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Overcoming original sin: insights from a new dataset

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Abstract: This paper introduces a new dataset on emerging market sovereign bonds, distinguishing between the currency of denomination and the residence of investors. Our dataset is on long-term debt securities and provides comprehensive coverage of bonds issued both in international and domestic markets. We document several salient trends. While a preponderance of foreign currency bonds is associated with greater holdings by foreign investors, the correlation has weakened. Over time, major emerging market governments have enhanced their ability to borrow abroad in their own currencies, reducing their reliance on foreign currency debt. In this sense, major sovereigns have made progress toward overcoming original sin. Nevertheless, the greater role of market and duration risk and the activity of foreign non-bank financial intermediaries (NBFIs) mean that emerging markets remain subject to fluctuations in global financial conditions.

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Introduction

An important lesson from the crises afflicting emerging market economies (EMEs) in the 1990s was that borrowing short-term in foreign currency exposes countries to the risk of rising debt burdens and sudden reversals of capital flows, with consequences for the financial system and the economy. Policy efforts since the 1990s crises have aimed to reduce the reliance on foreign currency debt, by developing domestic sovereign bond markets in local currency. Where the domestic investor base was small, this effort went hand in hand with promoting greater foreign participation in domestic bond markets.

The aim of our paper is to provide a “deep dive” into the sovereign bond markets for emerging market economies, and to take stock of the extent to which governments have reduced their reliance on foreign currency bonds. The focus on long-term government bonds is motivated by the greater role of non-bank financial intermediaries (NBFIs) in capital markets in recent years, and the recent focus on market and duration risk as factors underlying the propagation of stress. We introduce a new dataset on EME sovereign bonds, described in more detail below, and dissect the key trends.

We find that major emerging markets have made progress toward overcoming “original sin”, a term referring to the inability of a country to borrow abroad in its own currency (Eichengreen and Hausmann, 1999). Their governments increasingly tap bond markets in their local currency, with growing foreign participation in domestic bond markets. However, this development also implies greater reliance on foreign investors bearing the currency risk. To the extent that foreign investors are less willing to hold local currency bonds in periods of stress, sovereigns are subject to more volatile capital flows – a phenomenon Carstens and Shin (2019) dubbed “original sin redux”.

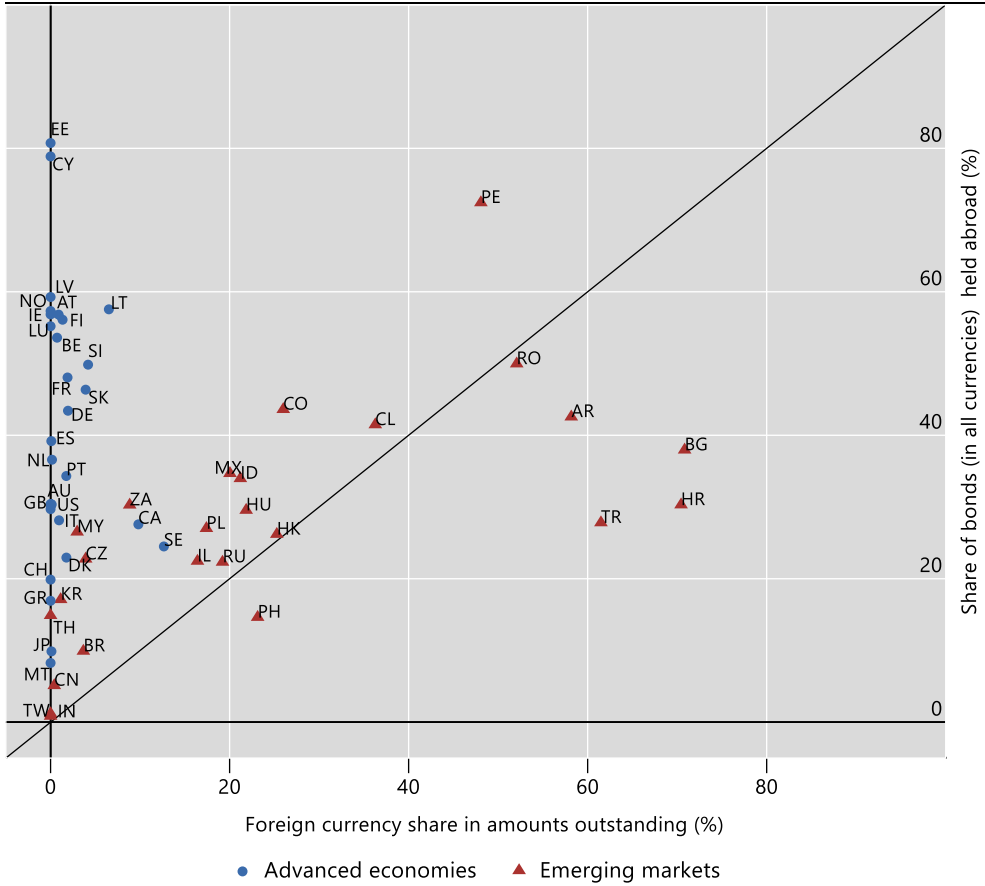
Our statistical contribution is to construct a new dataset on EME sovereign bonds that distinguishes the currency of issuance from the residence of investors – the two dimensions on which we build our analysis. We start with the BIS statistics on general government bonds in local and foreign currencies and match them with series on foreign holdings collected from national official sources. Our data coverage is broad: it encompasses all government bonds issued in domestic and international markets for 25 major EMEs from 2005 to 2021 in quarterly frequency. The dataset is published [online](#) along with two dashboards for visualising the time-series and cross-sectional data.

Compared with other related datasets, the use of national statistics reported by BIS member central banks helps to reduce the guesswork and approximations that beleaguer empirical efforts in this area. Our focus on long-term bonds is narrower than that of Arslanalp and Tsuda (2014), who also cover loans. This focus enables a consistent split of general government bond holdings by currency type and aligns with the role market and duration have played for institutional holders. Our data collection has the advantage of incorporating domestic issuance, which is a key reason why we observe higher local currency shares than Eichengreen et al (2022). Greater market coverage, however, comes at the expense of a smaller country coverage. Nevertheless, our sample includes the largest sovereign issuers among EMEs and accounts for the lion’s share of the asset class.

Our dataset allows us to draw a sharp distinction between currency and geography (Figure 1). The vertical axis measures the share of sovereign bonds held abroad, while the horizontal axis shows the share denominated in foreign currency. A common assumption in the literature is that foreign currency bonds are a good proxy for foreign holdings. But the overlap turns out to be weak. Local currency bonds are not all with residents, nor are foreign currency bonds held exclusively by foreign investors. To be sure, there is a positive relationship: some EMEs rely on foreign currency bonds to attract foreign investors, while those issuing mainly in local currency also see a low share of bonds held abroad (eg China and India). Yet all countries above the 45° line must have sold local currency bonds to foreign investors – this is not the prerogative of advanced economies (AEs). A growing number of EME

sovereigns no longer need to issue in foreign currency to attract foreign investors. AEs have already overcome original sin, while major EMEs are in the process of doing so – moving north-west in Figure 1.²

Sovereign bonds: foreign currency vs foreign holdings¹
 Cross-section, at end-2021 Figure 1



¹ This figure contrasts the share of foreign investors in bond markets (y-axis) with the share of foreign currency bonds outstanding (x-axis), for a cross-section of 28 advanced economies and 25 emerging markets.
 Sources: Arslanalp and Tsuda, *Sovereign Investor Base Estimates for Advanced Economies*; Quarterly External Debt Statistics; national data; BIS; authors' calculations.

We document four key trends and their implications in this paper. First, major EME governments have gradually reduced their reliance on foreign currency borrowing by tapping bond markets in their local currencies. The largest EMEs, China and India, issue sovereign debt almost exclusively in local currency; many other sovereigns increasingly borrow in their own currencies too. Second, foreign participation in EME sovereign bond markets has increased against a backdrop of the global search for yield. EME issuers have actively encouraged foreign participation in *local currency* bond markets through investor-friendly policies, which helped sustain their access to external financing while reducing currency risk. Foreign investors grew more comfortable with this asset class thanks to sound macroeconomic policies, better

² Including smaller EMEs and developing economies would add a cloud below the 45° line in this figure, since much of their debt is in foreign currency yet with lower foreign participation than for major EMEs. This is the case for sovereign debt (loans and bonds combined) in Arslanalp and Tsuda's extended dataset. See also Figure 9 below.

institutions and stronger economic fundamentals in EMEs. As a result of these trends, EME sovereigns now finance more of their external debt in their own currency than was the case in the early 2000s.

The evidence for the gradual shift toward local currency bonds is clearer for governments than for other sectors, and stronger for large EMEs than for smaller emerging and developing markets (Du and Schreger, 2022; Eichengreen et al, 2022). Eichengreen et al conclude that smaller economies have made little progress toward overcoming original sin: most still rely on foreign currency bonds when borrowing in international markets. Many governments, however, have been placing a growing share of their bond issuance in domestic markets, typically in local currency (Bogdanova et al, 2021). With rising foreign participation, the domestic segment of the bond market has fuelled substantial progress toward overcoming original sin, at least among major EMEs.

Progress towards overcoming original sin has slowed in the past decade, however. The four trends we document appear to have stalled or even partially reversed since 2013. We show that the extent to which local currency depreciates during periods of stress tends to hinder the progress over time. As foreign investors measure their returns in terms of US dollars or other major currencies, exchange rate movements amplify their gains and losses on local currency bonds; EME depreciations have repeatedly undermined their returns on local currency bonds. Furthermore, the weakness of EME currencies overstates setbacks in recent years through valuation effects on the stock of debt. On a flow basis, we find that aggregate foreign investment in local currency sovereign bond markets remained stable for the most part.

We thus find that EMEs have made more progress toward overcoming original sin than commonly thought – but this progress could be less helpful than is generally believed. Major EME sovereigns are overcoming original sin in the original sense of the term. But the flipside of reducing the currency mismatch on the borrower side is that the mismatch moves to the balance sheets of foreign investors. As foreign portfolios become more exposed to local currency bonds, currency risk looms larger in investors' allocation decisions. When flighty global investors sell at the first signs of stress, EMEs remain vulnerable to exchange rate depreciation – and continue to be exposed to the ebb and flow of global financial conditions. This gives rise to policy challenges, for EMEs and for small open economies alike.

The paper is structured as follows. Section 1 introduces key concepts and describes the construction of our new dataset on EME sovereign bonds. Section 2 documents key trends in foreign participation and local currency shares, and how these trends have come together to reduce original sin over time. Section 3 examines how progress and setbacks in this process relate to EME exchange rates. Section 4 discusses the main policy implications.

1. The international dimension of original sin

Background and related literature

Eichengreen and Hausmann (1999) coined the term "original sin" to describe *the inability of a country to borrow abroad in its own currency*. The concept was motivated by the experience of the emerging market crises of the 1990s, when the combination of currency mismatch and maturity mismatch placed emerging market borrowers in difficulty when facing the challenges of capital outflows and tightening global credit conditions. The concept was further developed in Eichengreen, Hausmann and Panizza (2005, 2007), who found this issue to be highly persistent for emerging market economies (EMEs).

The concept of original sin involves two separate dimensions. The first is across currencies, and the second is across the investor's residence. Each has figured prominently in the literature on financial fragility in emerging markets. By focusing on external liabilities in foreign currencies, original sin links the cross-border dimension with the cross-currency dimension. Original sin can be understood as a

precondition for currency mismatch. Currency mismatch compares assets and liabilities, with the view that *net* foreign currency liabilities heighten financial fragility: in many EME crises, foreign currency liabilities have financed local currency lending, exposing the foreign currency borrowers to exchange rate risk (Goldstein and Turner, 2004).

The literature on original sin makes broader points on the structure and evolution of financial markets at various stages of development. A country's inability to borrow abroad in its own currency may be rooted in weak institutions and policies, as reflected, for instance, in a country's inflation history, exchange rate regime and repayment or default record (Hale et al, 2020; Ottonello and Perez, 2019; Engel and Park, 2022). On the other hand, Eichengreen, Hausmann and Panizza (2005) emphasise that many countries with strong policies and institutions also suffer from original sin, suggesting that global factors beyond the control of individual borrower countries also inhibit the flow of capital from rich to poorer countries.³

Empirical papers on original sin focus on specific instruments and sectors, and therefore come out with different measures. At the most general level, original sin is about the extent to which emerging markets' external liabilities continue to be denominated in foreign currencies. The currency composition of external positions for 50 countries has been compiled by Bénétrix et al (2019); their panel includes external liabilities by instrument.⁴ Arguably, the notion of "borrowing abroad" is best captured by external *debt* liabilities (bonds and loans). The currency breakdown of external debt reveals how much local currency debt is held by non-residents. In 1990, a mere \$0.1 trillion (10%) of external debt was denominated in the local currencies of the 27 EMEs in their sample; by 2017, the same group reported \$1.8 trillion (23%) of external debt to be in local currency. This is a broad measure of progress.

Eichengreen, Hausmann and Panizza (2022), however, find little evidence of progress since their seminal work in the early 2000s. They rely on the BIS International Debt Securities (IDS) statistics to track a broad sample of 85 emerging markets and developing economies since 1994. They find that for the majority of developing countries, original sin persists; only emerging markets (ie upper-middle income countries with access to international markets) have made great strides in borrowing abroad in their own currency. Most smaller countries, however, continue to rely heavily on foreign currency bonds. Even those EMEs least afflicted by original sin issued less than 20% of international bonds in local currency; and part of the progress since 2007 has been reversed in recent years.⁵ Original sin thus proves to be common and persistent when measured this way.

Compared with Eichengreen, Hausmann and Panizza (2022), who use BIS IDS data for all sectors, our exercise is limited to sovereign bonds but incorporates the BIS Domestic Debt Securities (DDS) statistics (see data section). This gives a more comprehensive picture of government bonds issued in all markets (and in all currencies) and therefore leads to higher observed local currency shares. Our focus on long-term government bonds is akin to Bertaut, Bruno and Shin (2023), who provide a sectoral breakdown of US resident investors in EME local currency government bonds. They show that mutual funds tend to be most procyclical, and that holdings of long-term bonds with remaining maturity of five years or more tend to exhibit the greatest fluctuations. The findings draw attention to market and duration risk as

³ See Eichengreen et al (2007, 2022), and the contributions in the volume edited by Eichengreen et al (2005).

⁴ The primary focus of Bénétrix et al (2019) is to document that EMEs have improved their net external liabilities. Reserve accumulation played a part, as did a shift of external liabilities toward local currency instruments. However, much of the latter was due to the expansion of non-debt liabilities (with equity and FDI both treated as local currency instruments). Measuring the foreign currency share of overall external liabilities (all instruments) paints a more benign picture of original sin than doing so for external debt only.

⁵ Similarly, Hale et al (2020) document a rise in local currency international bonds placed by corporates from small countries since 2008, but the amounts and shares in total corporate issuance remain in the single digits.

sources of stress propagation, and the trade-off between rollover risk and market risk when choosing the maturity of issuance.

Our paper is closely related to Arslanalp and Tsuda (2014) and Du and Schreger (2022). Both papers cover sovereign debt, combining loans and bonds. Arslanalp and Tsuda (2014) examine foreign holdings of government debt; they document substantial inflows from foreign asset managers during the period from 2009 to 2013, mostly in local currency. Du and Schreger (2022), in a sample of 14 EMEs, compare external debt across sectors and highlight the shift in sovereign debt toward local currency, from 20% in 2003 to 60% in 2017; by contrast, the local currency share in corporate debt remained largely unchanged at 10%. Original sin persists among corporates but slowly recedes for major sovereigns.

Sovereign borrowing is therefore the exception to the predicament of original sin. Governments of major EMEs now borrow substantial amounts in their own currencies abroad, mainly by issuing bonds in domestic and international capital markets. In so doing, they increasingly resemble the small open economies among advanced countries (recall Figure 1). To measure their progress and assess whether it helped secure stable external financing, our data collection focuses on general government bonds issued in all markets, broken down by currency. We match amounts outstanding with series on foreign holdings collected from national sources. The remainder of this section explains the concepts and data behind this effort.

Key concepts and notation

To explain how the key ratios and trends in the literature relate to original sin, we introduce the notation in Table 1. We focus on government bonds, although the notation would be no different for debt at the country level. Capital letters refer to outstanding stocks, denominated in local currency (L) or in foreign currencies (F). The corresponding foreign holdings are denoted by l and f . For ease of exposition, we take all foreign currency bonds to be denominated in US dollars.⁶

Notation for outstanding stock and foreign holdings

Table 1

Variable	Description	Units (nominal value)
B	Government bonds in all currencies	Local currency
b	Foreign holdings of B	Local currency
L	Government bonds in local currency	Local currency
l	Foreign holdings of L	Local currency
F	Government bonds in foreign currencies	US dollars
f	Foreign holdings of F	US dollars
ε	Exchange rate, local currency units per US dollar	\uparrow = local currency depreciation
$\theta = 1/\varepsilon$	Exchange rate, US dollar per local currency unit	\downarrow = local currency depreciation

Agents take different perspectives on the valuation of their respective positions, depending on their currency of reference:

- Agents in the issuer country bonds in terms of the local currency since their payment streams are primarily in their own currency. The value of their positions in terms of local currency equals $B = L + \varepsilon F$, where εF is their foreign currency borrowing evaluated at the current exchange rate, ε .

⁶ This comes with little loss of generality. Our data include bonds in all foreign currencies, most of which is denominated in US dollars, except for EMEs close to the euro area. To accommodate other foreign currencies in our notation, εF can be generalised to $\sum_c \varepsilon_c F_c$.

- Foreign investors, on the other hand, assess the value of their bond holdings – l and f – in terms of their own reference currency – generically the US dollar.⁷ From their perspective, they hold f in dollar bonds and θl worth of local currency bonds.

It is essential to keep currency and geography apart – they are separate dimensions. Consider the ‘debt matrix’ (Table 2), a simple device for tracking the key ratios used in the literature. The rows represent geography: they distinguish domestic holders from foreign investors and their external holdings. The currency dimension, on the other hand, appears in the columns: they split bonds into those denominated in local currencies from those in foreign currencies.⁸ We can now form and relate various ratios:

- The share of bonds held abroad is the **foreign participation ratio**; it measures the reliance on foreign investors. Capitalised Π refers to all bonds, and π_L to local currency bonds.⁹
- The share of bonds denominated in local currency is the **local currency share**. Λ refers to the local currency share in bonds outstanding, and λ to that in foreign holdings. Hence λ also measures foreign investors’ exposure to a particular EME currency.

Debt matrix: two separate dimensions

Table 2

↓ Geography	Currency →	All currencies	Local currency	Foreign currencies	Local currency shares
All holders		$B = L + \varepsilon F$	L	εF	$\Lambda = \frac{L}{B} = \frac{L}{L + \varepsilon F}$
foreign holders		$b = l + \varepsilon f$	l	εf	$\lambda = \frac{l}{b} = \frac{\theta l}{\theta l + f}$
domestic holders		$B - b$	$L - l$	$\varepsilon(F - f)$	$\lambda_d = \frac{L - l}{B - b}$
Foreign participation ratios		$\Pi = b/B$	$\pi_L = l/L$	$\pi_F = f/F$	

The definitions in the debt matrix clarify the mutual dependencies between various ratios. Each capitalised ratio (Π , Λ) can be written as a weighted average of the interior ratios,

$$\Pi = \Lambda \pi_L + (1 - \Lambda) \pi_F \quad \text{and} \quad \Lambda = \Pi \lambda - (1 - \Pi) \lambda_d \quad (1)$$

A country demonstrating its ability to borrow abroad in its own currency is said to be *overcoming original sin*. The quantity l plays a key role in this respect: it shapes both the foreign participation in local currency bond markets (π_L), and the local currency share in foreign portfolios (λ). The share λ is generally taken as evidence for overcoming original sin, since much of the literature measures original sin by $(1 - \lambda)$, the continued reliance on foreign currency when borrowing abroad. However, it is a moot point whether λ is high or not if the underlying holdings (b) are negligible; hence, we also track the foreign participation ratios to ensure that they cover a meaningful share of the country’s public financing needs. Section 2 documents the trends and relationships among the ratios in Table 2. Section 3 examines drivers behind the evolution of λ , distinguishing between financing flows and exchange rate valuation effects.

⁷ The US dollar is the predominant global currency (Boz et al, 2022). The preference of international investors for the dollar is known to shape portfolio choice (Maggiore et al, 2020).

⁸ Other relevant dimensions are subsumed here. For instance, the governing law and market of issue can be domestic or foreign too; our exposition and data collection include government bonds issued in all markets.

⁹ We use the terms “external”, “held abroad” and “foreign investors” interchangeably.

A new dataset on EME sovereign bonds

Forming the ratios in Table 2 requires data on government bonds that identify the currency of denomination (local vs foreign) and the residence of the holder (domestic vs foreign).¹⁰ We combine the BIS statistics on bonds outstanding with series on external holdings by foreign investors collected from national sources. Our data collection aims to cover issuance in all markets and all currencies.

Compared with related efforts, our bond series are more comprehensive and rely more extensively on official sources. The meticulous work of matching the individual holdings series with existing BIS statistics allows us to create consistent ratios that could be of value to policymakers. We differ from Arslanalp and Tsuda (2014) in that we focus solely on long-term general government debt securities. Our focus on bonds is narrower than theirs, but it enables a more consistent split by type of currency for major EMEs.¹¹ In terms of government finances, sovereign bonds are the main type of instrument; they also serve as financial market benchmarks. The tradable nature of these instruments lets us highlight how investor reallocations lead to volatile capital flows during periods of stress.

Outstanding stocks. BIS statistical [Table C4](#) reports the outstanding amounts of general government bonds with a currency breakdown. The dataset provides broad country coverage and a consistent currency breakdown across domestic and international markets (Bogdanova et al, 2021). Accordingly, these statistics combine domestic debt securities (DDS) and international debt securities (IDS).¹² DDS are aggregate statistics on the size of domestic markets reported by national authorities to the BIS; the IDS, on the other hand, provide complementary information on international bond markets, compiled using security-by-security information from commercial sources.

The statistics thus capture the entire asset class, split into local currency bonds (mostly DDS) and foreign currency bonds (mostly IDS). In our notation, the series correspond to θL for local and F for foreign currency bonds, in US dollars at nominal value where available, and market values otherwise (see Appendix 1). The data are available at quarterly frequency for 56 economies, including 27 EMEs.

Foreign holdings. We match the amounts outstanding with series on foreign holdings of government bonds collected from national sources. In selecting series, we sought to match the attributes of the available series for amounts outstanding. When series from several sources are available, we follow a preference order that favours securities holdings statistics reported by central banks, ministries of finance, or national statistical offices over other sources (see Appendix 2).

The challenge is to determine the currency composition of foreign bond holdings, since published series typically report only one term from $b = l + \varepsilon f$. When l is reported, we estimate εf as a residual using statistics on total external holdings of government bonds (IIP, QEDS, Arslanalp and Tsuda, 2014); when no information on currency is available, we instead estimate l by using IDS data as a proxy for εf . In both cases, we force the estimates to satisfy logical constraints (Appendix 2 elaborates). This ensures that our holdings estimates are consistent with what is known about EMEs' external bond liabilities (IIP), their foreign currency bonds issued in international markets, and total amounts outstanding.

¹⁰ Bonds are long-term debt securities with original maturities longer than one year. The general government comprises central, state and local government and social security funds, but excludes state-owned companies and the central bank.

¹¹ Arslanalp and Tsuda publish total credit as well as holdings of government debt securities (in all maturities). The latter include a breakdown by currency type for 22 EMEs (as classified in the BIS country groupings) but covers *central* government securities only.

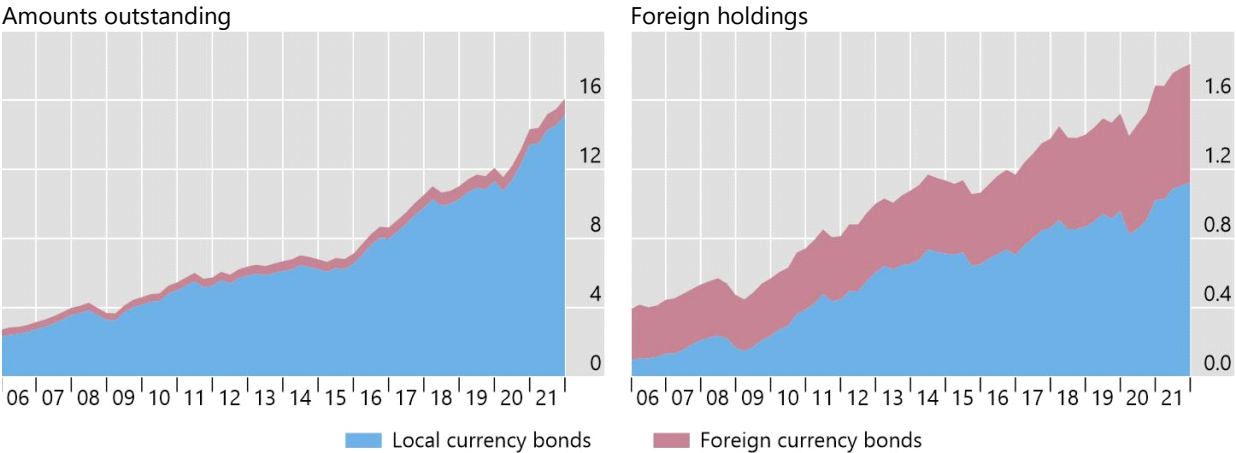
¹² The IDS include international debt securities issued outside the domestic market where the borrower resides (Gruic and Wooldridge, 2012).

The final dataset published [online](#) is a quarterly panel of 25 countries for the period of 2005 to 2021, and features bonds outstanding and foreign holdings by currency, underpinning the ratios in Table 2.¹³ The sample covers major EMEs from Asia (9), Europe (8), Latin America (6) and Africa and the Middle East (2), as listed in Table A. This group accounts for a quarter (\$16 trillion) of the global sovereign bond market.¹⁴ The universe of EME government bonds has steadily expanded during this period, with a surge in borrowing since the onset of the pandemic in March 2020 (Figure 2, left panel). In general, the bulk of government bonds outstanding is denominated in local currency (blue area). At the same time, the aggregate value of government bonds held by foreign investors quadrupled since 2005, with some dents during episodes of financial stress (right panel). The foreign currency share in external holdings is larger than that in the amounts outstanding, but local currency bonds account for a growing share in both.

Emerging market sovereign bonds, by currency¹

In trillions of US dollars

Figure 2



¹ Includes long-term debt securities issued by general governments in domestic and international markets. Outstanding amounts represent a balanced panel of 25 countries. For foreign holdings, Chile and Romania enter the sample late (2010 and 2013, respectively).

The value of covering bonds issued in all markets becomes clear when comparing our dataset with a view from international bond markets only. International bond issuance can be measured by the BIS IDS, which comprises bonds issued outside the domestic market of the borrower (the general government). This segment includes what market participants have traditionally referred to as foreign bonds or eurobonds, typically issued in foreign currency and targeted at international investors (Gruic and Wooldridge, 2012). Looking at original sin through this lens, however, comes with several limitations.

For sovereign bonds, international markets account for a small and falling share of the total (Figure 3, left panel). On average, less than 25% of EME bonds outstanding were issued internationally (black solid line); in the aggregate, the share of international bonds is as low as 5% (dashed line). Moreover, international bonds are geared toward foreign currency. Most foreign currency bonds are issued internationally (captured in IDS data), whereas most local currency bonds are placed in domestic markets

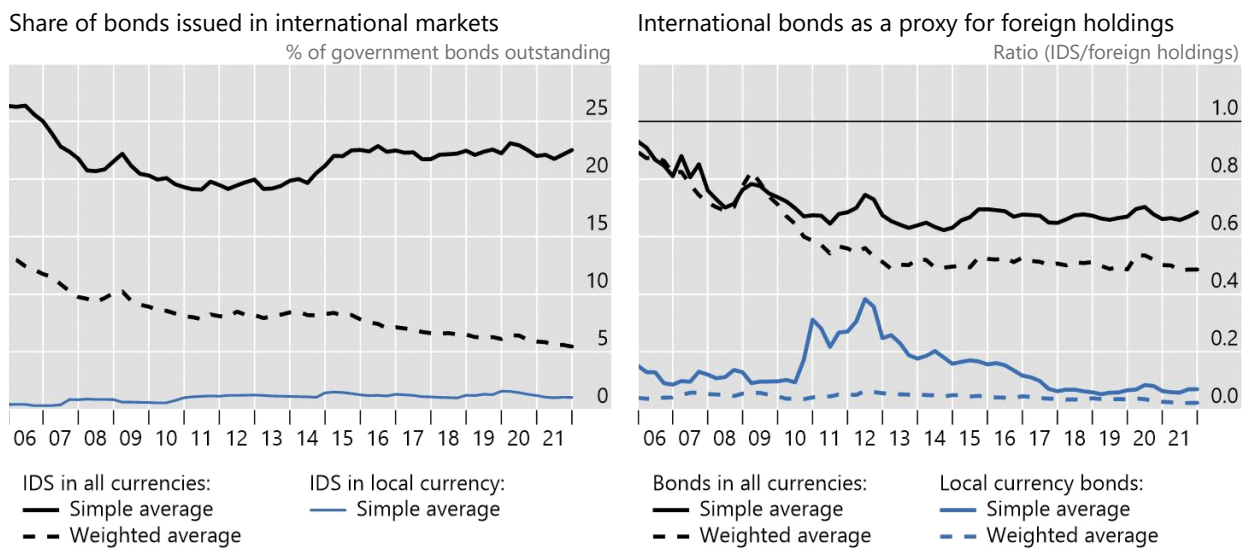
¹³ Outstanding amounts are available for 27 countries and holdings for 25 (excluding Saudi Arabia and Singapore).
¹⁴ The total value of the general government bond market was \$63 trillion at end-2021, based on the 56 economies included in BIS [Table C4](#).
¹⁵ Outstanding amounts are available for 27 countries and holdings for 25 (excluding Saudi Arabia and Singapore).
¹⁶ The total value of the general government bond market was \$63 trillion at end-2021, based on the 56 economies included in BIS [Table C4](#).

(excluded from IDS data).¹⁷ It is in this segment that most of the progress toward overcoming original sin took place, in the form of rising foreign participation in domestic markets for local currency government bonds. Therefore, the small fraction of local currency bonds visible in IDS (blue line) does not reflect the weight of local currency bonds in foreign holdings or in the amounts outstanding.

As a result, international bonds are not a good proxy for foreign holdings, and certainly not for the local currency content of bonds held abroad. The right panel of Figure 3 compares the stock of international government bonds (from IDS) with foreign holdings of all government bonds (from the holdings series constructed in this paper). Across the 25 EMEs, international bonds only amount to two thirds of total foreign holdings (black lines). This is because foreign investors hold far more local currency bonds those issued in international markets (blue lines).¹⁸ Considering only IDS will underestimate l and bias the ratios involving l , notably π_L and λ (Table 2). This is why our dataset comprises sovereign bonds issued in all markets and all currencies, for holdings as well as for the amounts outstanding.

EME government bonds issued in international markets¹

Figure 3



¹ International bonds definition based on BIS International Debt Securities (IDS) statistics.

Sources: National data; BIS debt securities statistics; authors' calculations.

2. Overcoming original sin

This section draws on the analysis of our dataset to document four related trends in the ratios bordering the debt matrix (Table 2). Their evolution takes place against the backdrop of rising public debt levels (B in Table 2), reaching nearly 60 percent of GDP by 2020 among EMEs (Arslanalp and Eichengreen 2023). Each figure below plots the evolution of a ratio (or share in percentage terms), showing simple and weighted averages across the shares of individual EMEs. The simple average represents the typical experience of EMEs in the sample, while the weighted average reflects aggregate behaviour shaped by larger EMEs. We test each trend for significance and report on how common the trend is across EMEs; specifically, for each trend we test the significance of the slope estimated by regressing the ratio of interest on a time variable. Hence, the trend counts include only those EMEs whose trend is statistically

¹⁷ Only few countries (eg Peru) issue substantial amounts of local currency bonds in international markets.

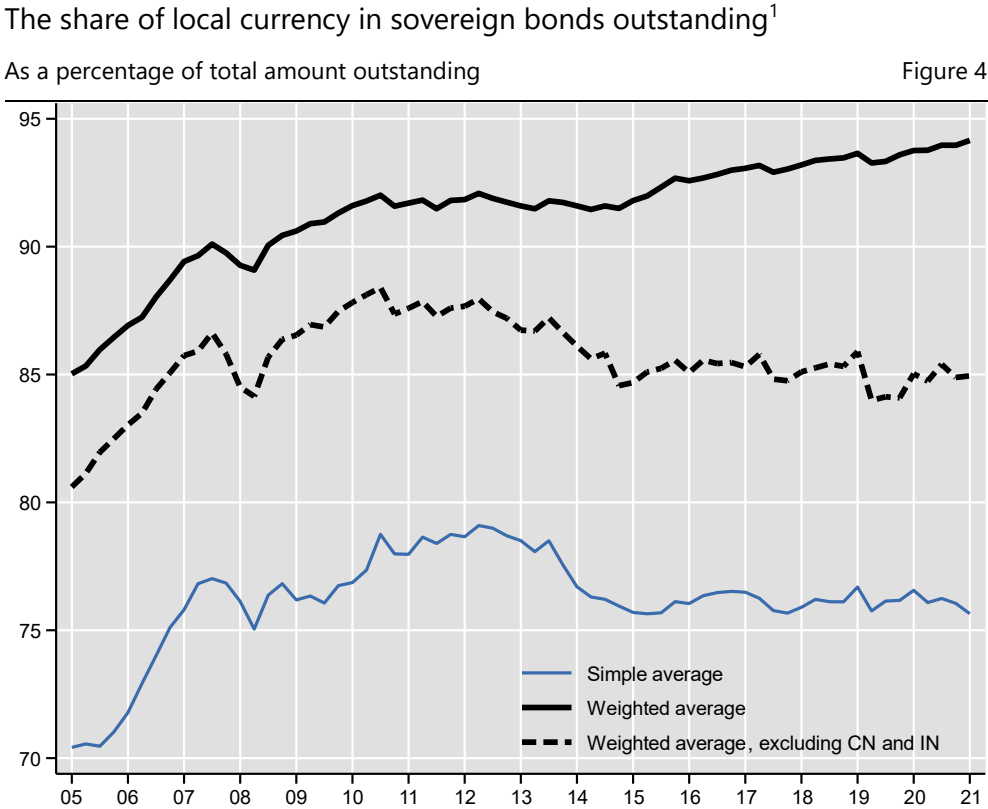
¹⁸ The ratio is somewhat higher for bonds in all currencies because the IDS comprise most foreign currency bonds.

significant over their respective horizon governed by data availability and excludes countries whose shares remain constant or move sideways.¹⁹

Trend 1: The currency composition of government bonds (Λ)

The first trend concerns *the type* of bonds that are issued, regardless of who holds them: we examine Λ , the local currency share in total government bonds outstanding (Table 2).

The local currency share in EME government bonds exhibits a positive long-term trend, as major EMEs have been tapping bond markets in domestic currency (Figure 4, thick line). Even in the early 2000s, the majority of EME government bonds outstanding was denominated in local currency, at least in terms of value. Advanced economies, for their part, boasted local currency shares above 95% for decades on the back of deep domestic bond markets and the reserve status of the main currencies (Bogdanova et al, 2021). The corresponding share for the average EME (thin solid line) stood at 70% in 2005 and has trended up over the first half of the sample period.



¹ Local currency-denominated government bonds as a share of government bonds outstanding in all currencies. With reference to Table 2, the local currency share for each country is calculated as $\Lambda = L / (L + \epsilon F)$, in percent. The simple average is the mean across individual country shares. The weighted averages express EMEs' combined local currency bonds as a percentage of total government bonds outstanding. The sample of 25 countries is balanced between Q4 2005 and Q4 2021.

The broad upward trend in the local currency share in sovereign bonds is driven by large EMEs. Some countries, including Brazil, Korea and Mexico, have actively reduced their reliance on foreign currency

¹⁹ We test each time trend for significance after regressing the ratio of interest on the time variable; the counts include only those EMEs whose trend is statistically significant over their respective horizon governed by data availability.

bonds; Chile, Peru and Russia managed the steepest rises in λ . Meanwhile, China and India, both with vast domestic bond markets, stepped up their bond issuance, which has been almost exclusively in local currency. As a result, the weighted average share rose over most of the sample period (Figure 4, thick solid line). The influence of China and India on this trend becomes apparent when removing the countries from the sample: now, the rise in the EME aggregate is much less pronounced (dashed line).

Most of the gains took place in the years before and shortly after the global financial crisis of 2007–09, but the pace of local currency bond issuance appears to have slowed since 2013. Over the entire sample period, the simple and weighted averages for all EMEs combined exhibit a statistically significant positive trend. The weighted average excluding China and India, however, peaks and reverts, with a structural break detected in mid-2011. The apparent reversion over the past decade is largely due to weak EME exchange rates – the trend toward local currency bonds is more prominent when currency valuation effects are removed (see Section 3).

Still, the positive trend in the local currency share overall is, in fact, quite common among the countries in our sample. A majority of EMEs (15 out of 25) saw their local currency shares rise significantly since the early 2000s. Greater reliance on hard currency bonds by some EMEs (eg Argentina and Turkey) has resulted in a trend decline in the simple average (blue line) in the 2010s. Even so, only six countries in the sample saw a significant drop in their local currency share over the period as a whole: Argentina, Bulgaria, Colombia, Hong Kong SAR, Indonesia and Turkey, whose local currency share fell substantially, from 82% to 39%, over the past decade.

Despite a broad trend toward local currency issuance, there remains considerable variation across countries in terms of the currency composition of sovereign bonds today. India, Thailand and Chinese Taipei denominate their entire government debt in local currency, and Chinese government bonds are almost entirely denominated in renminbi. In that respect, these countries resemble traditional reserve currency issuers: the United States, Japan, the United Kingdom and Switzerland. Argentina stands out at the other extreme, with a foreign currency share near 70%, along with Bulgaria and Croatia, who meet even more of their long-term financing needs in foreign currency with their currencies closely pegged to the euro. Both countries joined the exchange rate mechanism (ERM II) in July 2020, and Croatia became a member of the euro area in January 2023.²⁰

Trend 2: Reliance on foreign investors (II)

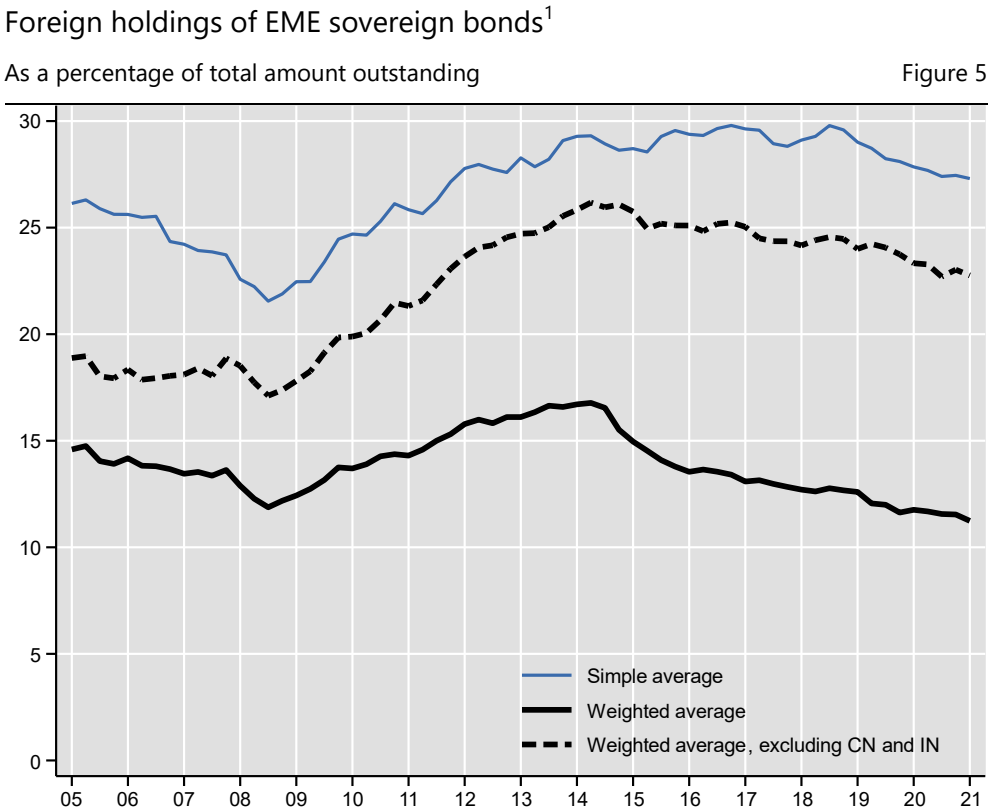
We now examine *where* government bonds are held – regardless of their currency of denomination. Currency and geography are entirely separate dimensions. The extent to which government bonds are held abroad relates to b and the ratio $\Pi = b/B$ known as foreign participation (Table 2). The overall ability to borrow abroad (in *any* currency) is an important precondition: if foreign investors hold only a small fraction of a country's sovereign bonds, the currency composition of these holdings (λ) becomes a moot point.

Overall, EMEs have increased their borrowing abroad: this holds for levels, for ratios to GDP and, to a lesser extent, for the foreign participation ratio Π as well (Figure 5). The years after the global financial crisis show the clearest evidence of EMEs' growing reliance on foreign investors: all three averages were trending up between 2009 and 2015. Stronger economic fundamentals and the global search for yield have boosted foreign participation in EME sovereign bond markets. Investors in advanced economies tied up in a low interest rate environment were attracted to the growth prospects of EMEs. And many EMEs took advantage of benign funding conditions during this period.

²⁰ With the adoption of the euro as the official currency, all euro-denominated debt will be treated as local currency debt in the future. We treat the kuna as the local currency, since our sample ends in Q4 2021.

The increasing weight of China and India has a confounding effect, in that it pushes down the overall weighted average over time (black line). This is a purely compositional effect: their own foreign participation ratios also increased over time, albeit from a low base. This finding is in line with Lane and Milesi-Ferretti’s (2017) observation that the share of bonds held abroad falls with a country’s market size and rises with its level of development. Their domestic sovereign bond markets have limited foreign participation, with foreign-held shares as low as 1% in India and 5% in China by 2021. This has pushed down foreign participation in the aggregate as China and India’s combined share in total EME sovereign bonds outstanding surged from 23% in 2005 to 61% by 2021.

The growing reliance of EMEs on external financing is seen most clearly in the upward trend of the average foreign participation (Figure 5, blue line) and the weighted average excluding China and India (dashed line). In fact, 13 out of the 25 countries exhibit significant positive trends over the full horizon (2005–21), including China and India. Colombia, Indonesia, and South Africa saw the steepest trend increases in the share of bonds held abroad. Eight countries in the sample show no significant trend in either direction, while only four EMEs witnessed a trend decline in foreign participation, including Hungary and the Philippines.

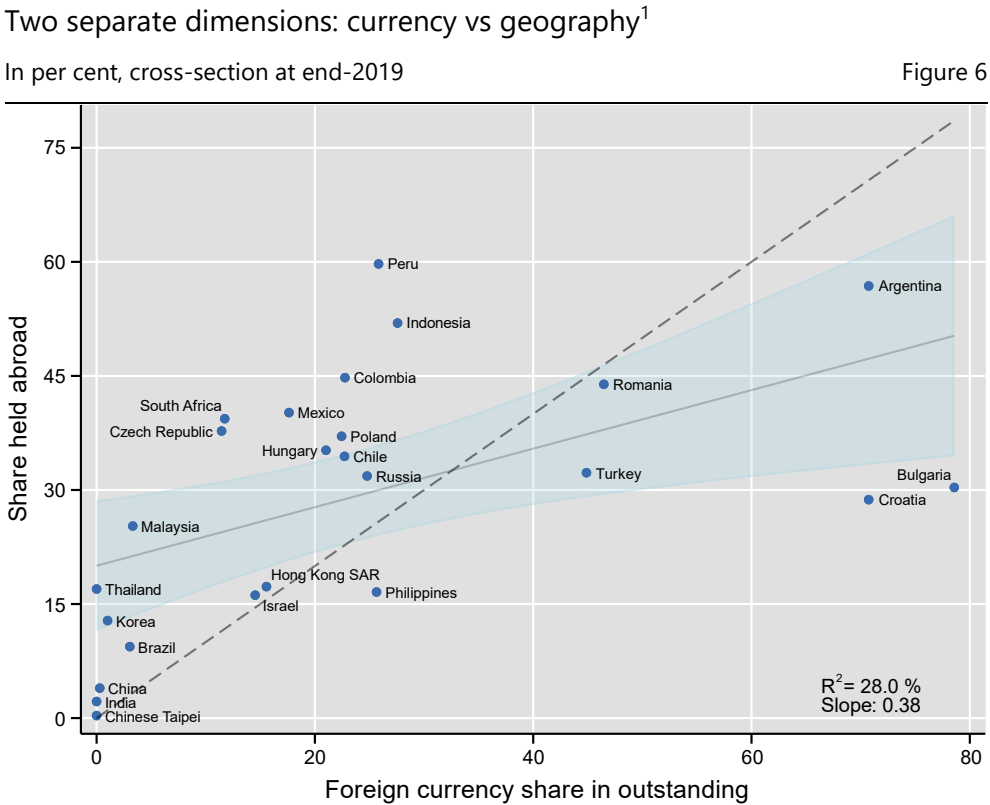


¹ Foreign holdings of government bonds as a share of government bonds outstanding in all currencies. With reference to Table 2, the share for each country is calculated as $\Pi = b/B$, in percent. The simple average is the mean across individual country shares. The weighted average expresses the combined external holdings of EME government bonds as a percentage of government bonds outstanding, calculated over the set of EMEs for which both parts are available. The sample comprises 25 countries between Q4 2005 and Q4 2021; Romania enters the sample in 2013.

The extent of foreign participation has levelled off since 2015 (Figure 5). The value of foreign holdings has continued to grow but has not kept pace with the rising stock of government debt outstanding; EMEs with a growing institutional investor base may also rely less on foreign investors over time. The

ratio of foreign participation has stagnated as a result. Formal tests point to a structural break in 2015.²¹ Despite levelling off, foreign participation remains higher than in the early 2000s, leaving an overall positive trend. The rise in foreign participation in EME bond markets has been noted by Arslanalp and Tsuda (2014) and by Lane and Milesi-Ferretti (2017). This is in contrast to advanced economies, where the foreign participation ratio has remained flat in aggregate (at around 40%) and has even trended down for most countries.²²

The trends covered so far underscore that currency and geography are separate dimensions. To be sure, they overlap to some extent: for the cross-section of EMEs at any point, there is a positive relationship between the share of sovereign bonds in foreign currencies and the share held abroad (Figure 6, fitted line). The two shares align for some countries, eg China and India (both close to the origin) issue virtually all government debt in local currency, with low foreign participation in their domestic markets. Argentina, at the other extreme, issued most of its bonds in foreign currency, and more than 50% of government bonds are held by foreign investors. At intermediate values, Romania, Russia, and Israel are also close to the 45° line.



¹ This figure contrasts foreign participation in government bond markets (II, y-axis) with the share of foreign currency bonds in total amount outstanding (1-I, x-axis), respectively, for a cross-section of 25 EMEs.

But the overlap between the two dimensions is far from perfect. The least-squares slope, and the fit (R^2) are both far below unity: local currency bonds are not all with residents, nor are foreign currency bonds

²¹ Flows to EME sovereign bond funds turned somewhat earlier. Cumulative inflows show a peak around mid-2013 (based on EPFR data since 2005). Domestic currency bonds saw particularly large inflows from 2010 to 2013.

²² In a sample of 26 advanced economies, nine trended up (including Australia, Canada, Japan and the United Kingdom) while 14 trended down (including the United States, France, Germany and Italy). The rapid rise in government debt coupled with quantitative easing may account for some of these developments.

held exclusively by foreign investors. This runs counter to the presumption that foreign currency bonds are a good proxy for foreign holdings. Pooling all 1,593 panel observations (2005–21) yields a tighter fit, with an R^2 of 47% and an estimated slope of 0.54. The fit has been declining in annual cross-sections from 2008 to 2019, which suggests that the relation between these two dimensions has become weaker as EMEs open their domestic bond markets to foreign investors.

For many EMEs the two dimensions do not align, and for good reasons. All countries above the 45° line must have sold local currency debt to foreign investors, in some cases substantial shares of their bonds outstanding. Asian EMEs clearly do borrow abroad, even if they issue fewer government bonds in foreign currency – Thailand, for instance, no longer has any foreign currency bonds outstanding, yet foreign ownership is near 20%. Several Latin American countries have also marketed their local currency bonds to foreign investors and built infrastructure to allow foreign investors to clear and settle domestic bonds. At 60% foreign ownership, Peru leads in terms of foreign participation: external holdings of local currency bonds were near zero in 2004 and overtook those of foreign currency bonds by 2017.

By contrast, countries below the 45° line must have domestic residents substantially invested in foreign currency bonds. Not all foreign currency bonds issued by Argentina, Bulgaria and Croatia can be held abroad – the amounts would exceed total external bond holdings.²³ For Argentina and Turkey, it may be economic uncertainty and depreciation that led investors – including residents – to favour hard currency bonds. Bulgaria and Croatia lie below the 45° line for a different reason: they tap domestic and international financing in euro, given their closeness to the common currency.

Note that seeing a trend in one dimension over time does not imply the same trend in the other – quite the contrary. The local currency share Λ trending up (our Trend 1), all else equal, will *reduce* overall foreign participation Π , given that foreign investors participate less in local than in foreign currency bond markets. To see this, recall equation (1),

$$\begin{aligned}\Pi &= \Lambda\pi_L + (1 - \Lambda)\pi_F \\ &= \pi_F - (\pi_F - \pi_L)\Lambda\end{aligned}\tag{2}$$

An increase in Λ tends to reduce Π , given $\pi_F > \pi_L$. But we observe positive trends in both Λ and Π , enabled by another development: the rise in foreign participation π_L – the next trend we examine.

Trend 3: Foreign participation in local currency bond markets (π_L)

We now cross the dimensions in Table 2 to examine *foreign* holdings of *local* currency bonds: this narrows the scope of foreign participation to that in the local currency bond market (l and π_L in Table 2). To what extent do EME governments rely on external financing when borrowing in their own currency?

Figure 7 documents the rising share of foreign investment in the local currency bond market. All three averages exhibit significant positive trends over the sample period. Most EMEs in the sample saw higher shares of their local currency bonds in foreign hands than was the case in the early 2000s: 18 out of the 25 EMEs share the positive trend, with the steepest slopes estimated for South Africa, Russia and Colombia.²⁴ China and India, with low foreign participation in their vast domestic bond markets, slow the rise in the overall weighted average (thick line), even as their own foreign-held shares have been trending up too. The substantial increase in the value of assets benchmarked in local currency bond indices such as the JP Morgan GBI-EM since the early 2000s was a significant driver for foreign flows

²³ The two shares are defined over the same denominator, $B = L + \varepsilon F$ (see Table 2). Foreign currency bonds outstanding can exceed the value of external holdings only if domestic investors hold more in foreign currency bonds than foreign investors hold in local currency bonds: $\varepsilon F > (L + \varepsilon f) \leftrightarrow \varepsilon(F - f) > L$.

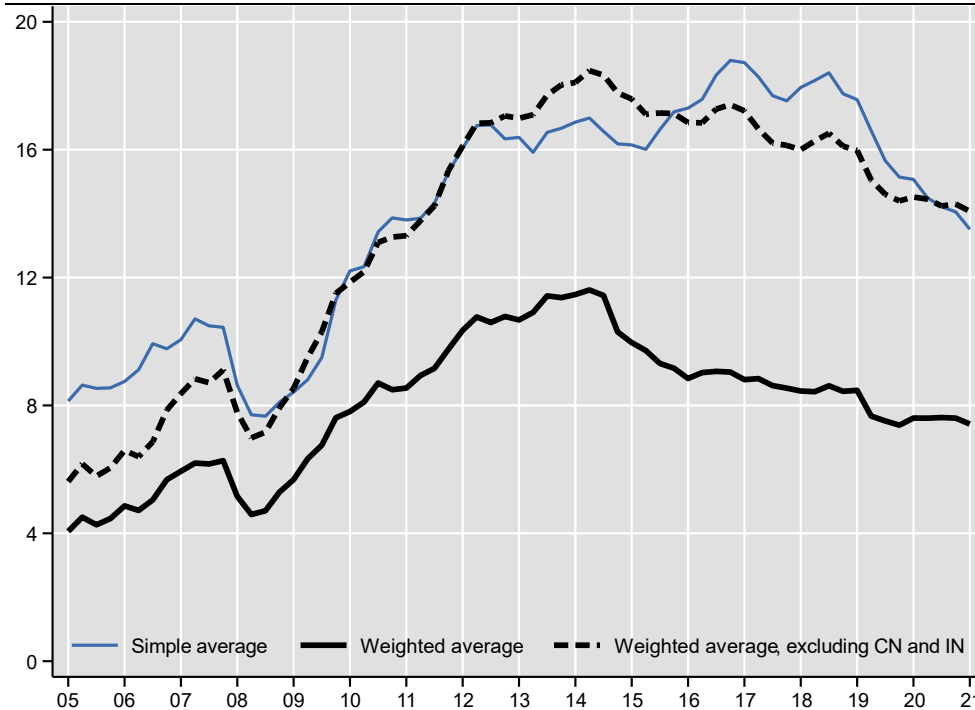
²⁴ Only five EMEs in the sample, Chinese Taipei, Croatia, Hungary, Hong Kong SAR and Romania, exhibited the opposite trend.

into this asset class (Arslanalp et al, 2020). A few EME currencies have even established themselves in official reserves holdings. Arslanalp and Tsuda (2014) reported that foreign central bank holdings of government bonds were concentrated in the sovereign debt of seven EMEs at the time: Brazil, China, Indonesia, Malaysia, Mexico, Poland, and South Africa.

Foreign participation in local currency bond markets¹

As a percentage of outstanding local currency sovereign bonds

Figure 7



¹ Foreign holdings of local currency government bonds as a share of local currency government bonds outstanding. With reference to Table 2, the share for each country is calculated as $\pi_L = l/L$, in percent. The simple average is the mean across individual country shares. The weighted average expresses the combined external holdings of EME local currency government bonds as a percentage of local currency bonds outstanding, calculated over the set of EMEs for which both parts are available. The unbalanced panel covers 25 countries between Q4 2005 and Q4 2021; Chile and Romania enter the sample late.

These statistics underscore the extent of rising foreign participation in domestic sovereign bond markets across many EMEs. Naturally, the shares held abroad are lower for local currency bonds (Figure 7) than for all sovereign bonds combined (Figure 5), but the trend increase in local currency bond markets is steeper. The share of local currency bonds held abroad surged from 2009 to 2014 but has stagnated since.²⁵ Even so, it is the rising participation in local currency bond markets (π_L , Figure 7) that supported overall foreign participation (Π , Figure 5), even as the composition of sovereign debt has shifted toward local currency (Λ , Figure 4).²⁶

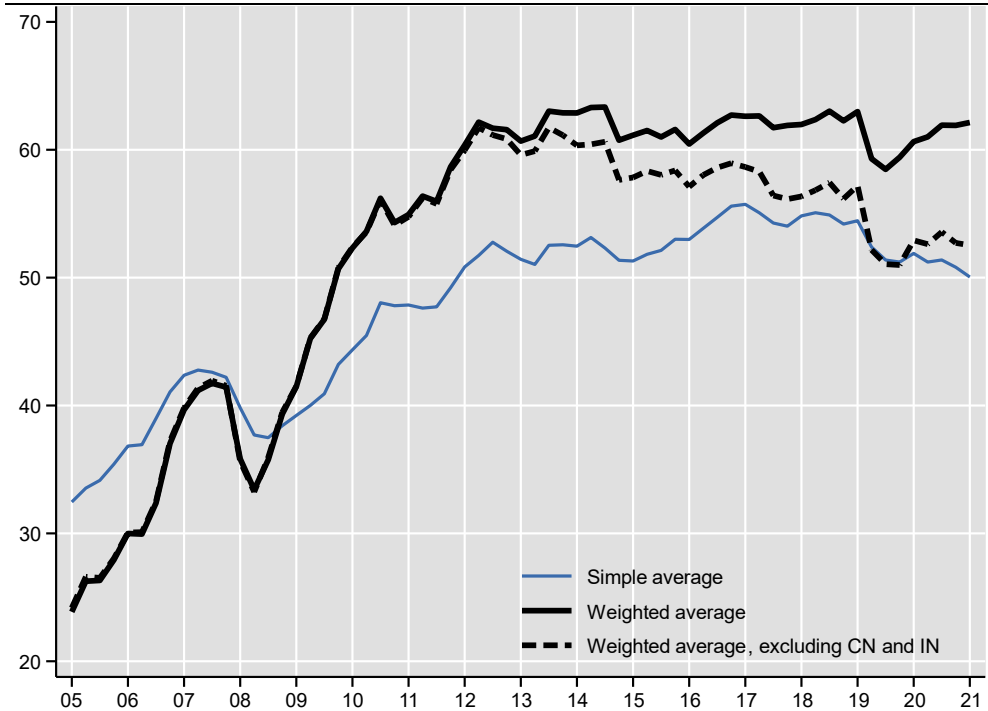
²⁵ The recent decline in π_L is not due to valuation effects: it is the only ratio of the four we examine that does not (directly) depend on exchange rates (see Table 2).

²⁶ Recall equation (1), which shows that Π is a weighted average of the participation ratios in local currency (π_L) and in foreign currency bonds ($\pi_F > \pi_L$), with a larger weight on the former.

Trend 4: Foreign investor exposure to EME local currencies (λ)

The analysis so far took the borrower perspective, looking at EMEs’ reliance on external financing. We now shift perspective to foreign investors and focus on their external portfolios (the row “foreign holders” in Table 2), to examine λ , the currency composition of foreign holdings. Since the literature measures the extent of original sin by the *foreign* currency share of external borrowing ($1 - \lambda$), the rise in the *local* currency share λ can be taken as a measure of progress on this front.

Local currency exposure in foreign portfolios¹
 As a percentage of total foreign holdings of EME sovereign bonds Figure 8



¹ Local currency-denominated government bonds held abroad, as a share of foreign holdings of government bonds in all currencies. With reference to Table 2, the share for each country is calculated $\lambda = \theta l / (\theta l + f)$, in percent. The simple average is the mean across individual country shares. The weighted average expresses the combined foreign holdings in local currency as a percentage of foreign holdings in all currencies, calculated over those EMEs for which both parts are available. The panel covers 25 countries between Q4 2005 and Q4 2021; Chile and Romania enter the sample late.

Figure 8 shows the share of local currency bonds in external sovereign bond holdings. In the aggregate, foreign investors have clearly taken more exposure to local currencies in their EME sovereign portfolios over time. All three lines exhibit significant positive trends over the sample period. In other words, foreign investors increasingly geared their sovereign bond portfolios toward EME local currencies. The estimated slope of the weighted average line is approximately 0.55, indicating that the share of local currencies in foreign portfolios rose by about 2 percentage points each year.²⁷ The trend in the weighted average across EMEs is slightly weaker without China and India (dashed line), since sovereign bonds in renminbi and rupee play a prominent role in foreign portfolios.

²⁷ With quarterly observations, the trend slope of the weighted average (0.55) implies that the domestic currency share in foreign bond holdings rises by some 2.2 percentage points per year on average. This is close to the change between the shares in 2005 and 2021 (+38 percentage points) divided by the number of years between.

Much of the shift toward local currency bonds occurred in the post-crisis environment of 2009 to 2012, fuelled by the search for yield. By 2011, the local currency share in the external holdings of EME sovereign bonds exceeded 50%: foreign holdings of local currency bonds had eclipsed those of foreign currency bonds. By 2020, they would reach more than \$1 trillion in value. In 2012 Q4, a structural break interrupted that trend. The weighted average levelled off at 63% in 2013–15, and dropped below 60% in the first half of 2020, when EME currencies lost value (thick solid line, Figure 8). Weak exchange rates tend to reduce the observed λ even when foreign investors do not actively shift allocations toward foreign currency bonds (see Section 3). That said, several EMEs also increased bond issuance in foreign currencies to raise external funding for pandemic-related spending, lowering the local currency share in foreign portfolios.

The aggregate trend conceals substantial variation across individual country portfolios. Investors holding East Asian government bonds naturally incur higher local currency exposure than those invested in Latin American sovereigns, since the latter issued more foreign currency bonds. Investors in Chinese or Indian sovereign bonds have little choice but to hold local currency bonds. The simple average and weighted average excluding China and India exhibit more moderate increases over the horizon than the weighted average, hovering in a range closer to 50%; apparently, foreign investors are more comfortable with a higher local currency share when it comes to larger issuers. Even so, the external holdings of bonds issued by 13 of our 25 EMEs saw significant positive trends in the local currency share, with the steepest slopes for China, Russia, South Africa, and Brazil; only six EMEs saw the opposite trend.²⁸

The major EMEs in our sample thus show evidence of overcoming original sin, as their sovereigns increasingly borrow abroad in their own currency – both in levels and as a share of their external borrowing. These findings generalise the observation of Du and Schreger (2022) – that the local currency share of sovereign debt held abroad rose from 2003 to 60% in 2017 – in a larger sample of EMEs. Our local currency shares exceed those in Eichengreen et al’s (2022) study because they focus on international bonds in a sample that covers all sectors and more countries for which original sin persists. The most robust result in this literature is that larger EMEs, by aggregate GDP, face less original sin.

The trend in λ (Figure 8) in fact depends on the first three trends we have documented. To see this, we rewrite the definition of λ in terms of the foreign participation ratios, using $l = \pi_L L$ and $f = \pi_F F$, as well as the definition of Λ ,

$$\lambda = \frac{\theta l}{\theta l + f} = \frac{l}{l + \varepsilon f} = \frac{\pi_L L / B}{\pi_L L / B + \pi_F \varepsilon F / B} = \frac{\Lambda \pi_L}{\Lambda \pi_L + (1 - \Lambda) \pi_F} = \frac{\Lambda \pi_L}{\Pi} \quad (3)$$

The formulation $\lambda = \Lambda \pi_L / \Pi$ combines the four ratios we examine and makes clear how a sustained rise in λ – the main measure of progress toward overcoming original sin – relates to our Trends 1 to 3. The local currency share in external borrowing λ increases when the share of bonds denominated in local currency Λ goes up and foreign participation π_L rises at a faster pace than π_F and thus Π .²⁹ Intuitively, when governments shift their issuance toward local currency bonds and foreign investors increase their local participation (*more* than in the market for foreign currency bonds), the consequence is that external portfolios shift toward local currency. Part and parcel of overcoming original sin is that foreign investors become more exposed to EME currencies.

²⁸ A trend toward foreign currency was significant in foreign bond holdings of Turkey, Romania, Croatia, Hong Kong SAR, Indonesia and Argentina. The country portfolios with no significant trends include Bulgaria, Chile, Chinese Taipei, Hungary, Thailand and India (Chinese Taipei, Thailand and India issue only in local currency).

²⁹ These simultaneous increases are sufficient, not necessary, for a positive trend in λ . A rising foreign participation ratio π_L / Π can offset a falling Λ . And the ratio π_L / Π also rises if π_F falls faster than π_L , ie if foreign investors turn away from foreign currency bonds.

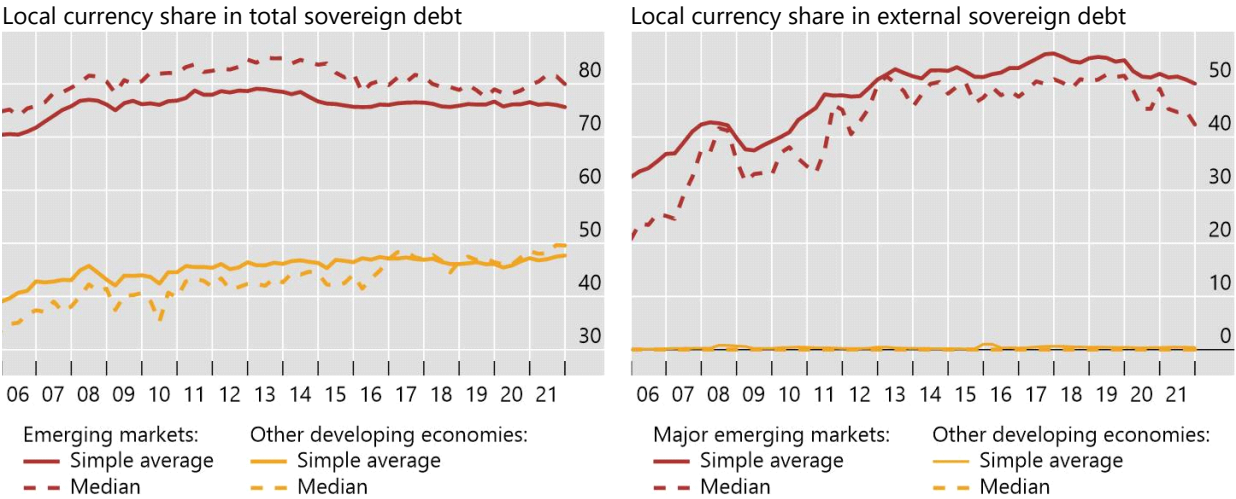
3. Progress and setbacks

The long-term perspective taken in Section 2 shows that major EMEs have been in the process of overcoming original sin: they have done so by raising the local currency share in sovereign bond issuance (Trend 1, Figure 4), and by relying more on foreign investors (Trend 2, Figure 5) to finance local currency borrowing (Trend 3, Figure 7). This went hand in hand with a rising exposure to local currency bonds in foreign portfolios (Trend 4, Figure 8).

While this progress is broad-based among the major EMEs, it is less common outside our sample. Eichengreen et al (2022) use a larger panel covering international bonds (IDS) and show that original sin persists for smaller EMEs and developing economies. As described in Section 1, the use of IDS alone understates local currency shares (recall Figure 3). Still, the same conclusion can be drawn from Arslanalp and Tsuda’s extended sovereign investor base dataset: the sovereign debt (loans and bonds) of developing economies clearly differs from that of the major EMEs we covered (Figure 9). Smaller sovereign issuers rely less on local currency debt overall, with less than half their total government debt denominated in local currency (left panel). And hardly any of these issuers’ local currency debt is held abroad, in sharp contrast to the bonds issued by larger EMEs. Our evidence for overcoming original sin seems to be driven by the major EME sovereigns that make up our sample.

Major EMEs are the exception when it comes to local currency debt

As a percentage of total and external sovereign debt, respectively Figure 9



The EME sample (red lines) refers to sovereign bonds, matching earlier figures. For smaller emerging markets and developing economies (yellow lines), the panels show total sovereign debt (bonds plus loans and other instruments).

Sources: Arslanalp& Tsuda; BIS emerging market sovereign bonds dataset; authors’ calculations.

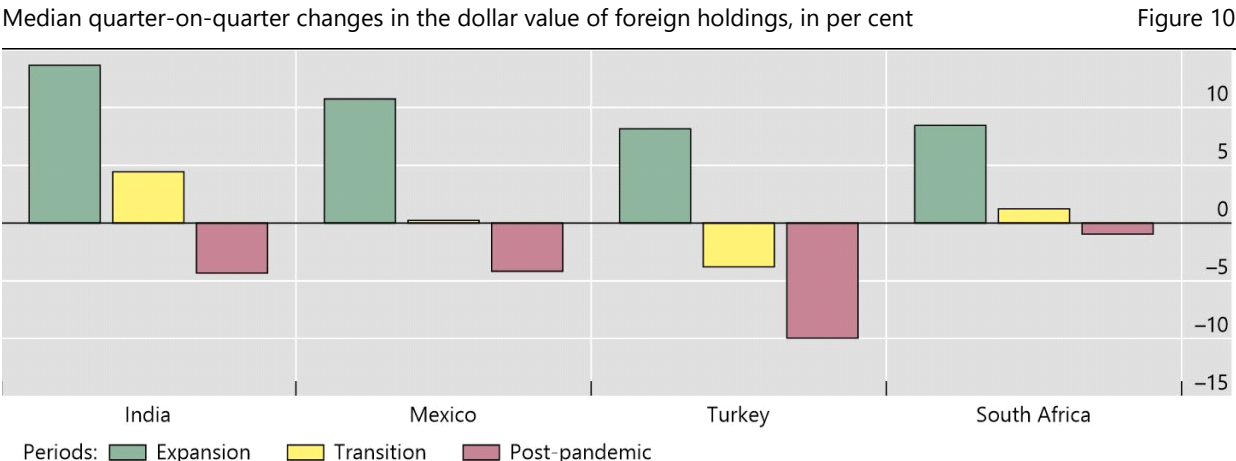
Moreover, the trends we have documented for major EMEs appear to have stalled or even reversed over the past decade. Even countries that made substantial progress have faced various setbacks on the way, underscoring their continued vulnerability to global financial conditions. The rest of this section focuses on the role of exchange rate dynamics in these developments. For issuers, local currency depreciations increase the burden of foreign currency bonds; for foreign investors, depreciations inflict losses on local currency bonds in dollar terms. To distinguish financing flows (at a given exchange rate) and valuation changes due to shifting exchange rates, we decompose the overall change in the value of sovereign bond portfolios. We find that the weakness of EME currencies over the past decade has concealed some of the progress major issuers have continued to make.

The role of exchange rates

Sound macroeconomic management, better institutions and economic fundamentals have made global investors more comfortable with EME sovereign bonds. Governments gained greater control over their finances by developing domestic bond markets, shifting their economies away from the 1990s-style short-term borrowing in foreign currency, while accumulating significant FX reserves (Burger et al, 2012; Amstad et al, 2020). Indeed, the development of local currency bond markets has been promoted in policy circles as a cornerstone of broader capital market development, not least to attract foreign investors (IMF and World Bank, 2021). At the same time, greater external openness, as well as shifting preferences among foreign investors and plentiful global liquidity, have also contributed to the long-term success of this asset class (Bruno and Shin, 2015; Cerutti et al, 2019).

However, these long-term developments have been uneven, and punctuated by various setbacks along the way.; All the graphs presented in Section 2 feature dents in 2008–09 as the retrenchment of investors amidst tight global financial conditions and dollar strength battered many EMEs. The post-GFC period itself has distinct phases, as Figure 10 illustrates for four major issuers. The expansionary phase from 2009 to 2013 saw the fastest growth in foreign holdings of local currency bonds (green bars). Those inflows were broad-based, as foreign investors differentiated little between EMEs in their search for yield (Arslanalp and Tsuda, 2014). This dynamic faltered after 2013, with marked differences across EMEs due to idiosyncratic factors (yellow bars). Then the pandemic took a toll, affecting foreign holdings of local currency bonds particularly hard (red bars).

Foreign holdings of local currency bonds in selected EMEs¹



¹ Expansion is defined as period between Q1 2009 (end of GFC) and Q1 2013 (Taper tantrum); transition between Q2 2013 and Q4 2019; decline between Q1 2020 (eve of the Covid pandemic) and Q4 2021 (latest available data). The median represents the typical quarterly change in each phase for each of the countries shown. Foreign holdings of local currency bonds measured in US dollar terms.

Exchange rates play a key role in these developments. In the process of overcoming original sin, foreign investors incur greater exposure to local currencies (recall Figure 8). It is not common practice among investors to fully hedge their exposures to emerging market currencies.³⁰ Reducing EMEs’ reliance on foreign currency debt thus shifts the currency mismatch to the balance sheets of foreign investors. From their perspective, the rising exposure to emerging market currencies comes with considerable risks.

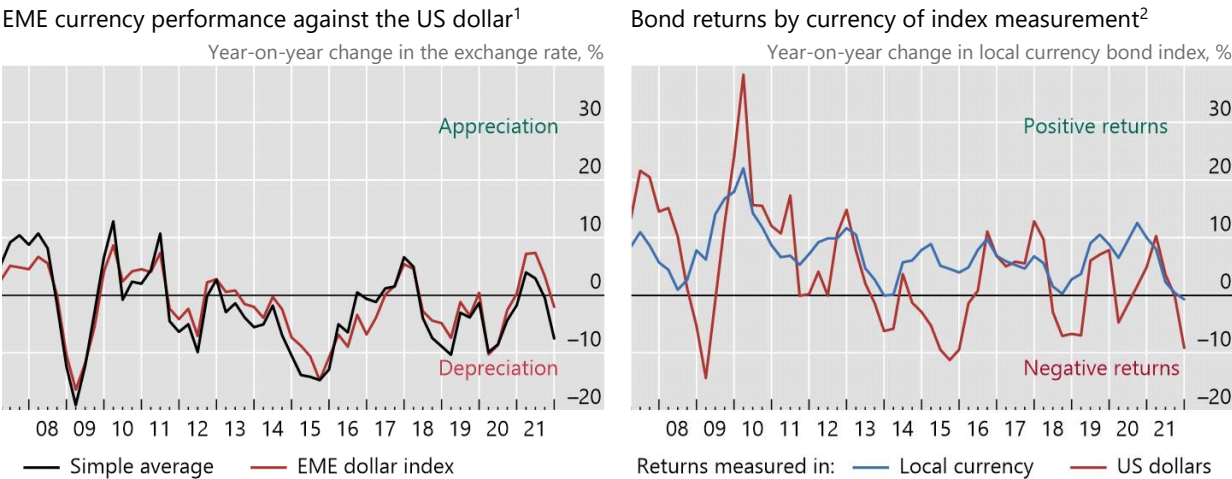
³⁰ The extent of hedging among foreign investors in EME local currency debt is rarely reported but known to be low in general (Siddiqui et al, 2020, FSB, 2022). Full hedging would seem to be the exception, given that the cost of hedging EME currencies eliminates much of the yield spread on sovereign bonds. The arguments in this paper remain intact when foreign holders invest in EMEs on a partially hedged basis.

The periods marked in Figure 10 indeed reflect episodes with major exchange rate developments. The GFC entailed strong dollar appreciation and a generalised retreat across asset classes, taking a toll on local currency bond portfolios; conversely, appreciation in emerging market currencies fuelled the post-GFC boom in local bond markets visible in Figures 7 and 8. When the Federal Reserve announced its intention to phase out quantitative easing in May 2013, the ensuing period of dollar strength saw EME currencies lose more than 25% of their value from 2013 to late 2016. Several major issuers, notably Argentina, Turkey, and South Africa, suffered credit rating downgrades that further weighed on their currencies. Foreign participation in sovereign bond markets stalled as a result (Figures 5 and 7).

The period since the 2013 taper tantrum saw bouts of depreciation in EME currencies, some in excess 10% per annum (Figure 11, left panel). These episodes are mirrored in weaker local currency bond returns when measured in the reference currency of global investors. Returns in dollar terms (right panel, red line) often turned negative even as returns in local currency (blue line) remained positive throughout. Depreciations and volatility of EME currencies curb returns and dampen investor risk appetite (Du and Schreger, 2016; Hofmann et al, 2022). Hence, emerging market issuers pay a large spread over the risk-free benchmark when borrowing in their own currency; three quarters of this spread can be attributed to currency risk (Du and Schreger, 2016). Lee (2022) shows that the premium on local currency debt rises with exchange rate volatility and can dissuade governments from borrowing in local currency.

Bond return performance undermined by weak exchange rates

Figure 11



¹ EME dollar index is the Federal Reserve’s trade-weighted index (H.10 release). Simple average represents the sample average of year-on-year changes in bilateral exchange rates against the US dollar. A positive percentage change in EME dollar index corresponds to appreciation against the US dollar. ² Based on 23 EMEs in our sample; simple average across the year-on-year returns of individual country constituents of GBI-EM Broad Diversified and GBI Broad Diversified indices.

Sources: Federal Reserve Bank of St. Louis; JP Morgan; national data; BIS; authors’ calculations.

For foreign investors, exchange rate movements effectively add duration risk. The duration of a typical bond in the JP Morgan GBI-EM index, which tracks EME local currency government bonds, is about 4 years. Duration also measures the sensitivity of a bond’s market price to changes in its yield. The blue line of Figure 12 (left panel) indicates that a 1 percentage point rise in yields goes with a 3.7% drop in the local currency price of bonds. This effect is more pronounced for foreign investors, who evaluate returns in US dollars: for the same change in yields, the return in dollar terms is about -6.6%, nearly twice as large as in local currency terms. Since spikes in emerging market government yields tend to go hand in hand with currency depreciations, the effective duration of EME local currency bonds is higher for foreign holders than for domestic investors.

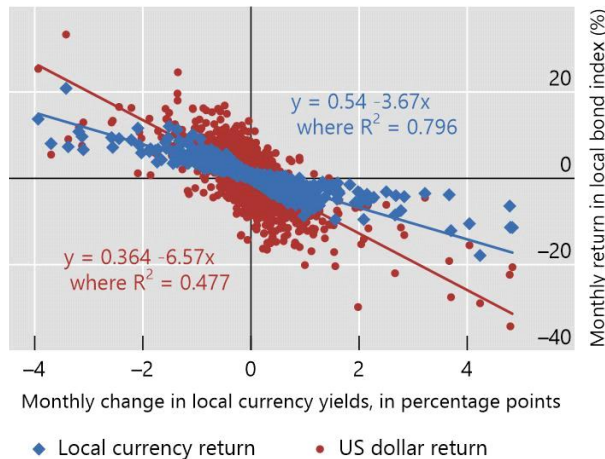
The role of duration and market risk has become more prominent with the growing heft of NBFIs as holders of local currency sovereign bonds. Mutual funds appear particularly sensitive. Shek et al (2018) document substantial bond sales by EME mutual funds during the taper tantrum, well in excess of

redemptions. Similarly, Bertaut et al (2023) show that mutual funds react more sensitively than other sectors. The non-bank sector (which includes investment funds) has provided a growing share of external financing to EMEs over the past decade: by end-2021, some 70% of external government debt was held by non-banks (Figure 12, right panel). Investment flows into EMEs have thus become volatile at times (IMF, 2021; FSB, 2022). This procyclicality came to the fore in the March 2020 turmoil, when investment funds drove foreign outflows from EME bond markets (Hofmann et al, 2020; FSB 2022; Shin, 2023).

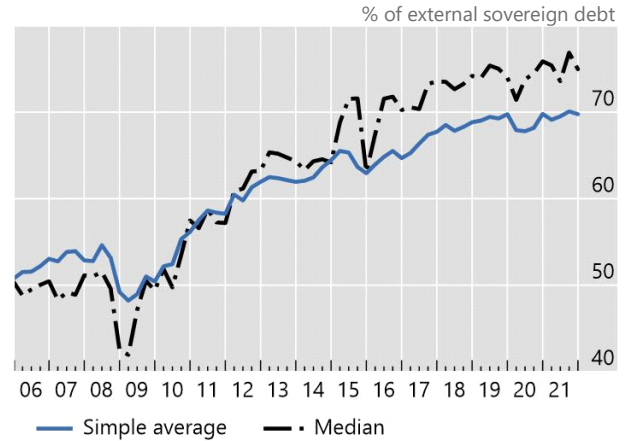
Non-banks' increasing share in EME government debt market

Figure 12

Dollar returns are sensitive to changes in yields



Foreign non-bank share in external sovereign debt¹



¹ For a balanced panel of 21 EMEs (excluding HK, TW, IL, and HR due to incomplete data.)

Sources: Arslanalp & Tsuda (2014); JP Morgan; BIS; authors' calculations.

Decomposition: financing flows vs valuation effects

Exchange rate movements induce currency valuation effects and trigger portfolio reallocations, two separate effects that we wish to disentangle. To do so, we examine how exchange rate depreciations affect the balance sheets of EME governments and foreign investors. We decompose the overall change in the value of sovereign bonds into financing flows (at a given exchange rate) and valuation changes due to exchange rate movements. This allows us to distinguish their roles in the trends we documented.

We first adopt the perspective of the sovereign issuer. Recall from Section 1 that borrowers view the value of their liabilities in terms their own currency, $B = L + \varepsilon F$. Using primes to denote the next period, we decompose the change in the value of foreign currency debt, $\varepsilon' F' - \varepsilon F$, into two parts: financing and valuation. Suppose the government raises $(F' - F)$ in dollar financing by issuing (or repaying, if negative); with this, the value of sovereign bonds evolves as

$$B' - B = (L' - L) + (\varepsilon' F' - \varepsilon F) = \underbrace{(L' - L) + \varepsilon' (F' - F)}_{\text{Net financing}} + \underbrace{F(\varepsilon' - \varepsilon)}_{\text{Valuation effect}}. \quad (4)$$

A depreciation ($\varepsilon' > \varepsilon$) raises the burden of foreign currency debt evaluated in terms of local currency – an effect familiar from the Asian financial crisis (eg Chang and Velasco, 2001; Bruno and Shin, 2015).

Foreign investors, on the other hand, assess the value of their EME sovereign bond holdings in terms of their reference currency, taken to be the US dollar, where $\theta b = \theta l + f$. From their perspective, the change in the value of their holdings can be decomposed as follows,

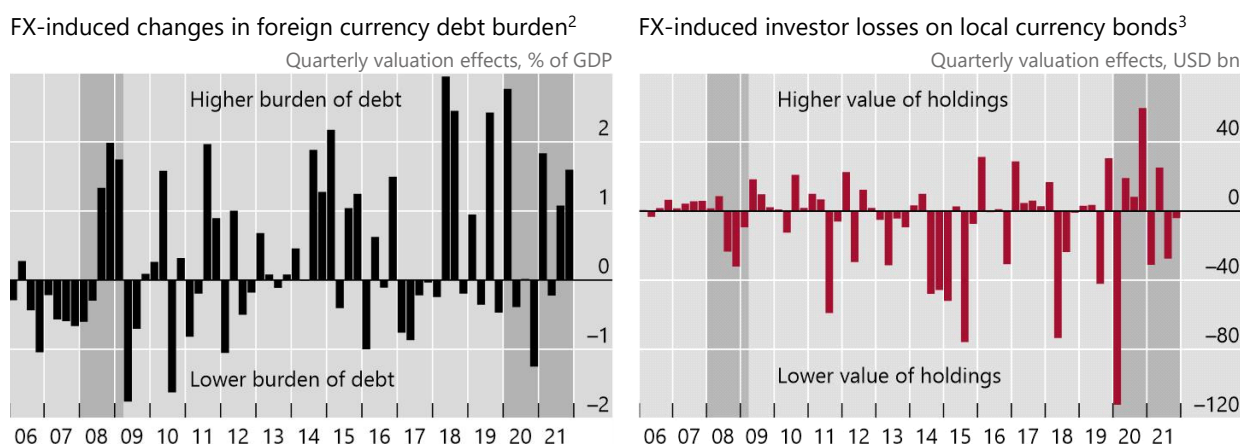
$$\theta' b' - \theta b = \underbrace{(f' - f)}_{\text{Net investment}} + \theta' \underbrace{(l' - l)}_{\text{Valuation effect}} + \underbrace{l(\theta' - \theta)}_{\text{Valuation effect}} \quad (5)$$

There is no valuation effect on dollar bonds; instead, the currency mismatch is on local currency bonds: EME depreciation ($\theta' < \theta$) inflicts losses on local currency bond holdings when expressed in US dollars.

The next two figures plot the net financing and valuation effects in equations (4) and (5) for all EMEs combined. Figure 13 shows that **valuation effects** on EME sovereign bonds have been sizeable over the past decade. Issuers face currency valuation effects on the foreign currency bonds they owe (left panel, from equation (4)). Before the GFC, the strength of EME currencies helped sustain foreign currency debt, lessening the burden on domestic balance sheets; the GFC reversed those gains, giving way to a period with adverse valuation effects. EME governments regularly saw their debt burden grow due to depreciation, by as much as 3% of GDP in some quarters. For some countries, valuation effects exceed 20% of GDP (eg Argentina and Turkey since 2018). At the onset of the pandemic, Brazil, Mexico, and Russia faced depreciations of more than 20%. Such episodes are relatively frequent and can be painful when foreign currency bonds come due for repayment.³¹

Exchange rate valuation effects facing borrowers and lenders¹

Figure 13



¹ Both panels show valuation effects, leaving out the changes in F and l within each quarter. ² For each EME, the valuation effect is calculated by evaluating the initial stock of foreign currency bonds in terms of local currency at the beginning and at the end of each quarter; this difference $F(\varepsilon' - \varepsilon)$ is scaled by the same quarter's GDP. The panel shows a simple average of this ratio across the EMEs in the sample. ³ The valuation effect facing foreign investors is calculated separately for each EME, by comparing the dollar value of the initial level of holdings of local currency bonds at the beginning and at the end of the quarter; the difference $l(\theta' - \theta)$ is aggregated across EMEs.

Sources: National data; BIS; authors' calculations.

Foreign holders, on the other hand, face currency valuation effects on their holdings of *local* currency bonds. The right panel plots the last term in equation (5). Depreciations of EME currencies ($\theta' < \theta$) reduce the dollar value of local currency bonds, and thus inflict losses on foreign investor portfolios. Valuation effects have grown larger over time, in line with greater holdings. However, most of the largest changes have been negative; this has undermined returns even as sovereign bonds performed well in local currency terms (recall Figure 11). This affects foreign investors whenever bonds are repaid, sold, or

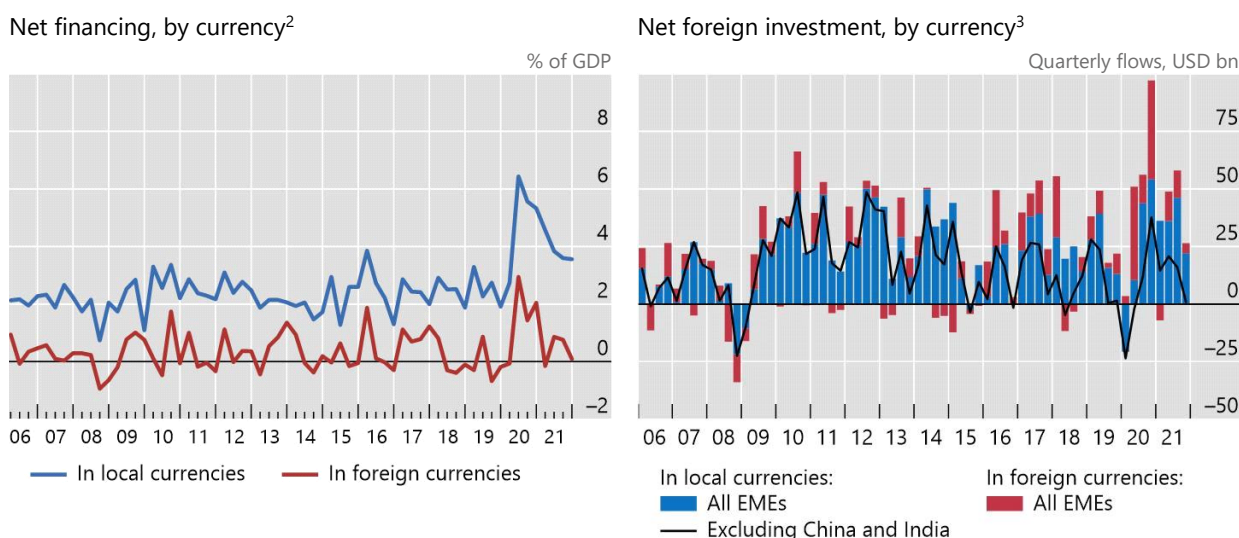
³¹ The long maturity of most EME government bonds, typically above five years at issuance, helps in that respect.

marked to market. At the onset of the pandemic (Q1 2020), the surge in the value of US dollar against EME currencies inflicted losses of more than \$100 billion.³²

Even so, these valuation effects have not dissuaded governments from issuing foreign currency bonds, nor foreign holders from investing in local currency bonds. Figure 14 plots **net financing** (left panel) in local and foreign currencies – the first two terms in equation (4). EME governments have tapped international bond markets for foreign currency as needed. For example, the pandemic in 2020 saw a spike in EME foreign currency bond issuance (notably by Chile, Mexico, Peru, and Romania). Still, EMEs have financed themselves more consistently in local than in foreign currencies over the sample period. Net issuance of local currency bonds remained positive throughout, running at 1% to 4% of GDP on average – at no point have redemptions fallen short of new issuance.

Issuance and foreign investment in EMEs sovereign bonds¹

Figure 14



¹ Both panels show financing flows after removing valuation effects by holding exchange rates constant within each quarter. ² Net issuance (gross issuance minus redemptions) is the change in the amount outstanding from the beginning to the end of the quarter. For the EMEs in the sample, the blue line tracks the average $(L' - L)$ in local currency scaled by the same quarter's GDP in local currency. Similarly, the red line plots the average across EMEs of $\varepsilon'(F' - F)$ in US dollars scaled by that quarter's GDP in US dollars. (Foreign currency bonds are assumed to be denominated in US dollars. ³ The panel shows the quarterly changes in external holdings of foreign currency bonds $(f' - f)$, aggregated across EMEs, in red. For local currency bonds (in blue), the change in foreign holdings $(l' - l)$ is calculated at constant exchange rates for each quarter and converted to US dollars at the end-of-quarter exchange rate to obtain $\theta'(l' - l)$ before aggregation. The black line excludes net investment into Chinese and Indian local currency government bonds.

Sources: National data; BIS; authors' calculations.

Figure 14 (right panel) tracks net investment by foreign holders, after stripping out valuation effects. Foreign holdings have held up better than the trends in Section 2 may suggest. Despite valuation-induced losses (Figure 13), local currency net inflows from abroad have continued over the past decade. Foreign investors have still increased their holdings of EME sovereign bonds, providing continued external financing to EMEs in the aggregate. In most quarters (83%), EMEs as a group received more external funding through local than through foreign currency bonds; these findings hold also without China and India. But the aggregate conceals variation at the country level; LC bond inflows can be volatile, with large outflows in few quarters. Countries experiencing exchange rate depreciations, in

³² Hale and Juvenal (2022) find substantial currency-induced valuation effects on EMEs' external positions during the pandemic. On valuation gains helping to raise external holdings, see Burger et al (2012); on the risks, Burger et al (2007), Du and Schreger (2016). Currency valuation effects on external balance sheets also matter for advanced economies (Tille, 2003; Rey and Gourinchas, 2014; Bénétrix et al, 2015).

particular, can see substantial outflows through LC bonds. Even so, all 25 EMEs in our sample attracted positive net flows to local currency bonds when cumulated over the entire sample period.

That said, there are instances in which foreign investors shifted out of local currency bonds en masse. This is visible in the aggregate during the GFC and at the onset of the pandemic in 2020 Q1 (Figure 14, right panel).³³ In the face of valuation losses, foreign investors in the aggregate shed more local currency government bonds than foreign currency bonds of the same issuer. Individual EMEs saw more frequent episodes of foreign investor retrenchment from local bonds. Bertaut et al (2023) show that depreciations amplify selloffs by US investors in EME local currency bonds, but not in dollar-denominated bonds. Hofmann et al (2022) report a similar finding at the fund level, and Jansen et al (2023) at the security level. During the pandemic, local currency fund flows have also taken longer to recover than flows to hard currency EME funds (FSB, 2022).

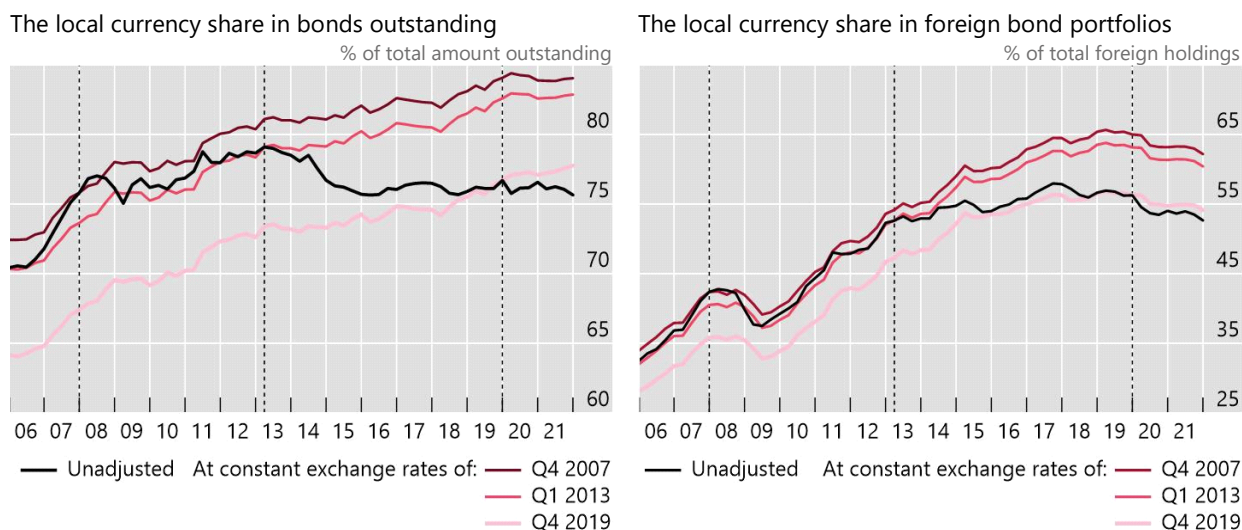
These observations have in common that flows into local currency bonds are more volatile. Nonetheless, the underlying financing patterns suggest that major EMEs have continued to make progress toward overcoming original sin, even against the backdrop of EME depreciations. In terms of financing flows, sovereigns have continued to attract external funding – even as the trends covered in Section 2 suggest otherwise for recent years. The trends were based on bond portfolios reported at current – and rapidly moving – exchange rates. Local currency bonds are worth less in dollar terms when EME currencies depreciate, which helps to explain why some trends appear to have stalled or reversed over the past decade. Finding continued financing flows, despite valuation losses, helps reassess the recent drops in our four trends.

Indeed, the local currency trends we highlighted would have been more prominent in the absence of EME depreciations. The black lines in Figure 15 reproduce the average shares from Figures 4 and 8. The local currency share in debt outstanding (Trend 1, left panel) reverts after 2011, but much of this reversion is due to weakness in EME currencies. The ratios Δ and λ mechanically decline when EME currencies depreciate, since the value of local currency bonds falls relative to that of foreign currency bonds (Appendix 3 derives the corresponding elasticities). The upward trend would have continued had exchange rates remained stable, as in the coloured lines. Valuation effects also weigh on Trend 4: the right panel illustrates that the local currency share in foreign portfolios would have held up longer at constant exchange rates. Instead, the observed share (black line) levelled off after 2013 largely because of the erosion in the dollar value of these assets following the taper tantrum; without those valuation effects, the trend would have continued through 2019, before the pandemic led to a genuine drop in investors' local currency bond holdings (red line).

The counterfactuals in Figure 15 illustrate that progress toward overcoming original sin would have been more manifest had EME currencies held their value over the past decade. Persistent depreciations have induced valuation effects that tended to mute the local currency trends observed in Section 2.³⁴ Valuation losses to foreign investors were substantial, but so was their continued investment in local currency bonds. When EM currencies depreciate, even a growing stock of local currency bonds appears to shrink gradually in dollar terms, compared with the hard currency bonds in their portfolios. The weakness of EME currencies thus conceals some of the progress EMEs have continued to make in overcoming original sin.

³³ Accordingly, those episodes left dents in the foreign participation ratio (Figure 7).

³⁴ This is not the case for the trends in foreign participation. There is no valuation effect in the foreign participation in local currency bond markets, since $\pi_L = l/L$ (Trend 3, Figure 7). As for overall foreign participation $\Pi = b/B$, the reversion in Trend 2 appears stronger at constant exchange rates (see Appendix 3).



¹ This figure shows Trends 1 (λ) and Trend 4 (λ), comparing the unadjusted shares (black lines) with hypothetical lines expressed at constant exchange rates (coloured lines). All lines show simple averages across the EMEs in the sample. The unadjusted shares are based on ratios of amounts outstanding (left) and foreign holdings (right panel) evaluated at *current* exchange rates (see Figures 4 and 8, and Table 2). The coloured lines instead recast both ratios at *constant* exchange rates, fixed at their values indicated in the legend.

Sources: National data; BIS; authors' calculations.

4. Policy implications

The trends we documented in this paper suggest that EMEs have made progress toward overcoming original sin over the past two decades, demonstrating their ability to borrow abroad in their own currency. The evidence is clearer for governments than for other sectors, and stronger for larger EMEs than for smaller emerging and developing economies. Both the greater reliance on local currency issuance and a larger footprint of local currency bonds in foreign portfolios stand out in the aggregate, and they hold for a majority of EMEs in the sample. Despite various setbacks in recent years, the comparison with the early 2000s makes clear that major EME sovereigns have come a long way.

Sound economic policies and favourable global financial conditions have played a role in these developments. Since increased issuance in local currency bonds tends to reduce foreign participation, a shift toward local currency debt should be coupled with deliberate efforts to foster foreign participation in domestic bond markets. Partly as a result of these efforts, many EMEs in the sample have seen continued interest from foreign investors over the past decade, even as spells of depreciation have reduced the attractiveness of this asset class. On a flow basis, aggregate foreign investment in local currency bonds remained positive for the most part.

Major EME sovereigns have thus made progress toward overcoming original sin in the original sense of the term. This process has helped to reduce currency mismatch on the borrower side but has shifted the mismatch to the balance sheets of foreign holders. Faced with extra duration and market risk, foreign investors can become reluctant to hold local currency bonds in periods of stress (Hofmann et al 2020, and IIF 2020, FSB 2022). Currency depreciations erode the value of local currency bonds to all investors who measure returns in hard currencies. Such losses can set off a feedback loop, where the shedding of bonds leads to greater valuation losses and depreciation and a further tightening of financial constraints (Hofmann et al, 2022).

This is not to suggest that EMEs would have fared better had governments continued to rely more on foreign currency bonds. The history of currency crises has underscored the dangers of an overreliance

on foreign currency debt. At the onset of the pandemic, EMEs again saw deep depreciations, with the currencies of Brazil, Mexico and South Africa among others falling more than 20% against the dollar. Fortunately, each had less than 20% of their government bonds denominated in foreign currency at the time (Brazil as little as 3%) – in contrast to, say, Indonesia or Turkey. Depreciations make foreign holders shed local currency bonds, but at least they do not raise the burden of debt to the issuer.

Instead, the underlying circumstances facing EME governments have changed the nature of EME stress events. The problem has morphed: in overcoming their reliance on foreign currency debt, EMEs have come to depend on investors whose exposure to local currency make capital flows more volatile in times of stress. The term “original sin redux” (Carstens and Shin, 2019; Bertaut et al, 2023) captures the idea that original sin can come back in a different guise – even for EMEs that no longer owe foreign currency debt. Recent experience underlines the remaining fragilities associated with original sin, and the fact that EMEs continue to find themselves exposed to the ebb and flow of global financial conditions.

Original sin in both guises comes with macroeconomic costs. Foreign currency debt is associated with lower creditworthiness and less flexible macroeconomic policies (Eichengreen et al, 2005, 2022). Depreciations raise the burden of foreign currency debt, and may drain official reserves or deepen the budget deficit; either outcome can put pressure on yields, inflation, and the exchange rate. The policies many EMEs follow in response – notably capital controls and reserve accumulation – have substantial costs for countries on their development path.

Volatile capital flows associated with original sin redux can also heighten financial instability and reduce fiscal space in times of stress. When capital flows turn away, foreign bond holdings end up being absorbed by domestic investors; EMEs thus finance a larger share of government debt domestically, compounding fiscal strains and lowering aggregate demand. This narrows EMEs’ fiscal space just when it is needed most. Fiscal space among EMEs had already deteriorated during the 2010s (Kose et al, 2022). In the pandemic, some sovereigns resorted to heavy issuance of foreign currency bonds (IIF, 2021). EME central banks also intervened, launching local currency bond purchase programmes to signal their willingness to act as buyer of last resort (Arslan et al, 2020; IMF, 2020; Cantu et al, 2021).

To capitalise on the benefits of local currency debt, longer-term policies should strengthen and diversify the domestic investor base and develop local financial markets. Since global portfolios exhibit strong home currency bias (Burger et al, 2018; Maggiori et al, 2020), foreign investor interest in local currency bonds may run into natural limits. A bedrock of domestic institutional investors is often seen as essential for sustaining the demand for sovereign bonds. However, turning away from external finance or building large official reserves erode the advantages of capital flows from advanced economies to EMEs. An alternative is to improve liquidity in sovereign bond trading, develop hedging markets and support – via appropriate regulation – those sectors that could take the other side in currency hedges, while reducing frictions that prevent investors from holding additional currencies in their portfolios.

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Appendix

1. BIS statistics on government bonds

The amounts outstanding in BIS statistical [Table C4](#) report general government bonds by the currency of denomination (as discussed in Bogdanova et al, 2021) in US dollars at nominal value where available, and market values otherwise. Nominal values represent issuers’ repayment obligation (face value plus accrued interest) vis-à-vis bond holders. Values are reported in US dollars, using end-of-period BIS exchange rates. Some calculations in Section 3 use changes in local currency or at constant exchange rates instead.

We enhance the reported statistics with other sources to obtain more complete quarterly coverage. We enhance these statistics to extend the sample period back to early 2000s for several countries, harmonise valuation methods and generate an upper bound for outstanding government bond stocks by using country-specific information, some judgment, and additional series provided by central banks.

Our sample covers the 25 countries in BIS Table C4 that the [BIS country groupings](#) classify as EMEs.

Emerging market economies in the sample				Table A
Asia (9)	Europe (8)	Latin America (6)	Africa & Middle East (2)	
China	Bulgaria	Argentina	Israel	
Chinese Taipei	Croatia	Brazil	South Africa	
Hong Kong SAR	Czech Republic	Chile		
India	Hungary	Colombia		
Indonesia	Poland	Mexico		
Korea	Romania	Peru		
Malaysia	Russia			
Philippines	Turkey			
Thailand				

2. Foreign holdings of government bonds

The statistics described in Appendix 1 cover the outstanding amounts issued on the primary market. It is more difficult to ascertain where bond holders reside, since bonds are traded freely on the secondary market. We hand-collect series from national sources capturing foreign (non-resident/external) holdings of general government bonds. Our holdings series were first presented in von Peter and Shin (2022) to

highlight four trends related to original sin. For this paper, we have implemented numerous data improvements and expanded the analysis beyond what was presented in our earlier work.³⁵

National series vary widely in terms of coverage, quality, valuation and frequency. Where several consistent series are available, we follow this preference order:

1. Securities holdings statistics (whom-to-whom) or financial market statistics reported by the ministry of finance, the central bank, or national statistical offices.
2. External debt statistics: Quarterly External Debt Statistics (QEDS), provided by the World Bank, and the updated dataset of Arslanalp and Tsuda (2014), who augment the QEDS with corrections and estimates.

To match the holdings series with the total outstanding amounts for each country, two main cases typically arise:

1. If the collected holdings series refer to *local currency* government bonds (l in Table 2), we can compare them with local currency bonds outstanding (L). Separately, the IIP, QEDS or Arslanalp-Tsuda data provide total external holdings of government bonds without a currency breakdown (b). Since $b = l + \epsilon f$, we can combine these sources to infer external holdings of *foreign* currency bonds ϵf as a residual. We ensure consistency through several logical tests, such as constraining all holdings series to lie between 0 and the outstanding amounts.
2. If the collected series refer to foreign holdings of government bonds in *all currencies* (b), the information less useful, as it does not complement reported external positions as in case 1. In this case, we have to estimate external holdings of local currency bonds (l) by other means. Absent other information, we take foreign currency bonds in the BIS IDS statistics as a proxy for external holdings of foreign currency bonds (ϵf), since they are marketed to international investors. We then estimate the holdings of local currency bonds from the difference between total external holdings (b , as in case 1) and this proxy as follows:
 - a. If the IDS in foreign currency lies below the total outstanding in foreign currency and total external holdings, we estimate the holdings of local currency bonds as a residual, Since $l = b - \epsilon f$.
 - b. If not, we cap external holdings of foreign currency bonds at the lower of the two series in step 2a. In the few cases where foreign currency bonds cannot all be held abroad (they would exceed total foreign holdings), we assume proportionality, ie that local and foreign currency bonds outstanding are held in equal shares abroad. This approach tends to underestimate the holdings of foreign currency bonds and overestimate the holdings of local currency bonds.
 - c. Where it is not possible to infer a local (or foreign) currency holdings series, we contact the relevant central bank or finance ministry and request the currency breakdown. In those instances where the requested data are provided, we include the series in aggregate calculations and in the shared dataset (unless the series are confidential).

³⁵ First, we extended the time period up to end-2021, which helps cover the stress in government bond markets during COVID-19. Second, we combined (or replaced) the data for several countries with official statistics to improve the accuracy of our estimates. Finally, where possible, we harmonised the valuation methods and imputed missing data to enhance coverage.

3. Ratios: definitions and derivations

This appendix briefly sets out the ratios used in the text, their relationships and valuation effects, using the notation established in Tables 1 and 2. The elasticities measure the percentage change in each ratio in response to a percentage depreciation (ε) of an EME's currency against the US dollar.

Ratio 1. Local currency share in government bonds outstanding

$$\begin{aligned} \text{Definition: } \Lambda &\equiv \frac{L}{B} = \frac{L}{L + \varepsilon F} \\ \text{Elasticity: } \frac{\partial \Lambda}{\partial \varepsilon} \frac{\varepsilon}{\Lambda} &= (\Lambda - 1) < 0 \end{aligned}$$

Ratio 2. Foreign participation in sovereign bond markets

$$\begin{aligned} \text{Definition: } \Pi &\equiv \frac{b}{B} = \frac{l + \varepsilon f}{L + \varepsilon F} \\ \text{Elasticity: } \frac{\partial \Pi}{\partial \varepsilon} \frac{\varepsilon}{\Pi} &= \frac{\pi_f - \pi_l}{\Pi} (1 - \Lambda) \Lambda > 0 \end{aligned}$$

Ratio 3. Foreign participation in local currency sovereign bond market

$$\begin{aligned} \text{Definition: } \pi_l &\equiv \frac{l}{L} \\ \text{Elasticity: } &0 \text{ (no direct effect)} \end{aligned}$$

Ratio 4. Local currency exposure in foreign investor portfolios

$$\begin{aligned} \text{Definition: } \lambda &\equiv \frac{l}{b} = \frac{l}{l + \varepsilon f} = \frac{\theta l}{\theta l + f} \\ \text{Elasticity: } \frac{\partial \lambda}{\partial \theta} \frac{\theta}{\lambda} &= (1 - \lambda) > 0 \text{ akin to } \frac{\partial \lambda}{\partial \varepsilon} \frac{\varepsilon}{\lambda} = (\lambda - 1) < 0. \end{aligned}$$

Relationships between ratios. The definition of ratios in the debt matrix clarifies the mutual dependencies between the various ratios. Each marginal (large cap) ratio can be written as a weighted average of their interior ratios,

$$\begin{aligned} \text{Local currency share: } \Lambda &= \Pi \lambda + (1 - \Pi) \lambda_d \\ \text{Foreign participation: } \Pi &= \Lambda \pi_l + (1 - \Lambda) \pi_f. \end{aligned}$$

$\lambda_d = \frac{B-b}{L-l}$ represents the local currency share in domestic portfolios (Table 2). The second expression leads to equation (1) in the text:

$$\Pi = \pi_f - (\pi_f - \pi_l) \Lambda.$$

When Λ increases, a rise in foreign participation (Π) is possible only if π_l rises to lessen the difference in parentheses. In other words, a shift toward issuing local currency bonds requires an accompanying policy of fostering foreign participation in local bond markets to sustain the same degree of foreign participation overall.

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