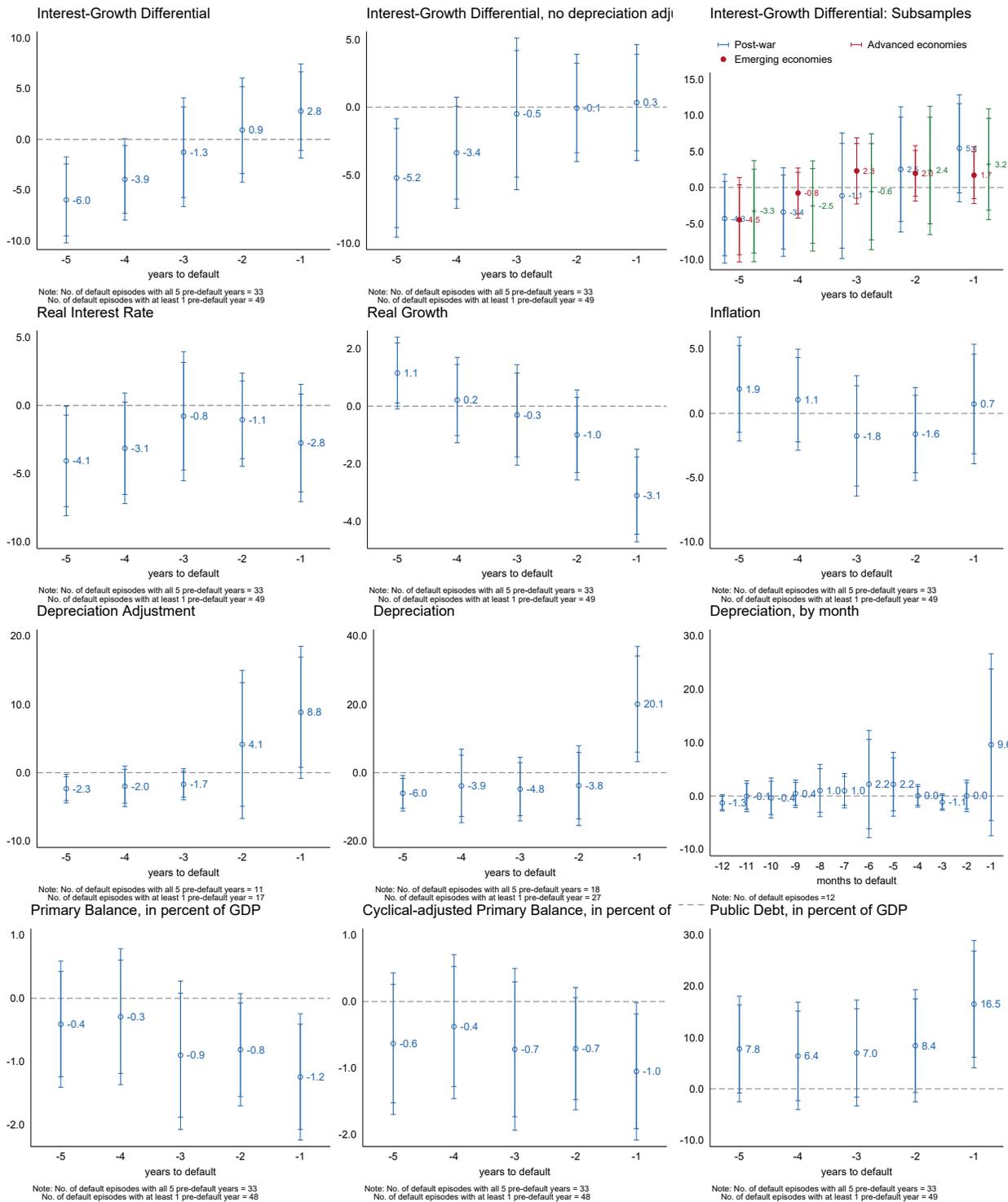
Note: This chart plots the average of interest-growth differential, real growth, effective interest rate, and inflation of advanced economies and emerging countries, respectively. The confidence band is calculated with normal kernel smoothing. The advanced economies include AUS, BEL, CAN, DEU, DNK, ESP, FRA, GBR, ITA, JPN, NLD, NOR, NZL, PRT, SWE, and USA, which have at least 100 observations. The emerging countries included are ARG, BRA, COL, CRI, IND, MEX, PAK, PHL, THA, UEN, and ZAF, which have at least 50 observations.

Figure 4: Interest-Growth Differentials After Financial Liberalization, Local Projection



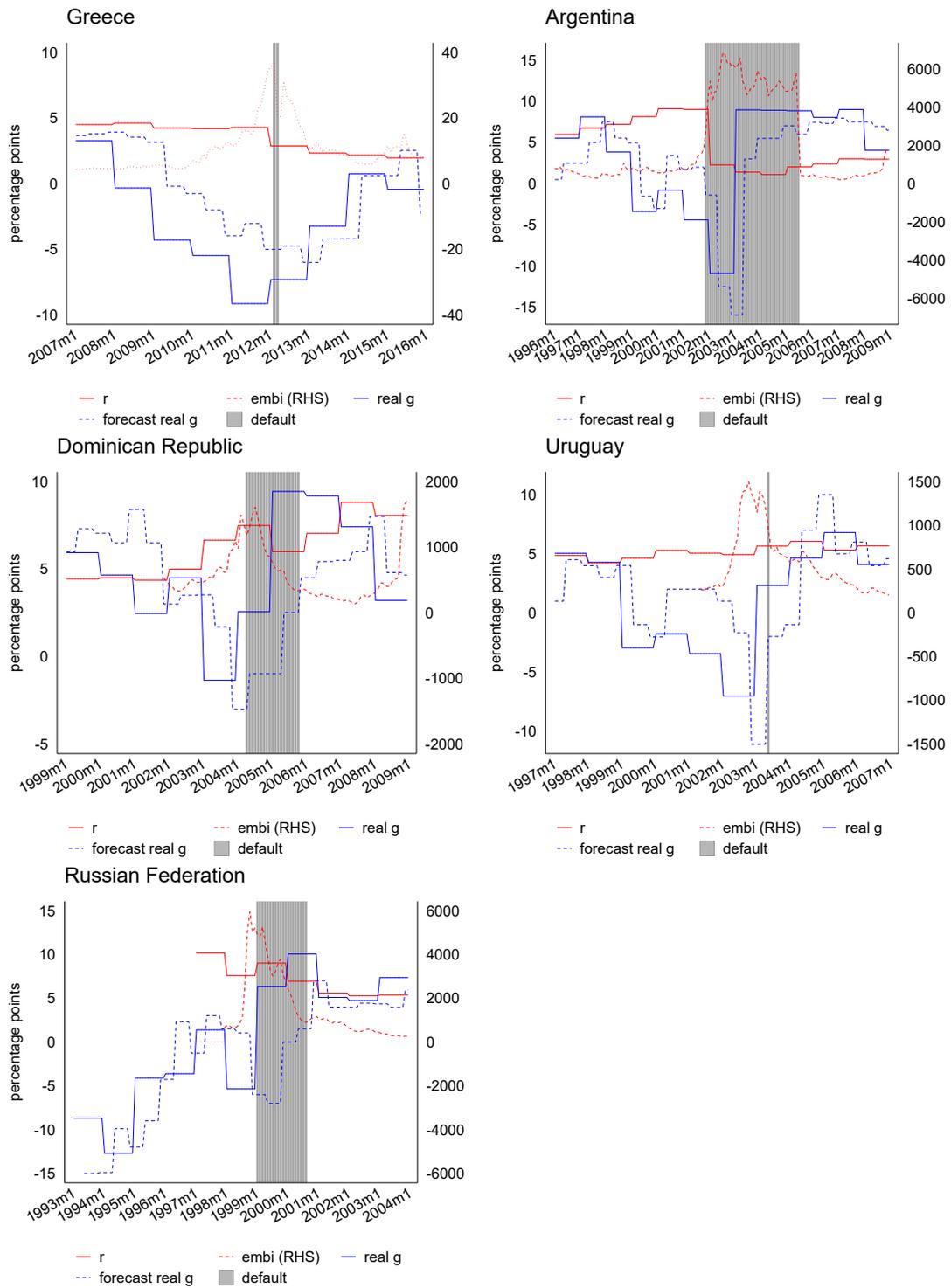
Note: This chart plots the changes in interest-growth differentials after financial liberalizations, based on local projection. Financial liberalizations are measured by de jure measures—interest rate controls removal, capital controls removal, and credit controls removal, respectively. De facto measure is also included (right lower corner panel), measured by structural breaks in the deviations to the uncovered interest rate parity. The shaded areas indicate 95% (the lighter) and 90% (the darker) confidence intervals, respectively.

Figure 5: Interest-Growth Differentials and Fiscal Variables in the Run-up to Sovereign Default



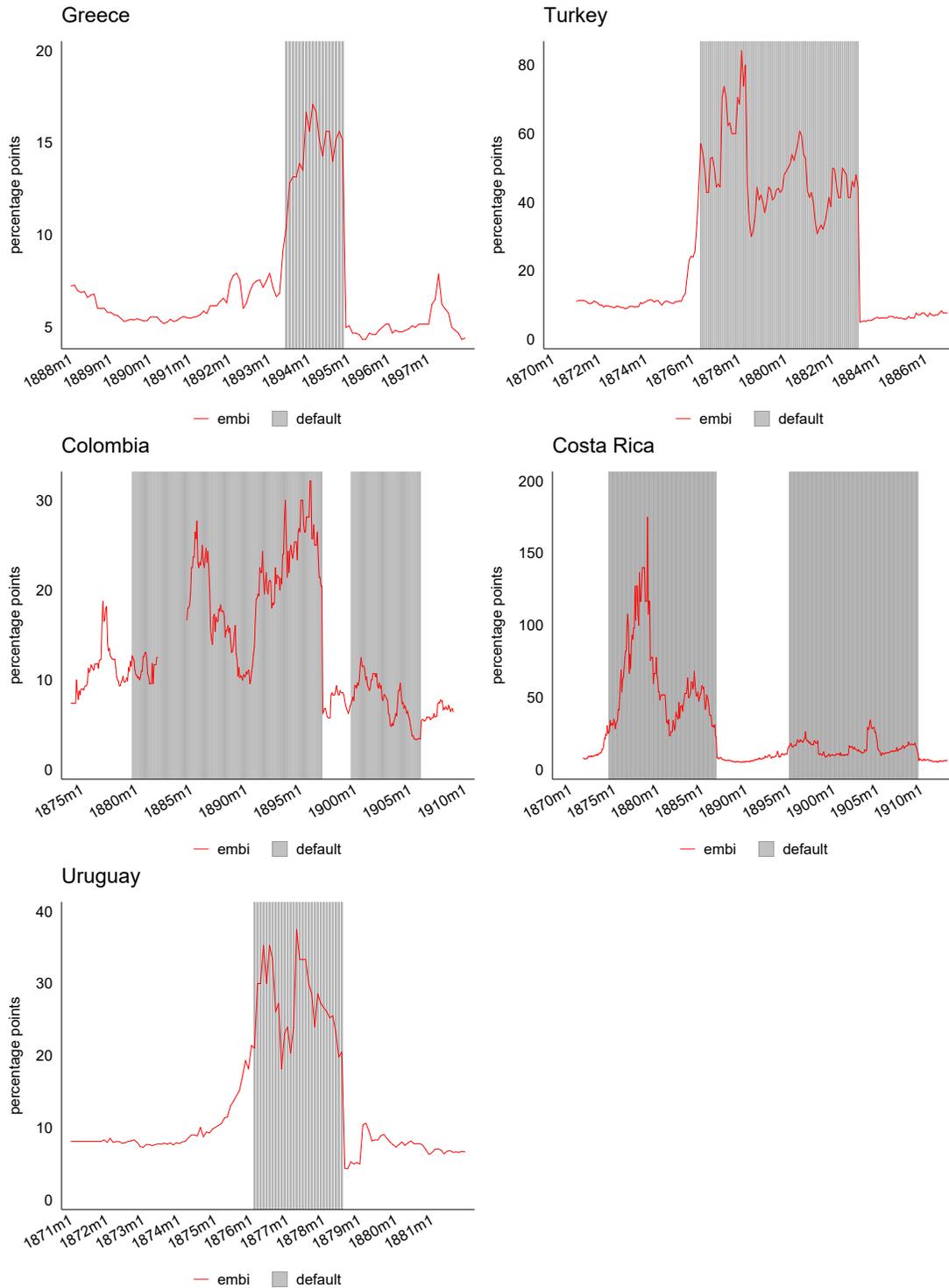
Note: This chart plots the interest-growth differentials, the real interest rate, the inflation, the real growth, the exchange rate depreciations, the primary fiscal balance, and public debt as share of GDP in the run-up to sovereign default. The point estimate is the value in years before the onset of sovereign default compared with normal years, controlling for country and year fixed effects. Debt restructuring years and (three years) post debt restructuring years are dropped from the sample. The sample contains 27 sovereign default episodes for annual depreciation-related variables, 12 for monthly depreciation, and 49 for the rest. The narrower and wider bands indicate the 90% and 95% confidence intervals, respectively.

Figure 6: Dynamics of Marginal Interest Rate during Recent Sovereign Default Episodes



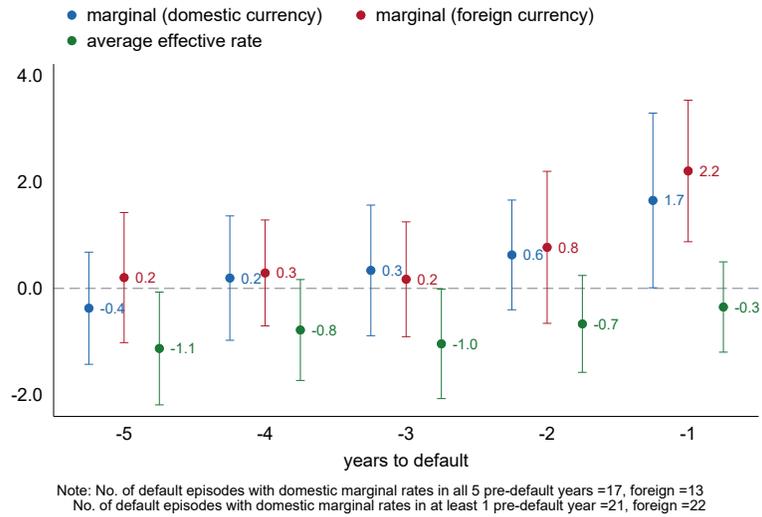
Note: This chart plots the evolution of marginal interest rate during recent sovereign default episodes. The margin interest rate is the sum of sovereign bond EMBI spread and the U.S. 10-year treasury bond yield.

Figure 7: Dynamics of Marginal Interest Rate during Historical Sovereign Default Episodes



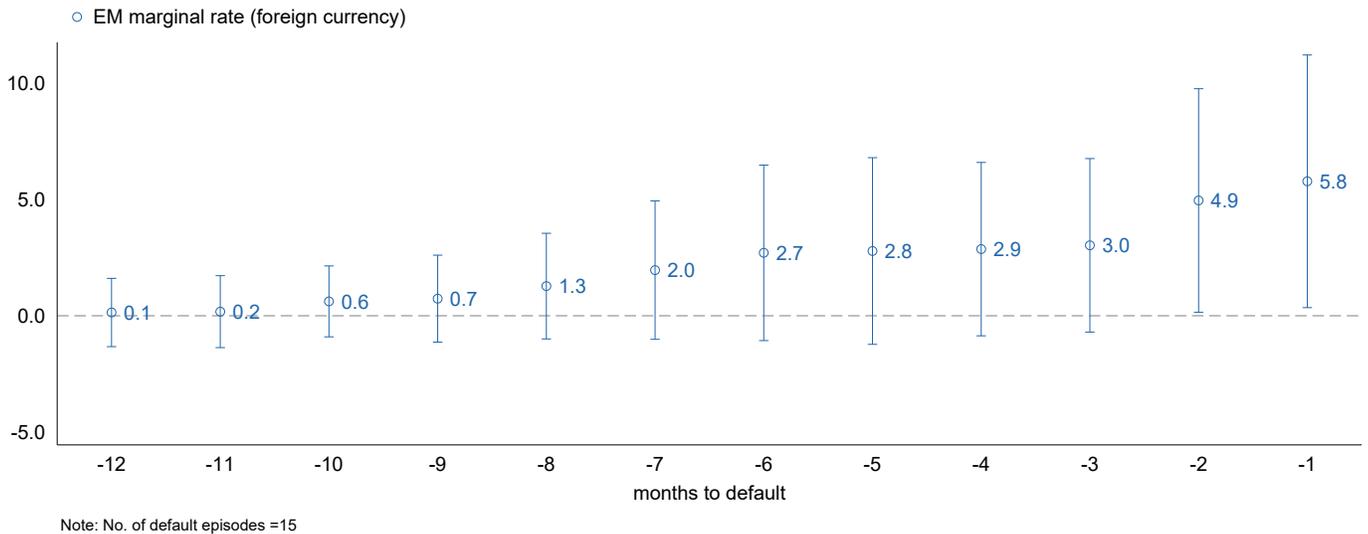
Note: This chart plots the evolution of marginal interest rate during historical sovereign default episodes before 1930s. The margin interest rate is the sum of sovereign bond spread and the consol bond rate.

Figure 8: Marginal Interest Rates in the Run-up to Sovereign Default



Note: This chart plots the marginal interest rates in the run-up to sovereign default. Domestic marginal rates are the 10-year treasury bond yields, and foreign marginal rates are the sum of EMBI spreads and 10-year U.S. treasury bond yields. The point estimate is the value in years before the onset of sovereign default compared with normal years, controlling for country and year fixed effects. Debt restructuring years and (three years) post debt restructuring years are dropped from the sample. The band indicates the 95% confidence interval.

Figure 9: Marginal Interest Rates in the Run-up to Sovereign Default, by Month



Note: This chart plots the marginal rates in the twelve months preceding sovereign default. The sample covers 15 default episodes, 8 cases in the late 1800s and early 1900s, and the rest in the post-1985 years. The point is the value in months before the onset of sovereign default compared with normal months, controlling for country and year fixed effects. In-default months and three years post debt restructuring are dropped out from the sample. The band indicates the 95% confidence interval.

References

- Abbas, Ali, Alex Pienkowski, and Kenneth Rogoff.** 2019. *Sovereign Debt: A Guide for Economists and Practitioners*. Oxford University Press, USA.
- Abbas, Ali, and Jakob E Christensen.** 2010. “The role of domestic debt markets in economic growth: An empirical investigation for low-income countries and emerging markets.” *IMF Economic Review*, 57(1): 209–255.
- Abbas, Ali, Laura Blattner, Mark De Broeck, Ms Asmaa El-Ganainy, and Malin Hu.** 2014. *Sovereign debt composition in advanced economies: a historical perspective*. International Monetary Fund.
- Abbas, Ali, Nazim Belhocine, Asmaa A ElGanainy, and Mark Horton.** 2010. “A historical public debt database.” *IMF Working Papers*, 1–26.
- Abel, Andrew B, N Gregory Mankiw, Lawrence H Summers, and Richard J Zeckhauser.** 1989. “Assessing dynamic efficiency: Theory and evidence.” *The Review of Economic Studies*, 56(1): 1–19.
- Abiad, Abdul, Enrica Detragiache, and Thierry Tressel.** 2008. *A new database of financial reforms*. International Monetary Fund.
- Aguiar, Mark, and Gita Gopinath.** 2007. “Emerging market business cycles: The cycle is the trend.” *Journal of political Economy*, 115(1): 69–102.
- Arellano, Cristina.** 2008. “Default risk and income fluctuations in emerging economies.” *American Economic Review*, 98(3): 690–712.
- Asonuma, Tamon, and Christoph Trebesch.** 2016. “Sovereign debt restructurings: preemptive or post-default.” *Journal of the European Economic Association*, 14(1): 175–214.
- Bai, Jushan, and Pierre Perron.** 1998. “Estimating and testing linear models with multiple structural changes.” *Econometrica*, 47–78.
- Ball, Laurence, Douglas W Elmendorf, and N Gregory Mankiw.** 1995. “The deficit gamble.” National Bureau of Economic Research.
- Barrett, Philip.** 2018. “Interest-growth differentials and debt limits in advanced economies.” International Monetary Fund.
- Blanchard, Olivier.** 2019. “Public Debt and Low Interest Rates.” *American Economic Review*, 109(4): 1197–1229.
- Bohn, Henning.** 2008. “The sustainability of fiscal policy in the United States.” *Sustainability of public debt*, 15–49.
- Broner, Fernando A, Guido Lorenzoni, and Sergio L Schmukler.** 2013. “Why do emerging economies borrow short term?” *Journal of the European Economic Association*, 11(1): 67–100.
- Chari, V V, Alessandro Dovis, and Patrick J Kehoe.** forthcoming. “On the optimality of

- financial repression.” *Journal of Political Economy*.
- Eichengreen, Barry, Ricardo Hausmann, and Ugo Panizza.** 2003. “The pain of original sin.” *Other people’s money: Debt denomination and financial instability in emerging market economies*, 13–37.
- Escolano, Julio.** 2010. “A Practical Guide to Public Debt Dynamics.” *Fiscal Sustainability, and Cyclical Adjustment of Budgetary Aggregates, IMF*.
- Escolano, Julio, Anna Shabunina, and Jaejoon Woo.** 2017. “The Puzzle of Persistently Negative Interest-Rate–Growth Differentials: Financial Repression or Income Catch-Up?” *Fiscal Studies*, 38(2): 179–217.
- Garín, Julio, Robert Lester, Eric Sims, and Jonathan Wolff.** 2019. “Without looking closer, it may seem cheap: Low interest rates and government borrowing.” *Economics Letters*, 180: 28–32.
- Giovannini, Alberto, and Martha De Melo.** 1991. “Government revenue from financial repression.” National Bureau of Economic Research.
- Girouard, Nathalie, and Christophe André.** 2005. “Measuring cyclically-adjusted budget balances for OECD countries.” *OECD Economics Department Working Papers*.
- Gourinchas, Pierre-Olivier, and Maurice Obstfeld.** 2012. “Stories of the twentieth century for the twenty-first.” *American Economic Journal: Macroeconomics*, 4(1): 226–65.
- Guscina, Anastasia, and Olivier Jeanne.** 2006. *Government debt in emerging market countries: A new data set*. International Monetary Fund.
- Jordà, Òscar, Katharina Knoll, Dmitry Kuvshinov, Moritz Schularick, and Alan M Taylor.** 2019. “The rate of return on everything, 1870–2015.” *The Quarterly Journal of Economics*, 134(3): 1225–1298.
- Jordà, Òscar, Moritz Schularick, and Alan M Taylor.** 2017. “Macrofinancial history and the new business cycle facts.” *NBER macroeconomics annual*, 31(1): 213–263.
- Kozlowski, Julian, Laura Veldkamp, and Venky Venkateswaran.** 2019. “The tail that keeps the riskless rate low.” *NBER Macroeconomics Annual*, 33(1): 253–283.
- Mauro, Paolo, Nathan Sussman, and Yishay Yafeh.** 2002. “Emerging market spreads: then versus now.” *The Quarterly Journal of Economics*, 117(2): 695–733.
- Mauro, Paolo, Nathan Sussman, and Yishay Yafeh.** 2006. *Emerging markets and financial globalization: sovereign bond spreads in 1870-1913 and today*. Oxford University Press.
- Mauro, Paolo, Rafael Romeu, Ariel Binder, and Asad Zaman.** 2015. “A modern history of fiscal prudence and profligacy.” *Journal of Monetary Economics*, 76: 55–70.
- McCallum, Bennett T.** 1976. “Rational expectations and the estimation of econometric models: An alternative procedure.” *International Economic Review*, 484–490.
- Mehrotra, Neil R, and D Sergeyev.** 2019. “Debt sustainability in a low interest rate world.”
- Moreno Badia, Marialuz, Paulo Medas, Pranav Gupta, and Yuan Xiang.** 2020. “Debt Is

- Not Free.” IMF Working Papers, 20/1.
- Morsy, Hanan, Ludvig Söderling, Martin Petri, Manal Fouad, and Wojciech Maliszewski.** 2007. *Public debt and fiscal vulnerability in the Middle East*. International Monetary Fund.
- Piketty, Thomas.** 2014. *Capital in the Twenty-First Century*. Cambridge, MA: Harvard University Press.
- Rachel, Łukasz, and Lawrence H Summers.** 2019. “On Secular Stagnation in the Industrialized World.” National Bureau of Economic Research.
- Reinhart, Carmen M, and Kenneth S Rogoff.** 2009. *This time is different: Eight centuries of financial folly*. Princeton University Press.
- Reinhart, Carmen M, and M Belen Sbrancia.** 2015. “The liquidation of government debt.” *Economic Policy*, 30(82): 291–333.
- Reinhart, Carmen M, Jacob F Kirkegaard, and M Belen Sbrancia.** 2011. “Financial repression redux.” *Finance and Development*, 22–26.
- Schmelzing, Paul.** 2019. “Eight centuries of global real interest rates, R-G, and the ‘suprasecular’ decline, 1311 – 2018.” *Bank of England Staff Working Paper No. 845*.
- Turner, David, and Francesca Spinelli.** 2011. “Explaining the interest-rate-growth differential underlying government debt dynamics.”

Appendix

A Data Appendix

A.1 Fiscal Variables

The centerpiece of our data consists of fiscal variables and, in particular, the interest bill from which we compute the effective interest rate on government debt, covering an unbalanced panel of 55 countries (24 advanced economies and 31 emerging economies, using the present-day classification from the IMF’s World Economic Outlook classification) over 1800-2018.¹⁵

An important issue in the construction of long-term fiscal data series relates to the choice of government sector coverage. In order to refer to the most comprehensive sector of government for which they were available, the data at the general government level are collected wherever available. In most cases, general government data are unavailable before 1960—not surprisingly, given that for most countries the share of spending by sub-national governments has risen significantly only since then. As a result, the sector reported switches (in most cases, simultaneously for all variables—including the interest bill and the debt stock—for a given country) from central government to general government in nearly all final spliced series, and this switch generally happens in the 1960s or 70s. Breaks in series are recorded in the database.

The average effective interest rate on debt is computed as the ratio of the interest bill in year t to the stock of government debt (average of debt stocks of year-end t and $t - 1$) from the sources above. The marginal cost of borrowing (in most cases, yield to maturity on the secondary market) is compiled from Mauro, Sussman and Yafeh (2002, 2006) for 1870-1914 and Datastream—updated to June 2019.

External public debt comes from a dataset assembled by the IMF staff using the WB-IMF Quarterly Public Sector Debt, OECD Central Government Debt, WEO, Guscina and Jeanne (2006), Morsy et al. (2007), Abbas and Christensen (2010), Abbas et al. (2010), and Abbas et al. (2014). We extend it back to 1970 using the World Bank’s International Debt Statistics when possible.

¹⁵Half of the observations for the fiscal variables in the dataset are drawn from various cross-country sources, including the IMF’s World Economic Outlook (WEO) and International Financial Statistics (IFS) and the OECD Analytical Database for the past 20 to 50 years (subject to availability); the Statistical Yearbooks of the League of Nations and the United Nations (as well as their Public Debt Supplements) for the period between World War I and the 1970s; and Flandreau and Zumer (2004) for the pre-World War I era; in addition, long-run historical series are drawn from Mitchell’s International Historical Statistics and the Montevideo-Oxford Latin American Database (MOXLAD). The other half of the data is hand-collected from country-specific sources, such as official government publications or economic histories that included public finance statistics. Examples of such data sources include Fregert and Gustafsson (2005) for Sweden over 1800-2004; Fernandez and Acha (1976) for Spain over 1850-1975; and Junguito and Rincon (2004) for Colombia over 1923-2003.

A.2 GDP

For nominal GDP data from the distant past, the main sources are Mitchell and MOXLAD. For most countries, GDP data do not exist before World War I: in these years, GDP is proxied by variables such as Gross National Product or Net National Product from Mitchell's International Historical Statistics. In a few cases, UN statistical yearbooks are used to fill in gaps in coverage between 1940 and 1975. GDP data are drawn from the OECD database for a few member countries beginning as early as 1960. For some countries, such as the United States, the United Kingdom, Italy, the Netherlands, Japan, Canada, and India, GDP is based on government publications or other country-specific sources. Starting in the mid 1990s, GDP data for almost all countries are taken from the WEO. Many sources, both cross-country and country-specific, provided fiscal data already expressed in terms of GDP as well. To ensure the quality of our fiscal and GDP data, we crosscheck with [Jordà, Schularick and Taylor \(2017\)](#) for 17 advanced economies from 1870 to 2016.

Based on the fiscal variables and GDP data, the interest-growth differentials are calculated as the differences between average effective interest rates on debt and nominal growth rates. To take account of the revaluation impact of exchange rate depreciation on public debt denominated in foreign currency, we later allow for depreciation adjustment, and more details can be found in Section 3.3.

A.3 Other Financial Variables

Money market rates, exchange rate. Drawn from Global Financial Data. Money market rate is the 3-month treasury yield in the secondary market, and 3-month interbank overnight borrowing rate is used if 3-month treasury yield not available.

Sovereign defaults. Years of default are drawn from [Reinhart and Rogoff \(2009\)](#) and, for 2009 to 2018, Moody's "Sovereign Default and Recovery Rates, 1983-2018" over 2009 to 2018. Months of default are from [Mauro, Sussman and Yafeh \(2002\)](#) and [Asonuma and Trebesch \(2016\)](#).

Financial repression. Based on a dataset of financial reforms from [Abiad, Detragiache and Tressel \(2008\)](#), covering 91 countries since 1973. The database recognizes the multi-faceted nature of financial reform and records financial policy changes along seven different dimensions: credit controls and reserve requirements, interest rate controls, entry barriers, state ownership, policies on securities markets, banking regulations, and restrictions on the capital account. Liberalization scores for each category are combined in a graded index that is normalized between zero and one.

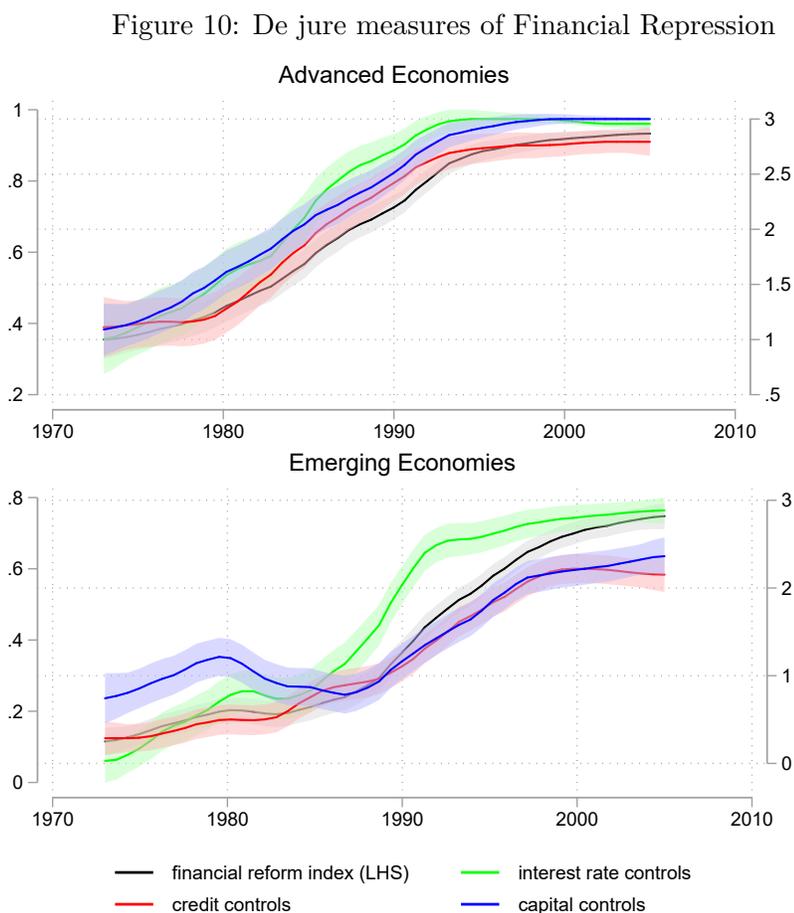
B Identify Financial Repression Years

To analyze the role of financial repression in reducing debt cost, we begin with identifying the financial repression years for each country. We employ both de jure and de facto measures. The de jure measures come from [Abiad, Detragiache and Tressel \(2008\)](#), as illustrated before, they cover inclusive aspects of financial sector policy such as interest rate controls and capital controls. We define the liberalization year as the first year that the index of interest rate controls and capital controls reach the highest category, meaning free market. For the case the index decreases after reaching the highest category, we set the most recent year when the highest value is first reached. Therefore, our estimates can be viewed as a lower bound. The de facto measures are the structural breaks in the UIP deviations, which we identify by applying [Bai and Perron \(1998\)](#). The motivation comes from that frictions in the financial market imposed by financial repression can lead to UIP deviations. We calculate the 3-month horizon UIP deviation using the second market yields of the sovereign bonds. We set the 3-month horizon as the 3-month interest rates provide the largest country and year coverage, and the 3-month provides sufficient frequency to identify structure breaks. Note that as we use the 3-month interest rates, their structure breaks are neither automatically nor substantially lead to structure breaks on the effective interest rate which is used in interest-growth differentials.

The de jure and the de facto measures complement each other and provide ways for cross-validation. The advantage of the de jure measures is that they are objectively defined by the change in the policy regulations. However, the available policy measures still miss certain types of financial repression. For instance, financial repression can take the non-legislated form, such as moral suasion by putting pressure on banks to extend material support to the government. For instance, in the late 1940s, the Bank of England can make recommendations to bankers to take actions in the public interest and if these recommendations were not followed, with the approval of the Treasury, to issue directions to any banker. The de facto measures are market-based, which are able to capture the changes in interest rate resulted from all explicit and implicit regulations. That said, there are a couple of challenges. First, the UIP deviation suffer from measurement errors because the expected exchange rate is unobservable. To minimize measurement errors in using the UIP deviations and work around the benchmark, we employ various approaches to calculate expected future exchange rates, namely, the actual exchange rate, last period's exchange rate, the average of last three periods, and the expected future exchange rate backed from the Purchasing Power Parity. Second, as UIP usually does not hold, it is difficult to benchmark a counterfactual for no financial repression. Therefore, we only focus on the structure breaks rather than all deviations from UIP. The liberalization years identified by de facto measures are considerably close to those by the de jure. For instance, the median difference of the liberalization years between the UIP deviation and the capital controls abolishment is 2-year. Also, different measures of UIP deviation result in very similar liberalization

years, with the largest difference of 2-year.

As presented in Figure 10, the de jure measures show that there is a significant wave of financial liberalization starting from the early 1980s for advanced economies (earliest as 1963, latest as 1988) and from the late 1980s for emerging countries (earliest as 1974, latest as 2004). For instance, the Bank of England stopped publishing the Minimum Lending Rate in 1981, interest rates ceilings were abolished on 1967 in Canada, deposit rates were liberalized in 1988-89 in Mexico, and restrictions on capital movements were lifted after August 1989 in Turkey. By the end of 1990s, the majority of advanced economies have abolished interest controls and capital controls. The liberalization process in emerging economies is still ongoing.



Note: This chart plots the average of financial repression indexes across years. The financial indexes include interest rate controls, credit controls, capital controls, and an overall financial reform index. The shaded area is the 95% confidence band calculated by normal kernel smoothing. For all the indexes, the higher the value, the less regulated.