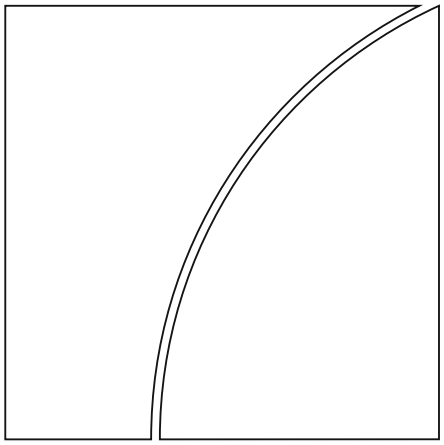

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Overcoming original sin: insights from a new dataset

by Mert Onen, Hyun Song Shin and Goetz von Peter

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Overcoming Original Sin:

shedding new light on uneven progress

Mert Onen, Hyun Song Shin and Goetz von Peter[1]

April 2025

Abstract: This paper examines sovereign bond markets to assess the current state of *Original Sin*, the inability of a country to borrow (abroad) in its own currency. We present a synthesis of different strands of the literature using a new, tailored dataset. We find that major emerging market economies (EMEs) have made progress toward overcoming original sin by issuing more government bonds in local currency while promoting foreign participation in domestic bond markets; this went hand in hand with rising exposure to EME currencies among foreign investors. In panel regressions, we show that country-specific variables played a role alongside global push factors. However, progress has been slow and uneven, with a key role for institutional development. Progress is most evident among major EMEs, and stronger for sovereigns than for other issuers. Reducing reliance on foreign currency borrowing implies a greater role for investors whose sensitivity to currency risk can make capital flows more volatile – reintroducing the problem in a different guise, as original sin redux.

JEL: F34, G15, H63.
Keywords: Emerging market economies, sovereign bonds, international lending, international financial markets, foreign investors, original sin.

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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.[2] Where the domestic investor base was small, this effort went hand in hand with promoting greater foreign participation in domestic bond markets.

Our paper aims to provide a "deep dive" into the sovereign bond markets for emerging market economies (EMEs), and assess the extent to which governments have reduced their reliance on foreign currency (FC) bonds. The focus on long-term government bonds is motivated by the increasing 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 to dissect the key trends.

Our point of departure is the debate about ***original sin***, the inability of a country to borrow abroad in its own currency, or borrow long-term even domestically. Eichengreen, Hausmann and Panizza (2005, 2007, 2023) observed that original sin is too widespread and persistent among emerging markets and developing economies (EMDEs) to be explained by their monetary and financial history; only economic size helps to predict which countries overcome original sin. The main challenge to this view comes from research on local currency (LC) bond markets. Burger and Warnock (2006) and Burger et al (2015) show that country-specific variables have explanatory power for local currency bond issuance and foreign participation in local bond markets, to argue that EMEs are not inherently dependent on foreign currency debt when they improve policy performance and strengthen their institutions.

All contributions in this literature relate to original sin in some way, but the evidence is difficult to compare and reconcile. Each paper emphasizes different ratios or shares, using data on various instruments and sectors, not to mention different country groupings and time horizons. To provide a comprehensive analysis based on consistent metrics, we (1) examine the relationships between key variables and track the evolution of foreign participation and local currency shares over time; (2) focus on EME government bonds, since sovereign issuance represents the best recent evidence; (3) construct a dataset tailored for adjudicating the original sin debate; and (4) apply panel methods to identify the role of global versus country-specific factors in overcoming original sin.

Our statistical contribution is to construct a new dataset on EME sovereign bonds that distinguishes the currency of issuance from investor residence – two key dimensions of our analysis. The dataset builds on earlier efforts. Eichengreen, Hausmann and Panizza's work mostly focused on *international bond markets*. Burger and Warnock (2006) recognised the need to incorporate *domestic bond markets* for a fuller picture. Yet, to obtain a consistent currency breakdown across all markets, a new data collection was necessary. We initiated the BIS statistics on government bonds in local and foreign currencies, and matched them with series on foreign holdings collected from national official sources. Our focus on long-term bonds is narrower than that of Arslanalp and Tsuda's (2014) on government debt but enables a consistent split by currency. This comes at the expense of country coverage; still, our sample covers most of the asset class. The panel covers 27 major EMEs over 2004-2022 at quarterly frequency; it is published online along with dashboards for visualising the time-series and cross-sectional data.

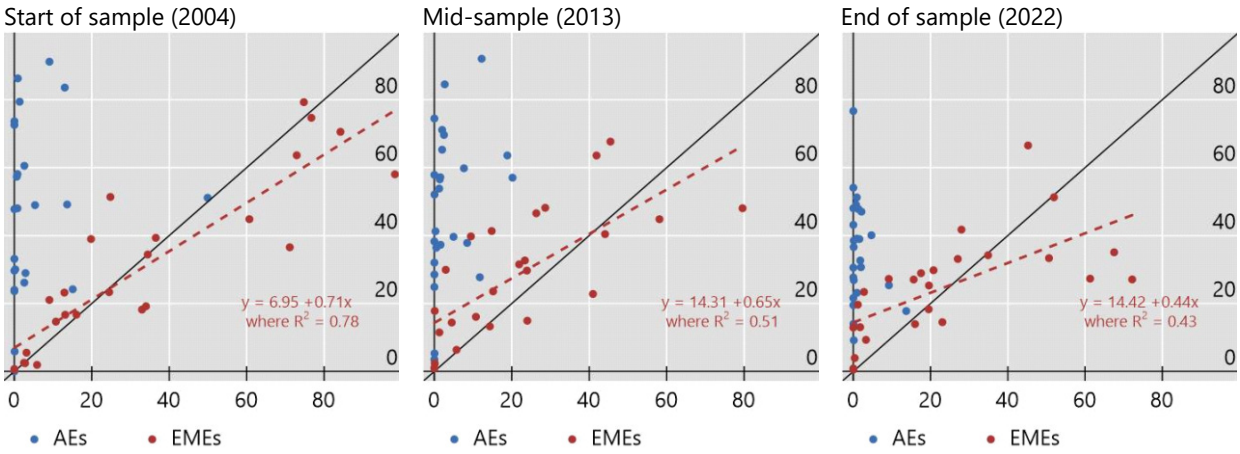
Our dataset allows us to draw a sharp distinction between currency and geography (Figure 1). Each scatter contrasts the share of government bonds in foreign currencies with the share held abroad, i.e.

[2] The paper views currencies from the issuer perspective. Local currency (LC) bonds are denominated in the issuer country's domestic currency (which is a foreign currency to foreign investors). Foreign currency (FC) bonds are denominated in any other currency, typically in US dollars or other key currencies.

foreign participation. There is a positive correlation: some EMEs rely on FC bonds to attract foreign investors, while those issuing mainly in local currency see lower foreign participation.[3] But all countries above the 45° line must have sold local currency bonds to foreign investors – this is not the prerogative of advanced economies (AEs). Nor are all foreign currency bonds held by foreign investors. The overlap between the two dimensions is far from perfect, and it has weakened over time: the regression slopes and fits decline over time across the panels. We therefore examine the distinct evolution of each.

Two dimensions: foreign currency vs foreign holdings[1]

Foreign currency share (x-axis) vs foreign participation (y-axis), in % of government bonds outstanding Figure 1



[1] For a cross-section of 28 AEs and 25 EMEs at three points in time, each scatter contrasts two shares (in %). The x-axis shows the share of government bonds denominated in foreign currencies; the y-axis measures the share of government bonds (all currencies) held abroad, i.e. foreign participation in government bond markets. The dashed lines show the linear regressions line for EMEs, quoting slope and fit (R^2).

Sources: Arslanalp and Tsuda (2012); Quarterly External Debt Statistics; national data; BIS; authors' calculations.

We first document how four trends have come together to reduce original sin over time. First, major EME governments have gradually reduced their reliance on foreign currency borrowing by tapping bond markets in their own currency. That weighed on foreign participation – except during periods of favourable global financial conditions – as foreign investors hold lower shares of local currency bonds than of foreign currency bonds. Third, EME issuers have promoted foreign participation in local currency bond markets to maintain access to external financing. These trends went hand in hand with a fourth: the rising exposure to EME currencies in foreign portfolios. Progress has been uneven, however. The evidence is stronger for governments than for other sectors, and clear only for major EMEs. Moreover, progress appears to have stalled since 2013: even major EMEs faced setbacks, underscoring their continued vulnerability to global financial conditions – particularly during episodes of dollar strength.

These findings suggest that original sin is not a permanent state even if progress can be slow. Exploring the drivers in panel regressions, we find country-specific variables to matter, suggesting that countries can do their part. Global push factors also play a role, most noticeably during the global search for yield in the years 2010-2013. That said, most of the variance in the panel dataset is *between* variation: persistent differences between countries point to the importance of slow-moving institutional factors. This interpretation reconciles the observation that original sin persists over long periods (Eichengreen et al) with the more sanguine view that countries can overcome original sin through their own efforts

[3] 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 Figure 8.

(Burger and Warnock). It is natural for policy discussions to focus on measures that countries can take to develop their domestic bond markets (e.g. IMF and World Bank, 2021).

A final contribution is to show that overcoming original sin does not eliminate but change the nature of EME stress events. 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 LC bonds, currency risk looms larger in investors' allocation decisions. When global investors pull back at the first sign of stress, EMEs remain vulnerable to exchange rate depreciations and fluctuations in global liquidity. The term ***original sin redux*** captures the idea that original sin can come back in a different guise – even for EMEs that no longer owe foreign currency debt.

The paper is structured as follows. Section 1 presents a unified notation that links the variables examined in the literature and outlines the construction of our dataset on EME sovereign bonds. Section 2 documents key trends in foreign participation and local currency shares, and how these trends have contributed to reducing original sin over time. The empirical analysis in Section 3 explores the correlates of original sin discussed in the literature, pitching groups of variables against each other. Section 4 examines the role of exchange rates in original sin redux, and Section 5 concludes with policy implications. The appendix provides additional details on notation and the dataset.

1. The international dimension of original sin

This paper aims to present a unified approach that connects the variables examined in several strands of the literature. We begin by introducing notation to contextualise the various ratios and shares discussed in earlier research. Each reference paper covers one or two variables, whereby differences in focus account for some of the distinct findings. We also introduce our dataset, devised to measure the most relevant shares. The unified approach proposed here helps to reconcile the various perspectives into a more comprehensive picture of original sin.

Key concepts and notation

Our basic notation begins with nominal values for amounts outstanding (Appendix 1 lists the variables). We focus on government bonds (B), although the notation would be no different for debt at the country level (all sectors). 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 FC bonds to be denominated in US dollars.[4] Agents take different perspectives on the valuation of their respective positions, depending on their reference currency:

- Agents in the issuer country value bonds in terms of the local currency since their payment streams are mainly in their own currency. The value of their positions thus equals $B = L + \varepsilon F$, where εF is their FC borrowing expressed in domestic currency at the current exchange rate, ε.
- 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.[5] From their perspective, they hold f in FC bonds and θl worth of LC bonds, where $\theta = 1/\varepsilon$ is US dollars per local currency units.

[4] This comes with little loss of generality. Our data include bonds in all foreign currencies, most being denominated in US dollars, except for EMEs close to the euro area. To accommodate other foreign currencies, εF can be generalised to $\sum_c \varepsilon_C F_C$.

[5] 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 (Maggiori et al, 2020).

These amounts can be scaled in various ways. Scaling by issuer country GDP gives rise to ***ratios***: L/Y represents the relative size of the LC bond market, and l/Y measures foreign participation as a ratio to GDP. Scaling by amounts outstanding instead gives rise to ***shares***, i.e. proper percentages.

It is essential to keep currency and geography apart – they are separate dimensions. Consider the 'debt matrix' (Table 1), a simple device for tracking the key shares used in the literature. The currency dimension appears in the columns: they split bonds into those denominated in local currencies from those in foreign currencies. The rows represent geography: they distinguish domestic holders from foreign investors and their external holdings.[6] We can now form and relate various shares:

- The share of bonds held abroad is the ***foreign participation share***; it measures the reliance on foreign investors. Capitalised Π refers to all bonds, and π to LC bonds.
- The share of bonds denominated in local currency is the ***local currency share***. Λ refers to the LC 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 1

↓ **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 shares		$\Pi = b/B$	$\pi = l/L$	$\pi_f = f/F$	

The debt matrix clarifies the mutual dependence between various shares. For instance, each capitalised share (Π, Λ) can be written as a weighted average of the interior shares,

$$\Pi = \Lambda\,\pi + (1 - \Lambda)\,\pi_f \quad and \quad \Lambda = \Pi\,\lambda + (1 - \Pi)\,\lambda_d. \tag{1}$$

We now connect the various ratios and shares examined in the literature using this notation.

The literature in context

Eichengreen and Hausmann (1999) coined the term "original sin" to describe a situation in which *the domestic currency cannot be used to borrow abroad or to borrow long-term, even domestically*. In subsequent work they came to conclude that *external* borrowing in one's own currency seems particularly intractable and adopted the narrower "international" definition: *the inability of a country to borrow abroad in its own currency* (Eichengreen, Hausmann and Panizza, 2005, 2007, 2023). The concept was motivated by the experience of the emerging market crises of the 1990s, when currency mismatches put strains on EMEs borrowers facing capital outflows and tightening global financial conditions. Original

[6] We use the terms "external", "held abroad" and "foreign investors" interchangeably. 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.

sin can be seen as a precondition for currency mismatch.[7] The literature also makes broader points on the structure of financial markets at various stages of development.

Eichengreen et al's measures of original sin involve the *foreign currency share* in debt securities,

- The 1999 definition implies that bonds outstanding are mostly in foreign currency: high $1 - \Lambda$
- The narrow definition states that bonds held abroad are mostly in foreign currency: high $1 - \lambda$

Persistently high FC shares indicate a continued reliance on foreign currency. *Overcoming* original sin would show in falling FC shares, hence *rising* LC shares. Sustained increases in Λ – and λ in particular – are evidence of progress toward overcoming original sin. We thus look for positive trends in Λ and λ.

Eichengreen, Hausmann and Panizza (2005, 2007, 2023) argued that original sin persists among EMDEs, and that the phenomenon is too widespread to be explained by their monetary and financial history. They mainly focused on international bond markets and observed that the bulk issuance was – and still is – denominated in few key currencies, led by the US dollar. The majority of developing countries issued international bonds almost exclusively in foreign currencies: for them, original sin persists. Only EMEs (i.e. upper-middle income countries with access to international markets) have made progress in borrowing abroad in their own currencies. But EMEs issued less than 20% of IDS in local currency; and part of the progress since 2007 has been reversed after 2013. Original sin thus remains common and persistent when measured this way.

The main challenge to the original sin hypothesis comes from research on local currency bond market development and foreign participation (Table 2). Burger and Warnock (2006) studied local bond market development of 49 AEs and EMEs in a cross-section at end-2001. They focused on two variables: the size of local bond markets as a ratio to GDP (L/Y), and the LC share in bonds outstanding, $\Lambda = L/B$ in our notation. Countries with stable inflation rates and stronger creditor rights had larger LC bond markets and relied less on FC bonds. Burger et al (2015) extended the analysis to a panel of 41 countries (2006-11). Similarly, Claessens et al (2007) showed in a panel of 35 countries (1993-2000) that the size (L/Y) and LC share (Λ) in government bond markets depended on macroeconomic and institutional variables, such as the domestic investor basis.

The key step, however, is to go from bonds outstanding to *foreign holdings*. Burger et al (2015) study portfolio reallocations in global bonds, using TIC data on US bond holdings scaled by bonds outstanding. They document the growing foreign participation by US investors in EME local currency bond markets and find that US investors differentiated among EMEs based on country-level macroeconomic factors. They express a given country *i*'s weight in US portfolios relative to its weight in the global market. This is equivalent to comparing US investors' foreign participation in country *i* to their foreign participation in all countries combined – in our notation:

$$\frac{l_i/l}{L_i/L} = \frac{l_i/L_i}{l/L} = \frac{\pi_i}{\pi}. \qquad (2)$$

A third line of work directly examines the currency composition of countries' external positions for evidence on the LC share in external debt (λ). The "borrowing abroad" in the definition of original sin

[7] 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).

relates to external *debt* liabilities.[8] 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 LC share in corporate debt remained largely unchanged at 10%.[9] Arslanalp and Tsuda (2014) focus on foreign holdings of government debt; they document substantial inflows from foreign asset managers during the period from 2009 to 2013, mostly in local currency. Original sin persists among corporates but slowly recedes for major sovereigns.

Perspectives on original sin[a] Table 2

Variable of interest		**Reference paper**
Government bonds, all currencies (ratio to GDP)	B/Y	Literature on fiscal sustainability, debt intolerance
LC bonds outstanding (ratio to GDP)	L/Y	Burger and Warnock (2006), Claessens et al (2007)
LC share in bonds outstanding (share of total)	Λ	Burger and Warnock (2006), Claessens et al (2007)
Foreign participation, all currencies (share of total)	Π	Arslanalp and Tsuda (2014)
Foreign participation in LC bond market (share of total)	π	Burger et al (2015)[b]
LC share in bonds outstanding (share of total)	λ	Eichengreen et al (2005b, 2023). Du Schreger (2022)

[a] The selection focuses on empirical papers that cover government bonds at least in part of the analysis. [b] Their use of relative portfolio weights is closely related to foreign participation in local bond markets, see below.

All these important contributions relate to original sin in one way or another, but the evidence is difficult to compare and reconcile. Each paper emphasizes different ratios or shares, using data on various instruments (debt, or bonds, or IDS only) and sectors (all sectors vs government), not to mention different country groupings (EMEs or all countries) and time horizons (cross-section or panel data).

To provide a more comprehensive analysis and generate comparable metrics, our paper (1) examines the relationships between key variables and tracks the evolution of four shares over time (Λ and λ, as well as Π and λ); (2) focuses on government bonds of EMEs, since AEs have long overcome original sin, and sovereign issuance of major EMEs affords the best recent evidence; (3) constructs a tailored dataset aligned with the dimensions of Table 1 crossed; and (4) applies panel regression analysis to identify the role of country-specific factors for evidence of countries overcoming original sin by their own efforts.

On point (1), a pivot on which measures of original sin hinge is foreign participation in local currency bond markets (l in Table 1). It shapes both the foreign participation share in LC bond markets (π), and the LC share in foreign portfolios (λ). Clearly, those shares matter jointly: a higher λ is less meaningful when foreign holdings, l, are negligible; conversely, a rise in foreign participation in LC bond markets means limited progress if foreign investors continue to prefer FC bonds (implying low λ). We find it more insightful to track several shares and clarify the relation between them. Indeed, the prime indicator for measuring progress toward overcoming original sin as defined by Eichengreen et al, the LC share in bonds held abroad (λ), can be written as a product of our other three shares,

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

[8] Allen et al (2023) compiled external positions by currency and instrument. In 1990, only \$0.1 trillion (11%) of external debt was denominated in the local currencies of the 27 EMEs in their sample; by 2020, external debt in local currency had grown to \$1.8 trillion, or 19% (λ). External *liabilities* more generally shifted more toward local currency instruments, mostly due to the expansion or equity and FDI (both assumed to be in local currency).

[9] 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.

A new dataset on EME sovereign bonds

We now introduce a dataset tailored specifically designed to measure those ratios and shares. Forming the shares in Table 1 requires data on government bonds that identify the currency of denomination (local vs foreign) crossed with 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 covers issuance in all markets and all foreign holdings, by currency.

Eichengreen, Hausmann and Panizza's work had mostly focused on international bond markets. The assumption that international debt securities (IDS) were targeted at international investors was reasonable, but this left out foreign holdings of bonds issued in domestic bond markets. Burger and Warnock (2006) recognised that a more complete picture requires domestic debt securities (DDS) to be added to IDS, both from the BIS. This was a fine approximation, but the required split is by currency, not by market of issue (which is only a proxy for currency).[11] Hence, a separate data collection was necessary to obtain a consistent currency breakdown for government bonds in all markets. We augment the BIS statistics on government bonds in local and foreign currencies with series on foreign holdings collected from national official sources. These include all foreign holdings, not only those of US investors (in Burger et al, 2015). In particular, the ingredients are:

Outstanding stocks. BIS statistical Table C4 reports the outstanding amounts of general government bonds issued in all markets (domestic and international), with a consistent currency breakdown (Bogdanova et al, 2021). In our notation, the series correspond to θL for LC bonds and F for FC bonds, in US dollars. The data are available at quarterly frequency for 56 economies, including the 27 EMEs covered here (Appendix 2 elaborates and lists the sample countries).

Foreign holdings. We match the amounts outstanding with series on foreign holdings of government bonds collected from national sources. We selected series to match the attributes of the series for amounts outstanding. When series from several sources are available, we follow a preference order over sources and implemented various data improvements; we triangulated with IDS and external positions statistics to complete data for countries reporting only one term of $b = l + \varepsilon f$ (Appendix 3 elaborates).

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 shares that can be of value in policy work. We differ from Arslanalp and Tsuda (2014) in that we focus 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.[12] In terms of government finances, long-term 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. Furthermore, tracking long-term bonds relates to 'domestic original sin' (Eichengreen and Hausmann, 1999), the inability to borrow domestically in long maturities.

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

[11] IDS captures international markets, and DDS domestic markets – the latter includes some issuance in foreign currencies that cannot be removed from reported aggregates. DDS and IDS were not harmonised before 2012 (Gruic and Wooldridge, 2012) – still today, DDS and IDS do not exactly sum to total debt securities (TDS) reported by central banks, since IDS are compiled from granular vendor data tracking mostly syndicated issuance.

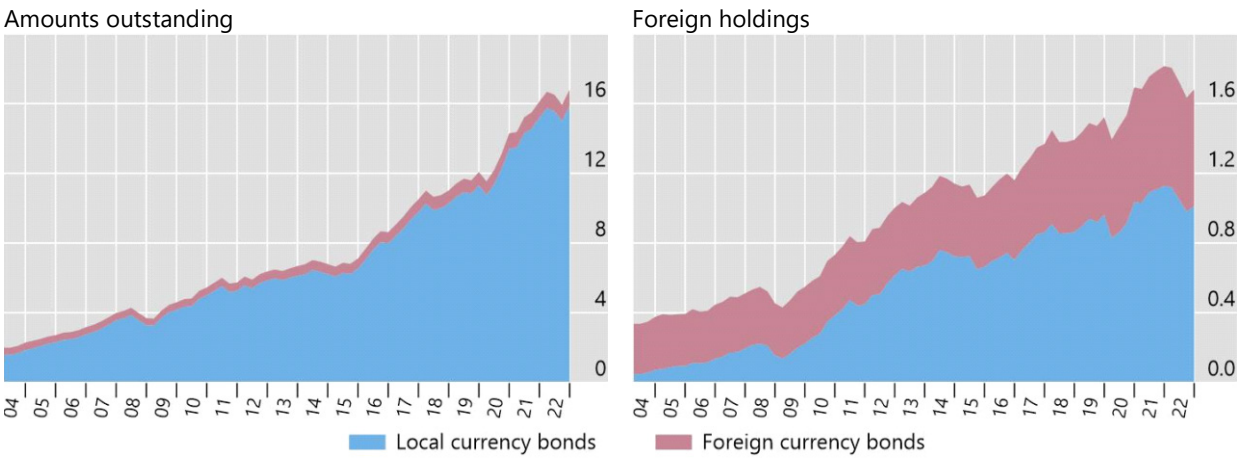
[12] The strength of Arslanalp and Tsuda's (2014) collection is their data on the sector of holders, as well as the broad coverage across EMDEs (not for bonds, however). Arslanalp and Tsuda publish total credit as well as holdings of government debt securities (in all maturities). The latter include a breakdown by currency type for 22 EMEs (as classified in the BIS country groupings) but covers *central* government securities only.

Our final dataset (published online) is a quarterly panel of 27 countries for the period 2004-22, and features bonds outstanding and foreign holdings by currency type, underpinning the shares in Table 1.[13] The sample covers major EMEs from Asia (9), Europe (8), Latin America (6) and Africa and the Middle East (2), as listed in the appendix Table B. This group accounted for a quarter ($16 trillion) of the global sovereign bond market at end-2022.[14]

The universe of EME government bonds has steadily expanded during the sample 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 is denominated in local currency (blue area). At the same time, the aggregate value of government bonds held by foreign investors more than quadrupled since 2004, 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 LC bonds account for a growing share in both.

Emerging market sovereign bonds, by currency

In trillions of US dollars — Figure 2



The data in these figures cover 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).

Sources; BIS; author's calculations.

The value of covering bonds issued in *all markets* becomes clear when comparing our dataset with a view from *international bond markets*, as measured by the IDS. For sovereign bonds, international markets account for a small and falling share of the total; and international bonds are not a good proxy for overall foreign holdings due to the rise in LC bonds held abroad (see Appendix 4 and Graph A1). Looking at original sin through the lens of IDS thus comes with severe limitations, especially for government bonds. This is why our dataset covers sovereign bonds issued in all markets, in line with Burger and Warnock (2006) and Arslanalp and Tsuda (2014).

Our dataset allows us to exactly measure the ratios and shares in Table 1. Table 3 presents summary statistics for levels (top half) and the shares (bottom half) for the sample used in subsequent analysis.

[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.

Summary statistics (Q1 2004 – Q4 2022) Table 3

At constant sample of N=1,749	Mean	Median	Std. dev	Min	Max
	Outstanding amounts (in billions of USD)				
Bonds outstanding $\theta L+F$	323.3	122.8	790.2	3.9	8807.3
Foreign holdings $\theta l+f$	42.8	27.4	48.1	0.2	421.2
Local currency bonds outstanding θL	298.1	98.4	790.8	0.2	8,775.7
Foreign holdings of LC bonds θl	24.2	9.5	38.9	0.0	386.3
Foreign currency bonds outstanding F	25.2	18.2	25.5	0.0	148.5
Foreign holdings of FC bonds f	18.6	12.2	19.2	0.0	91.1
	Shares (%)				
Local currency, % of outstanding $\boldsymbol{\Lambda}$	76.0	80.4	22.6	1.7	100
Overall foreign participation, in % $\boldsymbol{\Pi}$	27.3	26.9	17.5	0.0	73.7
Foreign investors, % of LC bond market $\boldsymbol{\pi}$	13.9	10.8	12.8	0.0	57.6
Local currency bonds, % of foreign holdings $\boldsymbol{\lambda}$	48.0	44.8	34.1	0.0	100

The column "mean" reports the simple average across all countries and quarters in our sample. For comparison, the corresponding shares for *advanced economies* can be approximated using the updated database of Arslanalp and Tsuda (2012): for their set of advanced economies (and the United States, in parentheses), the averages are approximately:
$\boldsymbol{\Lambda}$ = 96% (100%), $\boldsymbol{\Pi}$ = 45% (19%), $\boldsymbol{\pi}$ = 45% (19%), and $\boldsymbol{\lambda}$ = 96% (100%).

Sources: BIS; authors' calculations.

2. Overcoming original sin

This section draws on our panel dataset to document significant trends in the four shares highlighted in the debt matrix (Table 1). Their evolution takes place against the backdrop of rising public debt levels *B* reaching nearly 60 percent of GDP by 2020 among EMEs (Arslanalp and Eichengreen, 2023). Each figure below plots the evolution of a share (in percent), showing simple and weighted averages across individual EMEs. The former represents the typical experience of a country in our sample, while the latter reflects aggregate behaviour shaped by larger EMEs such as China and India. We test each trend for significance and report on how common the trend is across EMEs (Table 4).

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

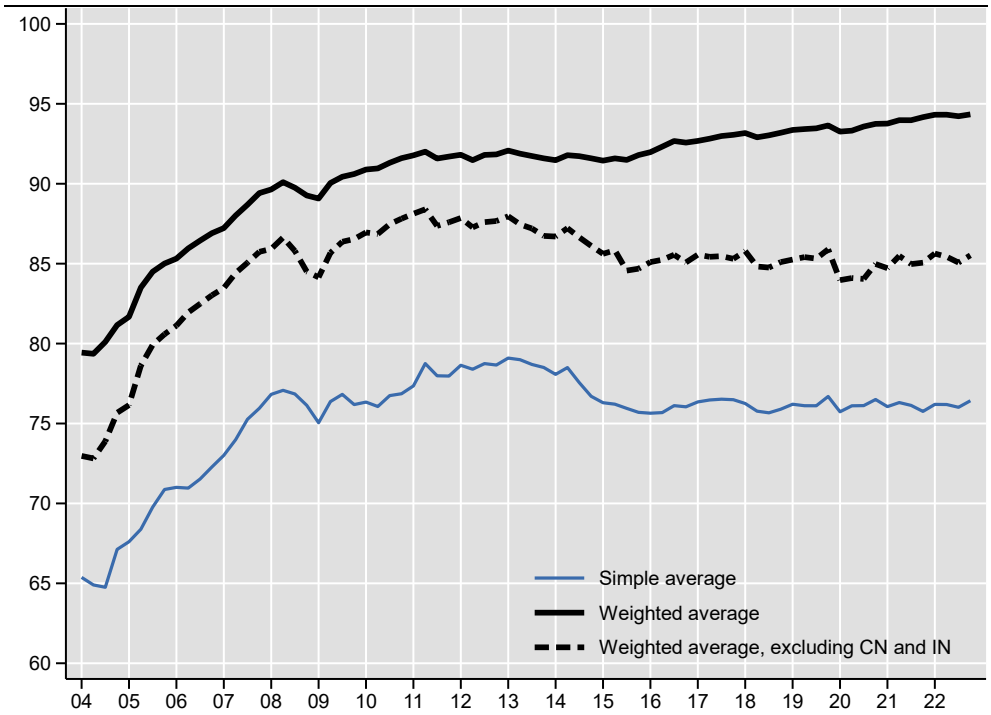
The first trend concerns *the type* of bonds that are issued, regardless of who holds them. Since domestic investors are the most natural investor base for local currency bonds, this speaks to the broad definition of original sin (Eichengreen and Hausman, 1999). In our EME sample, LC bonds account for 76% of bonds outstanding; while substantial, the share is close to 100% among advanced economies (Table 3). AE governments have for decades issued mainly in local currencies, on the back of deep domestic bond markets and the reserve status of the main currencies (Bogdanova et al, 2021).

Over time, the LC share in EME government bonds witnessed a positive long-term trend, as major EMEs have been tapping bond markets in their domestic currency (Figure 3, thick line). Even in the early 2000s, the bulk of government bonds in the EME aggregate was denominated in local currency. The LC share for the average EME (thin solid line) was 65% in 2004 and increased mostly over the first half of the sample period to reach almost 80% by 2013. The continued upward trend later in the sample is driven by large EMEs. China and India, both with vast domestic bond markets, stepped up their bond issuance almost exclusively in local currency. As a result, the weighted average share rose over almost the entire sample period (thick solid line). Their influence on this trend becomes apparent when removing China

and India from the sample (dashed line): now, the EME aggregate levels off after 2011 Q2 (where a structural break is detected). The pace of LC bond issuance appears to have slowed since: in the 2010s, greater reliance on hard currency bonds by some EMEs (e.g. Argentina and Türkiye) has contributed to a decline in the simple average (blue line). Weak exchange rates also played a role.[17]

The share of local currency in sovereign bonds outstanding[1] (Λ)

As a percentage of total amount outstanding — Figure 3



Local currency-denominated government bonds as a share of government bonds outstanding in all currencies. With reference to Table 1, the LC share for each country is calculated as $\Lambda = L/(L + \varepsilon F)$, in percent. The simple average is the mean across individual country shares. The weighted averages express EMEs' combined LC bonds as a percentage of total government bonds outstanding. The sample of 25 countries is balanced between Q1 2004 and Q4 2022.

Sources: BIS; authors' calculations.

Still, the simple and weighted averages exhibit statistically significant positive trends overall. A positive overall trend in Λ is common: a majority of EMEs in our sample (16 out of 27) saw their LC shares rise significantly since the early 2000s (Table 4). Major EMEs, including Brazil, Korea and Mexico, have actively reduced their reliance on FC bonds; Chile, Peru and Russia managed the steepest rises in Λ. Only six countries in the sample saw a significant decline in their LC shares over the period as a whole: Argentina, Bulgaria, Colombia, Hong Kong SAR, Indonesia and Türkiye, whose LC share fell from 82% to 39%.

Despite a broad trend toward local currency issuance, there remains considerable variation across countries in terms of the currency composition of sovereign bonds today. Two decades of local bond market development did not eliminate the dispersion in Λ that Burger and Warnock (2006, Table 1) had documented as of end-2001. Some countries, notably India and Thailand, now denominate their entire government debt in local currency, and Chinese government bonds are almost entirely in renminbi. In that respect, they 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

[17] Part of the measured reversion over the past decade is due to weak EME exchange rates – the trend toward LC bonds is more prominent when currency valuation effects are removed (see Appendix 5).

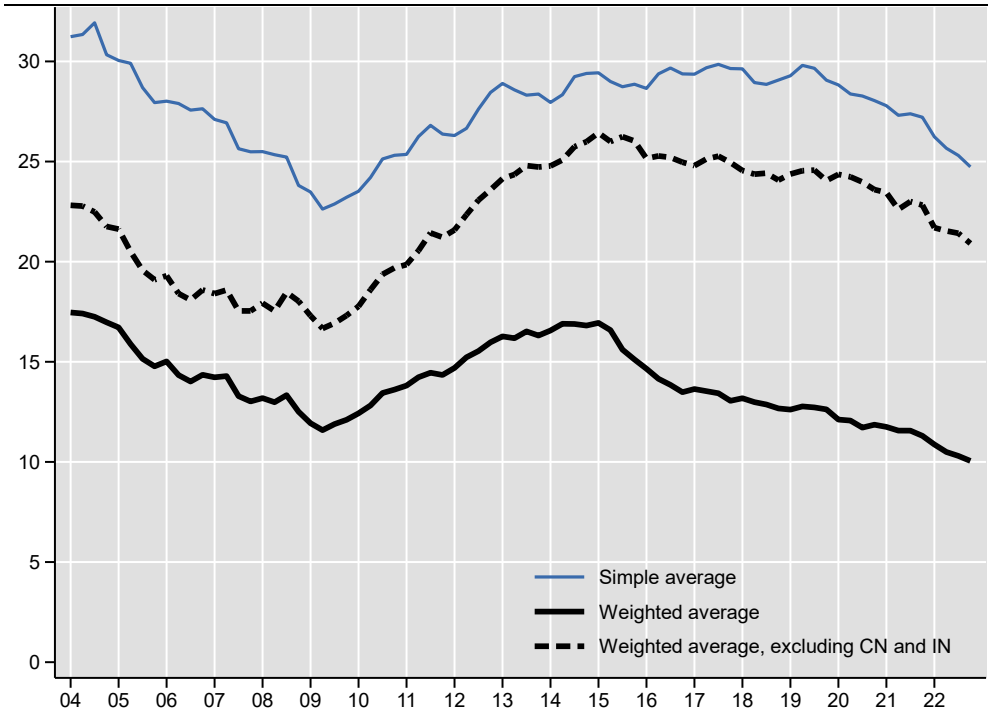
70%, along with Bulgaria and Croatia, who meet even more of their long-term financing needs in foreign currency with their currencies closely pegged to the euro.[18]

Trend 2: Reliance on foreign investors *(Π)*

We now examine *where* government bonds are held – regardless of their currency of denomination. In Table 1, b tracks foreign holdings of government bonds, with foreign participation equal to $\Pi = b/B$. The ability to borrow abroad (in *any* currency) is an important condition for making the currency composition of these holdings (λ) relevant. In our EME sample, foreign participation averaged around 27%, somewhat below the average of 45% among advanced economies (Table 3).

Foreign holdings of EME sovereign bonds[1] (Π)

As a percentage of total amount outstanding — Figure 4



Foreign holdings of government bonds as a share of government bonds outstanding in all currencies. With reference to Table 1, 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 Q1 2004 and Q4 2022; Romania enters the sample in 2013.

Sources: BIS; authors' calculations.

Over the sample period, EMEs have increased their borrowing abroad: this holds for levels, and for ratios to GDP. However, the foreign participation share Π has not increased in the aggregate: the lines in Figure 4 do not exhibit a significant trend over the sample period. If anything, the aggregate pattern resembles a cycle.

The years after the global financial crisis show the clearest evidence of EMEs' growing reliance on foreign investors: all three averages trended up between 2009 and 2015. Stronger economic fundamentals and

[18] Both countries joined the exchange rate mechanism (ERM II) in July 2020, and Croatia became a member of the euro area in January 2023. With the adoption of the euro as the official currency, all euro-denominated debt will be treated as LC debt in the future. We treat the kuna as the local currency, since our sample ends in Q4 2022.

the global search for yield have boosted foreign participation in EME sovereign bond markets. Investors in AEs 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.[19]

Around 2014, however, the extent of foreign participation has turned (Figure 4).[20] The value of foreign holdings b has continued to grow but has not kept pace with the rising stock of government debt B; The share of foreign participation has declined as a result. The decline in the weighted average (black line) has been accentuated by the growing heft of China and India. This is a purely compositional effect: their own foreign participation shares *increased* over time: their vast domestic sovereign bond markets have limited foreign participation, with Π_i as low as 1% in India and 4% in China by 2022.[21] This has pushed down Π in the aggregate as China and India's combined share in EME sovereign bonds outstanding surged from 23% in 2005 to 61% by 2022.

The reliance of EMEs on external financing is seen more clearly in country-level data (Table 4). 13 out of the 25 EMEs (for which we can calculate Π_i) exhibit significant positive trends over the full horizon, including China and India. Colombia, Indonesia, and South Africa saw the steepest trend increases in the share of bonds held abroad. Four countries in the sample show no trend in either direction, while eight EMEs witnessed a significant trend decline in Π_i. Foreign participation Π is the only aggregate share with an insignificant trend. The mixed evidence for foreign participation is similar to the experience of AEs, where aggregate Π has remained relatively flat (varying around 42%) with negative trends for individual countries – possibly as a result of their growing institutional investor bases and expanding central bank balance sheets.

Table 4:	Country counts			
Significance of trends	up	down	insignificant	not reported
LC share in outstanding $\boldsymbol{\Lambda}$	16	6	5	0
Foreign participation $\boldsymbol{\Pi}$	13	8	4	2
Foreign participation in LC bond market $\boldsymbol{\pi}$	17	3	4	3
LC share in foreign investor portfolios $\boldsymbol{\lambda}$	12	5	7	3

Note: Table 4 reports on the significance of trends and how common they are across EMEs (column "Trend analysis"). For each country, we test the significance of the slope estimated by regressing the share of interest on a linear time trend. The counts for up and down include only those EMEs whose trend is statistically significant, and thus excludes countries whose shares remain constant or move sideways (insignificant) or countries with insufficient data (not reported).

It is unsurprising to see foreign participation under pressure when LC bond issuance is on the rise (Trend 1). LC share Λ trending up, all else equal, will *reduce* overall foreign participation Π, given that foreign investors participate less in LC than in FC bond markets. From equation (1),

$$\Pi = \Lambda\,\pi + (1-\Lambda)\pi_f \;\; = \;\pi_f - (\pi_f - \pi)\Lambda. \tag{4}$$

An increase in Λ tends to reduce Π, since $\pi_f > \pi$. Overcoming original sin thus requires rising foreign participation in *local currency* bond markets (π) - a trend we examine below.

The divergence again illustrates that a positive trend in one share does not imply the same trend in the other: currency and geography are separate dimensions. In the cross-section, the dimensions overlap to

[19] The rise in foreign participation in EME bond markets has been noted by Arslanalp and Tsuda (2014), Burger et al (2015) and Lane and Milesi-Ferretti (2017).

[20] Formal tests point to a structural break in 2015. Flows to EME sovereign bond funds turned somewhat earlier, judging by cumulative inflows in EPFR data. LC bonds saw particularly large inflows from 2010 to 2013.

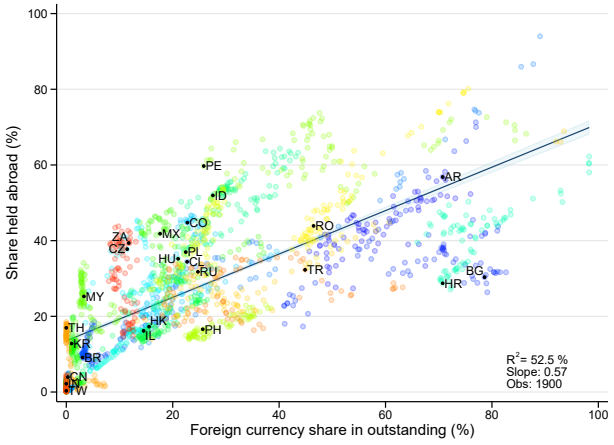
[21] This is in line with Lane and Milesi-Ferretti's (2017) observation that the share of bonds held abroad falls with a country's market size and rises with its level of development.

some extent: there is a positive relationship between the share of FC bonds $(1-\Lambda)$ and the share Π held abroad: pooling all 1,900 panel observations between 2004 and 2022 yields a fit of 52.5% and an estimated slope of 0.57 (Figure 5.A). The two shares align for some countries: 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 mostly FC bonds, with over 50% held by foreign investors.

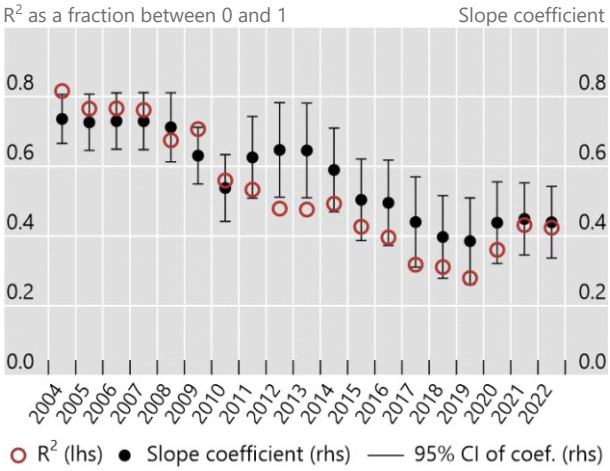
Two separate dimensions: currency vs geography

Figure 5

A. There is a positive correlation between the two…[1]



B. … but the relationship has weakened over the years[2]



[1] Panel A contrasts foreign participation in government bond markets (Π, y-axis) with the share of FC bonds in bonds outstanding (1-Λ, x-axis), for a quarterly panel of 25 EMEs over 2004–22 (1,900 observations), with a linear regression fitted on $\Pi_{it} = \alpha + \beta(1\text{-}\Lambda_{it}) + u_{it}$. [2] Panel B runs the same linear regression separately for each year (with 100 observations from 25 countries and 4 quarters per year), and records the estimates of β and the fit (R^2) over time.

Sources: authors' calculations.

But for many EMEs the two dimensions do not align, and for good reasons. All countries above the 45° line must have sold LC bonds to foreign investors. Asian EMEs do borrow abroad, even if they issue fewer bonds in foreign currency – e.g. Thailand no longer has any FC bonds, yet foreign ownership is near 20%. Several Latin American countries have also marketed their LC bonds externally and built infrastructure to allow foreign investors to clear and settle domestic bonds. At 60%, Peru leads in terms of foreign participation: LC bond holdings were near zero in 2004 and by 2017 overtook those of FC bonds. Conversely, countries below the 45° line must have domestic residents invested in FC bonds. Not all FC bonds issued by Argentina, Bulgaria and Croatia can be held abroad – the amounts would exceed total foreign holdings.[22] For Argentina and Türkiye, it may be economic uncertainty and currency depreciation that led investors – including residents – to favour hard currency bonds. Bulgaria and Croatia lie below the 45° line because they tap bond markets in euro, given their closeness to the common currency.

Hence the overlap between the two dimensions is far from perfect: LC bonds are not all with residents, nor are FC bonds held exclusively by foreign investors. The regression slope and the fit (R^2) are well below unity, indicating that many EMEs are far off the regression line. Moreover, the fit has been declining in annual cross-sections (Figure 5.B). The relation between these two dimensions has become weaker as EMEs open their domestic bond markets to foreign investors.

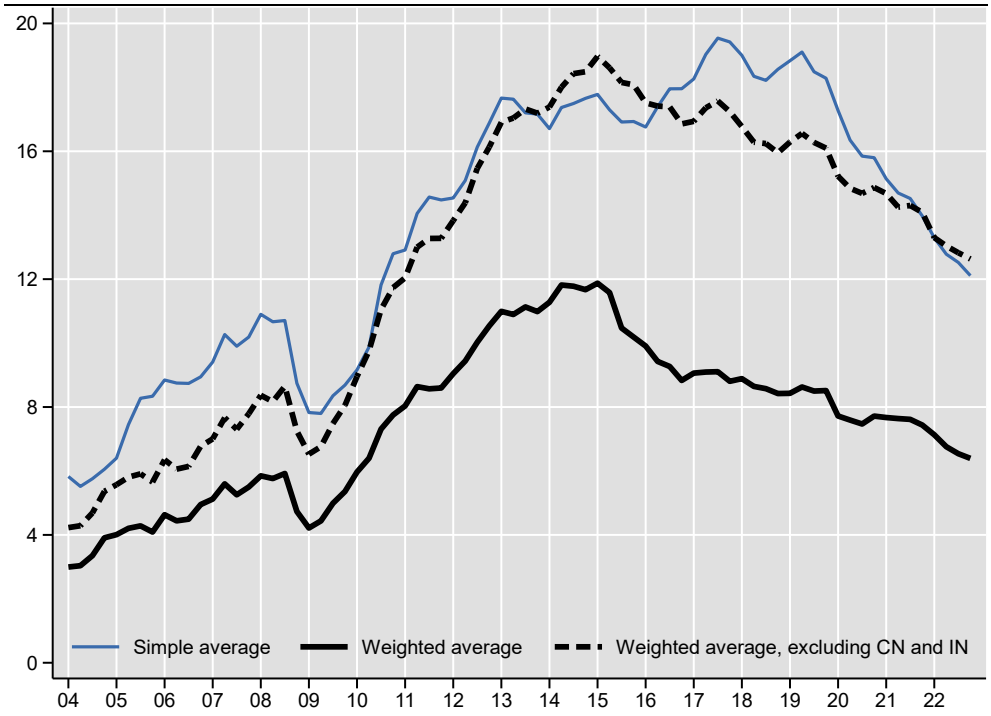
[22] The two shares are defined over the same denominator, $B = L + \varepsilon F$ (see Table 1). FC bonds outstanding can exceed the value of external holdings only if domestic investors hold more in FC bonds than foreign investors hold in LC bonds: $\varepsilon F > (l + \varepsilon f) \leftrightarrow \varepsilon(F - f) > l$.

Trend 3: Foreign participation in LC bond markets *(π)*

We now cross the dimensions in Table 1 to examine *foreign* holdings of *LC bonds*: this narrows the scope of foreign participation to the LC bond market (l and π). To what extent do EME governments rely on external financing when borrowing in their own currency? In our sample, foreign investors held some 14% of EME LC bonds, well below the average foreign participation of 45% among advanced economies (Table 3). Over time, however, EMEs have attracted more foreign participation to their LC bond markets.

Foreign participation in LC bond markets[1] (π)

As a percentage of outstanding local currency sovereign bonds — Figure 6



Foreign holdings of local currency government bonds as a share of local currency government bonds outstanding. With reference to Table 1, the share for each country is calculated as $\pi = l/L$, 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 LC bonds outstanding, calculated over the set of EMEs for which both parts are available. The unbalanced panel covers 24 countries between Q1 2004 and Q4 2022; Chile and Romania enter the sample late.

Sources: BIS; authors' calculations.

All three averages in Figure 6 exhibit a significant positive trend over the sample period. Most of the gains took place between 2004 and 2014, with a dent during the GFC. Foreign participation surged from 2009 to 2014, extending a trend observed by Burger et al (2015) for US investors through 2011. The willingness to hold LC bonds abroad appears to have slowed since 2014, in part owing to rapid issuance of LC bonds (Trend 1). In addition, the weight of China and India pulls down the aggregate share (black line) as their low participation (4% and 1%, respectively) account for a growing share of total foreign holdings. Foreign participation in China has been trending up as well.

Most EMEs in our sample saw higher shares of their LC bonds in foreign hands than was the case in the early 2000s. Specifically, 17 out of 24 EMEs share in the positive trend, with the steepest slopes estimated for South Africa, Russia and Colombia.[23] The rise in the value of assets benchmarked in LC bond indices such as the JP Morgan GBI-EM since the early 2000s was a significant driver for foreign flows into this

[23] Only three EMEs in the sample, Croatia, Hungary and Hong Kong SAR and, exhibited a negative trend.

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.

These statistics underscore the fact that rising foreign participation in domestic sovereign bond markets is fairly broad-based. The shares held abroad remain lower than for all sovereign bonds combined (Figure 4), but the trend increase in LC bond markets is steeper. It is the rising participation in LC bond markets (π) that supports overall foreign participation (Π), even as the composition of sovereign debt has shifted toward local currency (Λ). Recalling equation (4), when Λ increases, sustaining Π requires that π increases to reduce the difference ($\pi_f - \pi$). In terms of policy, a shift toward issuing local currency bonds requires an accompanying policy of fostering foreign participation in local bond markets to sustain the same degree foreign participation overall.

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

The discussion so far took the borrower perspective, looking at EMEs' reliance on (external) financing. We now shift perspective to foreign investors and their external portfolios (the row "foreign holders" in Table 1) to examine λ, the currency composition of foreign holdings. Eichengreen et al measure original sin by the *foreign* currency share of external borrowing ($1 - \lambda$); a rise in the LC share λ can thus be taken as a measure of progress toward overcoming "international" original sin. Some 48% of foreign bond holdings were in LC bonds, only half of the share for advanced economy bonds. Even so, the LC bond exposure among foreign investors in EMEs has seen a sharp rise.

Figure 7 plots the share of LC in external sovereign bond holdings in the aggregate, showing a significant positive trend in each measure of λ over the full horizon. Foreign investors have increasingly geared their EME sovereign bond portfolios toward local currencies. The estimated slope of the weighted average is approximately 0.61, indicating that the share of LC bonds in foreign portfolios rose by 2.4 percentage points each year on average.[24] The broad shift toward LC bonds in the post-crisis environment of 2009 to 2012 was fuelled by the search for yield – a global factor. By 2011, λ exceeded 50%, as foreign holdings of LC bonds eclipsed those of FC bonds. By 2020, they would reach more than $1 trillion. By end-2012, however, a structural break interrupted that trend. The weighted average levelled off at 63% in 2013–14, and dropped below 60% in the first half of 2020, when EME currencies depreciated significantly.[25] Several EMEs also increased bond issuance in foreign currencies to raise external funding for pandemic-related spending, which lowered the LC share in foreign portfolios.

The aggregate trend again conceals substantial variation across individual country portfolios. The trend in the weighted average across EMEs is weaker without China and India, since sovereign bonds in renminbi and rupee play a prominent role in foreign portfolios. Foreign investors appear to be more comfortable with a higher LC share when it comes to larger issuers. Investors holding East Asian government bonds naturally incur higher local currency exposure than those invested in Latin American sovereigns, since the latter issued more FC bonds. Investors in Chinese or Indian sovereign bonds have little choice but to hold LC bonds. Overall, 12 of our 24 EMEs saw significant positive trends in the LC

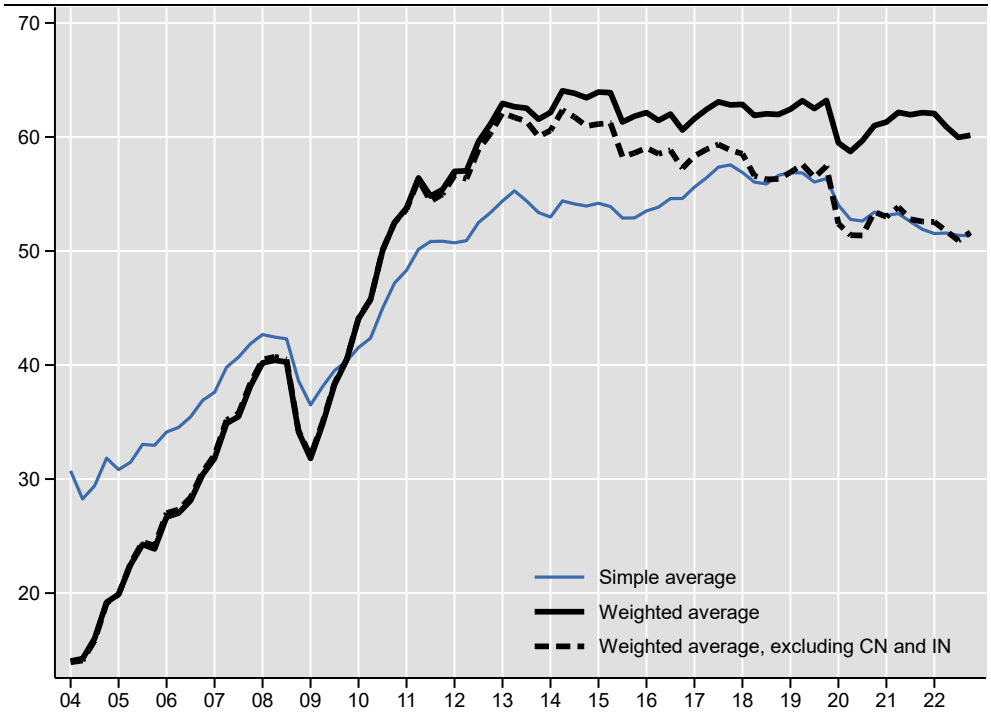
[24] With quarterly observations, the trend slope of the weighted average (0.55) implies that the domestic currency share in foreign bond holdings rises by some 2.4 percentage points per year on average. This is close to the change between the shares in 2004 and 2022 (+46 percentage points) divided by the number of years between.

[25] Weak exchange rates tend to reduce the observed λ even when foreign investors do not actively shift allocations toward FC bonds (see Appendix 5).

share in the external holdings of the bonds they issued, with the steepest slopes measured for China, Russia, South Africa, and Brazil; only five EMEs saw the opposite trend (Table 4).[26]

Local currency exposure in foreign portfolios *(λ)*

As a percentage of total foreign holdings of EME sovereign bonds — Figure 7



Local currency-denominated government bonds held abroad, as a share of foreign holdings of government bonds in all currencies. With reference to Table 1, 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 24 countries between Q1 2004 and Q4 2022; Chile and Romania enter the sample late.

Sources: BIS; authors' calculations.

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 overall external borrowing. These findings generalise the observation of Du and Schreger (2022) in a larger sample of EMEs. Our LC shares exceed those in Eichengreen et al (2023) because they focus on international bonds in a sample that covers all sectors and more countries for which original sin persists. We now see more clearly the relations between the trends in the shares we examined. From equation (3), $\lambda = \Lambda\ \pi/\Pi$, so the fourth trend depends on the first three. Ramping up LC bond issuance (Λ up) can lead to a sustained rise in λ if π rises faster than π_f and thus Π.[27] Intuitively, when governments shift their issuance toward LC bonds and foreign investors increase their participation in LC markets (*more* than in FC bonds), external portfolios shift toward local currency as a result. Part and parcel of overcoming original sin is that foreign investors become more exposed to EME currencies – raising issues examined in Section 4.

[26] The trend toward *foreign* currency was significant in foreign holdings of bonds issued by Türkiye, Romania, Hong Kong SAR, Indonesia and Argentina.

[27] These simultaneous increases are sufficient, not necessary, for a positive trend in λ. A rising foreign participation ratio π/Π can offset a falling Λ. And the ratio π/Π also rises if π_f falls faster than π, i.e. if foreign investors turn away from FC bonds.

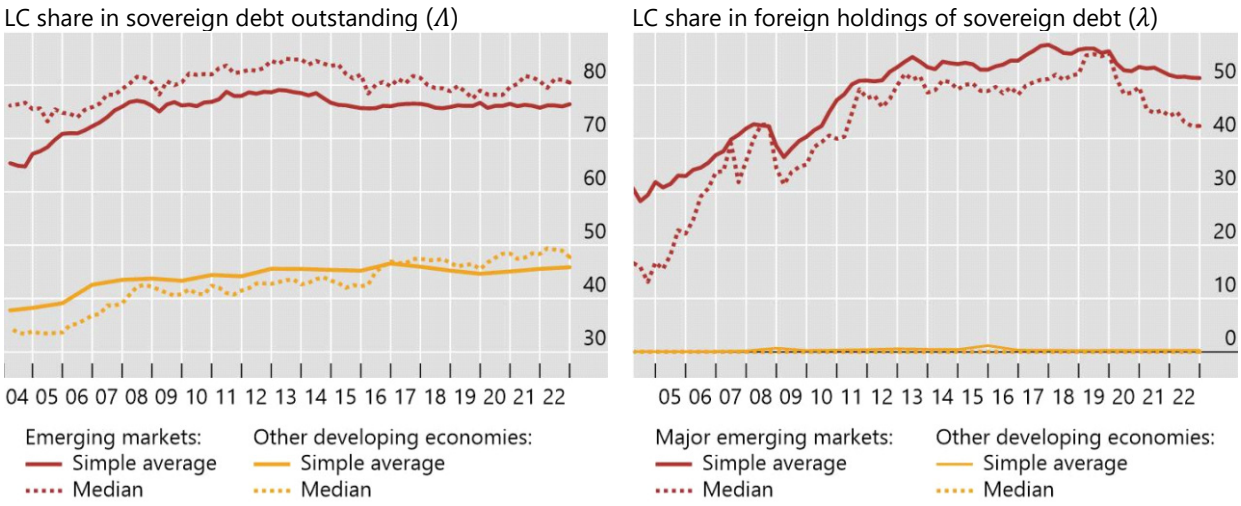
Uneven progress

The long-term perspective taken in this section suggests that major EMEs have been in the process of overcoming original sin. They have done so mainly by brisk issuance of government bonds in domestic markets, raising the LC share in (Trend 1, Figure 3), and by raising foreign participation in local currency bond markets (Trend 3, Figure 6). This went hand in hand with a rising exposure to LC bonds in foreign portfolios (Trend 4, Figure 7).

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 LC 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).

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

As a percentage of total sovereign debt and external sovereign debt, respectively Figure 8



The EME sample (red lines) pertains to sovereign bonds, consistent with earlier figures. For other developing economies (yellow lines), the panels show total sovereign debt (bonds plus loans).
Sources: Arslanalp and Tsuda, *Sovereign Investor Base Estimates for Emerging Markets*; BIS; authors' calculations.

While this progress is broad-based among the major EMEs, it is less common outside our sample. Eichengreen et al (2023) use a larger panel covering international bonds (IDS) and show that original sin persists for smaller EMEs and developing economies. As discussed, the use of IDS alone understates LC shares (Appendix 4). Still, the same conclusion can be drawn from Arslanalp and Tsuda's extended sovereign investor base dataset: the sovereign debt (bonds and loans combined) of developing economies clearly differs from that of the major EMEs we covered (Figure 8). Smaller sovereign issuers rely less on LC debt overall, with less than half their total government debt denominated in LC (left panel). And hardly any of these issuers' LC debt is held abroad, in sharp contrast to the bonds issued by major EMEs. Our evidence for overcoming original sin is driven by the major EME sovereigns that constitute our sample.

Moreover, the trends we have documented appear to have stalled or even reversed over the past decade. Even major EMEs have faced various setbacks on the way, underscoring their continued vulnerability to global financial conditions. Progress toward overcoming original sin has been uneven, punctuated by various setbacks along the way. All the graphs presented in this section 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. The expansionary phase from 2009 to 2013 saw the fastest growth in foreign holdings of LC bonds. 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, before the pandemic took another toll.

To what extent can EMEs overcome original sin, and do so by their own efforts rather having to rely on favourable global financial conditions? This is an empirical question addressed in the next section.

3. How can EMEs overcome original sin?

A country's inability to borrow abroad in its own currency may be rooted in weak institutions and policies, as reflected in a country's inflation history and its repayment or default record (Hale et al, 2020; Ottonello and Perez, 2019; Engel and Park, 2022). Countries can reduce their dependence on FC debt and develop their local bond markets by strengthening their macroeconomic performance through appropriate policies and stronger institutions (Burger and Warnock 2006, Burger et al 2015). Eichengreen et al (2005b, 2023), on the other hand, argued that the dependence on FC is too widespread and persistent to be explained by countries' monetary and financial past – poorer countries are stuck with original sin, and the problem calls for international policy initiatives.

These contrasting views emphasize separate groups of variables in regressions exploring the correlates of original sin. Eichengreen et al (2005b) reported that the only robust predictor of a country's ability to borrow abroad in its own currency was its economic size (log GDP). Thus, inherent differences between countries imply that original sin persists, unless global factors provide support. Eichengreen et al (2023) updated the analysis and found little evidence of progress in a sample of 85 emerging markets and developing economies (EMDEs) since 1994. Burger and Warnock (2006) and Burger et al (2015) found more support for country-specific variables driving improvements over time; they argue that original sin a misnomer since EMEs borrow more in LC and therefore not inherently dependent on FC financing.

The empirical analysis in this section proposes a horse-race pitching global against country-specific factors – push vs pull factors, respectively – in driving the evolution of the shares described in Section 2.[28] We start with a variance decomposition to provide bounds on the explanatory power each group of variables can potentially achieve. Each share represents a panel variable covering 23 to 25 EMEs over 19 years (2004-2022). Table 5 splits the sample variance into its between and within components around their respective full-sample means. *Between* variation captures persistent differences across countries in their respective mean shares over the sample period. *Within* variation instead gauges the extent to which each country's share deviates from its own mean over time; after accounting for global factors, *within* variation can be attributed to changes in local, country-specific factors.

So, do shares change mainly due to country-specific factors? Or do countries remain largely tied to their respective long-term averages? The variance decomposition suggests that overcoming original sin is a slow process, where countries' own efforts and global factors play a limited part over short periods of time. *Within* variation on average accounts for 23% of the panel variation in each share; of this, a quarter (some 5% of total variation) is due to global factors common to the EMEs in the sample, leaving about 17% to changes in country-specific factors over time. We concur with Burger et al (2015) that country-specific factors play an important role in explaining changes over time (*within* variation). However, most variation is *between* countries: the persistent differences between them on average account for 77% of

[28] We focus on shares rather than on ratios to GDP. The latter are easily swayed by macroeconomic fluctuations, e.g. falling GDP boosts L/Y. The shares we consider are less prone to fluctuations in GDP, and closer to the definition of original sin – especially the LC shares Λ and λ.

the panel variation in each share.[29] Countries deviate only slowly from their respective means, underscoring that overcoming original sin is a slow process, helped along by global factors over some periods. Performing the variance decomposition on Arslanalp and Tsuda's larger dataset on government debt yields similar results.[30]

Table 5: Variance decomposition

	Mean	*Within*-variation, of which:			*Between*-variation:
Share of interest	(%)	overall	global factors	local factors	across countries
LC share in outstanding $\boldsymbol{\Lambda}$	76.8	12.5%	1.2%	11.3%	87.5%
Foreign participation $\boldsymbol{\Pi}$	27.7	19.2%	1.3%	17.9%	80.8%
For. part. in LC bond market $\boldsymbol{\pi}$	13.9	34.2%	10.6%	23.7%	65.8%
LC share foreign portfolios $\boldsymbol{\lambda}$	48.0	23.7%	7.1%	16.5%	76.3%

Table 5 reports the results of a variance decomposition for the panel dataset at annual frequency, splitting the overall variance into *between* variation (across EMEs) and within variation (over time), which in turn consists of country-specific variation and global factors (yearly dummy variables).

Our panel regressions extend the logic of the variance decomposition: they identify the role of country-specific (local) factors separately from that of a global factor. Table 6 reports panel regressions for three of our shares, in two specifications: the column "POLS" shows pooled OLS regressions with country-specific variables only; the column "FEs" adds country and time fixed effects. As in Table 5, the yearly fixed effects capture all global push factors combined. Comparing these specifications underscores how much variation those fixed effects account for: in line with Table 5, country fixed effects (*between* variation) account for 66% to 88% of total variance, while the remaining *within* variation partly reflects global factors common to all countries, for up to 10.6%. Adding the variance explained by the specific country-specific variables then yields the overall R^2.

The individual regressors provide some evidence that country-specific circumstances do play a part in the process of overcoming original sin. The set of regressors is informed by prior research (Table 2).[31] The size of the economy (*log GDP*) was found to be the single robust variable in Eichengreen et al (2005b, 2023). Larger economies are clearly associated with higher LC shares in bonds outstanding (Λ, column 1), and with higher LC shares in foreign holdings (λ, col. 5), but not with higher foreign participation in LC bond markets as a share of bonds outstanding (π, col. 3).

Institutional factors, like other slow-moving variables (notably country size, *log GDP*), tend to lose their significance in the FE specifications, since country fixed effects absorb any time-invariant characteristics. The inclusion of *domestic investor base* is informed by Claessens et al (2007) and IMF and World Bank (2021): it is an important aspect of domestic bond market development studied in Burger and Warnock (2006). A larger domestic investor base enables countries to issue more of their government bonds in local currency (higher Λ). LC bond issuance responds to investor demand. Since we scaled Λ by bonds outstanding, not by GDP, this effect is distinct from that of country size (*log GDP*).[32] The opposite holds for π: countries with larger domestic bond markets also tend to have lower foreign participation (e.g.

[29] We decompose total sample variance to trade off *within* and *between* variation in each share, whereas Burger et al (2015) focus on *within* variation, in US investors' relative portfolio weights (see our equation (2)).

[30] At more than 80%, between variation plays an even larger role in their sample, because smaller EMEs and developing countries have made less progress over time than the major EMEs in our sample.

[31] Some regressors in previous research, such as current account and fiscal balance, are omitted as they are not expected to affect the shares, in contrast to the ratios studied elsewhere (local bond market development, L/Y).

[32] Domestic investor base is defined here as the amount of long-term government bonds in LC and FC held by domestic investors, scaled by GDP.

India and China). The same variable appears to be insignificant for λ. *Regulatory quality* appears significant only for Λ, while *capital account openness* mainly helps with λ.

Table 6: Panel regressions for the main shares of interest

Dependent variable:	LC share Λ		For. participation π		LC share external λ	
Specification:	POLS	FEs	POLS	FEs	POLS	FEs
	(1)	(2)	(3)	(4)	(5)	(6)
Country size (log GDP)	12.58***	5.65	1.30	-5.06	12.99***	21.67
Domestic investor base	0.49***	0.33**	-0.26**	-0.22	0.40	0.43
Regulatory quality	0.58***	0.04	0.23	0.36	0.68	-0.20
Monetary policy rate	-0.25	-0.28***	-0.17	0.04	-0.99	-0.57***
Yield spread over US Treasury	-0.15	0.34***	0.25	-0.03	-0.03	0.53**
Bilateral depreciation vs USD	-0.11**	-0.07	0.06	-0.06*	0.10	-0.02
Inflation volatility	-0.04***	-0.03***	-0.02**	-0.02**	-0.05***	-0.04***
Capital account openness			0.06	0.00	-0.26	0.20*
R^2	*62.3*	91.3	*15.7*	*78.1*	*41.0*	*84.5*
Country fixed effects	*No*	87.5	*No*	*65.8*	*No*	*76.3*
Year fixed effects	*No*	1.2	*No*	*10.6*	*No*	*7.1*
Number of countries	25	25	23	23	23	23
Panel observations	470	470	414	414	414	414

Dependent variables: Λ is the LC share in government bonds outstanding. π is foreign participation in local currency bond markets. λ is the LC share in foreign investors' bond portfolios. Specifications: POLS = Pooled OLS without fixed effects. FEs = panel regression with country fixed effects as well as year fixed effects. The rows for fixed effects report the percentage of variance each group accounts for: country fixed effects capture *between* variation, and year fixed effects capture global factors, i.e. the amount of *within* variation common to the EMEs in the sample. Significance: Standard errors clustered at the country-level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Several macroeconomic variables appear to matter, although not in every specification. Higher *interest rates* are neither conducive for LC bond issuance Λ nor for the LC share in foreign holdings, λ. A positive *yield spread*, however, incentivises higher LC shares, both among domestic and foreign investors. That said, higher *inflation volatility* deters both the issuance and foreign holding of LC bonds across the board – this variable was found to be a consistent explanatory variable in reference papers, both in the cross-section for Λ (Burger and Warnock, 2006) and in panel data for π (Burger et al, 2015).[33] This result extends to λ, "international" original sin. Finally, *bilateral depreciation* – the loss of value of the local currency against the US dollar – tends to reduce the LC share Λ as well as π: depreciation deters foreign participation in local bond markets.

Country-specific variables clearly played a role over the sample period. Some countries with rising shares have also seen their macroeconomic conditions improve over time, accounting for some of the progress. The same holds on the downside, as demonstrated by poor macroeconomic performance (and deteriorating shares) of Argentina and Türkiye, for instance. Country-specific factors generally play a larger part in changes over time (*within* variation) than global factors do. Global push factors (measured by the size of year dummies) contributed the most in 2010-2013. Those years stood out as low interest rates and ample liquidity fuelled a search for yield that pushed up all shares in Figures 3-7; these push factors were also noted in Arslanalp and Tsuda (2014), Burger et al (2015) and Bertaut et al (2023).

Even so, the bulk of the overall variation reflects the persistent differences between countries. How do we interpret the preponderance of *between* variation? If persistent differences between countries are viewed as insurmountable, their own policy efforts do nothing to help overcome original sin – an extreme

[33] Exchange rate volatility was insignificant when included alongside inflation volatility, presumably because both variables capture similar aspects, namely the absence of monetary stability.

take on Eichengreen et al's position. Our preferred interpretation is that they represent institutional and structural factors that are essential for progress yet slowly-moving. It can take decades to achieve measurable advances in legal frameworks and market infrastructure, and hence the differences between countries appear constant over any short sample period. This interpretation reconciles the view that EME performance and policies do help (Burger and Warnock 2006; Burger et al, 2015) with the finding that country-specific changes have little explanatory power in empirical work (Eichengreen et al 2005b, 2023).

If so, we should observe that country fixed effects correlate with institutional variables prior to the sample, resulting from each country's earlier performance and policy decisions up to that point in time. Table 7 regresses the country fixed effects from Table 6 on pre-existing institutional factors (as of 2003). The results are suggestive that the stage of development of financial markets inherited at the beginning of the sample shapes the subsequent evolution of original sin (broad Λ, and international λ). For foreign participation π, the extent of openness among floating exchange rate regimes matters more. It is certainly within the power of individual countries to shape institutional variables such as these over the long run. In other regressions, some institutional variables were significant at times, but not robust. Finding the most relevant set of institutional variables behind country fixed effects could be topic for future research.

Table 7: Regression of country fixed effects (2004-2022) on institutional factors (at end-2003)

	LC share Λ	For. particip. π	LC share external λ
	(1)	(2)	(3)
Financial institutions index	0.003	-0.026	-0.001
Financial markets index	0.033***	0.002	0.039***
Openness x floating ex. rate regime	0.005	0.015**	0.002
R^2	0.415	0.361	0.463
Observations	24	23	23

Heteroskedasticity-robust standard errors. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Dependent variables are the country fixed effects recovered from panel regressions of each share on country and time dummies only. *Financial institutions* and *financial markets* development indices from IMF financial development dataset, and cover 3-sub-indices: access, depth, efficiency. We rescaled the indices from 0-1 to 0-100. *Open and floating* is an interaction between capital account openness (Chinn and Ito, 2006) and floating exchange regime dummy (based on Ilzetzky et al, 2021). We use pre-sample (end-2003) values for all explanatory variables.

This is preliminary evidence that observed differences between countries could result from their earlier efforts to improve institutional factors to a point that sets one country apart from another. Claessens et al (2007) explored some of the factors supporting deeper domestic financial systems, such as building an investor base for domestic bonds. In policy circles, discussions naturally focus on measures that countries can take themselves to develop their LC bond markets. The IMF and World Bank (2021) guidance note, for instance, lists specific macroeconomic and institutional factors as pre-conditions, and market infrastructure as well as the legal and regulatory framework as key building blocks. Most of these factors require sustained efforts in institution building over the long periods of time. If these factors are behind the persistent differences, countries are not as doomed as the term original sin would suggest.

4. Original sin redux and the role of exchange rates

Major EME sovereigns have made considerable progress toward overcoming original sin, with their own macroeconomic policies playing a role over and above global push factors; at the same time, persistent differences between countries point to the importance of slow-moving institutional factors. This interpretation reconciles the observation that original sin persists over long periods with the more sanguine view that countries *can* overcome original sin through their own efforts.

The flipside of reduced currency mismatch on borrowers' balance sheets is that the mismatch moves to the balance sheets of foreign investors. As foreign portfolios become more geared toward LC bonds (Figure 7), the exposure to emerging market currencies looms larger in investors' allocation decisions. It is not common among investors to fully hedge their exposures to emerging market currencies.[34] Rising exposure to EME currencies thus comes with considerable risks. When global investors sell bonds on account of their own currency mismatch, EMEs remain vulnerable to exchange rate depreciation – and continue to be exposed to global financial conditions.

This can give rise to "original sin redux", a term that captures the idea that original sin can come back in a different guise (Carstens and Shin, 2019; Bertaut et al, 2023). This section examines this idea and the role played by exchange rates. Exchange rate movements induce currency valuation effects and trigger portfolio reallocations, two points to be distinguished. To do so, we first decompose how exchange rates affect the balance sheets of EME governments and foreign investors.

Financing flows vs valuation effects

The overall change in the value of sovereign bonds can be decomposed into financing flows and valuation changes due to exchange rate movements. For issuers, depreciations increase the burden of FC bonds; for foreign investors, depreciations inflict losses on LC bonds in dollar terms.

Consider the perspective of a sovereign issuer first. 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

$$B' - B = (L' - L) + (\varepsilon' F' - \varepsilon F) = \underbrace{(L' - L) + \varepsilon'(F' - F)}_{Net\ financing} + \underbrace{F(\varepsilon' - \varepsilon)}_{\substack{Valuation \\ effect}}. \quad (5)$$

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 (e.g. Chang and Velasco, 2001; Bruno and Shin, 2015), and a known macroeconomic cost to countries afflicted by original sin (Eichengreen et al, 2005).

Foreign investors, on the other hand, assess the value of their 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 holdings can be decomposed as follows,

$$\theta' b' - \theta b = \underbrace{(f' - f) + \theta'(l' - l)}_{Net\ investment} + \underbrace{l(\theta' - \theta)}_{\substack{Valuation \\ effect}}. \quad (6)$$

There is no valuation effect on FC bonds; instead, the currency mismatch is on LC bonds: EME depreciation $(\theta' < \theta)$ inflicts losses on LC bond holdings when expressed in US dollars. For global investors, this exposure can be a large part of the country risk they face.

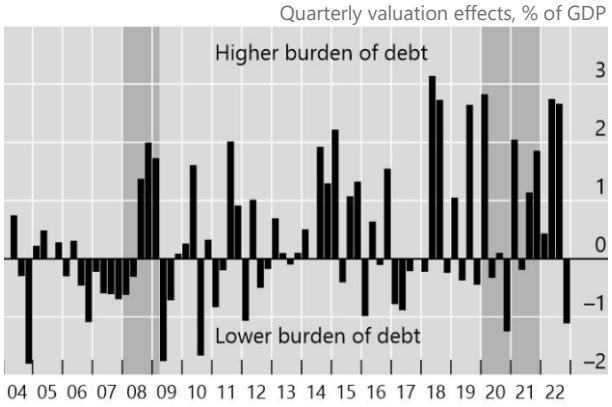
Figures 9-10 present the parts of equations (5)-(6) for all EMEs combined. Figure 9 shows that ***valuation effects*** on sovereign bonds have been sizeable. Sovereigns regularly saw their debt burden grow due to depreciation, by as much as 3% of GDP in some quarters (left panel, from equation (5)). Before the GFC, the strength of EME currencies helped sustain foreign currency debt, lowering the burden on domestic

[34] 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; Jansen et al, 2024). 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.

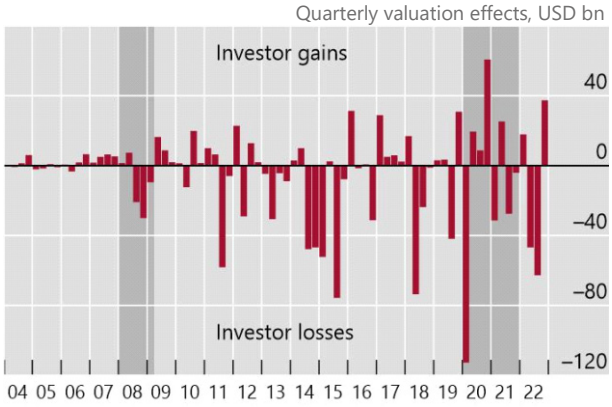
balance sheets; the GFC reversed those gains, giving way to a period with adverse valuation effects. For some countries, valuation effects can exceed 20% of GDP (e.g. Argentina and Türkiye since 2018). At the onset of the pandemic, Brazil, Mexico, and Russia faced depreciations of more than 20%. Such episodes are relatively frequent and can be painful when FC bonds come due for repayment.[35]

Exchange rate valuation effects facing borrowers and lenders[1] Figure 9

FX-induced changes in foreign currency debt burden[2]



FX-induced investor losses on LC bonds[3]



[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 FC 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 LC 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 LC bonds (right panel, from equation (6)). Depreciations reduce the dollar value of LC bonds, and thus inflict losses on foreign investor portfolios. Valuation effects have grown larger over time, in line with greater holdings. The largest changes have often been negative, undermining returns even as sovereign bonds performed well in local currency terms. This affects foreign investors whenever bonds are repaid, sold, or 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.[36]

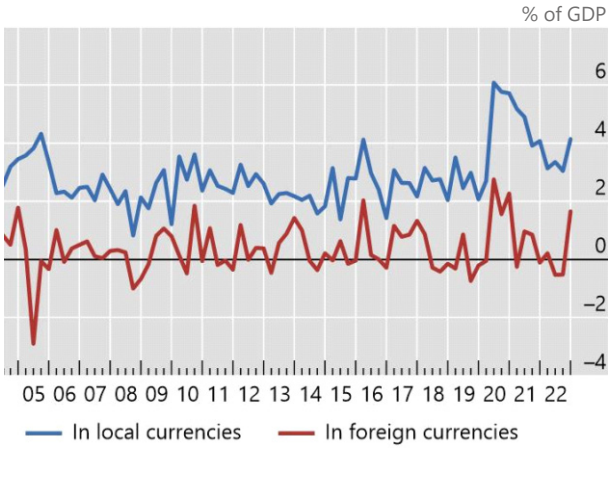
The exposure of foreign investors to local currency bonds is highly correlated across EMEs due to the co-movement of their exchange rates. Losses on local currency bonds in Figure 9 (right panel) are proportional to depreciations in EME currencies (equation (6)). Pairwise correlations between EME currencies (θ_i) average around 50% in our sample, with the median correlation exceeding 60%. Most EME currencies exhibit a strong negative correlation with the overall value of the US dollar (measured by the Broad Dollar Index, BDI), with mean and median correlations of -0.70 and -0.87, respectively, even as the BDI references the largest US trade partners (rather than our sample of EMEs). A simple principal component analysis reveals that the first principal component accounts for as much as 66% of the variation, indicating that a common factor induces substantial co-movement among EME exchange rates. This suggests limited scope for risk-sharing and diversification for EME bondholders.

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

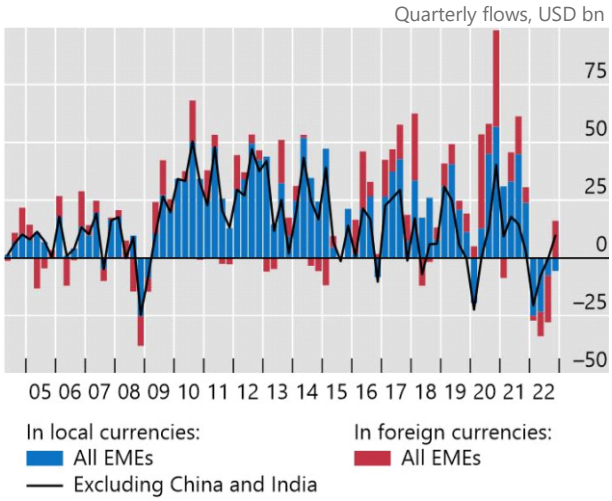
[36] Hale and Juvenal (2022) find substantial currency-induced valuation effects on EMEs' external positions during the pandemic. On valuation gains helping to raise external holdings, see Burger et al (2012); on the risks, Burger and Warnock (2007), Du and Schreger (2016). Currency valuation effects on external balance sheets also matter for advanced economies (Tille, 2008; Gourinchas and Rey, 2014; Bénétrix et al, 2015).

Issuance and foreign investment in EMEs sovereign bonds[1] Figure 10

Net financing, by currency[2]



Net foreign investment, by currency[3]



[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. (FC bonds are assumed to be denominated in US dollars. [3] The panel shows the quarterly changes in external holdings of FC bonds $(f' - f)$, aggregated across EMEs, in red. For LC 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.

Valuation effects have not dissuaded governments from issuing FC bonds, nor foreign holders from investing in LC bonds. Figure 10 plots ***net financing*** (left panel) in local and foreign currencies, the first two terms in equation (5). Governments have tapped international bond markets for foreign currency as needed; the pandemic in 2020, for instance, saw a spike in FC bond issuance (notably by Chile, Mexico, Peru, and Romania). Still, EMEs have financed themselves predominantly in local currency over the sample period. Net issuance of LC bonds remained positive throughout, running at 1% to 4% of GDP on average – at no point have redemptions fallen short of new issuance in the aggregate.

A similar finding holds for net investment by foreign investors (right panel). Investment in LC bonds has held up better than the trends in Section 2 suggest. Despite valuation-induced losses, net inflows have continued over the past decade with foreign investors providing external financing to EMEs. In most quarters (83%), EMEs as a group received more external funding through LC than through FC bonds (with or without China and India). But the aggregate conceals much country-level variation: LC bond inflows can be volatile, with large outflows in quarters with exchange rate depreciations. Even so, all 25 EMEs in our sample attracted positive net flows to LC bonds when cumulated over the full sample period.

That said, there are episodes in which foreign investors shifted out of LC bonds in aggregate. This is visible during the GFC and at the onset of the pandemic in 2020 Q1 (Figure 10, right panel).[37] In the face of valuation losses, foreign investors shed more local currency government bonds than FC 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 LC bonds, but not in dollar-denominated bonds. Hofmann et al (2022) report a similar finding at the fund level, and Jansen et al (2024) 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).

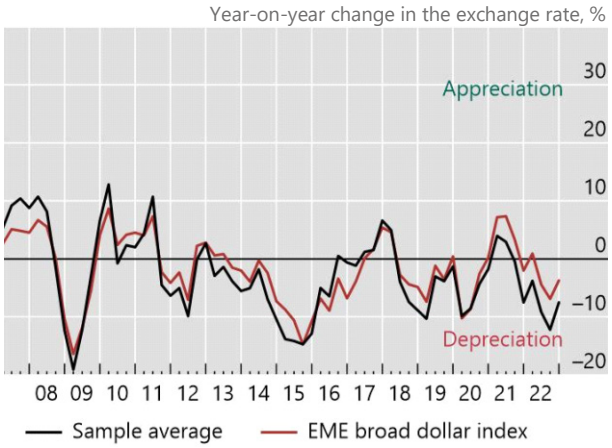
[37] Accordingly, those episodes left dents in the foreign participation ratio (Figure 6).

Exchange rates, returns and duration

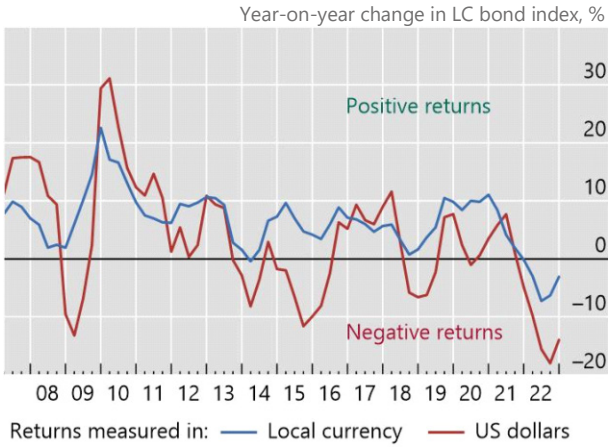
Currency risk can reduce the attractiveness of LC bonds to foreign investors. Burger et al (2012) found for their sample (2002-2011) that unhedged currency risk significantly increased portfolio risk, but the added risk was also compensated by strong returns because of a falling dollar. The period since the 2013 taper tantrum, however, saw bouts of depreciation in EME currencies, some in excess of 10% per annum (Figure 11, left panel). These episodes are mirrored in weaker LC 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. Depreciations and volatility of EME currencies curb returns and dampen investor risk appetite (Hofmann et al, 2022). EME issuers often pay a large spread over the risk-free benchmark when borrowing in their currency; three quarters of this spread can be attributed to currency risk (Du and Schreger, 2016).[38]

Bond return performance undermined by weak exchange rates — Figure 11

EME currency performance against the US dollar[1]



Bond returns by currency of index measurement[2]



[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 25 EMEs in our sample; simple average across the year-on-year returns of individual country constituents of JP Morgan 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 add duration risk. The duration of a typical bond in the JP Morgan GBI-EM index, which tracks EME local currency government bonds, is approximately 4 years. Duration also measures the sensitivity of a bond's market price to changes in its yield. The blue regression line in Figure 12 (left panel) indicates that a 1 percentage point rise in yields goes with a 3.55% drop in the local 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 –6%. Since spikes in EME yields tend to go hand in hand with depreciations, the effective duration of LC bonds is higher for foreign holders than for domestic investors. Faced with extra duration and market risk, foreign investors can become reluctant to hold LC bonds in periods of stress (Hofmann et al 2020, and IIF 2020, FSB 2022). Losses can set off a feedback loop, where the shedding of bonds leads to greater valuation losses, depreciation and a further tightening of financial constraints (Hofmann et al, 2022).

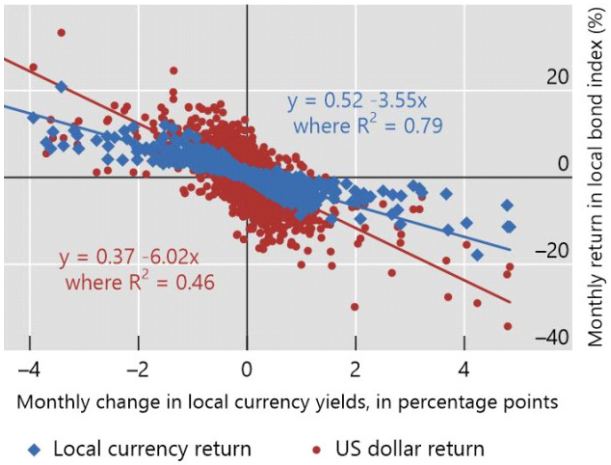
The role of duration and market risk has become more prominent with the growing heft of NBFIs as holders of local currency sovereign bonds. Mutual funds appear particularly sensitive. Shek et al (2018) document substantial bond sales by EME mutual funds during the taper tantrum, well in excess of redemptions. Similarly, Bertaut et al (2023) show that mutual funds react more sensitively than other

[38] Lee (2022) further shows that the premium on local currency debt rises with exchange rate volatility and can dissuade governments from borrowing in local currency.

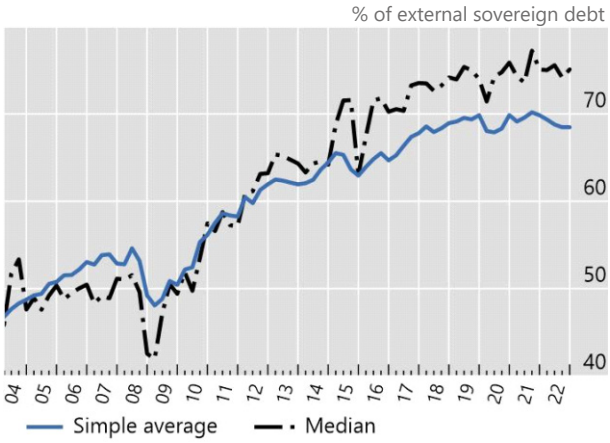
sectors. The non-bank sector (which includes investment funds) has provided a growing share of external financing to EMEs over the past decade: by end-2022, nearly 70% of external government debt was held by non-banks (Figure 12, right panel). Investment flows into EMEs have thus become volatile at times (IMF and World Bank, 2021; FSB, 2022). This procyclicality became evident in the March 2020 turmoil, when investment funds drove foreign outflows from EME bond markets (Hofmann et al, 2020; FSB 2022).

Effective duration and non-bank financial institutions — Figure 12

The sensitivity of dollar returns to changes in yields



The share of non-banks in foreign holdings[1]



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

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

Returning to the shares covered in Section 2, it stands to reason that their evolution has been shaped by exchange rate developments. The GFC entailed strong dollar appreciation and a generalised retreat across asset classes, taking a toll on LC bond portfolios; conversely, appreciation in EME currencies fuelled the post-GFC boom in local bond markets apparent from Figures 6 and 7. 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.[39] Foreign participation in sovereign bond markets stalled as a result (Figures 4 and 6). In a sign of original sin redux, this affected EMEs well beyond those borrowing predominantly in foreign currency.

The trends in Figures 3-7 were based on bond portfolios reported at current – and rapidly moving – exchange rates. The local currency trends we highlighted would have been more prominent in the absence of EME depreciations. The LC shares mechanically decline when EME currencies depreciate, since the value of LC bonds falls relative to that of FC bonds (see Appendix 1). Appendix 5 shows that the upward trends in Λ and λ would have appeared longer had exchange rates remained stable: the progress toward overcoming sin would have been more manifest had EME currencies held their value. That said, the LC share in foreign portfolios (λ) is that of Figure 7, not the one at hypothetical constant exchange rates (Figure B.2). The fact that foreign investors let λ decline as EME currencies depreciated suggests that they did not rebalance their portfolios enough as to maintain a target exposure to EME currencies (constant λ) – even if they continued to buy LC bonds on net.

[39] Several major issuers, including Argentina, Türkiye, and South Africa, suffered credit rating downgrades that further weighed on their currencies.

5. Concluding remarks

The trends documented in this paper show that major 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 issuers, and stronger for larger EMEs than for smaller emerging and developing economies. The majority of EMEs in the sample attracts greater participation in LC bond markets and issues a higher share of LC bonds with a larger footprint in foreign portfolios than was the case 20 years ago. 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 made global investors more comfortable with EME sovereign bonds. Increased issuance in LC bonds tends to reduce foreign participation, so a shift toward local currency bonds is best coupled with efforts to foster foreign participation in LC bond markets. This takes considerable investment in longer-term institutional development. Partly due to earlier efforts, aggregate foreign flows into LC bonds remained positive for the most part, even as spells of depreciation have reduced the attractiveness of this asset class.

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. Currency depreciations erode the value of LC bonds to all investors who measure returns in dollars or other reference currencies. In periods of stress, foreign investors quickly become reluctant to hold LC bonds, as they face more effective duration than domestic investors. Losses can set off a feedback loop, where selling, valuation losses and depreciation further tighten financial constraints.

This is not to suggest that EMEs would have fared better had governments continued to rely more on FC bonds. The history of currency crises has underscored the dangers of an overreliance on foreign currency debt. At the onset of the pandemic, EMEs 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 Türkiye. Depreciations make foreign holders shed LC 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. "Original sin redux" 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 liquidity.

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, 2023). 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 FC bonds (IIF, 2021). EME central banks

intervened to support LC bond markets by signalling 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, EMEs can do their part by improving fundamentals and monetary frameworks while pursuing longer-term policies to strengthen and diversify the domestic investor base and develop local financial markets (Burger et al, 2015). The domestic institutional investor base is regarded as essential for sustaining the demand for sovereign bonds (IMF and World Bank, 2021). However, turning away from external finance or building large official reserves erode the advantages of capital flows from AEs 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.

Creditors and the international community thus also have a role to play. Global portfolios exhibit strong home currency bias (Burger et al, 2018; Maggiori et al, 2020), limiting the potential for international diversification in LC bonds. The inclusion of LC bonds in benchmark indices helps to integrate EME currencies into international portfolios (Arslanalp et al, 2020). Policymakers are exploring ways to mitigate fluctuations in global financial conditions. And various proposals have been put forward for multilateral financial institutions to develop new instruments and structures aimed at facilitating the transformation or pooling of currency risk (e.g. Eichengreen et al, 2023).

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Appendices

1. Notation

The paper uses the following notation for the variables relevant to the analysis.

Notation for amounts outstanding and foreign holdings — Table A

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*	↑ = *local currency depreciation*
$\theta = 1/\varepsilon$	*Exchange rate, US dollars per local currency unit*	↓ = *local currency depreciation*

The 'debt matrix' (Table 1 in the text) uses these variables to define the shares of interest for the analysis. What follows elaborates how these shares depend on exchange rates, and thus valuation effects. The elasticities measure the percentage change in each ratio in response to a percentage depreciation ($\varepsilon\uparrow$) of an EME's currency against the US dollar, a stand-in for all foreign currencies combined.

Share 1. Local currency share in government bonds outstanding
Definition:

$$\Lambda = \frac{L}{B} = \frac{L}{L + \varepsilon F}$$

Elasticity:

$$\frac{\partial \Lambda}{\partial \varepsilon}\frac{\varepsilon}{\Lambda} = (\Lambda - 1) < 0$$

Share 2. Foreign participation in the sovereign bond market
Definition:

$$\Pi = \frac{b}{B} = \frac{l + \varepsilon F}{L + \varepsilon F}$$

Elasticity:

$$\frac{\partial \Pi}{\partial \varepsilon}\frac{\varepsilon}{\Pi} = \frac{\pi_f - \pi}{\Pi}(1 - \Lambda)\Lambda > 0$$

Share 3. Foreign participation in the local currency bond market
Definition:

$$\pi = \frac{l}{L}$$

Elasticity:

$$0\ (no\ direct\ effect)$$

Share 4. Local currency exposure in foreign investor portfolios
Definition:

$$\lambda = \frac{l}{b} = \frac{l}{l + \varepsilon f} = \frac{\theta l}{\theta l + f}$$

Elasticity:

$$\frac{\partial\, \lambda}{\partial \theta}\frac{\theta}{\lambda} = (1 - \lambda) > 0 \ \ or \ \ \frac{\partial\, \lambda}{\partial \varepsilon}\frac{\varepsilon}{\lambda} = (\lambda - 1) < 0.$$

2. BIS statistics on government bonds

By construction, the IDS dataset includes bonds issued outside the domestic market where the borrower resides (Gruic and Wooldridge, 2012). The BIS compiles IDS using security-level data obtained from commercial sources. By contrast, DDS aggregates statistics on the size of domestic markets reported by national authorities to the BIS. Therefore, IDS and DDS provide complementary information on the size of overall bond market in each country. To obtain a consistent currency breakdown for government bonds in *all* markets, we launched a separate data collection (Bogdanova et al, 2021).

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. These statistics thus capture the entire asset class, split into LC and FC-denominated bonds. The data are in annual frequency at nominal valuation where available, and market valuation otherwise. Nominal values represent issuers' repayment obligation (face value plus accrued interest) vis-à-vis bond holders. All values are reported in US dollars, using end-of-period BIS exchange rates.

For the current paper, we enhanced these statistics using several sources to obtain more complete quarterly coverage. We extended the sample period back to early 2000s for several countries, harmonised valuation methods and generated an upper bound for outstanding government bond stocks by using country-specific information, judgment, and additional series provided by central banks.

Our sample covers the 27 countries in BIS Table C4 that the BIS country groupings classify as EMEs.

Emerging market economies in the sample — Table B

Asia (10)	Europe (8)	Latin America (6)	Africa & Middle East (3)
China	Bulgaria	Argentina	Israel
Chinese Taipei	Croatia	Brazil	Saudi Arabia
Hong Kong SAR	Czechia	Chile	South Africa
India	Hungary	Colombia	
Indonesia	Poland	Mexico	
Korea	Romania	Peru	
Malaysia	Russia		
Philippines	Türkiye		
Singapore			
Thailand			

3. Foreign holdings of government bonds

The statistics described in Appendix 2 cover the outstanding amounts issued on the primary market. It is more difficult to ascertain where bond holders reside, since bonds can be traded freely on the secondary market. We collect series from national and/or other publicly available sources capturing foreign (non-resident/external) holdings of general government bonds. 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.

We implemented numerous data improvements; for example, we combined data from multiple sources to create longer time-series for several countries, harmonised valuation methods where possible, and imputed missing data to enhance coverage (see the compilation guide for a detailed description of methods and sources by country).

One challenge was 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 estimated εf as a residual using statistics on total external holdings of government bonds (IIP, QEDS, or Arslanalp and Tsuda (2014)); when no information on currency was available, we instead estimated l by using IDS data as a proxy for εf. (Note that this only uses IDS as a proxy for foreign holdings of FC debt, not for foreign holdings overall.) In both cases, we forced the estimates to satisfy logical constraints. This ensures that our holdings estimates are consistent with what is known about EMEs' external bond liabilities (IIP), their FC bonds issued in international markets, and total amounts outstanding. In particular, when matching the holdings series with the total outstanding amounts for each country, two main cases typically arose:

1. If the collected holdings series refer to *local currency* government bonds (l in Table 1), we compared them with local currency bonds outstanding (L). Separately, the IIP, QEDS or Arslanalp-Tsuda data provided total external holdings of government bonds without a currency breakdown (b). Since $b = l + \varepsilon f$, we could combine these sources to infer external holdings of *foreign* currency bonds εf as a residual. We ensured consistency through several logical tests, such as constraining all holdings series to lie between 0 and the outstanding amounts.
2. If the collected series referred to foreign holdings of government bonds in *all currencies* (b), the information was deemed less useful, as it did not complement reported external positions as in case 1. In this case, we had to estimate external holdings of local currency bonds (l) by other means. Absent additional information, we took foreign currency bonds in the BIS IDS statistics as a proxy for external holdings of *foreign* currency bonds (εf) since they are mostly denominated in FC and typically marketed to international investors. Indeed, the comparison of IDS outstanding and IDS holdings (available for Peru and Mexico for example) confirmed the validity of the assumption that majority of IDS are held abroad. We then estimated the holdings of local currency bonds using the difference between total external holdings (b, as in case 1) and the aforementioned proxy as follows:
    a. If the IDS in foreign currency was below the reported totals in foreign currency and external holdings, we estimated holdings of local currency bonds as a residual, Since $l = b - \varepsilon f$.
    b. If not, we capped external holdings of foreign currency bonds at the lower of the two series in step 2a. In the few cases where foreign currency bonds could not all be held abroad (when they exceeded total foreign holdings), we assumed proportionality instead, i.e. that local and foreign currency bonds outstanding were held in equal shares abroad. This tended to underestimate the holdings of foreign currency bonds and overestimate the holdings of local currency bonds.
    c. Where it was not possible to infer a local (or foreign) currency holdings series, we contacted the relevant central bank or finance ministry and requested the currency breakdown. When the requested data are provided, we included the series in aggregate calculations and in the shared dataset (unless the series were confidential).

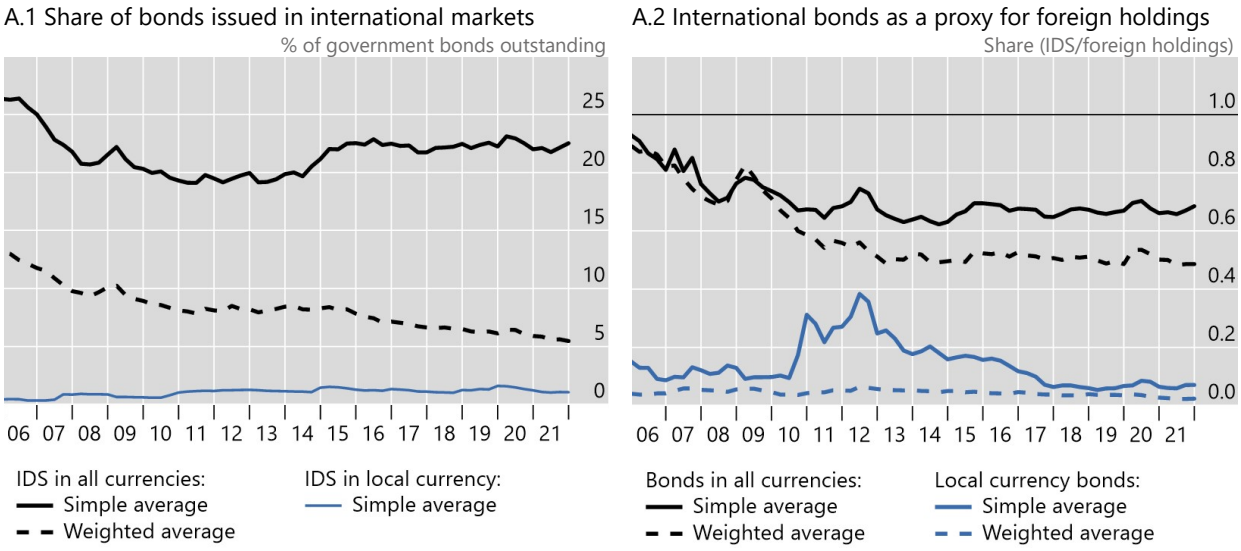
4. Capturing sovereign bonds in all markets

This appendix compares our approach in creating the current EME sovereign bonds dataset with the 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 issuer. This segment includes what market participants have traditionally referred to as *foreign bonds, offshore bonds,* or *eurobonds*, which are 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, as noted by Burger and Warnock (2006).

First, for the asset class of EME sovereign bonds, the international segment accounts for a small and falling share of the total (Figure A.1). On average, less than 25% of EME sovereign bonds outstanding were issued internationally (black solid line); in the aggregate (weighted average), the share of international bonds is as low as 5% (dashed line). Second, international bonds are geared toward foreign currency: most FC bonds were issued internationally (captured in IDS), whereas most LC bonds are placed in domestic markets (excluded from IDS). 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 bonds. Therefore, the small fraction of LC bonds issued as IDS (blue line) does not reflect the weight of LC bonds in foreign holdings, nor that in amounts outstanding.

EME government bonds issued in international markets[1] Figure A



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

As a result, international bonds are not a good proxy for *overall* foreign holdings, and certainly not for the local currency content of bonds held abroad. The right panel of Figure A.2 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 for which we have holdings data, the IDS outstanding only amount to two thirds of total foreign holdings (black lines). This is because foreign investors hold far more LC bonds than those issued in international markets (blue lines). (The ratio is somewhat higher for bonds in all currencies because the IDS comprise most FC bonds.) Considering only IDS will underestimate l and bias the shares involving l, notably π and λ (Table 1).

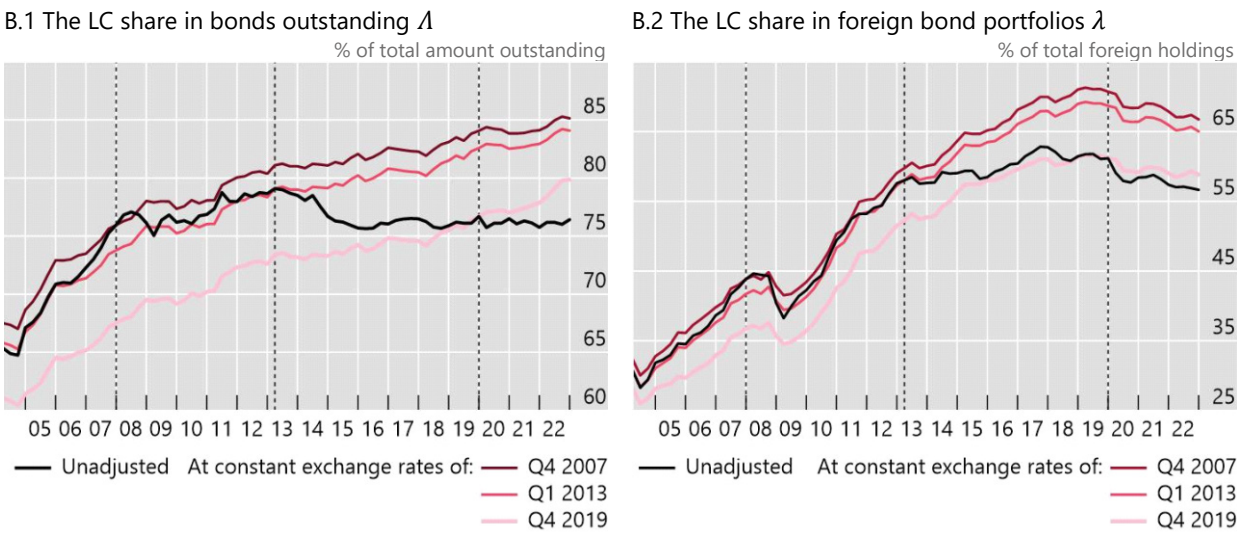
5. Aggregate measures of original sin at constant exchange rates

When EME currencies depreciate, even a growing stock of LC bonds appears to shrink gradually in dollar terms, compared with the hard currency bonds in investor portfolios. This appendix shows that the local currency trends we highlighted would have been more prominent in the absence of EME currency depreciations.

The black lines in Figure B reproduce the average shares from Figures 3 and 7. The LC share in debt outstanding Λ (panel B.1) reverts after 2011, but much of this reversion is due to weakness in EME currencies. The shares Λ and λ mechanically decline when EME currencies depreciate, since the value of LC bonds falls relative to that of FC bonds (Appendix 1 derives the elasticities). The upward trend would have continued had exchange rates remained stable, as in the coloured lines.

Valuation effects also weigh on λ (panel B.2): the LC 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' LC bond holdings (red line).

The trends in LC shares revisited[1] Figure B



[1] This figure shows Λ (left panel) and λ (right panel), 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 amounts outstanding (left) and foreign holdings (right panel) evaluated at *current* exchange rates (see Figures 3 and 7). The coloured lines instead recast both shares at *constant* exchange rates, fixed at their values indicated in the legend.

Sources: National data; BIS; authors' calculations.

The counterfactuals in Figure B 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.

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