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The Puzzle of Persistently Negative Interest Rate-Growth Differentials: Financial Repression or Income Catch-Up?

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Fiscal Affairs Department

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Prepared by Julio Escolano, Anna Shabunina, and Jaejoon Woo

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Abstract

The interest rate-growth differential (IRGD) shows a marked correlation with GDP per capita. It has been on average around one percentage point for large advanced economies during 1999–2008; but below -7 percentage points among non-advanced economies—exerting a powerful stabilizing influence on government debt ratios. We show that large negative IRGDs are largely due to real interest rates well below market equilibrium—possibly stemming from financial repression and captive and distorted markets, whereas the income catch-up process plays a relatively modest role. We find econometric support for this conjecture. Therefore, the IRGD in non-advanced economies is likely to rise with financial integration and market development, well before their GDP per capita converges to advanced-economy levels.

JEL Classification Numbers: E31, E4, E6, G1, H6, O47

Keywords: interest rate-growth differential, real interest rates, debt dynamics, dynamic efficiency, income catch-up, financial repression, financial integration.

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I. INTRODUCTION

The differential between the average interest rate paid on government debt and the growth rate of the economy (the interest rate-growth differential, henceforth IRGD for short) is a key parameter in assessing the sustainability of government debt.² This is founded in the logic of debt dynamics: the higher the IRGD, the larger the fiscal effort necessary to place the debt-to-GDP ratio (henceforth the debt ratio) on a downward path, or even to stabilize it. For example, during the sovereign debt crisis in the euro area, the IRGD has explicitly or implicitly played a significant role by underpinning market expectations of debt defaults in countries that faced rising interest rates paired with weak growth prospects.

Surprisingly, the actual behavior of IRGDs in a historical cross-country context encompassing economies of a broad range of income levels has received little attention in the literature. This is probably caused to a large extent by the paucity of data—which if available, typically refer only to advanced economies.³ Nevertheless, as we show below, the IRGD in advanced economies represents only the well-behaved tip of the iceberg. To allow for a wider exploration, we have constructed a database of average effective interest rates based on budget outturn data and debt stocks for a large sample of advanced and non-advanced economies. We also corrected these data for the effects of exchange rate changes on foreign currency-denominated debt, and dropped about one-third of countries because they had a substantial proportion of concessional debt. From this new database, it emerges that IRGDs are correlated with income levels, and are generally negative in non-advanced economies—often strongly so.

Negative IRGDs constitute a powerful debt-stabilizing force in many non-advanced economies, driving down debt ratios or keeping them stable even in the presence of persistent primary deficits. The question however is whether emerging market economies (EMEs) and low income countries (LICs) can rely on continued sizably negative IRGDs over the long term. It is often assumed, sometimes implicitly, that negative IRGDs are mainly due to higher growth, and hence they are an intrinsic feature of the income catch-up process:

² Except when otherwise indicated, the IRGD is computed as the differential between the effective interest rate (actual interest payments divided by the debt stock at the end of the previous year) and the growth rate of nominal GDP, divided by the latter plus one. It is immaterial whether the interest and growth rates are both measured in nominal or real terms. Also, the interest rate is adjusted for the change in the domestic currency value of foreign currency-denominated debt due to exchange rate changes. This measure best approximates the IRGD factor relevant for debt dynamics. When data availability does not allow computation of the effective interest rate paid, a market benchmark government rate is used. See Appendix 1 for details on the derivation of IRGD.

³ Even advanced economy data compiled on a reasonably consistent basis were scarce until relatively recently. In this regard, the AMECO database of the European Commission represented an important step forward, as it includes effective average interest rates on government debt as well as other variables relevant to the debt dynamics. However, at this time, AMECO only covers EU economies and the largest of the non-EU advanced economies.

Therefore, they will persist until GDP per capita reaches advanced economy levels. Thus, it is often thought that for most EMEs and LICs, positive IRGDs and their attendant adverse effects on debt dynamics would only be a problem, if at all, in a relatively distant future.

But is this benign outlook justified? We discuss below the causes of the correlation between GDP per capita and IRGDs. We start by looking into whether the IRGD facts are justified by basic growth theory. We argue that they are not, since lower real interest rates in developing economies than in advanced economies play as large or larger a role in low IRGDs than higher growth. Whereas higher growth in developing economies is consistent with an income catch-up process, lower interest rates are not. We conjecture that lower interest rates are related to captive financial markets, financial repression, and lack of financial development, and we provide supporting econometric evidence in a panel of 128 countries for the period of 1999–2008.

Therefore, non-advanced economies may see their IRGDs increase markedly in the not so distant future—well before their GDP per capita catches up with advanced economies. Rising IRGDs in EMEs could be a relatively fast process, a side effect of financial development and global integration.

This paper is organized as follows. The first section discusses the central role of the IRGD in debt dynamics and presents the basic IRGD facts in relation with income levels. The second section analyzes in more detail IRGDs and their components in non-advanced economies and argues that the profile of IRGDs cannot be explained by a standard income catch-up process. The third section presents evidence suggesting *prima facie* the hypothesis that low IRGDs are rooted in financial repression and distorted financial markets. The following section provides a formal econometric analysis and the statistical results in support of that hypothesis. Finally, the last section draws some conclusions.

II. INTEREST RATE-GROWTH DIFFERENTIALS AND INCOME

Conceptually, the IRGD is the rate at which the debt-to-GDP ratio (henceforth the debt ratio) would grow if the primary balance were zero and debt service (principal and interest) were financed by issuing more debt.

When the IRGD is positive (the interest rate exceeds the growth rate), policies that rely on rolling over debt and interest will result in a ballooning debt ratio and eventually in a debt crisis—the government cannot run a successful Ponzi scheme (Blanchard and Weil (1992)). Also, if the IRGD is positive, stabilizing the debt ratio will require a surplus in the primary balance. This required surplus is proportional to the IRGD and the debt ratio: the higher the debt ratio the higher the primary surplus required to stabilize it, and even higher the primary surplus necessary to place the debt ratio on a firmly declining path (Spaventa (1987), Escolano (2010)). On the other hand, if the IRGD is negative for an extended period, the debt ratio can decline towards zero even if the government runs a primary deficit—thus servicing

existing debt with new borrowing (Bartolini and Cottarelli, 1994). Essentially, output growth outpaces both the snowballing effect of interest payments and the annual addition to debt from a moderate primary deficit.

As a result, the IRGD plays a central role in the outlook for the public finances in advanced and developing economies. In most advanced economies, the IRGD is generally positive when averaged over long periods, preventing successful Ponzi schemes. For example, the IRGD among G-20 advanced economies averaged about 1 percentage point during 1999–2008.⁴ In contrast, among EMEs and LICs, IRGDs have generally been markedly negative, albeit with substantial variability across countries and periods (Table 1). For example, the average IRGD during 1999–2008 was almost -4 percentage points among a broad sample of EMEs and below -7 percent for the total sample of non-advanced economies.⁵

These examples epitomize a broader stylized fact: The IRGD shows a positive correlation with GDP per capita (Figure 1). Most non-advanced economies in the sample had a negative average IRGD in 1999–2008; well below -10 percentage points for a substantial proportion of them. The sample distribution of annual IRGDs confirms that average results are not driven by a small number of year or country outliers (Figure 2). Moreover, evidence from earlier decades for economies where data are available suggests that non-advanced economies have had a lower IRGD than the average for the G-7 at least since the 1970s.

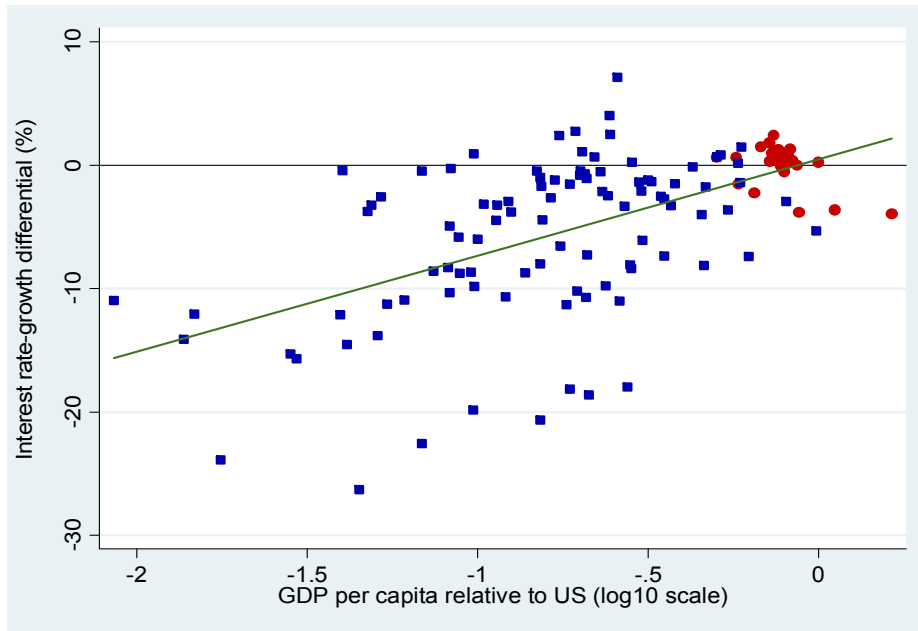
Another marked feature of IRGDs is that non-advanced economies tend to exhibit high within-country volatility in IRGDs and low persistence over time, relative to advanced economies (Table 2).⁶ Interestingly, the within-country volatility of the IRGDs is highest in the emerging economy group. This appears to reflect the fact that financial crises such as debt, currency, and banking crises tend to occur more often in emerging economies with fragile access to international capital market than in financially more closed developing economies. Debt or banking crises tend to raise sharply the IRGD during crises and immediately after, but the effects are of relatively short duration—typically 2–3 years

⁴ A similar value results from averaging broader OECD samples for 1991–2008 (Escolano 2010) and for the 1980s (Blanchard et al. 1990). The IRGD, however, was negative for many advanced economies during the 1970s and in some earlier periods (Reinhart and Sbrancia (2011)).

⁵ For the purposes of this analysis, we consider advanced economies the OECD members in 1990, except for Turkey, to eliminate those which are currently considered advanced economies but they may have been in transition towards a balanced growth path during a significant part of the sample period (such as Korea and new EMU members). Also, we dropped about one third of the low income countries in our sample because concessional debt was a substantial proportion of their debt (above 50 percent of public and publicly guaranteed external debt as reported in World Bank's Global Development Finance database).

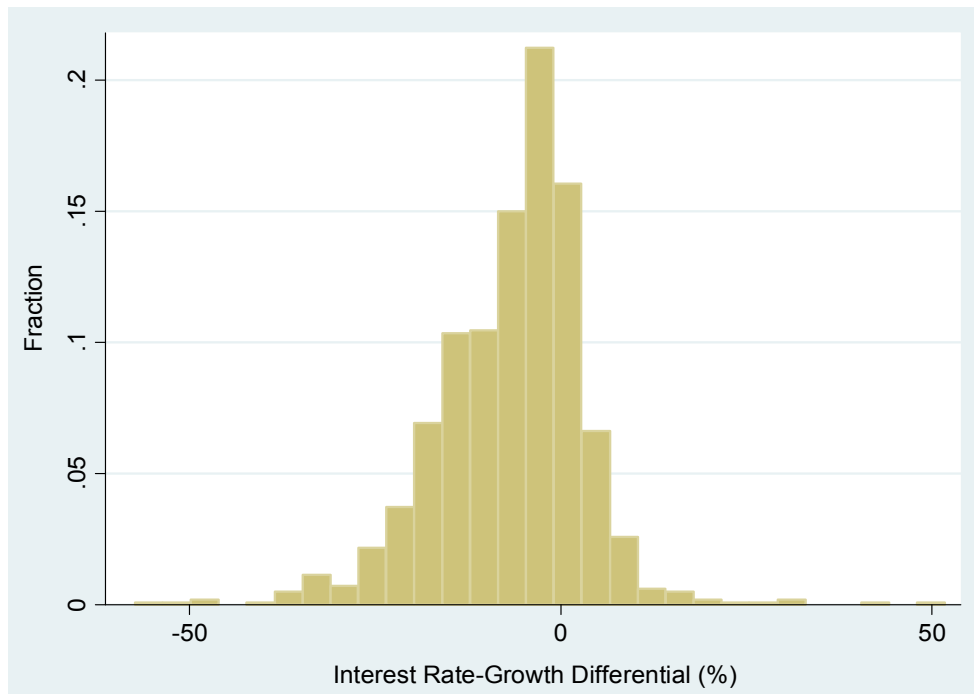
⁶ The volatility is measured by the standard deviation of the IRGD in each country, and the persistence is measured by the first-order autoregressive AR(1) coefficient.

Figure 1. Interest Rate-Growth Differential: 1999–2008 Average¹



¹ Includes currency valuation effects. Red dots indicate advanced economies.
Source: IMF Staff estimates.

Figure 2. Interest Rate-Growth Differential: Non-Advanced Economies, 1999–2008



Source: IMF Staff estimates.

(Appendix 2). On average, low or negative IRGD values tend to be accompanied with greater volatility, and vice versa. While this relationship is not explored further here, it provides a cautionary caveat on the favorable effects of low IRGDs on debt dynamics.

III. THE PUZZLING BEHAVIOR OF THE IRGD IN DEVELOPING ECONOMIES

Economic theory provides reasons to expect that the IRGD be positive, at least in advanced economies. The modified golden rule posits that, abstracting from temporary shocks, the real interest rate should exceed the growth rate in economies that are at, or near, their balanced growth path. The latter is generally thought to describe well the broad growth features of most advanced economies. The theoretical case for the modified golden rule rests on the efficiency of the dynamic equilibrium and the impatience of economic agents (see for example, Blanchard and Fischer (1989)). This theoretical conclusion is consistent with the evidence of the last three decades, as IRGDs for advanced economies have been generally positive.⁷

In contrast, for economies undergoing an income catch-up process, growth theory is ambiguous as to whether the IRGD should be positive or negative, or be higher or lower than in advanced economies—but real interest rates should unambiguously be no lower than in advanced economies. Growth theory provides good grounds to expect faster growth, but also higher real interest rates. For economies closed to financial flows, but with competitive domestic financial markets, the real interest rate would reflect the domestic marginal product of capital—which should be higher than in advanced economies. Higher marginal product of investment is indeed what makes these economies grow faster.⁸ Open economies may have lower real interest rates than their domestic marginal product of capital since they can borrow in international markets at the aggregate world marginal product of capital. Thus, the real interest rate on government debt from these economies should be equal to the real interest rate paid by G-7 governments plus risk, liquidity, and other premia. In practice, one would expect to observe real interest rates that are at some point between the pure closed and open economy cases. In any case, the real interest rate on government debt from non-advanced economies should be generally higher—or at least certainly not lower—than that from G-7 economies.

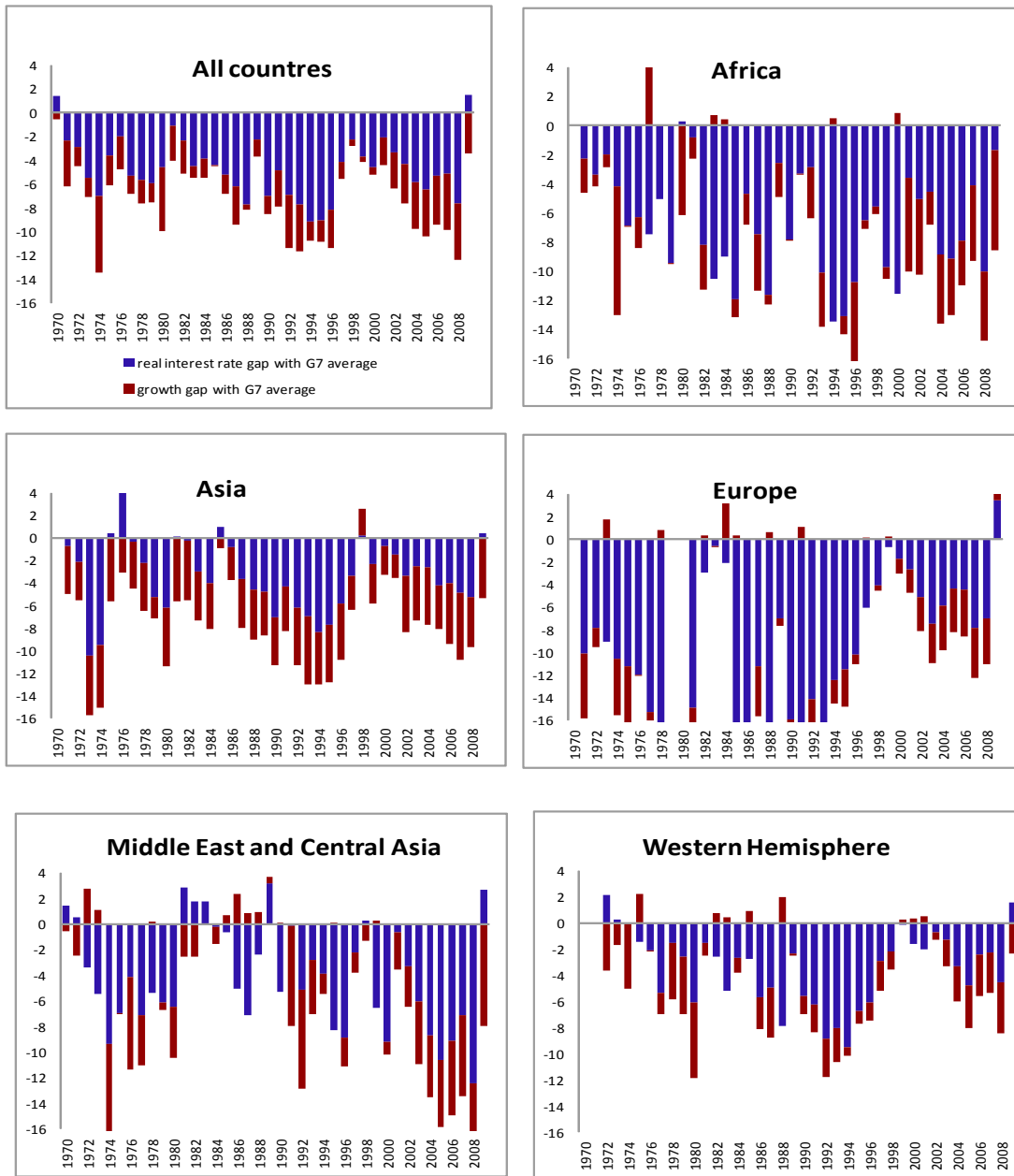
This conclusion is however strongly counterfactual: real interest rates on non-advanced economy government debt are generally substantially lower than on advanced economy debt; and this is the primary reason for lower IRGDs in non-advanced economies (Figure 3⁹).

⁷ For G-7 economies, the IRGD has averaged 2 percentage points during 1980-2009.

⁸ Incidentally, simulations for catch-up economies with realistically calibrated parameters tend to produce, not only higher real interest rates than in advanced economies, but also much higher IRGDs than for advanced economies and hence strongly positive (King and Rebelo (1993)).

⁹ The country sample size in Figure 3 changes (increases) over time due to data availability. Also, the growth-adjusted interest rate represented in this figure is the simple difference between the real interest rate and the real
(continued...)

**Figure 3. IRGD in Non-Advanced Economies Relative to G-7 Average, and Its Components
(In percentage points)**



Note: Real interest rate is corrected by exchange rate effects. Sample varies with time depending on the data availability

Source: IMF Staff estimates.

growth of GDP, both as a differential with respect to the corresponding average for the G-7. This allows the additive decomposition of this differential with the G-7 between the contributions of the real interest rate differential and the real growth rate differential.

During 1999–2008, real interest rates on government debt in non-advanced economies were on average almost 6 percentage points lower than the G-7 average; and their average GDP growth rate exceeded the G-7 average by about 3 percentage points (Table 1). Thus, the “anomalous” behavior of real interest rates in non-advanced economies accounted for about two thirds of the average IRGD difference with respect to the G-7 during 1999–2008.

The evidence therefore strongly suggests that the lower IRGDs in EMEs and most LICs are not primarily rooted in the income catch-up process. Growth rates, by themselves, would not suffice to explain the sharply lower IRGDs in EMEs and LICs relative to advanced economies. Despite higher growth, if real interest rates paid on debt by non-advanced economies had been roughly equal to the average of those paid by G-7 countries plus a market-determined premium, IRGDs in non-advanced economies would have probably been higher than IRGDs in advanced economies. For example, during 1999–2008, should EMEs have paid on average the same real interest rate as G-7 countries plus an average spread of 5 percentage points (the average EMBI spread above US Treasuries over the period), their average IRGD would have been about 3 percentage points, rather than the observed -4 percentage points. This illustrative calculation implicitly assumes that the economy has a fully open external financial account. Real interest rates in closed or partly closed economies would be, in principle, even higher, reflecting the higher marginal product of the relatively scarce domestic capital.

IV. WHY ARE INTEREST RATES SO LOW IN EMEs?

In view of the evidence, it is difficult to think of reasons for the “anomalous” behavior of real interest rates that do not involve severe financial sector and market distortions, including captive savings markets, directed lending, interest rate controls, or lack of financial development. The stylized facts point persuasively in that direction. We briefly discuss them here and develop more formal econometric testing of this conjecture in the following section.

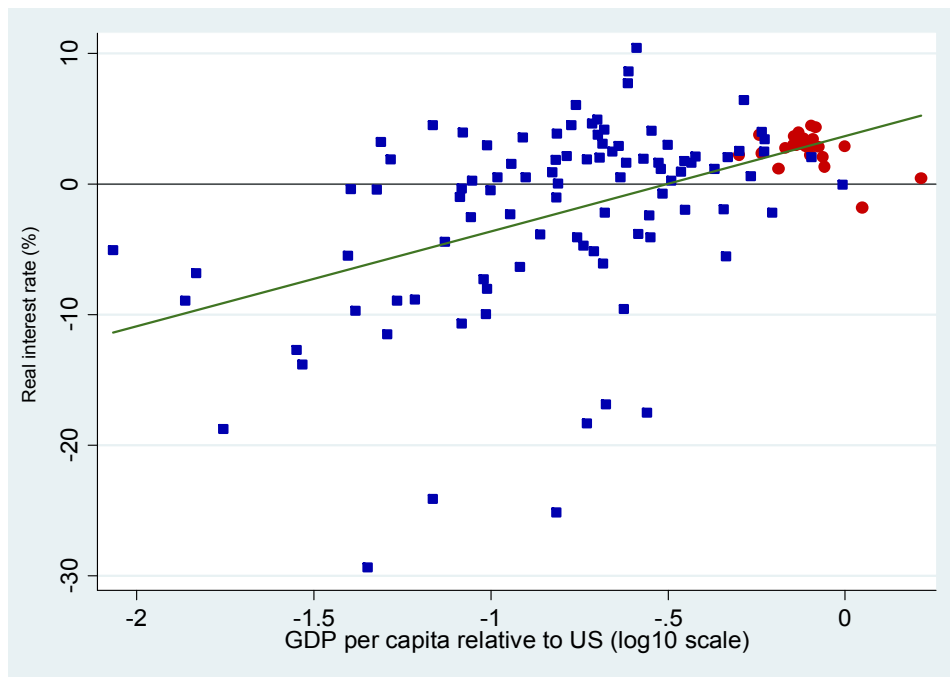
In a financially repressed economy, capital is underpriced by lenders. The returns on bank deposits are low and could be negative in real terms during inflationary periods. Typical elements of financial repression include legal ceilings on bank lending and deposit rates; high reserve ratios; substantial entry barriers into banking often combined with public ownership of major banks; quantitative restrictions on credit allocation and government-directed lending by financial institutions (including captive institutional investors such as pension funds); subsidized lending interest rates; and restrictions on capital transactions (McKinnon (1973) and Shaw (1973)).

Reinhart and Sbrancia (2011) documents key features of episodes of financial repression in advanced and non-advanced economies. They argue that capital controls, nominal interest rate ceilings, and persistent steady inflation can succeed in maintaining real interest rates on government debt at low or negative levels, driving down government debt ratios. The financial system is used as a way to extract resources by levying an inflation tax on currency,

and by borrowing at below-market rates. Reinhart and Sbrancia (2011) estimates that during 1945–80 the reduction in public debt burden via negative real interest rates due to financial repression in advanced economies was large, ranging from 3–5 percent of GDP a year in Australia, Italy, the United States, and the United Kingdom.

Effective real interest rates on government debt show a positive correlation with income per capita (Figure 4). As discussed above, this is at variance with the hypothesis that real interest rates in most EMEs and LICs reflect the domestic marginal product of capital or a basic international riskless rate plus a country-specific premium. The country-specific volatility of real interest rates on government debt shows an inverse relationship with income per capita (Figure 5). This suggests that return risk declines with higher income per capita. Other risks—such as liquidity or credit risks—are also typically seen by lenders as broadly declining with increasing income per capita. As a result, the yield spread of the EMBI over US Treasuries (generally positive) stands in sharp contrast to the spread over U.S. Treasuries of the effective interest rates actually paid on average by non-advanced economy government debt (Figure 6).

Figure 4. Real Interest Rates: 1999–2008 Average¹

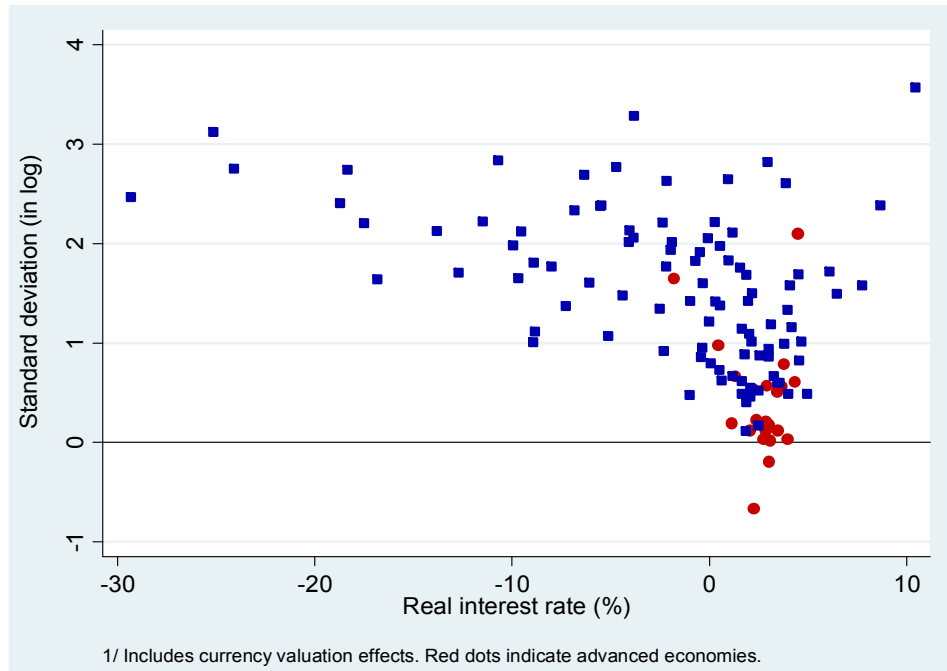


¹ Real interest rates include currency valuation effects.

Red dots indicate advanced economies.

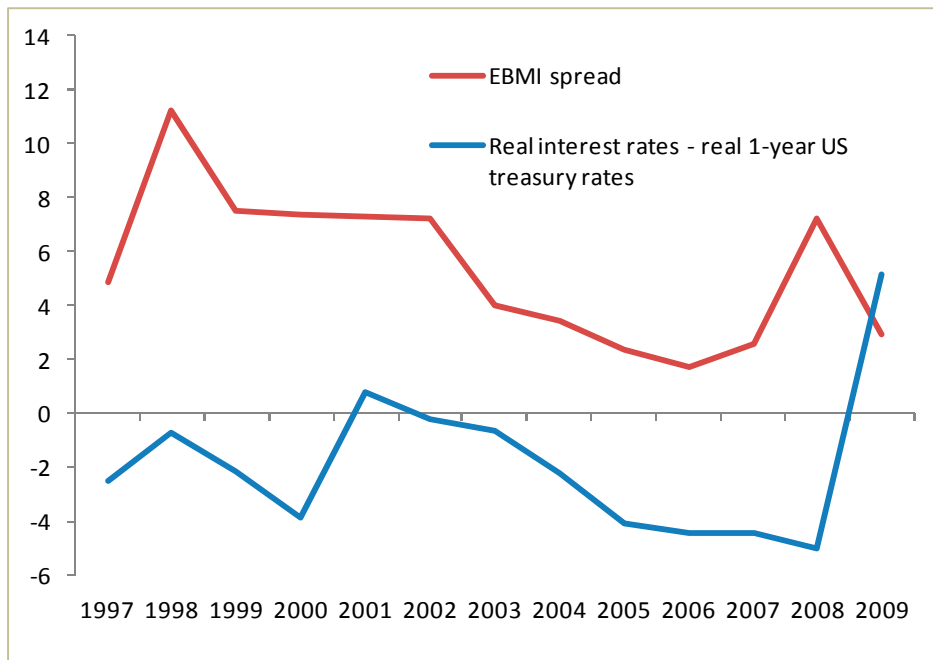
Source: IMF Staff estimates.

Figure 5. Real Interest Rates and Volatility: 1999–2008 Average¹



¹ Includes currency valuation effects. Red dots indicate advanced economies.
 Source: IMF Staff estimates.

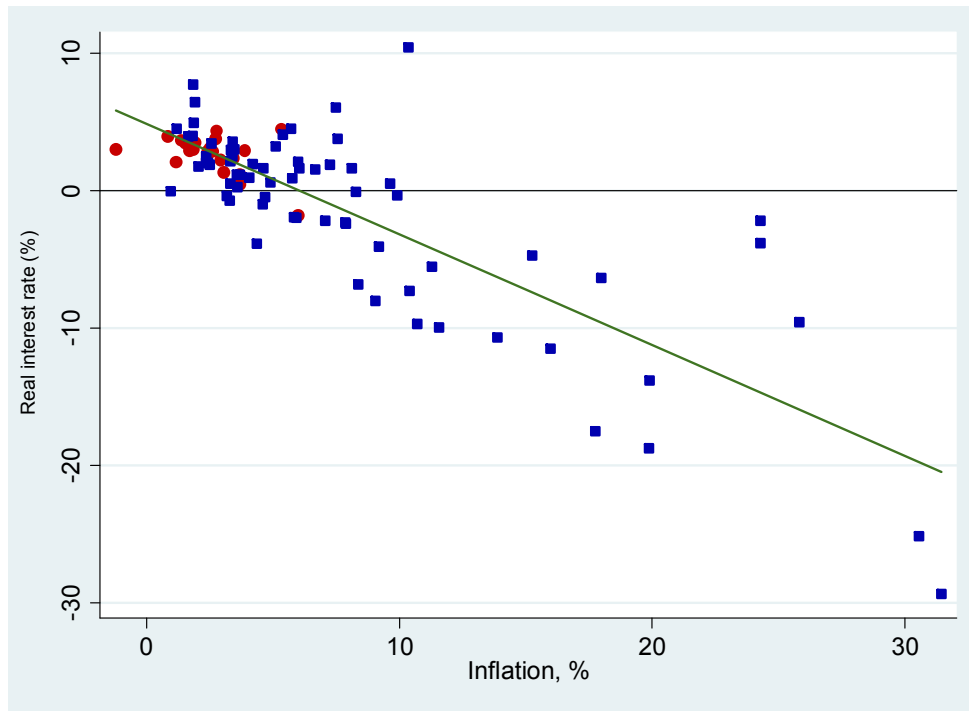
Figure 6. Real Interest Rates and Non-Advanced Economies and EMBI Spread



Source: JPMorgan EMBI, IMF staff estimates.

Real interest rates are inversely related to inflation and are negative for extended periods of time in many of the non-advanced economies in the sample. While lenders may fail to anticipate occasional surges in inflation, its systematic role in driving down real interest rates (Figure 7 and econometric results below) requires financial repression and possibly a ban on indexed or foreign currency-denominated instruments. Anecdotal evidence from many EMEs with open financial markets shows that, in the absence of forceful financial controls, hedging instruments (including dollarization, inflation indexation, or widespread holdings of financial assets abroad) develop easily in response to persistent inflation. Other indicators of financial repression and financial distortions also point in this direction (Figure 8).

Figure 7. Real Interest Rates and Inflation: 1999–2008 Average¹

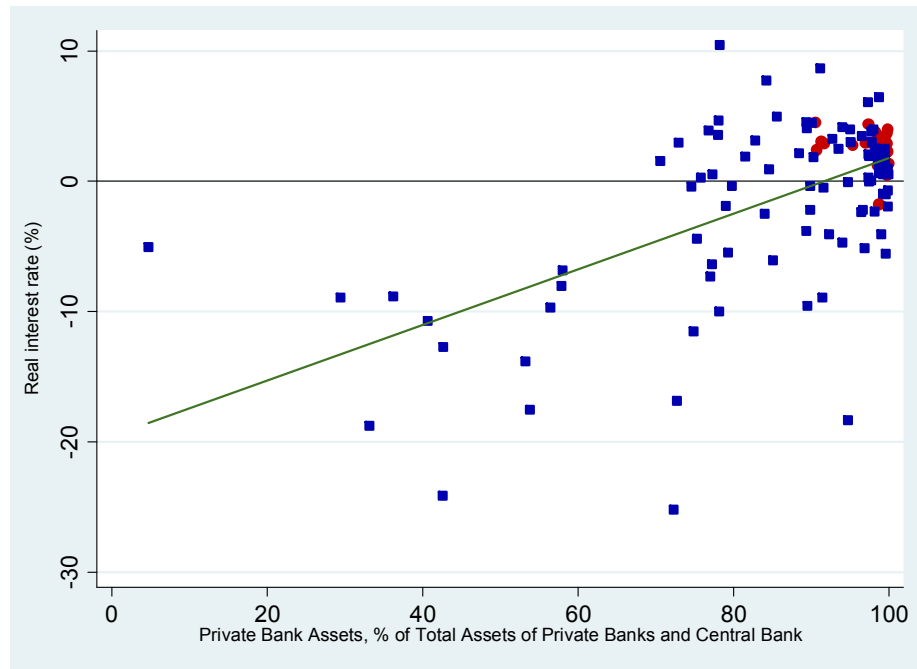


¹ Real interest rates include currency valuation effects.

Red dots indicate advanced economies.

Source: IMF Staff estimates.

Figure 8. Real Interest Rates and Financial Development: 1999–2008 Average¹

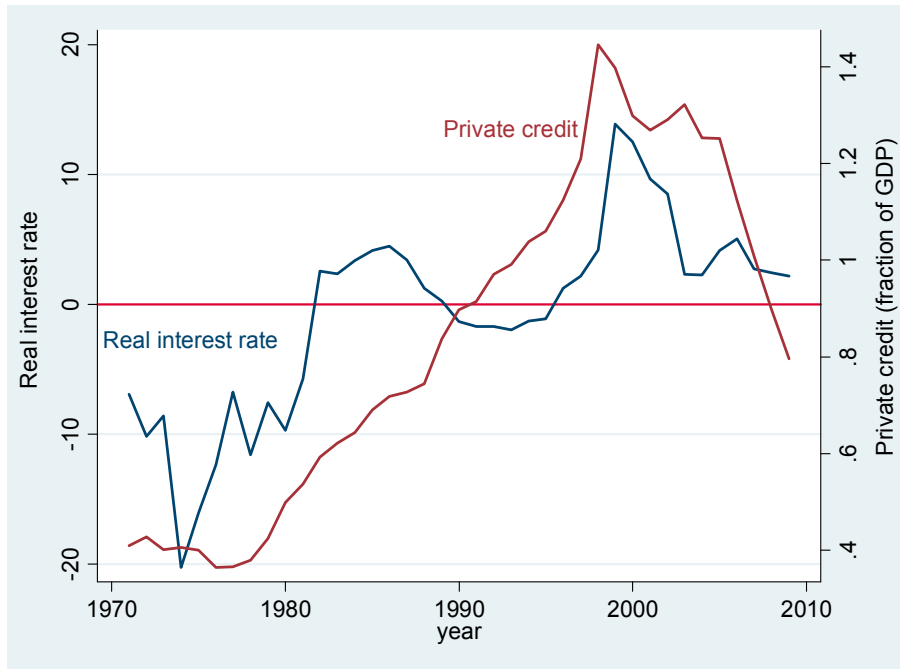


¹ Real interest rates include currency valuation effects. Red dots indicate advanced economies. Source: Beck, et al. (2000, updated 2010), IMF Staff estimates.

In turn, financial reforms are typically followed by substantial increases in real interest rates. Some examples of this process from different regions are Chile, Israel, Korea and South Africa, where real interest rates turned positive from large negative levels after major financial reforms in the 1980s and 1990s. In fact, real interest rates moved almost in tandem with the development of private credit markets in Korea and South Africa (Figures 9 and 10).

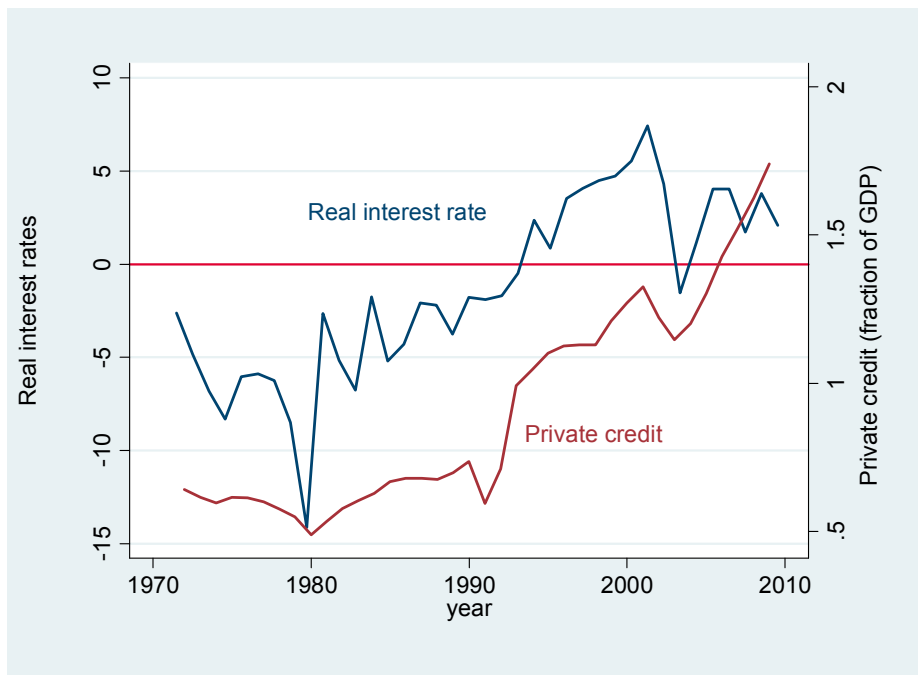
While financial liberalization reforms have been implemented in many emerging economies in recent decades, significant financial repression elements remain in place in many non-advanced economies. During 1998–2008, 25 percent of non-advanced economies had deposit or lending rates regulations, 13 percent had credit controls, 34 percent had entry barriers to domestic banking sector and 55 percent had significant restrictions on capital inflows and outflows (Abiad et al. (2008)).

Figure 9. Korea: Real Interest Rates and Private Credit¹



Note: 1/ Real interest rates include currency valuation effects.
 Source: Beck, et al. (2000, updated 2010), IMF Staff estimates.

Figure 10. South Africa: Real Interest Rates and Private Credit¹



Note: 1/ Real interest rates include currency valuation effects.
 Source: Beck, et al. (2000, updated 2010), IMF Staff estimates.

V. ECONOMETRIC TESTING OF THE FINANCIAL DISTORTIONS HYPOTHESIS

This section presents evidence on the relationship between real effective interest rates¹⁰ and financial repression. The empirical analysis is based on an annual panel data set for 1999–2008 with 128 advanced and non-advanced countries – after eliminating those with concessional debt exceeding 50 percent of their external public and publicly guaranteed debt.

Estimated model

The analysis below draws on a large empirical literature on the determinants of sovereign bond yields. Fiscal deficits, public debt, and financial system are main determinants of cross-country variations in long-term sovereign bond yields (Baldacci and Kumar (2010); Adagna et al. (2004); Gale and Orzag (2003)). Building on this literature, we select and include a set of controls. In this framework, we assess the impact of financial repression (or financial development) on the real effective interest rates.

The baseline panel regression specification for real interest rates is as follows:

$$r_{it} = \alpha r_{it-1} + \mathbf{X}_{it}'\beta + \gamma Z_{it} + v_i + \eta_t + \varepsilon_{it},$$

where r_{it} denotes the real effective interest rate for country i and year t ; v_i is the country-specific fixed effect (to control for country-specific factors including the time-invariant component of the institutional environment); η_t is the time-fixed effect (to control for global factors); ε_{it} is an error term; \mathbf{X}_{it} is a vector of fiscal and economic control variables; and Z_{it} is the measure of financial repression (or financial development).¹¹

\mathbf{X}_{it} includes the following:

- Fiscal variables: (i) lagged public debt in percent of GDP, and (ii) change in public debt in percent of GDP, which essentially measures fiscal deficits. Primary balance and

¹⁰ Consistently with estimates in previous sections, effective interest rates are computed as the government's actual interest cost divided by the stock of debt at the end of the previous year, adjusted for currency valuation effects.

¹¹ The dynamic panel regression is estimated by employing a system GMM approach, which uses suitable lagged levels and lagged first differences of the regressors as their instruments in order to mitigate the endogeneity problem (Arellano and Bover (1995); Blundell and Bond (1998)). The results from different estimation methods such as OLS or 5-year panel regressions are quite similar. Although results for longer time periods such as 1980-2008 are remarkably similar and often stronger, we focus on the period of 1999-2008 (post-Asian crisis period) because panel data are significantly unbalanced for longer periods with many missing observations especially for emerging and developing economies.

overall fiscal balances were considered as an alternative measure of fiscal deficits, but the results were largely the same.¹²

- Real GDP growth to control for the country's cyclical position. Also, fast-growing countries tend to save more than slowly-growing countries.¹³
- Domestic private savings and population aging. Economies with high domestic private savings and lower aged-dependency ratio tend to be more able to absorb a large increase in the government bond supply. It is not reported, as it was not significant and did not alter the results.
- US dollar 6-month Libor (real) was also tried to control for global liquidity conditions while dropping time-fixed effects. It did not alter the results. It is not reported as the alternative specification with time-fixed effects was chosen because it captures a wider range of global conditions.

Z_{it} contains indicators of financial repression (or development). These were included in the estimation successively or simultaneously, as noted below.

- Commercial bank claims on non-financial sectors as percent of total claims of commercial and central banks on non-financial sectors (from the database on financial development and structure, Beck, et al. (2000, updated 2010)). This measures the relative importance of commercial banks vis-à-vis the central bank. Higher values of this measure indicate that commercial banks have a larger role in financial intermediation relative to official credit—an indicator of financial development. King and Levine (1993) and Beck et al. (2000) find positive relationship between this indicator and economic growth.
- Private credit (as percent of GDP) extended to the private sector by deposit money banks and other financial institutions (from Beck, et al. (2000, updated 2010)). This measure is typically associated with growth.
- Inflation. A negative and significant coefficient would indicate a consistent and prolonged association between high inflation and low real interest rates. This points to a

¹² The effective interest cost of public debt also depends importantly on debt structure, debt management policies, taxation and other institutional factors, but there are no consistent data available in these features for a large number of countries.

¹³ An underdeveloped financial system can lead to higher savings (Baldacci et al. (2010); Caballero et al. (2008)). In a growing economy where the desired consumption bundle shifts towards durable goods, inability to borrow against future income streams could lead households to save more in order to self-finance their purchases. However, Edwards (1996) argues that financial deepening induces higher saving by creating more sophisticated financial systems.

systematic erosion of interest cost by inflation—a feature of captive financial and markets financially repressed environments (Reinhart and Sbrancia (2011)). Also, inflation may discourage financial development and encourage savings in real estate.

- Financial liberalization index (from Abiad, et al. (2008), normalized between 0 and 1). It is based on the presence of credit restrictions, high reserve ratio, interest rate controls, and restriction on entry to banking and on capital transactions with foreigners.
- Capital account openness index (normalized between 0 and 1) from Chinn and Ito (2002, update 2010), based on the IMF's Annual Report on Exchange Arrangement and Exchange Restrictions. Capital account liberalization erodes financial repression and frees captive markets by offering alternative investment opportunities to domestic savers.
- Principal components summarizing the common information contained in some of the above variables (commercial bank assets, private credit, liquid liabilities, capital market openness, and inflation). The first principal component appears to capture the common aspect of financial development among them, while the second component assigns a relatively very large weight to inflation.¹⁴

Empirical results

Indicators of financial repression or lack of financial development are found to be significantly associated with lower real effective interest rates (Table 3).¹⁵ The coefficients of commercial bank assets (as a ratio to commercial and central bank assets), private credit, financial liberalization index, and capital openness index have positive sign, as postulated, and all are significant at the 1–5 percent level.

Also, the implied magnitude of the impact of financial development indicators on real interest rates is economically meaningful. To put this in perspective, let us take the case of commercial bank assets. During the 1999–2008, the real interest rates in non-advanced and

¹⁴ The two first principal components account for 70 percent of total variance in the original variables. Since the number of observations available for the financial liberalization index is less than half of those of other financial repression measures, we did not include the financial liberalization index in the principal components analysis. However, the results do not change appreciably if we include it at the cost of fewer observations.

¹⁵ We performed two standard tests of the validity of the instruments—Arellano and Bover (1995) and Blundell and Bond (1998)—which were both passed. The first is a Hansen J-test of over-identifying restrictions, which tests the overall validity of the instruments by analyzing the sample analog of the moment conditions used in the estimation process. We cannot reject the null hypothesis that the full set of orthogonality conditions are valid (for example, p -value=0.29 for the regression in Column 1). The second test examines the hypothesis that the error term ε_{it} is not serially correlated. We use an Arellano-Bond test for autocorrelation, and find that we cannot reject the null hypothesis of no second-order serial correlation in the first-differenced error terms (p -value=0.68 for the regression in Column 1).

advanced economies were on average -2.7 percent and 2.6 percent respectively, while the average levels of commercial bank assets in non-advanced and advanced economies were respectively 84 percent and 97 percent of total (commercial and central bank) assets. The coefficient of commercial bank assets (0.144 in Column 1) suggests that, other things being equal, the real interest rate would rise by 1.9 percentage points if the level of commercial bank assets were to rise from 84 percent to 97 percent. Thus, this financial development indicator alone accounts for 36 percent of the contemporaneous 5.3 percentage point gap in average real interest rates between the advanced and non-advanced economy groups. If, in addition, the dynamic effects are also taken into account, its impact is even larger. The *long-run* effect (as measured by $\gamma/(1-\alpha)$) of an increase in the commercial bank asset ratio from 84 percent to 97 percent would be a rise in the real interest rate of about 3 percentage points.

Similarly, the coefficient of private credit (0.03 in Column 3) indicates that the real interest rate would increase by 2.3 percentage points if the private credit level were to rise from 42 percent of GDP (non-advanced economy average) to 118 percent of GDP (advanced economy average). The corresponding long-run effect would be a 4 percentage point rise in the real interest rate.

The coefficients of financial liberalization index and capital openness indices are also significant at 1–5 percent and of positive sign, indicating that financial liberalization and capital account openness tend to be accompanied with increases in real interest rates (Columns 2, 4, and 5). The regression coefficients suggest that the real interest rate would rise by about 3.4 percentage points if the financial liberalization level rose from the average level in non-advanced economies (0.72) to that in advanced economies (0.94). Similar results are obtained for the capital account openness index. Column 2 shows that commercial bank assets and capital account openness enter the regression with significant coefficients when we include them together in the regression. Inflation is strongly negatively associated with real interest rates and significant at 1 percent (Column 6). The regression coefficient suggests that a 1 percentage point increase in inflation is associated with a reduction in real interest rate around 0.69 percentage point.

The first and second principal components of the variables of financial repression are also significant and of the expected sign (column 7)—note that the second component assigns a very large weight to inflation, which enters the regression with a negative coefficient as expected. The order of magnitude of the impact of the second component is comparable to that of inflation. One percentage point of inflation amounts to 0.1 standard deviation in the sample, and represents an increase in the second principal component by 0.072 because the weight (loading factor) in the second principal component is 0.72. Thus, the implied magnitude of effect on real interest rate would be -0.48 percent (0.072 times -6.66).

We tested for the presence of non-linear effects. Columns 8–9 show the regression results when the measure of financial development (commercial bank assets, private credit) and its squared term are included together. The coefficient of the squared term is insignificant; and

also the coefficient of financial development itself becomes insignificant (commercial bank assets in Column 8) or weakens (private credit in Column 9). Similar results are obtained in the non-advanced country sample only (column 10), and also for longer periods (not shown).

Finally, the same regression exercises were conducted excluding the episodes of high inflation (above 20 percent) to check whether the results are driven by some of the high inflation episodes (Table 4). Results were largely unchanged. The coefficients of financial repression indicators remain significant at conventional levels, except for capital account openness that becomes insignificant. The order of magnitude of estimated impact of financial development on real interest rates is also similar, albeit slightly smaller.

VI. CONCLUSIONS

Low values of the IRGD in non-advanced economies have provided strong support to their debt sustainability. The average IRGD for these economies in 1999–2008 was about -7 percent (more than 8 percentage points lower than the G-7 average). For an average non-advanced economy, this means that the government debt ratio would have been reduced by half during that period by the combined effect of growth and low real interest rates alone. This allowed a looser fiscal position than otherwise would have been possible.

It is sometimes taken for granted that low, negative values of the IRGD are an intrinsic feature of the income catch-up process. And thus, they will only disappear very gradually as GDP per capita converges to advance-economy levels. However, most of the IRGD downward pressure on debt ratios is due to real interest rates on government debt much lower than in G-7 economies—well below what could be considered the interest rate that would prevail in a competitive market for savings. Growth, while important, played on average a comparatively lesser role. The evidence strongly suggests that these low (often negative) real interest rates stem from domestic financial market distortions, captive savings markets, and financial repression. Therefore, non-advanced economies could see their IRGD rise substantially in a relatively short period as a result of global financial integration and financial development—well before their GDP per capita catches up with advanced economies.

This has implications for the medium-term fiscal strategies of many EMEs and LICs. Emerging Eastern Europe, Western Hemisphere, and Asia appear to have already experienced in 1999–2008 higher real interest rates relative to earlier decades owing to their rising international financial integration and financial opening. This process is likely to continue apace and increasingly encompass virtually all emerging economies. Countries aiming at developing their domestic financial sector and planning liberalization reforms should also plan for associated fiscal policy reforms to accommodate rising costs on government debt.

Appendix 1. Derivation of Interest Rate-Growth Differential

With a portion of debt denominated in foreign currency, debt dynamics equation can be written:

$$D_t^d + e_t D_t^f = (D_{t-1}^d + e_t D_{t-1}^f) + (i_t^d D_{t-1}^d + i_{t-1}^f e_t D_{t-1}^f) - P_t \quad (1)$$

where D_t^d and D_t^f are domestic and foreign currency debt at end of period, respectively; e_t is spot exchange rate at end of period; i_t^d and i_t^f are nominal interest rates paid in period t on the domestic and foreign currency debt outstanding at end of t-1; and P_t is primary balance in t. Let $D_t \equiv D_t^d + e_t D_t^f$ (sum of domestic and foreign currency debt expressed in domestic currency); $\alpha_t \equiv D_t^d/D_t^f$ (share of domestic currency debt in total debt at t); $\frac{e_t}{e_{t-1}} \equiv 1 + \epsilon_t$ (ϵ_t is rate of nominal depreciation).

Then, (1) can be re-arranged as:

$$D_t = D_{t-1} + ((1 - \alpha_{t-1})\epsilon_t + i_t)D_{t-1} - P_t \quad (2)$$

where $i_t \equiv i_t^d \alpha_{t-1} + i_{t-1}^f (1 - \alpha_{t-1})e_t/e_{t-1}$ is the weighted effective interest rate; $(1 - \alpha_{t-1})\epsilon_t D_{t-1}$ captures the valuation change in the foreign currency debt portion due to exchange movements (i.e., capital gains/losses in terms of domestic currency).

In order to express the equation (2) in terms of share of nominal GDP, define $Y_t = (1 + \gamma_t)Y_{t-1}$; $\rho_t \equiv (1 - \alpha_{t-1})\epsilon_t + i_t$; $d_t \equiv D_t/Y_t$; and $p_t \equiv P_t/Y_t$.

Equation (2) can be written

$$d_t - d_{t-1} = \left[\frac{\rho_t - \gamma_t}{1 + \gamma_t} \right] d_{t-1} - p_t \quad (3)$$

The interest rate-growth differential refers to $\left[\frac{\rho_t - \gamma_t}{1 + \gamma_t} \right]$, and in case of no foreign currency debt (i.e., $\alpha_{t-1} = 1$), the differential is reduced to a more familiar expression $\left[\frac{i_t - \gamma_t}{1 + \gamma_t} \right]$, which is also equivalent to $\left(\frac{r-g}{1+g} \right)$ where r is real interest rate and g is real GDP growth rate.

Appendix 2. Financial Crises and Dynamics of the IRGD

Here we examine the impact of financial crises (currency, banking, and sovereign debt crisis) on the IRGD. As noted earlier, when a portion of debt is denominated in foreign currencies, the IRGD includes a term that captures valuation changes due to exchange rate movements. This is important for emerging and developing economies where the share of foreign currency debt is significantly large. During a currency crisis, large nominal depreciation of the domestic currency can sharply increase domestic currency value of foreign currency debt and of its debt servicing costs. At the same time, output tends to fall sharply before large depreciation boosts output recovery via export later on. In short, a currency crisis can sharply raise the differential, making the debt dynamics highly unfavorable at least in the short run. Similarly, banking and sovereign debt crises are expected to have significant impact on the IRGD.

The methodology used to assess the impact of financial crises on the IRGD follows Cerra and Saxena (2008). By using qualitative indicators of financial crises, we estimate the impulse response function to the shocks. Given that data cover a large number of countries, the panel data analysis is used and group averages of the impulse responses of $r-g$ to each type of shock are provided. Specifically, it estimates an univariate autoregressive model that is extended to include the current and lagged impacts of the shock, and to derive the relative impulse response functions (IRFs):

$$q_{it} = \alpha_i + \sum_{j=1}^4 \beta_j q_{i,t-j} + \sum_{s=0}^4 \delta_s D_{i,t-s} + \varepsilon_{i,t} ,$$

where i is a country, t is a year, q is the annual observation on the IRGD, D is a dummy variable which is equal to 1 during a crisis (currency, banking, or domestic government debt crisis), and α_i are country fixed effects.¹⁶ The equation is estimated on an unbalanced panel of annual observations from 1980 to 2010. The number of lags has been restricted to 4, but the presence of additional lags was rejected by the data. As financial crises are proxied by a dummy, the effect captured also encompasses the policy reaction triggered by the crisis and its consequences on the real economy. However, it is not easy to disentangle the pure crisis effect from the policy response, given the absence of a counterfactual.

Impulse response functions (IRFs) are obtained by simulating a shock on the crisis dummy.¹⁷ The shape of these response functions depends on the value of the δ and β coefficients, the

¹⁶ Panel unit root tests reject the presence of unit roots in the differential in the data. The country fixed-effects are correlated with the lagged dependent variables in the autoregressive model. The order of bias is $1/T$ (Nickell, 1981), which is small in this data. Judson and Owen (1999) also show that the bias of the least squares dummy variable (LSDV) estimators is approximately 2-3 percent on the lagged dependent variable and less than 1 percent on other regressors for a panel of size $N=100$ and $T=30$ and low persistence.

¹⁷ D_t is set equal to 1 for only one period and assumed to be zero otherwise. Data are from Reinhart and Rogoff (2009).

coefficients associated with the financial crisis dummy and past interest rate-growth differential. For instance, the simultaneous response will be δ_0 , while the one-year ahead response will be $\delta_1 + \beta_0\delta_0$, and so on. The 95 percent confidence intervals are derived from 1000 bootstrap replications.

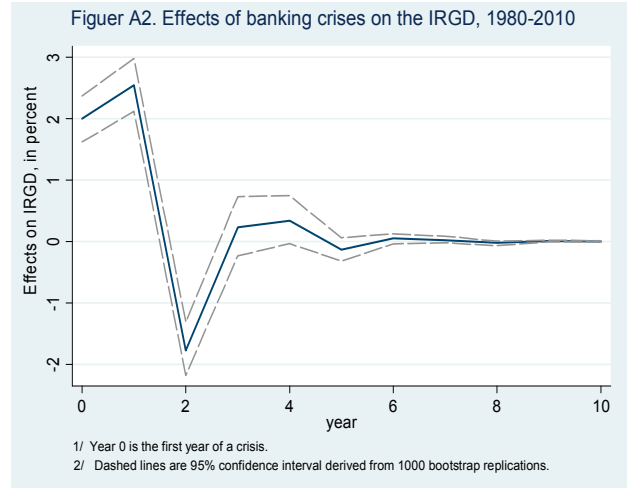
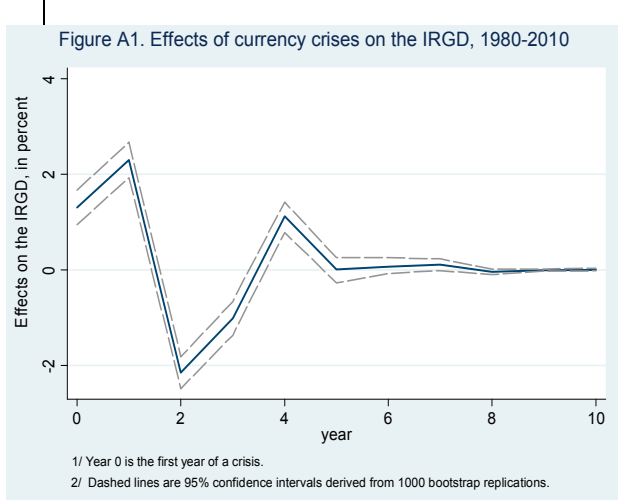
Overall, the IRGD tends to sharply rise during and immediately after the crisis (debt, banking or currency crisis), but the crisis impact on the IRGD is of relatively short duration. The effects of a currency crisis on IRGD are 1.3 and 2.3 percentage points in the first two years, respectively (Figure A1). However, the impact gets smaller over time and disappears by the fifth year, with the IRGD returning to the pre-crisis level.¹⁸

The dynamics of the impact on the IRGD of a banking crisis is similar to that of a currency crisis (2 and 2.5 percentage points in the first two years) and short-lived as well (Figure A2). Intuitively, the magnitude of impact on the IRGD is likely to vary with the severity of the crisis in terms of depth and duration, implying that an average estimate would overstate the impact of smaller financial crises and understate that of severe ones. The severe banking crises are estimated to have a more pronounced impact on the IRGD, compared to the average impact of all banking crises— at its peak in the second year, the IRGD rises by more than 11 percentage points above the pre-crisis level, but again tends to fade within 4–5 years.¹⁹ The sovereign domestic debt crises are estimated to have the most pronounced impact on the IRGD (Figure A3).²⁰ Unlike the currency and banking crises that tend to have largest effects with delay of a year or two, however, a debt crisis sharply raises the IRGD in the first year of the crisis (by about 18 percentage points above the pre-crisis level), followed by smaller impact in subsequent years.

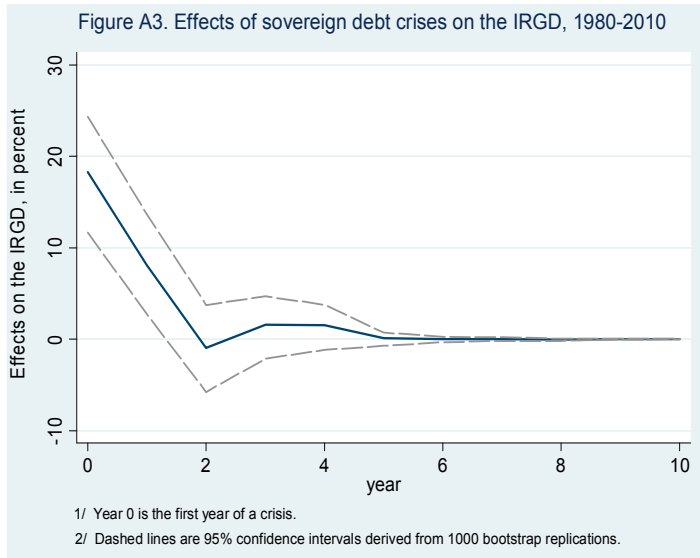
¹⁸ The coefficients of the first two lagged terms of the crisis dummy variable are statistically significant at the 1-5 percent level. Similarly, the coefficients of the crisis dummy and its lagged terms in the regressions for banking and sovereign debt crises are mostly significant at the conventional level.

¹⁹ The same estimation is also repeated only for the big five banking crises identified by Reinhart and Rogoff (2008) and four additional recent episodes (Laeven and Valencia (2010)): Spain (1977), Norway (1987), Finland (1991), Sweden (1991), Japan (1992), United States (2007), United Kingdom (2007), Ireland (2008) and Iceland (2008) (not shown to save space).

²⁰ Even in the absence of a debt crisis, high levels of sovereign debt are significantly negatively associated with subsequent growth and positively with sovereign bond yields (Kumar and Woo (2010); Baldacci and Kumar (2010), respectively), which in turn raises the IRGD. After controlling for other variables such as initial income per capita, inflation, trade openness, indicators of financial repression and capital market openness, the public debt is significantly and positively associated with the IRGD in a panel regression for our sample of countries for various periods (not reported to save space).



Source: IMF Staff estimates



**Table 1. Summary Statistics on Interest Rate-Growth Differentials (IRGD), Real Interest Rates (r), and Real GDP Growth Rates (g)
(in Percentage Points)**

	No. of obs.	r				g				r-g	IRGD 1/			
		Mean	S.T.D.	Min	Max	Mean	S.T.D.	Min	Max	Mean	Mean	S.T.D.	Min	Max
Based on all available annual data on r-g in 1966-2010 2/														
Advanced Economies 3/	715	3.16	3.90	-14.51	25.61	2.58	2.48	-8.02	11.51	0.58	0.63	4.73	-18.09	30.02
G-7	257	3.42	3.18	-14.51	11.33	2.42	2.24	-5.22	10.27	1.00	1.03	3.72	-13.29	11.70
G-20 Advanced Economies	279	3.62	3.33	-14.51	15.72	2.48	2.19	-5.22	10.27	1.15	1.16	3.83	-13.29	16.75
Non-advanced Economies	2149	-2.02	10.17	-81.45	84.09	4.71	6.17	-19.27	149.97	-6.73	-6.10	11.46	-87.50	106.59
Emerging Economies	532	0.97	8.38	-51.91	84.09	4.47	4.38	-17.98	21.18	-3.50	-3.07	10.56	-53.19	106.59
G-20 Emerging Economies	187	2.04	9.73	-16.64	84.09	4.73	4.29	-10.90	14.19	-2.69	-2.23	12.44	-22.21	106.59
Developing Countries	1617	-3.00	10.51	-81.45	60.21	4.79	6.65	-19.27	149.97	-7.80	-7.10	11.58	-87.50	52.10
Based on all available annual data in 1999-2008														
Advanced Economies 3/	230	2.59	2.58	-8.18	17.83	2.74	1.92	-3.55	10.89	-0.15	-0.11	3.21	-11.08	16.69
G-7	70	3.25	1.28	1.35	7.30	1.99	1.41	-1.31	5.53	1.26	1.25	1.51	-1.82	5.43
G-20 Advanced Economies	80	3.20	1.34	1.08	7.30	2.17	1.42	-1.31	5.53	1.03	1.02	1.61	-2.46	5.43
Non-advanced Economies	1315	-2.74	8.78	-51.13	84.09	5.22	4.70	-18.81	63.38	-7.96	-7.31	10.15	-57.33	106.59
Emerging Economies	317	0.97	8.05	-18.93	84.09	5.11	3.31	-10.90	21.18	-4.15	-3.74	9.93	-27.73	106.59
G-20 Emerging Economies	104	1.85	11.04	-16.64	84.09	5.12	3.74	-10.90	14.19	-3.26	-2.77	13.86	-22.21	106.59
Developing Countries	998	-3.92	8.68	-51.13	43.65	5.25	5.07	-18.81	63.38	-9.17	-8.44	9.96	-57.33	51.77

1/ The IRGD, which is computed as $(r-g)/(1+g)$, is the relevant factor for the debt dynamics. See Appendix 1 for details.

2/ Data availability is significantly different across countries during the period of 1966-2010.

3/ Advanced economies are defined as the OECD Members as of 1990, excluding Turkey, which is classified as an emerging economy.

Table 2. Average by Country Groupings: Within-Country Volatility and Persistence of Interest Rate-Growth Differentials (IRGD)¹

	Countries	Volatility within-country standard deviation of IRGD				Persistence AR (1) Coefficient			
		Mean	S.T.D.	Min	Max	Mean	S.T.D.	Min	Max
		1966-2010 2/							
Advanced Economies 3/	23	4.15	1.82	2.32	9.57	0.48	0.20	0.08	0.79
G-7	7	3.43	0.97	2.37	4.81	0.53	0.18	0.24	0.70
G-20 Advanced Economies	8	3.60	1.01	2.37	4.81	0.55	0.17	0.24	0.70
Emerging Economies	32	9.00	6.66	3.18	34.01	0.31	0.28	-0.15	0.80
G-20 Emerging Economies	11	10.24	9.80	3.18	34.01	0.19	0.28	-0.15	0.63
Developing Countries	95	8.03	5.00	2.12	24.74	0.17	0.31	-0.62	0.75
1999-2008 4/									
Advanced Economies	23	2.28	1.72	0.96	8.26				
G-7	7	1.36	0.34	0.96	1.82				
G-20 Advanced Economies	8	1.38	0.32	0.96	1.82				
Emerging Economies	32	6.96	6.49	1.69	37.09				
G-20 Emerging Economies	11	8.83	10.28	2.48	37.09				
Developing Countries	101	6.27	3.71	1.38	20.92				

- 1/ The IRGD, which is computed as $(r-g)/(1+g)$, is the relevant factor for the debt dynamics. See Appendix 1 for details.
- 2/ The sample of countries is restricted to those with at least 10 observations are available in the period of 1966-2010.
- 3/ Advanced economies are defined as the OECD Members as of 1990, excluding Turkey, which is classified as an emerging economy.
- 4/ The sample of countries is restricted to those with at least 7 observations are available in the period of 1999-2008.

Table 3. Panel Regression: Real Effective Interest Rates and Financial Repression (Development)
Dependent Variable: Real Effective Interest Rates (in percent)¹

VARIABLES	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample	Non-Advanced Countries
Lagged Dependent Variable	0.41*** (0.056)	0.40*** (0.059)	0.42*** (0.13)	0.23** (0.11)	0.45*** (0.11)	0.22*** (0.044)	0.24*** (0.054)	0.42*** (0.055)	0.42*** (0.12)	0.39*** (0.061)
Initial Public Debt (% of GDP)	0.033* (0.019)	0.028* (0.015)	-0.006 (0.013)	0.020 (0.033)	0.01 (0.014)	0.007 (0.013)	-0.007 (0.019)	0.035** (0.014)	-0.011 (0.011)	0.034** (0.017)
Change in Public Debt (% of GDP)	0.049* (0.027)	0.045* (0.024)	0.021 (0.034)	0.48*** (0.16)	0.042 (0.040)	0.032 (0.032)	0.013 (0.036)	0.05** (0.023)	0.017 (0.035)	0.049** (0.023)
Real GDP Growth (%)	-0.13 (0.12)	-0.11 (0.12)	-0.38 (0.26)	-0.13 (0.15)	-0.37 (0.22)	-0.21 (0.17)	-0.30 (0.23)	-0.122 (0.11)	-0.38 (0.25)	-0.11 (0.13)
Private Bank Assets (% of total assets of private and central banks)	0.144*** (0.029)	0.11*** (0.031)						0.065 (0.138)		0.14*** (0.030)
Private Bank Assets (% of total assets), squared								0.0006 (0.0009)		
Private Credit (% of GDP)			0.030** (0.013)						0.050* (0.029)	
Private Credit (% of GDP), squared									-0.0001 (0.0001)	
Financial Liberalization Index				15.3*** (5.54)						
Capital Account Openness Index		4.21** (2.09)			4.56** (2.15)					4.48** (2.17)
Inflation (%)						-0.69*** (0.086)				
First Principal Component							2.25*** (0.59)			
Second Principal Component							-6.66*** (1.11)			
Time-fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	963	947	931	406	1,045	1,068	830	963	931	763
Number of countries	123	120	114	73	125	128	106	123	114	98
Arellano-Bond AR(2) test p-value 2/	0.68	0.67	0.34	0.98	0.43	0.61	0.48	0.65	0.33	0.65
Hansen J-statistics (p-value) 3/	0.29	0.91	0.46	0.43	0.19	0.14	0.99	0.77	0.95	0.99

Note: The panel consists of 10 year periods for 128 countries. Robust standard errors in parentheses, and levels of statistical significance:

*** p<0.01, ** p<0.05, * p<0.1. Time-fixed effects are included in each regression (not reported).

The dynamic panel estimation employs a System GMM with the Windmeijer's finite-sample correction for the covariance matrix.

1/ Real interest rates are the effective interest cost of debt servicing (interest paid as a ratio of debt outstanding in the previous year), adjusted for currency valuation effects and inflation.

2/ The null hypothesis is that the first-differenced errors exhibit no second-order serial correlation.

3/ The null hypothesis is that the instruments used are not correlated with the residuals.

Table 4. Panel Regression: Real Effective Interest Rates and Financial Repression—Excluding the Episodes of High Inflation (above 20 percent)

Dependent Variable: Real Effective Interest Rates (in percent)¹

VARIABLES	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample	Non-Advanced Countries
Lagged Dependent Variable	0.37*** (0.051)	0.36*** (0.049)	0.38*** (0.054)	0.36*** (0.067)	0.42*** (0.055)	0.25*** (0.050)	0.27*** (0.058)	0.38*** (0.049)	0.38*** (0.051)	0.34*** (0.048)
Initial Public Debt (% of GDP)	0.018* (0.011)	0.017* (0.010)	0.0070 (0.0079)	0.0099 (0.019)	0.0041 (0.0097)	0.0057 (0.0087)	-0.012 (0.0093)	0.023** (0.011)	0.00047 (0.0068)	0.024** (0.011)
Change in Public Debt (% of GDP)	0.028** (0.014)	0.027** (0.013)	0.015 (0.0098)	0.17*** (0.055)	0.017 (0.016)	0.017 (0.012)	-0.0058 (0.011)	0.033** (0.014)	0.0083 (0.0087)	0.034** (0.014)
Real GDP Growth (%)	-0.23*** (0.056)	-0.24*** (0.060)	-0.26*** (0.062)	-0.19* (0.11)	-0.19*** (0.066)	-0.064 (0.040)	-0.18*** (0.066)	-0.24*** (0.056)	-0.26*** (0.059)	-0.23*** (0.078)
Private Bank Assets (% of total assets of private and central banks)	0.097*** (0.035)	0.087** (0.035)						0.051 (0.16)		0.12*** (0.029)
Private Bank Assets (% of total assets), squared								0.0004 (0.001)		
Private Credit (% of GDP)			0.031*** (0.0068)						0.044*** (0.016)	
Private Credit (% of GDP), squared									-0.0001 (0.0001)	
Financial Liberalization Index				4.43* (2.48)						
Capital Account Openness Index		1.33 (1.19)			0.9 (1.75)					2.22* (1.17)
Inflation (%)						-0.81*** (0.054)				
First Principal Component							1.45*** (0.23)			
Second Principal Component							-2.68*** (0.45)			
Time-fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	859	847	840	365	920	939	749	859	840	663
Number of countries	119	116	113	71	123	126	103	119	113	94
Arellano-Bond AR(2) test p-value ²	0.11	0.11	0.11	0.17	0.26	0.2	0.02	0.11	0.11	0.1
Hansen J-statistics (p-value) ³	0.57	0.98	0.71	0.75	0.44	0.31	0.99	0.95	0.99	0.99

Note: The panel consists of 10 year periods for 128 countries. Robust standard errors in parentheses, and levels of statistical significance:

*** p<0.01, ** p<0.05, * p<0.1. Time-fixed effects are included in each regression (not reported).

The dynamic panel estimation employs a System GMM with the Windmeijer's finite-sample correction for the covariance matrix.

¹ Real interest rates are the effective interest cost of debt servicing (interest paid as a ratio of debt outstanding in the previous year), adjusted for currency valuation effects and inflation.

² The null hypothesis is that the first-differenced errors exhibit no second-order serial correlation.

³ The null hypothesis is that the instruments used are not correlated with the residuals.

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