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In Search of the Origin of Original Sin Dissipation

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In Search of the Origin of Original Sin Dissipation
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ABSTRACT: In this paper, we examine how, contrary to the 'original sin' hypothesis, emerging market economies have gained the ability to borrow abroad in their local currency. We empirically analyze the relationship of various economic variables with local currency debt and identify three crucial conditions for the capacity to borrow in local currency: institutional quality, sufficient depth in the domestic bond market, and adequate performance in inflation targeting. While shares in JPMorgan Government Bond Index-Emerging Markets (GBI-EM) index also appear to be influential, the associations with local currency debt is less clear. We conduct a similar empirical analysis on portfolio equity, which represents a safer form of external liability than foreign currency debt, and verify that the depth of the equity market plays a key role in attracting foreign capital to domestic equity markets. Finally, we propose a simple portfolio model based on the inelastic market hypothesis to explain the positive correlation between capital market depth and the dissipation of original sin, which refers to the presence of more external liability in the form of equity or local currency debt. In essence, our analysis suggests that emerging market economies with reasonably strong fundamentals are not necessarily reliant on foreign currency debt.

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Contents

FIGURES

TABLES

Introduction

Since the sudden stop crises in the 1990s, the reliance of emerging market economies (EMEs) on foreign currency external debts has been identified as a significant source of fragility in these economies.[1] Eichengreen and Hausmann (1999) introduced the concept of "Original Sin" to economics; these authors went on to develop the idea in subsequent studies (Eichengreen et al. (2002); Hausmann and Panizza (2003); and Eichengreen et al. (2007)). Although its meaning has evolved, in general terms, original sin in the economic context references the inability of peripheral economies to borrow abroad in their own currencies.[2] These authors argue that a country’s inability to borrow in its own currency appears to be unrelated to fundamental variables, such as inflation or institutional quality, with only the size of its economy being a determining factor; larger economies enjoy advantages in borrowing abroad in their domestic currency. The original sin hypothesis has exerted significant influence in the literature and has been a focal point of discussions among policymakers and academics.

However, considerable shifts have been documented in the ability of EMEs to borrow abroad in their domestic (local) currency (Du et al. (2020); Arslanalp and Tsuda (2014)). Since the mid-2000s, there has been a steady growth in foreign investments in EME local currency bonds. As Carstens and Shin (2019) comment, the enhanced ability of EMEs to borrow in their local currency represents one of the most noteworthy transformations in the structure of global financial markets since the 1990s. This study aims to enhance our understanding of these changes. In other words, the central question in this paper is “What have enhanced EMEs ability to borrow abroad in local currency, as opposed to original sin hypothesis?” We empirically investigate the association between local currency debts and various factors, and propose a theoretical model to explain the most significant among our empirical findings.

The lack of data on external local currency debts in EMEs has been a significant obstacle to examining local currency debt. In our empirical analysis, we utilize a newly constructed dataset introduced in a companion study, Han (2022).[3] The dataset provides information on local currency-denominated bonds in EMEs that are held by foreign investors[4] and primarily issued in that EME. It should be noted that the dataset covers all local currency bonds, primarily sovereign or central bank bonds (for certain Asian EMEs).

Our panel regressions reveal the factors associated with the ability to borrow using local currency bonds. Among the variables considered, local currency bond market depth[5] exhibits the highest correlation with local

[1] Throughout this study, external debts refer to debts held by nonresidents, and thus include debts issued in domestic markets held by nonresident investors. This corresponds to the formal definition in the sixth edition of the IMF’s Balance of Payments and International Investment Position Manual (BPM6).

[2] Eichengreen et al. (2002) also highlighted the inability of a sovereign to borrow using long-term bonds, even domestically, referring to this as "domestic" original sin. However, subsequent studies have predominantly focused on the inability to borrow abroad in domestic currency.

[3] We also utilized the data from Arslanalp and Tsuda (2014). The authors regularly update the dataset, which they make available on their website. The version employed in this study was published in December 2022.

[4] Throughout this study, "foreign investments" refer to investments made by nonresident investors, and "foreign capital" is used similarly. Nonresident investors are not necessarily foreigners in terms of nationality; they could be domestic investors, such as a foreign subsidiary of a domestic company. We do not differentiate between foreign investors and nonresident investors, as it is difficult to distinguish one from the other; for further discussions on this topic, please refer to Chui et al. (2016).

[5] Throughout this study, we use market depth and size interchangeably. These are not necessarily the same as the definition of market depth considers other factors, such as turnover ratio. However, we cannot find a reliable source for data related to market depth; e.g., turnover ratios in EME bond markets

currency bonds. In simpler terms, larger bond markets attract more foreign investments. Other significant variables include the credibility of inflation-targeting central banks, measured by the deviation of realized inflation from inflation targets, and institutional quality. Other variables that have some association with local currency debt, albeit to a lesser extent than the aforementioned three, include trade openness (measured by the ratio of trade volume to GDP), capital control on bond inflows, and the EMEs' share in the JP Morgan Government Bond Index-Emerging Markets (GBI-EM). To the best of our knowledge, there have been no empirical results reported for the relationship between these variables and local currency bonds, except for institutional quality, which has been emphasized in some recent studies, such as Engel and Park (2022) and Devereux and Wu (2022).

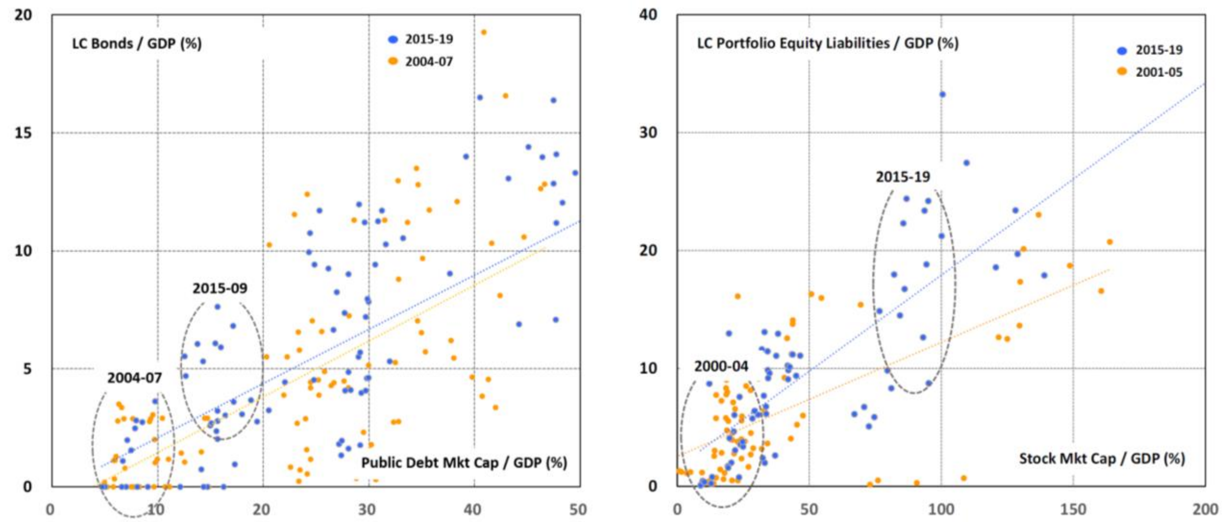
High correlations between bond market depth and external local currency debt are documented in a companion study by Han (2022), as depicted in Figure 1. In the left panel of Figure 1, the y-axis shows foreign investors' local currency bond holdings-to-GDP ratios in each of the EMEs, while the x-axis indicates the ratio of public bonds outstanding (government plus central bank bonds) to GDP. The blue dots indicate the average of each EME in the sample period from 2015–2019, while the orange dots indicate the averages in the period of 2004–2007. Accordingly, the dashed lines are the trend lines for the two periods. The first observation from Figure 1 is the shift of the dots from the bottom-left (orange dots) to the center (blue dots). The more important second observation is that the slopes of the two trend lines are almost the same: there has been no substantial change in the relationship between EME local currency bonds held by foreign investors and the size of the EME local currency bond market.

In this study, we formally test the association between bond market depth and local currency debts. Although some readers may anticipate these results, they nevertheless do not align with standard portfolio theory due to the significant variation in bond market sizes among the EMEs in the sample. Furthermore, despite the correlations between bond market depth and local currency debt being as predicted, they reinforce the key findings of our study: 1) capital market development has been the primary driver of original sin dissipation (OSD),[6] in the form of increased borrowing abroad in the local currency, and 2) EMEs with well-developed capital markets and reasonable institutional qualities are capable of substantial borrowing abroad in local currency, debunking the notion of a deeply rooted sin that fundamentally hampers their ability to borrow abroad in their local currency.

The results of inflation-targeting performance are also novel, although a few studies (e.g., Ogrokhina and Rodriguez (2018)) have documented that the adoption of inflation-targeting enhances the ability of EMEs to borrow abroad in local currency. The significance of inflation-targeting performance, which can be viewed as a measure of the credibility of monetary authorities, aligns with theoretical analyses (Ottonello and Perez (2019) and Du et al. (2020)) that emphasize the importance of monetary-authority credibility and stable inflation in facilitating borrowing abroad in local currency. The observed significance of trade openness may suggest that higher foreign-exchange (FX) market depth attracts foreign capital into local currency bond markets; bond investors assess their returns in foreign currency, and greater depth in the market implies that there will be less depreciation of the local currency during periods of foreign capital outflow. The findings concerning shares in the GBI-EM index might indicate the presence of numerous passive funds that track the index or an information effect: the index may inform global investors about the existence of local currency bond markets.

[6] In this study, OSD refers to the phenomenon of EMEs being unable to borrow abroad in their local currency. Depending on the context, it also includes external liabilities in the form of portfolio equity.

Figure 1: Capital Market Depth and Origsinal Sin Dissipation



Notes: The figure illustrates the strong correlation between capital market depth and external liabilities in the form of portfolio equity and local currency bonds, indicating the dissipation of original sin. The left panel depicts the relationship between the depth of the public bond market and external liability in the form of local currency bond. The right panel portrays the relationship between stock market depth and external liability in the form of portfolio equity—equities held by foreign portfolio investors. The orange-colored dots and trend line represent the early 2000s or mid-2000s sample period, while the blue-colored dots and trend line represent the 2015–2019 sample period. The comparison between these two sample periods demonstrates the consistent relationship between capital market depth and external liabilities in the form of equity and local currency bond.

Sources: authors' own calculations and IMF International Financial Statistics (IFS).

We also investigate the relationship between original sin dissipation and foreign exchange market liquidity. As measures of foreign exchange market liquidity, we use FX market turnover by currency, provided by BIS and international reserve-to-GDP ratio, among which the latter indicates foreign currency liquidity readily available for policy authorities in each of the EMEs. We find international reserve-to-GDP ratios are strongly associated with original sin dissipation, similar to Devereux and Wu (2022). We find a positive association between the FX market turnovers and original sin dissipation, but the association of FX market turnover with original sin dissipation appears to be much weaker than international reserves. However, it is important to note that the results of FX market turnovers are highly tentative as the frequency of FX market turnover surveys is triannual, which limits the observation numbers in the regressions, and the FX market turnover must be an imperfect measure of foreign exchange market liquidity.

In addition to analyzing local currency bonds, we also examine the association between various economic variables, similar to those considered in the local currency bond regression equations, and increased foreign portfolio investments in EME equity markets.[7] We explore portfolio equity as another secure form of foreign financing, akin to local currency debt, whereby the value of external liabilities decreases in periods during which EMEs experience challenges. Additionally, this exploration of the nature of foreign investments in EME equity markets may offer insights into the similarities between foreign investments in equity and local currency bonds.

We confirm that market size has a crucial role in attracting foreign portfolio investments to EME equity markets; the larger their markets the greater their ability to attract foreign capital. The right panel in Figure 1 shows the

[7] Equity portfolio investments in EME domestic markets are a subset of external equity liabilities in an international investment position; the latter also covers the equities issued by EME firms in foreign equity markets.

tight relationship between foreign portfolio investors' holdings of equities and equity market depth, which is similar to the left panel depicting the relationship with local currency bonds. As discussed in Han (2022), the flow of equity portfolio investments into EMEs is a precursor to the flow of local currency bond investments. If our empirical results demonstrate a causal relationship between capital market depth and foreign investments in EME equity and bond markets, the fact that equity flows precede local currency bond flows suggests that the development of an EME's equity markets precedes the development of its local currency bond markets.

Finally, we propose a theoretical model that explains the positive correlations between bond market depth and local currency debt, and the similarly positive correlations between equity market depth and external equity liability. We develop a simple portfolio model based on the concept of inelastic demand, inspired by the inelastic market hypothesis (IMH) introduced by Gabaix and Koijen (2021).

We gain insight from the model by first considering the portfolio problem faced by global investors whose portfolios include different types of assets in different countries. These investors experience recurrent shocks that affect their demand for assets in EMEs; these shocks resemble various global shocks, such as US monetary policy shocks. When global investors sell their holdings due to global shocks, those assets must be absorbed by local EME investors.

However, because local investors' demands are inelastic, their absorption capacity is insufficient and thus, the sell-off by global investors must lead to a drop in asset prices. More importantly, the magnitude of asset price movements resulting from global shocks is greater in markets where global investors have a higher market share since it will be harder for local investors to absorb the sell-off: the higher the share of global investors the more sell-off by global investors must be absorbed by local investors and the more extensive drop in total demand results in a larger drop in asset prices.

Consequently, the prices of assets in markets with higher shares of global investors exhibit a higher level of correlation with global shocks, which can pose systemic risks for global investors. As a result, assets in such markets become unattractive, given their poor risk-hedging properties. Conversely, assets in markets with lower shares of global investors become more attractive. These mechanisms offer a form of endogenous convergence of the shares of global investors in EME capital markets. Therefore, an EME with a larger capital market relative to its GDP has the ability to attract relatively more foreign capital into its domestic equity and local currency bond markets.

Based on the empirical and theoretical analysis in this study, we conclude that the improved ability of EMEs to borrow abroad through equity and local currency debt can be attributed to three key factors: capital market development, the establishment of credibility by monetary authorities, and the introduction of the JP Morgan GBI-EM Index in 2005.

Related Literature

Broadly speaking, this study belongs to the economics literature on original sin, which documents the reliance of EMEs on foreign currency debts and explores the causes of this reliance (the original sin) and its associated risks for financial stability. This study contributes to the literature by providing empirical evidence of Original Sin Dissipation (OSD) and an interpretation of these results using the theoretical model described below.

Eichengreen and Hausmann (1999) initially introduced the concept of original sin to economics. They defined this as a situation where "the domestic currency cannot be used to borrow abroad or for long-term domestic borrowing." In subsequent studies (Hausmann and Panizza (2003); and Eichengreen et al. (2002)), the authors separately defined "domestic original describe the situation where the domestic currency cannot be used for long-term domestic financing and “international original sin” to describe the situation where the domestic currency cannot be used for foreign financing. They also reported that economic fundamentals insufficiently explained the absence of external local currency debts in EMEs; only the size of the economy seemed to matter. Furthermore, they argued that no clear theories could explain these empirical findings, leaving the original sin a mystery.

In Eichengreen et al. (2005, 2007), the concept of domestic original sin is discarded, suggesting that some EMEs have overcome the limit on long-term domestic financing but have still been unable to borrow abroad in domestic currency. This implies that extensive use of local currency in domestic markets is not a sufficient condition for using local currency for external borrowing.

Despite the significant influence of these first studies on original sin, since the mid-2000s the presence of significant foreign investments in local currency bond markets in EMEs has been documented. Burger and Warnock (2003, 2006) note the growth of local currency bond markets in EMEs; finding that EMEs with stronger institutions and better inflation performance have larger local currency bond markets. Subsequent empirical works to identify the local currency debts of EMEs held by foreign investors document the gradual dissipation of original sin since the mid-2000s (Arslanalp and Tsuda (2014); Du and Schreger (2016); Juvenal et al. (2019); and Han (2022)). Eichengreen et al. (2022) insist that original sin persists as local currency denominated foreign borrowings in EMEs are mostly limited to the governments of those countries, and even this cannot be applied to most frontier market economies.

Another group of studies empirically investigates the cause of OSD. Ogrokhina and Rodriguez (2018) demonstrate that the adoption of inflation targeting can enhance the ability of EMEs to borrow abroad in local currency. Hale et al. (2020) examine local currency bond issuance by private sector investors in offshore markets and conclude that global financial conditions and inflation history are crucial determinants of external local currency debts in EMEs. Aizenman et al. (2021) argue that EMEs can issue more local currency bonds if they adopt inflation targeting and Arslanalp et al. (2020) emphasize the significance of the GBI-EM index in determining the size of inflows into various EME local-currency bond markets.

Our contribution to the literature is to identify empirical relationships between external local currency debts and three key fundamentals: bond market depth, inflation-targeting performance, and shares in the GBI-EM index. To the best of our knowledge, our study is the first to document the relevance of these three fundamentals to the dissipation of original sin. Our study thus expands knowledge on the significant transformation of the global financial architecture since the 2000s in the form of the dissipation of original sin. More specifically, our evidence demonstrates that EMEs with sound fundamentals can borrow substantial amounts in domestic currency from abroad. Our findings align with those of Burger and Warnock (2003, 2006), and we underscore their empirical findings and insights through a more comprehensive analysis.

A separate, but related group of studies have attempted to understand the dissipation of original sin using structural models. Ottonello and Perez (2019) demonstrate that having a more credible monetary policy, signified by a higher cost of deviating from the inflation target, can enhance a country’s ability to borrow abroad in its local currency. Du et al. (2020) and Engel and Park (2022) also develop structural models to support the narrative of the significance of disciplined monetary policy in local currency borrowing. Devereux and Wu (2022) introduce a model that incorporates central bank international reserves and shows that higher reserves enable governments to sell more local currency bonds to foreign investors. These reserves can be employed to reduce exchange rate volatility through FX market intervention be employed to reduce exchange rate volatility through FX market intervention.

Our contribution to the literature is to provide evidence that aligns with the narrative, emphasizing the importance of disciplined monetary policy in the dissipation of original sin. We empirically show that the history of monetary policy, measured as deviations of realized inflation from the target, a proxy for the discipline of monetary policy, significantly matters for OSD.

Layout

The remainder of this study is organized as follows: Section II presents our empirical analysis and the subsequent results. In Section III, we introduce a simple model to explain the key empirical findings from Section 2. Finally, in Section IV, we conclude and discuss the study's implications

Empirical Analysis

This section presents our empirical analysis and corresponding results. We empirically investigate the relationship between various economic variables and local currency debts.[8] First, we provide a description of the data for local currency debt that we use in the regressions. We then explain our empirical strategies, including our regression models. Finally, we present our empirical results and offer our interpretation of the findings.

Data

The local currency debt data used in this regression comes from the companion paper Han (2022). The paper constructs a dataset that separately identifies local currency debt and foreign currency debt in the classification of International Investment Position (IIP). To explain more, the author hand-collected different national sources and then combined them with the IIP database provided by IMF. Consequently, the dataset identifies external assets and liabilities in different currencies (foreign vs local) and different instruments.

It is important to note that we only consider local currency debt securities, that is, bonds. As explained in Han (2022), we can broadly classify local currency debts into three types: local currency foreign direct investment (FDI) debts, local currency bonds, and local currency deposits. FDI local currency debts are sizable, but the currency denomination of FDI debts would be meaningless (it could be mere inter-company lending or

[8] Henceforth, the term 'local currency debt' refers to external debts denominated in the local currency, i.e., local currency external debt.

transfers). Local currency deposits are likely to be held by foreign portfolio investors who recently sold off local currency assets but are yet to convert the proceedings to foreign currency, as discussed in Han (2022).[9] It seems that in some EMEs, such local currency deposits are missed in national statistics or foreign investors immediately convert their proceedings to foreign currency. Thus, we also discard local currency deposits in the analysis of local currency debt and only consider local currency debt securities. This coverage is similar to Arslanalp and Tsuda (2014), which covers local currency sovereign debt securities.[10] However, our dataset also covers the bonds issued by entities other than governments, in particular central banks. The outstanding bonds issued by the central bank are extensive in several Asian EMEs, such as Thailand, Korea, and Malaysia.[11]

Our data cover 21 EMEs; Egypt is added to the 20 EMEs covered in Han (2022) as its local currency bonds have been extensively purchased by foreign investors since the late 2010s. The time span of the dataset varies with countries. The data begin in 2002 (the earliest date) for Brazil and Korea or from the late-2000s (for Malaysia) or the early-2010s (for Chile). The sample period of each of the EMEs is reported in Annex A.

The available data frequency also varies along with the country. In the interests of having as many EMEs as possible, we use annual data. The detailed data for each country's sample period are in the dataset posted on the website of the author, Bada Han (https://sites.google.com/view/badahan).

Empirical Strategies

The regression analyses in the existing literature on original sin use different indices of original sin and a range of economic variables. The key challenge lies in measuring the magnitude of original sin or OSD. More precisely, we aim to determine the ratio of local currency debt to foreign financing needs.

Regarding the local currency debt—the numerator—we only use local currency debt securities (bonds). Only local currency bonds are genuine external debts as discussed above among different types of external local currency debts. This also corresponds to Engel and Park (2022) wherein the authors use the ratio of local currency government debt securities held by foreign investors to the total government external debt.[12]

It is not clear what the right denominator is to measure foreign financing needs. We use the following three denominators: GDP, government external debts, and total external debts, excluding FDI debts. First, the need for foreign financing is obviously related to the size of the economy, measured by GDP. Moreover, the GDP ratio is a simple and widely used way to normalize a macroeconomic aggregate. Second, considering that much of EMEs' local currency bonds held by foreign investors are sovereign bonds, we use total government

[9] In some EMEs, such as India, local currency deposits are also held by citizens working abroad. Then, the local currency deposits are not external debts in the nationality-based classification. Thus, it is unclear how relevant such local currency deposits are to OSD.

[10] Ottonello and Perez (2019), Devereux and Wu (2022), and Engel and Park (2022) also use the dataset in Arslanalp and Tsuda (2014)

[11] However, the volume of outstanding central bank bonds in EMEs are relatively small compared to government bonds. Thus, our main results are mostly unchanged, although we use the data from Arslanalp and Tsuda (2014) (instead of the data from Han (2022)) and the results are introduced in Appendix D.

[12] The studies in the early literature on original sin use the ratio of local currency debts in international debt securities. As discussed in Onen et al. (2023), this might miss local currency bonds purchased by foreign investors as these are mostly issued domestically. Furthermore, international debt securities might include FDI debts, the denomination of which is irrelevant to the discussion of OSD.

external debts. When using total government external debt, we accordingly replace total local currency bonds with local currency sovereign bonds. This has been used in recent studies such as Engel and Park (2022) and Devereux and Wu (2022). Finally, we consider the ratio of local currency bonds to total external debts, excluding FDI debts. The ratio measures the ability of the economy to borrow abroad in local currency. Consequently, the three OSD indices we consider are as follows:

$$osd\_index\_1 = \frac{Local\ Currency\ Bonds\ held\ by\ Foreign\ Investors}{Gross\ Domestic\ Product}$$

$$osd\_index\_2 = \frac{Local\ Currency\ Goverment\ Bonds\ held\ by\ Foreign\ Investors}{Government\ External\ Debt}$$

$$osd\_index\_3 = \frac{Local\ Currency\ Bonds\ held\ by\ Foreign\ Investors}{Total\ External\ Debt}$$

We cannot add many control variables as there are fewer than 300 observations included in the regressions. We test a range of economic variables and, after considering existing studies and our economic intuition, select the following: bond market depth (the ratio of the market value of outstanding public bonds to GDP), trade openness, bond-inflow control index, institutional quality (government effectiveness) and GBI-EM Index;[13] details on the sources for each variable are available in Annex A. GBI-EM Index is the emerging market local currency bond index that JP-Morgan has provided since 2005. Arslanalp et al. (2020) document the existence of passive funds following the index. If it is correct, local currency bond markets with high shares in the index can attract more foreign capital.

We also include macroeconomic variables in some of the regressions: the three-year average GDP growth, ten-year average inflation, and annual average interest rate differential, calculated using three-year government bonds or the equivalent.[14] Summary statistics for each of the variables and indices of OSD are available in Annex A.

An important recent finding regarding the dissipation of original sin is that EMEs adopting inflation-targeting tend to have more local currency debts (Ogrokhina and Rodriguez (2018); Engel and Park (2022); and Devereux and Wu (2022)). Hence, we add an inflation-targeting dummy. Our approach differs from existing studies using inflation targeting in that we also include a measure of the inflation targeting performance, that is, how close realized inflation is to the target. More specifically, our measure of inflation-targeting performance, ρ, is expressed as follows:

$$\rho_{i,t} = 1 - \sum_{j=1}^{3} \left(\frac{\pi_{i,t-j} - \pi^*_{i,t-j}}{\sigma} \right)^2$$

[13] The two variables in existing studies—economy size and international-reserve-to-GDP ratio—are not included as regressors. Economy size is reported as significantly correlated with original sin in Eichengreen et al. (2002) but not in Engel and Park (2022) or the current study; the significance varies with the empirical specifications, and the signs are often reversed.

[14] The sample periods of the interest rate differential of some EMEs are shorter than the local currency bonds. Thus, we lost some observations once we control interest rate differentials. However, we use all available observations in every estimation as the observation number in the estimation is limited. Results reported in this paper are mostly unchanged although we fix the sample period to those of interest rate differential.

where $\pi^*_{i,t-j}$ is the inflation target of the country i in year $t - j$ and $\pi_{i,t-j}$ is the corresponding realized inflation.

Hence, we assign one point to EMEs under inflation-targeting and deduct from one three- year average of realized inflation's deviation from the target: the closer to the target, the higher the score. [15] We adjust the constant σ so that the worst performance at the bottom 5% is lower than zero. [16]

This is an admittedly crude measure of inflation-targeting performance or monetary policy credibility. However, this simple metric can come quite close to the credibility measures employed by investors. Influential recent studies in the monetary economics literature, such as Coibion and Gorodnichenko (2015), show the existence of significant information rigidity: households and even firm managers pay little attention to announcements and actions by central banks. If this also applies to the evaluation of EME central banks by global investors, our proposed measure would be a reasonable proxy for monetary policy credibility since, at best, investors pay attention to recent inflation and the corresponding inflation targets.[17] The regression equation is expressed as follows:

$$\boldsymbol{osd_{index_{\tau_{i,t}}} = \alpha_i + \beta_0 \eta_{i,t-2} + \beta_1 IT_{i,t} + \beta_2 \rho_{i,t} + \gamma' \chi_{i,t-1} + \lambda' f_t + \varepsilon_{i,t}} \quad (1)$$

where $\tau \in \{1,2,3\}$; η is the bond market depth; IT and ρ are the inflation-targeting dummies and the deviation of realized inflation from the target; χ is the vector of other country-characteristic variables, such as the government effectiveness index, and macro controls; and α_i and f_t is the country-fixed effect and the vector of the global factor variables, respectively. As implied in Hale et al. (2020), the low interest rates in the US after the global financial crisis are an important reason for the drastic increase in foreign holdings of local currency bonds in EMEs in the early 2010s.

More broadly, global factors, such as the risk appetite of global investors, must affect foreign capital inflows into EME local currency bond markets. We capture these effects by adding the US dollar and commodity price indices. It is well-known that the US dollar exchange rate is a good proxy for global risk factors. Burger et al. (2022) show that commodity prices are an important global factor explaining capital inflows into EME asset markets. Thus, we use those as our global factor variables. In some estimations, we use time-fixed effects as a substitute for those global factors. We use Driscoll-Kraay standard errors to control possible cross-country dependence.[18]

All variables are lagged by one year to mitigate endogeneity concerns. Public bond market depth is lagged by two years as the endogeneity concerns are greater; for instance, the government might be tempted to issue

[15] Establishing credibility probably requires a longer history. However, many EMEs adopted inflation targeting in the 2000s, and using the three-year average is unavoidable to prevent loss of observations.

[16] One might question how monetary policy performance can be evaluated just by considering the deviation of realized inflation from the target since comprehensive assessment should account for economic conditions, communication, and the like. Furthermore, the inflation target for many central banks is a range rather than a point; we take the median of the range in such cases. However, it is beyond the scope of our study to consider all these details and institutional features of inflation targeting in different EMEs.

[17] To the best of our understanding of the literature, monetary economics literature has not reached a consensus about how to measure monetary policy credibility or score inflation targeting performance. Some studies use central bank independence and transparency as measures of central bank credibility (Kabundi and Montfort Mlachila, 2019). We also examine the central bank independence and transparency index developed in Dincer and Barry Eichengreen (2014). However, those factors are mostly uncorrelated with local currency debts.

[18] Devereux and Wu (2022) also used Driscoll-Kraay standard errors in a similar estimation.

more local currency bonds with the expectation that this will increase foreign investments in the bond market. However, even a two-year lag might be insufficient to address the problem of endogeneity. We find that the three-year lag of the corruption index is a good candidate for instrumenting bond market depth. The three-year lagged corruption index is positively associated with larger public bond markets. This may seem slightly counter-intuitive, but it makes sense once we assume that more corruption induces more government expenditure without more revenue; that is, higher fiscal deficits or government bond issuances offer some private benefits to government officials.[19]

Despite tight association between the bond market size and the corruption index, the corruption index is not a perfectly valid instrument in a strict sense as the exclusion condition would not be perfectly satisfied: corruption might matter for foreign investments, without through local currency bond issuance. Nevertheless, we note that our instrument variable approach is to lessen the endogeneity rather than draw a strict causality. Furthermore, the direct effects of higher corruption on foreign investments in local currency bond markets are likely to reduce the investments as more corruption itself should discourage foreign investments. Hence, the direct effects probably reduce the size of our key coefficient, which implies even stronger causality from local currency bond market depth to foreign local currency bond investments if we can see significantly positive coefficients in our instrument approach.

Thus, we instrument the one-year lag of the bond market depth by four-year lags of the corruption index and then replace the two-year lag of the bond market depth in Equation (1).[20] Our sample period begins in 2005, although for some EMEs, data are available for a period prior to 2005. As discussed below and in the companion paper, Han (2022), foreign investors began actively participating in local currency bond markets in EMEs around 2006, possibly supported by the launch of the JPMorgan GBI-EM Index in 2005. The sample is shorter for some EMEs; further details for each EME are available in Annex A.

Results

We first present the results for OSD Indices 1, 2, and 3. We then introduce the results using Index 4, which we argue is the appropriate specification to assess the relationship between OSD and the economic variables selected, with the exception of the public bond market depth.

OSD Indices 1–3

Our first empirical results are presented in Tables 1 and 2. Public market depth, defined as the ratio of government and central bank bonds outstanding to GDP, and the government effectiveness indices show strong correlations with OSD in all estimations. The shares in the GBI-EM index show high correlations with OSD, although the statistical significance is lost in Columns (1), (2), and (5). Other variables that are statistically significant with a consistent sign in some estimations are trade openness, capital control index (for bond flows), inflation-targeting dummy, and inflation-targeting performance. OSD Index 2 is the one used in existing studies, for example, Engel and Park (2022). Our results in Columns (3) and (4) are very close to theirs in that the coefficients for the inflation-targeting dummy and government effectiveness are significant.

[19] Del Monte and Pennacchio (2020) documented that in OECD countries, more corruption induces more public debts.
[20] To be more precise, we used Two-Stage Least Square (2SLS) estimation.

The results of IV regressions in Table 2 are close to the results in Table 1, although the results for the inflation-targeting performance and capital control index are weaker.

Overall, the most impressive and important result in Table 1 is the high correlation of bond market depth with the OSD indices. One plausible interpretation of these results is that larger domestic bond markets attract more foreign investors. This may sound like the "law of universal gravity" to some readers, but it goes against the original sin hypothesis, implying that EME governments can increase their borrowings in the local currency by developing domestic bond markets.

We test the relationship between bond market depth and the indices for different specifications. Once we assume that larger bond markets attract more foreign capital, then we should expect higher fiscal deficits to induce capital inflows into the domestic bond markets; a large share of the deficit should be financed through additional government bond issues. If the relationship between bond market size and foreign investments in the market is stable, then one should expect that a stronger domestic investor base will result in greater OSD—the stronger the domestic investor base, the more foreign investors will be attracted. We exploit these ideas to test the relationship between bond market depth and OSD and confirm that the relationship identified in Tables 1 and 2 is robust to the different specifications; the detailed results are available in Annex B.

Table 1. Original Sin Dissipation Indices 1-3

Type of Index	osd_index_1		osd_index_2			osd_index_3		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bond Mkt Depth$_{-2}$	0.216***	0.167***	1.189***	1.027***	0.905**	0.445***	0.315***	0.288***
	(0.036)	(0.039)	(0.337)	(0.282)	(0.385)	(0.078)	(0.068)	(0.071)
Govt Eff$_{-1}$	0.029***	0.030***	0.250***	0.228***	0.199***	0.112***	0.110***	0.090***
	(0.009)	(0.008)	(0.066)	(0.071)	(0.052)	(0.013)	(0.014)	(0.025)
IT Dummy 5)	-0.006	-0.013**	0.060*	0.039^{+}	0.007	0.007	-0.011	0.034**
	(0.004)	(0.005)	(0.029)	(0.023)	(0.044)	(0.009)	(0.010)	(0.011)
*IT Perform*5)	0.006*	0.004*	-0.008	-0.005	0.012	0.008**	0.008**	0.005^{+}
	(0.003)	(0.002)	(0.017)	(0.014)	(0.012)	(0.003)	(0.003)	(0.003)
TradeOpen$_{-1}$	0.021	0.044***	0.040	0.100^{+}	0.069	0.040	0.104**	0.082**
	(0.017)	(0.012)	(0.052)	(0.063)	(0.057)	(0.039)	(0.039)	(0.028)
Bond Inf low Control$_{-1}$	-0.014***	-0.013***	-0.059*	-0.073**	-0.092**	-0.006	-0.008	-0.022**
	(0.004)	(0.004)	(0.028)	(0.029)	(0.042)	(0.016)	(0.017)	(0.010)
*GBI − EMIndex*6)	0.034	0.043	1.615***	1.699***	0.469	0.264**	0.277**	0.466***
	(0.094)	(0.094)	(0.461)	(0.432)	(0.637)	(0.103)	(0.103)	(0.116)
Avg Growth					-0.012***			-0.007***
					(0.003)			(0.002)
Avg Inf					0.413			-0.009
					(0.341)			(0.209)
IRDif 7)					-0.272**			-0.000
					(0.092)			(0.020)
*Comp*8)	0.045**		0.197***			0.145***		
	(0.018)		(0.045)			(0.033)		
US Reer 9)	0.145***		0.558***			0.418***		
	(0.044)		(0.177)			(0.068)		
Obs.	250	250	277	277	246	250	250	231
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	N	Y	N	Y	Y	N	Y	Y
Macro control	N	N	N	N	Y	N	N	Y
Adj R-squared	0.221	0.101	0.221	0.129	0.131	0.240	0.121	0.194

Notes: 1) Annual data from 2005 to 2019; the sample is shorter for some EMEs. 2) Detailed sample period for each EMEs available in Annex A. 3) Driscoll-Kraay standard errors in brackets. 4) +, *, **, and *** indicate statistical significance at the 15%, 10%, 5%, and 1% levels, respectively. 5) IT refers to Inflation Targeting. 6) Share of EME in JP Morgan GBI-EM Index. 7) Long-term government bond interest rate differentials between each EME and the US. 8) Log of commodity price index. 9) Log of US real effective exchange rate.

Table 2. IV Regressions

Type of Index	osd_index_1		osd_index_2			osd_index_3		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bond Mkt Depth$_{-2}$	0.406***	0.355***	2.103***	2.061**	1.506**	0.805***	0.609***	0.598***
	(0.058)	(0.039)	(0.662)	(0.724)	(0.645)	(0.220)	(0.138)	(0.108)
Govt E f f$_{-1}$	0.044***	0.043***	0.298***	0.295**	0.232***	0.135***	0.129***	0.104***
	(0.004)	(0.005)	(0.092)	(0.102)	(0.076)	(0.015)	(0.017)	(0.023)
IT Dummy [5)]	-0.008**	-0.013**	0.064*	0.043	-0.013	0.005	-0.010	0.025*
	(0.004)	(0.005)	(0.032)	(0.028)	(0.034)	(0.010)	(0.011)	(0.012)
IT Perform[5)]	0.005*	0.003^{+}	0.012	0.013	0.007	0.011^{+}	0.010^{+}	0.003
	(0.003)	(0.002)	(0.022)	(0.023)	(0.016)	(0.007)	(0.006)	(0.002)
TradeOpen$_{-1}$	0.025**	0.037***	0.095	0.127*	0.089	0.049	0.094**	0.081**
	(0.010)	(0.009)	(0.061)	(0.062)	(0.064)	(0.034)	(0.035)	(0.035)
Bond Inf low Control$_{-1}$	-0.008	-0.008	-0.019	-0.030	-0.090**	0.008	0.003	-0.023*
	(0.005)	(0.005)	(0.037)	(0.039)	(0.038)	(0.018)	(0.018)	(0.012)
GBI − EMIndex[6)]	0.050	0.048	1.660***	1.680***	0.405	0.300***	0.287***	0.429***
	(0.070)	(0.075)	(0.349)	(0.322)	(0.610)	(0.065)	(0.078)	(0.094)
Avg Growth					-0.004			-0.004***
					(0.003)			(0.001)
Avg Inf					0.057			-0.140
					(0.476)			(0.137)
IRDi f [7)]					-0.337**			-0.033
					(0.139)			(0.027)
Comp[8)]	0.013		0.059			0.086**		
	(0.010)		(0.119)			(0.036)		
US Reer [9)]	0.037		0.087			0.222		
	(0.029)		(0.452)			(0.130)		
Obs.	250	250	277	277	246	250	250	231
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	N	Y	N	Y	Y	N	Y	Y
Macro control	N	N	N	N	Y	N	N	Y
Adj R-squared	0.221	0.101	0.221	0.129	0.131	0.240	0.121	0.194
1st Stage F-stat	60.7	49.3	74.1	66.2	42.4	60.7	49.3	48.4

Notes: 1) Annual data from 2005 to 2019; the sample is shorter for some EMEs. 2) Detailed sample period for each EMEs available in Annex A. 3) Driscoll-Kraay standard errors in brackets. 4) +, *, **, and *** indicate statistical significance at the 15%, 10%, 5%, and 1% levels, respectively. 5) IT refers to Inflation Targeting. 6) Share of EME in JP Morgan GBI-EM Index. 7) Long-term government bond interest rate differentials between each EME and the US. 8) Log of commodity price index. 9) Log of US real effective exchange rate

OSD Index 4

In the next section, we introduce a theoretical model in which the share of foreign investors in local asset markets (equity or bond) is endogenously determined. The model shows that the shares are bounded above and below. If we accept the theoretical result (or follow the usual presumption that larger bond markets naturally attract more foreign capital), then the importance of economic variables other than bond market depth should be evaluated based on their association with the shares of foreign investors in the domestic bond market, more precisely public bond market as an agglomeration of government bonds and central bank bonds.[21] [22] In other words, we should regress the foreign investors' shares on different economic variables to see how these are associated with the ability to attract foreign capital. Therefore, we estimate the regression equations with the dependent variables of OSD Index 4 defined as follows.

$$osd\_index\_4 = \frac{Local\ Currency\ Bonds\ held\ by\ Foreign\ Investors}{Local\ Currency\ Public\ Bonds\ Outstanding}$$

$$= foreign\ investor\ share\ in\ the\ local\ curreny\ bond\ \ market$$

Before assessing the empirical results, it is useful to consider a graphic representation of the evolution of the indices. Figure 2 shows the cross-country averages of the indices, with OSD beginning around 2006 and accelerating after the global financial crisis. Since the early 2010s, the indices have been relatively stable or on a slow upward trend. We encourage readers who are interested in further understanding the OSD trend to consult Han (2022).

One noteworthy fact worth emphasizing is that OSD Index 4—foreign investors' share—seems to be more stable than the others. It is more vivid once we put the indices together. The top panel in Figure 3 shows that Index 4 has risen less than the others. Moreover, its stability is even more obvious in the cross-country comparison. In the bottom panel in Figure 3, we compare Index 4 against Index 2 for each of the sample EMEs. The cross-country variation of Index 2 seems to be less than that of Index 4: there is little variation among the sample EMEs in terms of the foreign investor share in the domestic public bond market.

The results are set out in Table 3. In Columns (5) and (6), we exclude the macroeconomic controls that are insignificant or whose signs are counterfactual. In Column (7), we drop all variables other than those that relate to inflation targeting and the interest rate differential. This allows us to clearly see the association between inflation-targeting performance and the index.

A notable difference in the results from Table 1 and Table 2 is the much stronger result for the inflation-targeting performance, which is significant, at least at the 5% level, in all estimations.[23] It is also notable that

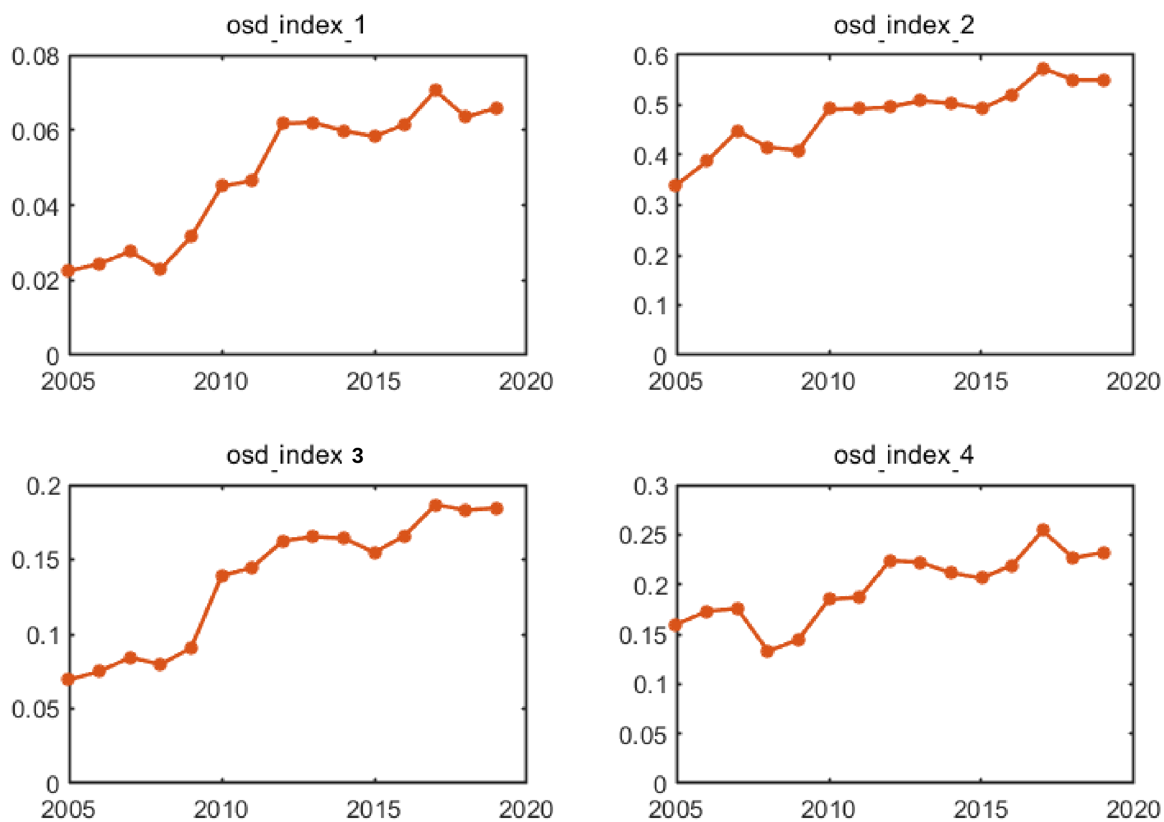
[21] Many emerging markets have well-developed corporate bond markets. However, the corporate bond markets are likely to be largely segmented from public bond markets as corporate bonds are risky assets. Furthermore, the majority of corporate bond trades in EMEs occur in over-the-counter markets, as in advanced economies, and this should also contribute to the segmentation between public bond markets and corporate bond markets.

[22] Henceforth, bond markets refer to public bond markets defined in this paper.

[23] Note that the inflation-targeting performance variable is not a proxy for inflation stability or standard deviation of inflation. We also examined the standard deviation of inflation separately or with the inflation-targeting performance. However, inflation standard deviation is insignificant in most estimations regardless of the inclusion of inflation-targeting performance. The significance of inflation-targeting performance is mostly unaffected by the inclusion of inflation standard deviation.

the positive sign of the interest rate differential corresponds to our intuition (the sign is negative in Table 1). Trade openness becomes significant once year-fixed effects are included, while the capital control index gains significance in the estimations including interest rate differentials. The GBI-EM share becomes weakly significant (at the 15% level) with the right sign with the inclusion of macroeconomic controls, especially interest rate differentials.

Figure 2: Evolution of OSD Indices



Notes: The figure shows the cross-country averages of the four OSD indices. We extended the data in Han (2022) using some simple interpolation to extend the indices back to 2005.

Sources: authors' own calculations.

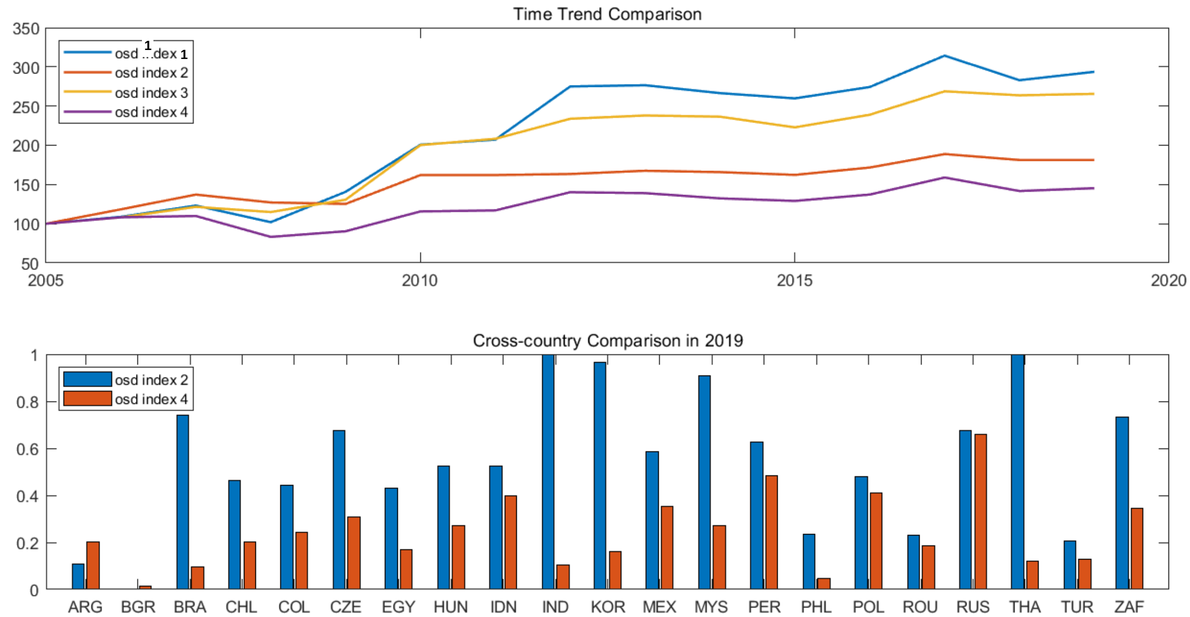
In sum, the results set out in Tables 1, 2, and 3 show that a larger domestic bond market attracts foreign investments in local currency bonds; thus, the shares of foreign investors seem to converge within a range. Better inflation-targeting performance is positively associated with a higher share of foreign investors in the market. Despite the inconsistency among estimations, greater trade openness, weaker restrictions on bond inflow, and higher shares in the GBI-EM Index are positively associated with more foreign investment in the market for local currency bonds.

Table 3. Original Sin Dissipation Index 4

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Govt E f f$_{-1}$	0.184***	0.201***	0.164***	0.180***	0.159***	0.166***	
	(0.018)	(0.022)	(0.019)	(0.019)	(0.009)	(0.021)	
IT Dummy 5)	-0.038	-0.059	0.053***	0.008	0.014	-0.007	0.041**
	(0.028)	(0.037)	(0.016)	(0.021)	(0.015)	(0.022)	(0.018)
*IT Perform*5)	0.029***	0.025***	0.024**	0.018**	0.027**	0.019**	0.030***
	(0.006)	(0.005)	(0.010)	(0.008)	(0.010)	(0.007)	(0.007)
TradeOpen$_{-1}$	0.056	0.118***	0.032	0.063***	0.009	0.065***	
	(0.055)	(0.037)	(0.044)	(0.021)	(0.053)	(0.017)	
Bond Inf low Control$_{-1}$	-0.037	-0.038	-0.076***	-0.063***	-0.078***	-0.080***	
	(0.033)	(0.037)	(0.016)	(0.016)	(0.012)	(0.011)	
*GBI − EMIndex*6)	-0.054	-0.046	0.787*	0.831^{+}	0.689^{+}	0.737^{+}	
	(0.345)	(0.336)	(0.430)	(0.471)	(0.427)	(0.434)	
Avg Growth			-0.014***	-0.006***			
			(0.004)	(0.002)			
Avg Inf			-0.373	0.277			
			(0.584)	(0.399)			
IRDif 7)			0.065**	0.166***	0.039	0.187***	0.172***
			(0.029)	(0.026)	(0.032)	(0.020)	(0.034)
*Comp*8)	0.179***		0.169***		0.204***		
	(0.041)		(0.042)		(0.063)		
US Reer 9)	0.645***		0.506***		0.653***		
	(0.129)		(0.093)		(0.137)		
Obs.	265	265	231	231	231	231	231
Country FE	Y	Y	Y	Y	Y	Y	Y
Year FE	N	Y	N	Y	N	Y	Y
Macro control	N	N	Y	Y	Y	Y	Y
Adj R-squared	0.010	0.034	0.273	0.246	0.104	0.198	0.190

Notes: 1) Annual data from 2005 to 2019; the sample is shorter for some EMEs. 2) Detailed sample for each of the EMEs available in Annex A. 3) Driscoll-Kraay standard errors in brackets. 4) +, *, **, and *** indicate statistical significance at the 15%, 10%, 5%, and 1% levels, respectively. 5) IT refers to inflation targeting. 6) Shares of each EME in JP Morgan GBI-EM Index. 7) Long-term government bond interest rate differentials between each EME and the US. 8) Log of commodity price index. 9) Log of US real effective exchange rate.

Figure 3: Comparison Among the OSD Indices



Notes: The OSD indices in the top panel are the time-trends of cross-country averages. All the indices in the top panel are normalized so that each of the indices is 100 as of 2005. The indices in the bottom panel are as of 2019.

Sources: authors' own calculations.

Interpretation of Inflation-targeting performance and GBI-EM Index

While the empirical result for inflation-targeting performance is new in the literature on OSD, it corresponds to the theoretical and quantitative analysis in existing studies (Ottonello and Perez (2019); Engel and Park (2022); and Du et al. (2020)). Since local currency bonds are nominal assets, governments have a strong incentive to inflate away the debts when a greater share of local currency bonds is held by foreign investors. Hence, policy authorities that want to attract these foreign investors to their domestic local currency bond markets must show that these incentives do not pertain. In the real world, where investor rationality is bounded above and information is asymmetric, the way to prove this is to build credibility through history: realized performance of inflation-targeting.

Our formal test of the GBI-EM share is, to the best of our knowledge, the first of its kind. Arslanalp et al. (2020) document benchmark-driven investments in EME local currency bond markets. The results show investors follow benchmarks, such as the GBI-EM index. Another possibility is that the index informs global investors of the existence of sizable bond markets in EMEs, although this interpretation is also in line with the existence of benchmark-following funds. The importance of information is documented in the well-known study on equity flows by Portes and Rey (2005). If the index signals the existence and size of the bond market, the significance of the GBI-EM index can be understood as indirect evidence of the information's effects on cross-border capital flows.

Foreign Exchange Market Liquidity and Original Sin Dissipation

If the positive association of inflation-targeting performance with local currency bond inflows implies that the investors evaluate the risk that the capital-recipient county depreciates the currency to inflate away the debt, the investors should care about other risks related to the exchange rates.

As such, you can test whether exchange rate risk matters for original sin dissipation. However, it is not clear what variables represent the exchange rate risk facing the local currency bond investors. The exchange rate volatility or covariance with other global risk measures such as VIX or the US dollar index must be tightly linked to local currency bond portfolio flows, and therefore, the use of such variables as regressors immediately causes serious endogeneity problems.

Other exchange rate-related variables with less concern about endogeneity are the measures of foreign currency liquidity in the foreign exchange (FX) markets. At the end of this paper, we provide theoretical illustrations of how foreign currency liquidity matters for foreign local currency bond or equity investors. To briefly summarize the discussions, ample liquidity in the foreign exchange markets lowers the exchange rate risk for foreign investors so as to attract more foreign capital into the domestic capital markets, as ample liquidity can limit the currency depreciation when foreign capital outflows from the markets.24

The first candidate for the foreign currency liquidity in FX markets of the sample EMEs is the FX market turnover data provided by BIS. It is a triennial survey on central banks about over-the-counter (OTC) market turnovers and a well-known measure of FX market transaction volumes or liquidity in the markets. However, the data has a few non-negligible issues for analytical purposes in this paper. First, the inclusion of the FX market turnover variable as a regressor obviously causes even fewer observations, limiting our statistical power even more. More seriously, the FX market turnover is an equilibrium variable endogenously related to capital flows in the country. Local currency bond market depth has a similar issue, but such endogeneity issues are more serious for FX market variables as the capital flows must be more tightly related to the FX market developments.

Therefore, it would be beneficial to seek another measure of foreign currency liquidity in FX markets, although we can examine FX market turnovers. Recently, Devereux and Wu (2022) provided a theory and empirical evidence that international reserves held by policy authorities, central banks in most EMEs, bring more foreign capital into local currency bond markets through foreign currency liquidity channel. That is, central banks supply foreign currency liquidity facing large outflows, to limit local currency depreciation. This in turn encourages local currency bond investments because of better risk-hedging properties for foreign investors: outflow events are difficult times for the investors as well and the expected losses during the difficult time become lower.

As a result, we include both FX turnover and international reserve-to-GDP ratios. The inclusion of FX market turnover lowers the observation number to less than 100. Hence, we choose original sin dissipation index 4—shares of foreign investors in the local currency bond markets—when including FX turnover as it turns out from

[24] Note that the outflows are likely to be driven by negative shocks to the investors themselves or the capital-recipient country. Limited currency depreciation, in either case, is crucial to lower the risk facing the investors. Higher losses associated with negative shocks to the investors mean poor risk-hedging property for the investors as such properties increase the covariance between the asset return and the investors' market returns. Negative shocks to the capital-recipient country should cause asset price falls and thus, limited currency depreciation is crucial in preventing excessive losses to the foreign investors.

previous estimations that the choice of original sin dissipation index 4 for the dependent variable helps with capturing the relevance of macroeconomic variables with original sin dissipation. For international reserve-to-GDP ratios, we examine the association of international reserve levels for each of the original sin dissipation indices.

Table 4 shows the results of the estimations with FX market liquidity variables. Columns (1) – (3) represent the results of each of the original sin dissipation indices 1 - 3, with the international reserve-to-GDP ratio. Columns (4) and (5) represent the results of OSD index 4. Higher international reserve-to-GDP ratios appear to be associated with more local currency borrowing, i.e., more original sin dissipation, except for OSD 3. The association between international reserves and local currency debts is particularly strong in OSD 4 estimations, similar to our inflation-targeting performance measure. While different interpretations can be suggested, the results overall well-correspond to the narrative that central bank international reserves have the effects of limiting currency depreciation during outflow events so as to attract more foreign investments into the local currency bond markets. All the estimations in columns (1) – (5) include year-fixed effects, but the sign and significance of international reserves are maintained in estimations without year-fixed effects or with different control variables.

The weak results of OSD 3 could reflect endogeneities between foreign currency debts and international reserves. Recall that the denominate in OSD 3 is the total external debts including foreign currency debts. More foreign currency debts call for more international reserve accumulation for central banks to prepare for sudden stops. In contrast, more international reserve accumulation might incentivize private firms to raise more foreign currency debts as they expect lower foreign exchange rate risk due to sufficient international reserves.

The results of FX market turnovers are in columns (6) – (8). To alleviate the limited observation problem, we drop all the regressors, which were not consistently significant in the estimations of OSD 4. While we cannot draw a strong interpretation, mainly due to the limited observation problem mentioned above, FX market turnovers do not appear to be consistently significant. It is significant in the estimations without year-fixed effects in columns (6) and (7), but the significance is quickly lost once year-fixed effects is added as in column (8). Since both FX market turnover and OSD 4 have risen in many EMEs over the sample period, we do not regard the results as even suggestive evidence that higher FX market turnover ratios prompt original sin dissipation. However, we also note that the insignificance might come from the limited observation or is because the FX market turnovers are not precise measures of FX market liquidity. Thus, the results should not be thought of as evidence against the hypothesis that higher FX market liquidity induces more inflows into local currency bond markets.

Table 4. Original Sin Dissipation and FX Market Liquidity

	osd_index_1	osd_index_2	osd_index_3			osd_index_4[10]		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bond Mkt Depth$_{-2}$	0.162***	0.978***	0.312***					
	(0.046)	(0.227)	(0.077)					
IT Dummy [5]	-0.006	0.081	-0.006	0.024	0.002	0.037**	0.035***	0.012
	(0.005)	(0.046)	(0.011)	(0.020)	(0.018)	(0.012)	(0.008)	(0.024)
IT Perform[5]	0.004*	-0.007	0.008**	0.017**	0.019**	0.026*	0.030**	0.024**
	(0.002)	(0.013)	(0.003)	(0.007)	(0.007)	(0.012)	(0.011)	(0.007)
International Reserve$_{-1}$	0.114**	0.781*	0.069	0.334***	0.318***		0.442**	0.369**
	(0.043)	(0.386)	(0.137)	(0.091)	(0.099)		(0.146)	(0.116)
FX mkt. turnover						1.461**	0.972*	0.291
						(0.447)	(0.461)	(0.396)
Govt Eff$_{-1}$	0.019*	0.168**	0.104***	0.156***	0.146***			
	(0.011)	(0.062)	(0.022)	(0.013)	(0.017)			
TradeOpen$_{-1}$	0.012	-0.100	0.084***	-0.028	-0.020			
	(0.014)	(0.111)	(0.021)	(0.019)	(0.018)			
Bond Inflow Control$_{-1}$	-0.011**	-0.064**	-0.007	-0.059***	-0.073***			
	(0.004)	(0.028)	(0.017)	(0.015)	(0.012)			
GBI − EM Index[6]	0.011	1.508***	0.258**	0.630*	0.554*			
	(0.068)	(0.318)	(0.116)	(0.318)	(0.307)			
Avg Growth				-0.008***				
				(0.002)				
Avg Inf				0.061				
				(0.298)				
IRDif [7]				0.211***	0.226***	0.033	0.091	0.292**
				(0.028)	(0.024)	(0.094)	(0.103)	(0.083)
Comp[8]						0.161	0.181	
						(0.130)	(0.132)	
US Reer [9]						0.385	0.469	
						(0.280)	(0.299)	
Obs.	250	277	250	231	231	83	83	83
R-squared	0.281	0.294	0.209	0.404	0.374	0.366	0.447	0.275
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	N	N	Y
Macro control	N	N	N	Y	N	N	N	N
Adj-R2	0.190	0.215	0.109	0.315	0.287	0.077	0.181	-0.020

Notes: 1) Annual data from 2005 to 2019; the sample is shorter for some EMEs. 2) Detailed sample period for each EMEs available in Annex A. 3) Driscoll-Kraay standard errors in brackets. 4) +, *, **, and *** indicate statistical significance at the 15%, 10%, 5%, and 1% levels, respectively. 5) IT refers to Inflation Targeting. 6) Share of EME in JP Morgan GBI-EM Index. 7) Long-term government bond interest rate differentials between each EME and the US. 8) Log of commodity price index. 9) Log of US real effective exchange rate. 10) The dependent variable in columns (5) – (8) is the foreign investors' share in local currency bond markets. The observation numbers in regressions (6) – (8) are trimmed down because of the fx market turnover variable. FX market turnover is the Turnover of OTC foreign exchange instruments by currency, table D11_3 in the BIS triennial survey database and the sample years in the dataset are 2004 – 2019 with three years interval. The BIS triennial survey database covers all the sample EMEs, except for Egypt.

Further Empirical Analysis of Equity Portfolio Investments

As stated earlier, we also examine various economic variables as possible determinants of equity investments in EME domestic equity markets. Similar to our bond regressions, we use the following three indices: the ratio of equity portfolio investments (equity) to GDP, the ratio of equity to total external liabilities (liability), and the ratio of equity and local currency bonds to liabilities. The third index measures the ability of an EME to attract foreign capital to its domestic capital market. The regressors are almost identical to those in the bond regressions, except that the bond flow control index is replaced by the equity flow control index and the government effectiveness index is replaced by the accountability index.

$$osd\_eq\_index\_1 = \frac{Local\ Currency\ Equities\ held\ by\ Foreign\ Investors}{Gross\ Domestic\ Product}$$

$$osd\_eq\_index\_2 = \frac{Local\ Currency\ Equities\ held\ by\ Foreign\ Investors}{Total\ External\ Liabilities}$$

$$osd\_eq\_index\_3 = \frac{Local\ Currency\ Equities\ and\ Bonds\ held\ by\ Foreign\ Investors}{Total\ External\ Liabilities}$$

The results of the equity regressions are close to those for local currency bonds. Equity market or capital market depth is key to increasing foreign investments in the capital or equity market.[25] High trade openness appears to be negatively related to increasing investments, which may reflect a country's higher exposure to global shocks through cross-border trade linkages. Inflation-targeting performance appears to be a significant determinant, which probably implies that the credibility of the monetary authority is also important for equity inflows. Inflation-targeting performance is a measure of the ability of policy authorities to stabilize the macroeconomy.[26]

[25] Equity market depth loses its statistical significance when the interest-rate differential is included, which may reflect the negative correlation between equity market depth and the differential at a certain point.

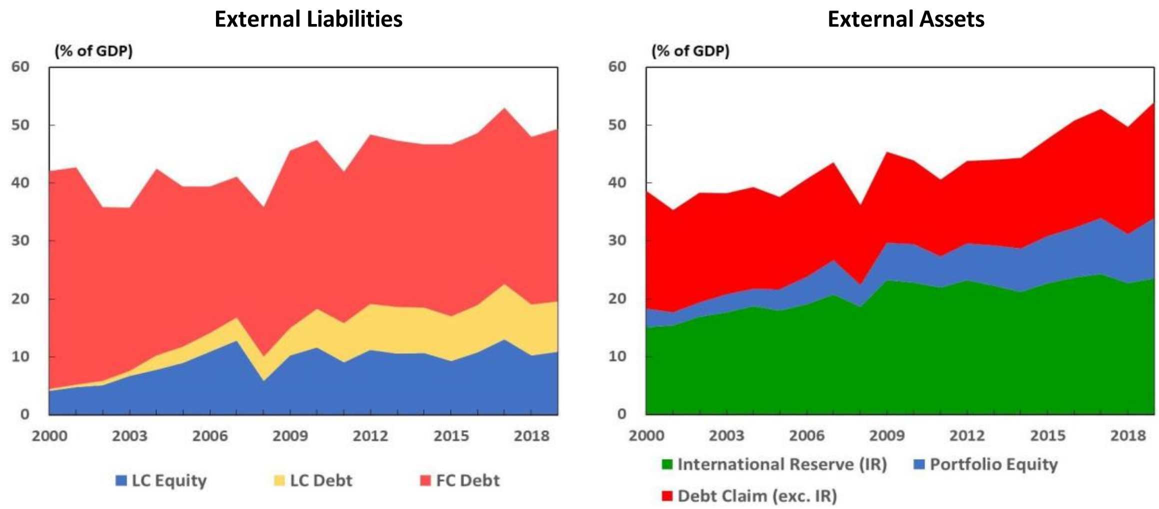
[26] Another possible interpretation is that attempting to inflate away debt might devalue equities in non-tradable- goods sectors. Nominal depreciation to inflate away the debt causes real depreciation of the currency, which can result in the repricing of equities in non-tradable goods sectors valued in foreign currency.

Table 5. Equity Original Sin Dissipation Indices

Type of Index	osd_eq_index_1		osd_eq_index_2			osd_eq_index_3		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Stock Mkt Depth$_{-2}$	0.080***	0.089***	0.033**	0.042***	0.017+			
	(0.017)	(0.021)	(0.014)	(0.014)	(0.010)			
Capital Mkt Depth−2						0.056***	0.076***	0.053***
						(0.010)	(0.008)	(0.007)
IT Dummy [5]	-0.017	-0.020*	-0.030*	-0.029*	-0.015	0.003	-0.002	0.018**
	(0.013)	(0.011)	(0.015)	(0.014)	(0.016)	(0.010)	(0.010)	(0.007)
IT Perform[5]	0.004***	0.005***	0.004**	0.006***	0.005	0.011**	0.008**	0.008*
	(0.001)	(0.001)	(0.002)	(0.002)	(0.005)	(0.005)	(0.003)	(0.004)
Accountability	0.161	1.152	2.183**	2.368**	0.559	0.326	1.020	-0.234
	(0.908)	(0.911)	(0.880)	(0.924)	(0.550)	(1.356)	(1.515)	(1.002)
TradeOpen$_{-1}$	-0.027**	0.020	-0.044**	-0.040*	0.003	-0.028	0.014	0.025
	(0.012)	(0.015)	(0.019)	(0.023)	(0.016)	(0.028)	(0.029)	(0.023)
Equity Inf low Control$_{-1}$	-0.001	-0.003	-0.017*	−0.014+	-0.021			
	(0.009)	(0.007)	(0.009)	(0.009)	(0.017)			
KAOpen[6]						-0.019	-0.029*	-0.048**
						(0.013)	(0.015)	(0.019)
Avg Growth					0.000			-0.003**
					(0.002)			(0.001)
Avg Inf					0.023			-0.205
					(0.036)			(0.207)
IRDi f [7]					-0.186***			-0.108***
					(0.020)			(0.017)
Comp[8]	0.043*		0.032			0.046		
	(0.022)		(0.031)			(0.040)		
US Reer [9]	0.175**		0.076			0.160*		
	(0.069)		(0.089)			(0.078)		
Obs.	352	352	352	352	282	248	248	231
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	N	Y	N	Y	Y	N	Y	Y
Macro control	N	N	N	N	Y	N	N	Y
Adj R-squared	0.147	0.151	0.0307	0.0624	0.167	0.0133	0.106	0.136

Notes: 1) Annual data from 2005 to 2019; the sample is shorter for some EMEs. 2) Detailed sample for each EMEs available in Annex A. 3) Driscoll-Kraay standard errors in brackets. 4) +, *, **, and * indicate statistical significance at the 15%, 10%, 5%, and 1% levels, respectively. 5) IT refers to inflation targeting. 6) Shares of each EME in JP Morgan GBI-EM Index. 7) Capital account openness index 8) Long-term government bond interest rate differentials between each EME and the US. 9) Log of Commodity price index. 10) Log of US real effective exchange rate.**

Figure 4: Capital Market Depth and Original Sin Dissipation



Notes: The figure shows the average ratio of external assets and liabilities to GDP, expressed as a percentage, in the following categories: international reserves held be central banks, portfolio equity claims on nonresidents, debt claims on nonresidents, local currency debt liabilities, foreign currency debt liabilities, portfolio equities held by nonresident investors.
Sources: authors' own calculations and IMF International Financial Statistics (IFS).

Discussion of the Evolution of EMEs' IIP

As the pioneering study by Lane and Milesi-Ferretti (2001, 2007) shows, in the 1990s and 2000s, the source of foreign financing for EMEs shifted from debt to equity, portfolio equity or direct investment: the share of equity-type to total external liabilities in the IIP had drastically risen. Simultaneously, EMEs accumulated foreign assets in the form of international reserves. Thus, equity inflows are also important in mitigating concerns regarding currency mismatch and, accordingly, financial stability in EMEs (Figure 4).

Portfolio equity inflows to EMEs slowed after the global financial crisis, as illustrated in Han (2022). At the same time, however, local bond inflows into EMEs expanded. Local currency bond inflows have helped EMEs reduce currency mismatches. Also, together with direct investment inflows, local currency bond inflows have contributed to the accumulation of external assets by EMEs, mainly in the form of private sector assets; this is unlike the case in the 2000s when asset accumulation was in the form of international reserve accumulation by central banks. Overall, the equity and local currency bond portfolio inflows have reduced currency mismatches in EMEs by reducing the need to borrow abroad in foreign currency and by providing sources to accumulate foreign currency assets abroad, with the latter being more important.

External portfolio equity liability and external local currency debt have been separately discussed in the literature.[27] However, equity and local currency bond inflows should be studied together. As discussed above, increased equity liability and local currency debt result in reduced currency mismatches in EMEs and, thus, have similar implications for financial stability. More importantly, two different phenomena seem to be connected in the evolution of the national balance sheets of EMEs. Figure 4 depicts the steady increase in the holding of EME equities and local bonds by foreign investors. One can easily see the two different time series

[25] For instance, Onen et al. (2023) only focuses on local currency debt

move together, although equity external liabilities had risen earlier than local currency debts. This probably reflects that equity market developments occurred earlier than those in the local currency bond market.

If capital market development is the key to OSD, which we now define as reduced reliance or concern regarding currency mismatch through additional foreign financing in the form of equity or local currency debt, then the remaining work is to establish a theory showing capital market depth leads to more foreign investments in the capital market. We introduce a simple international portfolio model for this purpose.

Model

This section presents a simple international portfolio model that offers insights into the significance of market depth in accommodating foreign investment. The model is simplified to derive the desired analytical results, and it is not utilized for quantitative analysis.

Environments

Model setup

The three-period model (t=0, 1, 2) consists of a global investor who allocates her money across different assets in different countries. The global investor resembles real-world global financial intermediaries, such as JP Morgan, BlackRock, or sizable sovereign wealth funds. While, for the purposes of the model, we abstract from details in assets markets in each of the countries, we assume that the demands for the assets from local investors, that is, investors based on the country, are inelastic, following Gabaix and Koijen (2021).[28]

Local asset markets

There are N countries indexed by i ; thus, $i \in \{1, 2, ..., N\}$. In each country, there is a country-specific asset, which we also index by i . There exists a unique type of asset i in country i . We abstract from the exchange rate. Below, we explain how the exchange rate movement can be relevant to foreign investments in equity and local currency bonds in EMEs in our model and how this relates to our empirical results for trade openness. The price of asset i in period 0, $q_{o,i}$, is given. Although the endogenous determination of the asset price in period 0 can be added to the model, it does not provide any extra insight.

In period 1, both domestic asset supplies and demands become finitely elastic. Asset demand (D_i) and supply (Q_i) for asset i in period 1, are given by

$$\boldsymbol{D_i = \kappa_i - \zeta_i q_{1,i}} \tag{2}$$

$$\boldsymbol{Q_i = \varphi_i - \chi_i q_{1,i}} \tag{3}$$

[28] The literature of inelastic asset demand has a long history and the discussion dates to at least Shleifer (1986).

Thus, the asset demand curve is downward sloping in the price $q_{1,i}$, as in Gabaix and Koijen (2021). Note that the demand "function" in Equation (2) differs from the standard theory. The standard asset pricing theory, assuming frictionless asset markets, implies infinitely elastic demand as the equilibrium asset price is dictated by the preference and technological features of the asset.[29]

Since the asset demand from local investors is finitely elastic, the shocks to global investors, described below, cause fluctuations in the asset price in period 1, $q_{1,i}$.

In period 2, the asset pays out the dividends to the asset holders. For simplicity, we assume that the dividend is deterministic. Since the shocks to global investors are the only shocks in our model, the expected return on the asset is denoted as follows:

$$R_i = \frac{z_i + q_{1,i}}{q_{0,i}}$$

where z_i is the dividend of asset i . Note that the capital gain is stochastic in period 0 as , $q_{1,i}$ will be determined in period 1.

Global investor (GI)

The global investor enters period 0 with her own capital $\overline{w}$ and establishes the composition of her portfolio, which she cannot change once it is made. Since the risk property is key in our model, we need to model global investors as risk-averse agents. Our key insights are not affected by different modeling of risk preferences. However, we model global investors in a way that we think is realistic and consistent with local investors having inelastic demands. The preference of global investors are risk-neutral. However, they face a value at risk (VaR) constraint. More specifically, the standard deviation of their portfolio cannot exceed a certain level, which depends on their capital and expected excess returns, defined as the expected difference between the portfolio return and the safe asset return. We denote θ and σ_θ as the portfolio of global investors and the standard deviation of the portfolio, respectively. Then, the VaR constraint facing global investors is as follows:

$$\alpha\sigma_\theta \leq w\left(\theta'\left(\mathbb{R} - R_f \cdot 1\right)\right)^\tau$$

where $\sigma_\theta = (\theta'\Sigma\theta)^{0.5}$ where θ is the portfolio by GI and Σ is the covariance matrix of the portfolio. Henceforth, $\mathbb{R} - R_f \cdot 1 = \mu$.

Thus, global investors can take more risk when they hold more capital or expect higher returns; $\tau > 0$ captures the real-world feature that investors are able to take greater risks when they expect higher returns. The specification of global investors under the VaR constraint is adopted from Hofmann et al. (2022).[30]

[29] There are different micro-foundations for the downward sloping asset demand curve. One way is to assume asset demands are mainly from leverage-constrained financial intermediaries. Assumptions of myopic investors or bounded rationality also can give finitely elastic demands.

[30] The specification in Hofmann et al. (2022) is rooted in Danielsson et al. (2010). Similar specifications can also be found in Miranda-Agrippino and Rey (2020).

Another component of the model is the shock to global investor capital. We can think of the shocks as different real-world global shocks, such as US monetary or commodity price shocks, or any other global shocks that impact the balance sheet of global financial intermediaries. More specifically,

$$w_1 \geq \overline{w}e^{\nu}, \nu \sim N(0, \sigma_\nu^2)$$

Note that ν is a random variable whose value is realized in period 1. Then, the optimization problem of global investors is formulated as follows:

$$\max_{\theta} \theta'\left(\mathbb{R} - R_f \cdot 1\right) \;\; subject\ to \;\; \alpha\sigma_\theta \leq w\left(\theta'\left(\mathbb{R} - R_f \cdot 1\right)\right)^{\tau}$$

The steps to solve the portfolio problem are set out in Annex C. For simplicity and illustrative purposes, we assume τ is 0.5 without loss of generality. Then, the solution to the optimal portfolio problem is as follows:

$$\theta = \frac{w^2}{\alpha^2}\Sigma^{-1}\mu \tag{4}$$

where Σ^{-1} is the inverse covariance matrix of the returns of different assets $\{1, 2, \ldots, N\}$.

It is important to note that global investors form their portfolio in period 0, as in Equation (4). We make one more crucial assumption: portfolio investors can change the size of the portfolio depending on the realization of v, global shock, while they cannot change the shares in Equation (4). This reflects the existence of many passive funds or the fact that many globally investing funds may withdraw their money from EMEs but face difficulties adjusting their portfolios in the short run.[31]

Global Asset Market Equilibrium

Thanks to the model's simple structure, it is easy to solve the model. Let θ_i denote the investments of GI in the asset i. The equilibrium price in period 1 is given by

$$q_{1,i} = \frac{\kappa_i + \theta_i - \varphi_i}{\chi_i + \zeta_i} \tag{5}$$

Note that $\theta_i = \bar{\theta}_i e^{2\nu}$, where $\bar{\theta}_i$ is θ_i with $\nu = 0$.

The return to asset i for GI (ignoring the currency appreciation/depreciation) is as follows:

$$\begin{aligned} r_i &= \frac{z_i + q_{1,i}}{q_{0,i}} - 1 \\ &= ln\left(q_{1,i}\right) - ln\left(q_{,i}\right) + \frac{z_i}{q_{0,i}} \\ &= ln(\kappa_i + \theta_i - \phi_i) - ln(\chi_i + \zeta_i) - ln\left(q_{,i}\right) + \frac{z_i}{q_{0,i}} \end{aligned} \tag{6}$$

[31] The assumption of an inflexible portfolio can be commonly found in the international finance literature. For example, see Bacchetta and Van Wincoop (2010, 2021).

Taylor approximation around $\nu = 0$ gives the following

$$\begin{aligned} r_i &= \hat{\alpha}_i + \left(\frac{\bar{\theta}_i}{\kappa_i + \bar{\theta}_i - \varphi_i}\right)\nu + \frac{z_i}{q_{0,i}} \\ &= \hat{\alpha}_i + \left(\frac{1}{(\kappa_i - \varphi_i)/\bar{\theta}_i + 1}\right)\nu + \frac{z_i}{q_{0,i}} \end{aligned} \tag{7}$$

Imagine the driving force behind asset prices, in reality, resembles the structure in Equation (7). In this case, a strategist or analyst in a global financial intermediary estimating a Fama equation finds that "beta"—the exposure to the common shock—increases in the share of GI in the local asset market.[32] We formally summarize the interpretation in the lemma below.

Lemma 1. *Let's take $\frac{\theta_i}{\kappa_i - \varphi_i}$ as the measure of GI's share in the local market i. If the return to asset i is linearized as in Equation (8), then $\hat{\beta}_i$ does increase in the measure of GI's share in the market.*

$$r_i = \hat{\alpha}_i + \hat{\beta}_i \nu + \varepsilon_i \tag{8}$$

Proof) See the discussion above.

Thus, assets in the market with a high share of foreign investors will be unattractive for individual foreign investors as these have poor risk-hedging properties (and vice-versa for assets in the market with low shares of foreign investors).[33]

Equilibrium portfolio determination

With the solutions in Equations (7), (8), and (4), we can fully characterize and solve the inverse covariance matrix as follows. The inverse covariance matrix is as follows:[34]

$$\Sigma^{-1} = \begin{bmatrix} \frac{1}{\sigma^2_{\varepsilon_1}} & -\frac{b_{12}}{\sigma^2_{\varepsilon_1}} & \cdots & -\frac{b_{1N}}{\sigma^2_{\varepsilon_1}} \\ & \cdots & & \\ & \cdots & & \\ -\frac{b_{N1}}{\sigma^2_{\varepsilon_N}} & -\frac{b_{N2}}{\sigma^2_{\varepsilon_N}} & \cdots & -\frac{b_{12}}{\sigma^2_{\varepsilon_N}} \end{bmatrix} \tag{9}$$

and b_{ij} and β_{ij} are characterized as follows

$$b_{ij} = \frac{\beta_i \beta_j \sigma^2_\nu}{\beta_j \sigma^2_\nu + \sigma^2_{\varepsilon_1}} \tag{10}$$

[32] This statement implicitly assumes $\kappa > \varphi$. This can be interpreted as a condition of minimal maturity of the domestic asset market. If this condition is violated, the asset market cannot exist since the equilibrium price is negative. Thus, κ larger than φ indicates the minimum domestic demand required for the asset market to exist.

[33] Han (2023) provides empirical evidence corresponding to the lemma: the global risk appetite, measured as VIX, loading on EME stock markets is positively correlated with the foreign investor share in the stock market.

[32] We follow Stevens (1998) for the formulation of the inverse covariance matrix.

$$\beta_i = \frac{w\theta_i/\varphi_i}{\kappa_i\varphi_i + w\theta_i/\varphi_i - 1} \quad (11)$$

The share of asset i, θ_i, is

$$\theta_i = \frac{w^2}{\alpha^2}\frac{1}{\sigma_{\varepsilon_i}}\left(\mu_i - \sum_{j\neq i} b_{ij}\mu_j\right) \quad (12)$$

Recall Equation (4) in which the optimal portfolio is proportional to the inverse covariance matrix, which is, in turn, a function of the portfolio. Thus, the solution of the GI portfolio is a fixed-point in the equation below.

$$\frac{w^2}{\alpha^2}\Sigma^{-1}(\theta)\mu = \theta \quad (13)$$

Notice that the share of asset i is increasing in its own expected return μ_i and decreasing in the expected return of other assets μ_j. More importantly, the share is decreasing in both the idiosyncratic risk σ_{ε_i} and the systemic risk (the correlation with other assets) b_{ij}, which is increasing in the share of GI—θ_i/κ_i. Thus, increased domestic demands κ_i leads to lower systemic risk and, accordingly, attracts more investments from GI: thus, stronger domestic demand results in a higher share in the portfolio of GI. We summarize this finding in the proposition below.

Proposition 1. *We have the following properties.*

1) *Higher domestic demands for the asset lead to a higher share of the assets in the global investors' portfolio. Formally,* θ_i *increases in* κ_i

2) *If* $\kappa_i = \kappa_j$, $\varphi_i = \varphi_j$, $\varepsilon_i = \varepsilon_j$, $q_{0,i} = q_{0,j}$, *and* $z_i = z_j$ *then* $\theta_i = \theta_j$ $\forall j$.

Proof) See the discussion above.

The proposition shows that larger domestic bond markets attract more foreign capital. As a result, the growth of the local currency bond market must be positively associated with additional capital inflows into the markets. EME equity and bond markets, in particular the latter, were really thin until the mid-2000s, and there were not enough local currency bonds for foreign investors. Therefore, the findings in the early literature on the original sin phenomena—the inability of EMEs to borrow abroad in their local currency—reflect the near absence of local currency bond markets in EMEs at that time rather than deeply rooted "unidentified" malfunctions of the financial system in those countries.[35]

Linking the theoretical results to the empirical results in the previous section, the inflation- targeting performance, and institutional quality (government effectiveness) might be reflected in the idiosyncratic risk, ε_i. The successful implementation of inflation-targeting in many EMEs in the late-2000s might have contributed to greater foreign investments in local bond markets in EMEs. The capital control index may be related to the return as it will increase the cost of investments. Trade openness might matter for systemic risk through FX market fluctuations, as discussed below. Interest rate differentials are positively associated with high shares of

[35] In fact, Burger and Warnock (2003, 2006) documented the presence of US investors in local currency bond markets in EMEs in the early 2000s.

foreign investors in the public bond markets in the regressions of OSD Index 4; this corresponds with the prediction in Equation (13), if we assume that interest rate differentials are positively associated with higher expected returns.[36]

Model with Foreign Exchange Market

Recall that we abstracted from the FX market for simplicity. However, the mode can be easily extended to the FX market. Let's assume that the asset in each country is denominated in the country's domestic currency, that is, the local currency. Global investors must convert foreign currency to local currency to invest in local currency assets. Thus, their return should be evaluated while accounting for exchange rate changes. We denote s_t as the spot exchange rate in period t . Following the convention, a higher exchange rate indicates local currency depreciation against foreign currency. Then, the expected return in period 0 is as follows:

$$r_i = \mathbb{E}_0\left[\frac{s_1}{s_0}\frac{z_i + q_{1,i}}{q_{0,i}} - 1\right]$$

In addition, suppose the net export of the country i is

$$Ex_{t,i} = \bar{Y}_{i^*} + \gamma s_{t,i}$$

Note that the exporter (or importer) is the only participant in the country's FX market. Then foreign currency supply and demand are inelastic, as are domestic asset supply and demands. Hence, capital inflows and outflows change exchange rates. In reality, there are FX market participants other than exporters and importers. However, if their supply and demands are also inelastic, then our insight remains.

The seminal work by Gabaix and Maggiori (2015) introduces an exchange rate model in which global arbitragers have limited capacity to intermediate and accordingly, temporary capital flows have greater impacts on the market than changes in fundamentals. Considering the model in Gabaix and Maggiori (2015) is an application of the inelastic market hypothesis to the FX market, it is natural that the same mechanism emerges in the model that includes the FX market.

In this regard, the occasional significance of trade openness and international reserves in the local bond regressions might reflect that more FX market liquidity in an EME induces more foreign investments in the local currency bonds markets in the EME. Trade openness might be positively associated with a better capacity to absorb FX market pressures from capital flows driven by global shocks and reduce the exposure of the currency to global shocks or lower currency risk, as the entities involved in cross-border trades can provide more foreign currency liquidity. The slightly weak results for trade openness also reflect that there are market participants other than exporters, importers, and global investors, implying trade openness is an imprecise measure of FX market depth.

[36] It is well-known in the vast literature of forward premium puzzle that investments in higher yield currencies lead to excess return as opposed to the UIP hypothesis. See Engel (2014) for more discussion.

Concluding Remarks

In this study, we have explored the economic variables associated with OSD. More specifically, we have investigated the factors that enhance the ability of EMEs to borrow abroad in local currency. Our findings reveal that the depth of the domestic public bond market plays a crucial role in attracting foreign investments to the bond market. Additionally, institutional quality appears to be a crucial determinant of foreign investment in local currency bond markets, as documented in previous studies (e.g., Engel and Park (2022)). The performance of inflation-targeting, measured by the deviation of realized inflation from target levels, also significantly influences foreign investment in bond markets. While not consistently observed across different estimations, financial and trade openness, as well as shares in the GBI-EM index, are factors taken into account by foreign investors. The significance of the GBI-EM Index suggests the presence of passive funds that track the benchmark or information effects, where the index serves to gauge the existence and size of local currency bond markets for global investors.

We have also examined whether similar economic variables are relevant to portfolio equity investments in EMEs. Despite the distinct literature on equity flows separate from the original sin literature, exploring external equity liability is important. It represents an additional and safer means of acquiring foreign capital and is related to OSD, namely local currency debt. Our findings confirm that equity market depth is crucial in attracting foreign capital to the domestic equity market, similar to local currency bonds. Thus, there is a connection between the increase in equity financing in EMEs, as documented in Lane and Milesi-Ferretti (2007), and the subsequent rise in local currency debt following the global financial crisis, with equity market development preceding that of the local currency bond market.

Finally, we present a simple model to elucidate the link between capital market depth and increased foreign investments in EME equity and local bond markets. The model is based on Gabaix and Koijen (2021), and incorporates the concept of the inelastic demand of domestic investors. Global shocks induce fluctuations in asset prices through changes in the demand of global investors. Markets with a high share of global investors exhibit strong correlations with global shocks, while the opposite holds true for markets with a low share of global investors. Consequently, the share of global investors in the market is endogenously determined: countries with larger capital markets attract more equity and local currency bond investments, thereby reducing reliance on foreign currency debt and currency mismatch.

The empirical findings and theoretical model presented here may not be surprising when considered outside the context of EMEs and original sin. It appears that the underlying fundamentals are actually linked to the dissipation of original sin, contrary to the original sin hypothesis. The terminology of "original sin" has inadvertently created the impression that reliance on foreign currency debt and the subsequent currency mismatch cannot be avoided or overcome without incurring substantial costs, such as massive international reserve accumulation. As it turns out, EMEs with well-developed capital markets, high levels of institutional quality, and sound monetary policy records are capable of borrowing abroad in safe forms without having to rely solely on foreign currency debt.

In conclusion, it is important to acknowledge the limitations of our study and discuss avenues for future research. First, we utilized annual data for 21 EMEs, which significantly limited the number of observations. Since we relied on stock data, incorporating quarterly or monthly data would not provide substantial benefits. However, it would be valuable to expand the sample to include other EMEs since increased observations would enhance the reliability of our findings. Second, all the variables employed are endogenous, which prevents us from establishing causal relationships. For example, foreign portfolio investments may facilitate the long- term development of the capital market.

One way to address this issue is to examine events that lead to exogenous increases in the size of the capital market, such as unexpected institutional reforms. Lastly, if each type of external liability is associated with economic fundamentals, which are, in turn, linked to macroeconomic policies, an important question arises regarding the optimal structure of external assets and liabilities and how to achieve this. To the best of our knowledge, these questions remain largely unexplored. However, we believe that these limitations and unresolved issues raise challenging yet intriguing questions that warrant further investigation. We leave these topics for future research.

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Annex A. Data

A.1 Data Sources

osd_indices

The indices are constructed as explained in the text and the all local currency bond, local currency debt, local currency equity, and foreign currency debt data is from Han (2022) and the detailed information of the data construction is in the paper.

- Sample period of foreign local currency bond holding (osd indices 1, 3): Bulgaria (2012- 2019), Chile (2013-2019), Colombia (2009-2019), Hungary (2008-2019), Malaysia (2009-2019), Mexico (2012-2019), Poland (2010-2019), Romania (2008-2019), Turkey (2012-2019), all other EMEs in the sample (Argentina, Brazil, Czech Republic, Egypt, India, Indonesia, Korea, Peru, Philippines, Russia, South Africa, Thailand; 2005-2019)

Other Sources

- Bond Market Depth: Arslanalp and Tsuda (2014) for government bond market. Bank of Korea, Bank Negara Malaysia, and Bank of Thailand and for central bank bonds in Korea. Malaysia, and Thailand.

- Equity Market Depth: World Bank Global Financial Development Database

- Inflation targeting performance: Central banks of the sample EMEs

- GBI-EM Index: JPMorgan Chase (direct contact)

- Capital Control Index: Fernández et al. (2016)

- Interest rate differential: Bloomberg and CEIC database (Argentina, Egypt, Bulgaria)

- Other data: IMF International Financial Statistics

A.2 Summary Statistics

	count	mean	sd	min	p25	p75	max
osd_index_1	267	0.05	0.05	0.00	0.02	0.07	0.23
osd_index_2	301	0.48	0.30	0.00	0.25	0.69	1.00
osd_index_3	267	0.14	0.10	0.00	0.06	0.22	0.42
osd_index_4	265	0.20	0.15	0.00	0.08	0.31	0.59
osd_eq_index_1	315	0.10	0.10	0.00	0.03	0.14	0.59
osd_eq_index_2	315	0.13	0.11	0.00	0.03	0.19	0.45
osd_eq_index_3	267	0.19	0.13	0.00	0.08	0.25	0.55
Bond Market Depth	310	0.26	0.14	0.01	0.14	0.35	0.60
Stock Market Depth	292	0.59	0.53	0.07	0.24	0.78	3.28
Capital Market Depth	287	0.84	0.59	0.15	0.50	1.05	3.69
Government Effectiveness	315	0.23	0.51	-0.88	-0.15	0.62	1.38
Accountability	315	0.19	0.62	-1.45	-0.08	0.60	1.29
GDP share (%)	315	1.32	1.36	0.11	0.38	1.82	7.02
Trade openness	315	0.76	0.41	0.22	0.47	1.00	2.04
Bond Inflow Control	315	0.38	0.41	0.00	0.00	0.50	1.00
GBI-EM Index	315	0.05	0.04	0.00	0.00	0.10	0.10
IT Performance	315	0.34	0.70	-4.80	0.00	0.83	0.99
Average Growth	315	4.08	2.28	-2.50	2.62	5.68	9.45
Average Inflation	315	0.08	0.14	0.01	0.03	0.08	1.30
Interest-rate Differentials	276	0.09	0.12	-0.00	0.03	0.09	0.95
Fiscal balance	315	-0.02	0.03	-0.13	-0.04	-0.00	0.08

Annex B. Additional Results of Fiscal Balance and Domestic Investor Base

This section introduces additional results to see the relationship between the bond market size and foreign investor participation in the local currency bond markets identified in the main text is maintained in different empirical specifications. As explained in the text, we examine the relationship using two different empirical identifications.

First, we examine the association of fiscal deficits with capital inflows in local currency bond markets as measured by the difference of the original sin dissipation indices. More precisely, we estimate the following equation.

$$\Delta \boldsymbol{osd}_{\boldsymbol{index}_{\tau_{i,t,t-1}}} = \boldsymbol{\alpha}_{\boldsymbol{i}} + \boldsymbol{\beta}_{\boldsymbol{0}} \boldsymbol{fiscalbalance}_{\boldsymbol{i,t-1}} + \boldsymbol{\beta}_{\boldsymbol{1}} \boldsymbol{IT}_{\boldsymbol{i,t}} + \boldsymbol{\beta}_{\boldsymbol{2}} \boldsymbol{\rho}_{\boldsymbol{i,t}} + \boldsymbol{\gamma}' \boldsymbol{\chi}_{\boldsymbol{i,t-1}} + \boldsymbol{\lambda}' \boldsymbol{f}_{\boldsymbol{t}} + \boldsymbol{\varepsilon}_{\boldsymbol{i,t}} \qquad \text{(A.1)}$$

Thus, we examine how fiscal balances in year t − 1 are associated with original sin dissipation. Fiscal authorities in EMEs with mature local currency bond markets, as many are in our sample, should finance some of their deficits through local currency bond issuance. If large bond markets simply attract more foreign investments, then fiscal deficits are expected to lead to more local currency external debts, i.e., original sin dissipation.

A concern on the estimation is the chance of reverse causality: fiscal authorities accept more fiscal deficits when they expect more favorable bond market conditions including more capital inflows into the bond markets. However, fiscal balances are determined by various factors such as business cycles or political considerations. Although the expectation of capital inflows may induce more fiscal deficits to some extent if the relationship between capital inflows and the bond market size is unstable, as opposed to our prediction, the corresponding coefficients will turn out to be insignificant.

Second, we examine the relationship between the domestic investor base in local currency bond markets and capital inflows into the local markets, rather than the stock of investments. More precisely, we estimate

$$\Delta \boldsymbol{osd}_{\boldsymbol{index}_{\tau_{i,t,t+k}}} = \boldsymbol{\alpha}_{\boldsymbol{i}} + \boldsymbol{\beta}_{\boldsymbol{0}} \boldsymbol{DIB}_{\boldsymbol{i,t-1}} + \boldsymbol{\beta}_{\boldsymbol{1}} \boldsymbol{IT}_{\boldsymbol{i,t}} + \boldsymbol{\beta}_{\boldsymbol{2}} \boldsymbol{\rho}_{\boldsymbol{i,t}} + \boldsymbol{\gamma}' \boldsymbol{\chi}_{\boldsymbol{i,t-1}} + \boldsymbol{\lambda}' \boldsymbol{f}_{\boldsymbol{t}} + \boldsymbol{\varepsilon}_{\boldsymbol{i,t}} \qquad \text{(A.2)}$$

where DIB refers to Domestic Investor Base and $k \in \{3, 5\}$ so that $\Delta osd\_index_{-i,t,t+k}$ refers to the change of the index from year t to $t+k$. The domestic investors base is measured by the domestic investor local currency bond holding-to-GDP ratio.

Global capital has steadily inflowed into local currency bond markets in EMEs since the mid-2000s and the inflows must have been stronger in EMEs with a stronger domestic investor base in their domestic local currency bond markets, according to the prediction by our theoretical model. Another advantage of estimating (A.2) is to examine a stock variable against a flow variable. This allows us to examine whether the main results in the text are free from the concern of spuriousness that arises as we regress a stock variable against another stock variable.[37] To examine the effects of domestic investor base on the inflows in the medium and long run, we test the effect of domestic investor base on the average changes of the index for the next three and five years.

The results of the estimations are in Table A.1. As expected, fiscal deficits, i.e., negative fiscal balances, are positively associated with the progress of original sin dissipation: fiscal deficits are positively associated with more inflows into the local currency bond markets. Similarly, stronger domestic investor base is positively associated with more inflows into the bond markets.

[37] Stock variables usually move slowly and change little. Thus, two stock variables with similar time trends might look strongly correlated to each other.

Table B.1. Local Currency Debt Growth Regressions

Type of Index	△_osd_index_1		△_osd_index_2		△_osd_index_1_3Y			"–"_5Y
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Fiscal Bal$_{-1}$	-0.169***	-0.284***	-0.259**	-0.424**				
	(0.033)	(0.055)	(0.093)	(0.143)				
Domestic Invest .Base$_{-1}$					0.201**	0.225***	0.326***	0.247**
					(0.071)	(0.063)	(0.085)	(0.105)
IT Dummy [5)]	0.005	0.005	0.016*	0.010	0.000	0.003	-0.013*	0.000
	(0.004)	(0.007)	(0.009)	(0.012)	(0.002)	(0.003)	(0.006)	(0.000)
IT Perform[5)]	0.001	0.003**	-0.004	0.002	-0.006	-0.005	-0.011	-0.010**
	(0.001)	(0.001)	(0.005)	(0.003)	(0.004)	(0.003)	(0.007)	(0.004)
TradeOpen$_{-1}$	0.010	0.014	0.012	0.026	-0.068**	-0.075**	-0.054	-0.053*
	(0.019)	(0.019)	(0.039)	(0.050)	(0.029)	(0.024)	(0.036)	(0.024)
Bond Inf low Control$_{-1}$	0.000	-0.008	0.011	-0.002	0.006	0.011	0.006	0.015*
	(0.004)	(0.007)	(0.010)	(0.013)	(0.005)	(0.007)	(0.008)	(0.007)
GBI − EMIndex[6)]	-0.010	-0.036	-0.040	-0.163	0.070	0.073	0.081	-0.056
	(0.044)	(0.064)	(0.099)	(0.146)	(0.073)	(0.073)	(0.081)	(0.075)
Avg Growth		0.000		0.000			0.005***	0.005**
		(0.000)		(0.002)			(0.001)	(0.002)
Avg Inf		-0.097**		-0.167**			-0.261	-0.561**
		(0.043)		(0.073)			(0.146)	(0.170)
IRDi f [7)]		-0.010		-0.013			0.002	0.020
		(0.007)		(0.017)			(0.015)	(0.017)
Comp[8)]	-0.021		-0.043		-0.087***			
	(0.015)		(0.042)		(0.021)			
US Reer [9)]	-0.065		-0.127		-0.303***			
	(0.042)		(0.114)		(0.065)			
Obs.	246	223	246	223	181	181	160	117
R-squared	0.064	0.083	0.037	0.035	0.175	0.173	0.277	0.267
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	N	Y	N	Y	N	Y	Y	Y
Macro control	N	Y	N	Y	N	N	Y	Y
Adj R-squared	-0.0616	-0.0597	-0.0912	-0.115	0.0181	0.0286	0.110	0.0364

Notes: 1) The annual data from 2005 to 2019 is used, but the sample is shorter for some EMEs. 2) Detailed sample period for each of the EMEs can be found in Appendix A. 3) Reported in brackets are Driscoll-Kraay standard errors. 4) +, *, **, and *** indicate statistical significance at the 15%, 10%, 5%, and 1% levels, respectively. 5) IT refers to Inflation Targeting. 6) Shares of each EME in JP Morgan GBI-EM Index. 7) Long-term Government Bond Interest-rate Differentials between each EME and the US. 8) Log of Commodity price index. 9) Log of US Real effective exchange rate.

Annex C. Optimal Portfolio of Global Investors

Henceforth, let's denote Global Investors by GI. Then the optimal portfolio decision by GI is as follows.[38]

$$\max_{\theta} \theta'\left(\mathbb{R} - R_f \cdot 1\right) \;\; subject\ to \;\; \alpha\sigma_\theta \leq w\left(\theta'\left(\mathbb{R} - R_f \cdot 1\right)\right)^{\tau}$$

where $\sigma_\theta = (\theta'\Sigma\theta)^{\frac{1}{2}}$where Σ is the Covariance matrix. $w = \overline{w}e^{v}$where v is a random variable. v is realized in period 1 and not known to GI in period 0. Henceforth, $\mathbb{R} - R_f \cdot 1 = \mu$.

Denoting the Lagrange multiplier by λ, the first order condition is

$$\mu - \lambda\left(\frac{\alpha}{2}(\theta'\Sigma\theta)^{-\frac{1}{2}}\Sigma\theta - w\tau(\theta\mu)^{\tau-1}\mu\right) = 0$$

$$(1 + \lambda w(\theta'\mu)^{\tau-1}\tau)\frac{2}{\alpha\lambda}(\theta'\Sigma\theta)^{\frac{1}{2}}\Sigma^{-1}\mu = \theta \qquad \text{(A.3)}$$

Note that if the constraint binds,$\theta'\Sigma\theta = \frac{w}{\alpha}(\theta'\mu)^{\tau-1}$, then we have

$$\frac{2}{\alpha\lambda} = \frac{\theta'\mu - \frac{2w^2}{\alpha^2}(\theta\mu)^{2\tau-1}\tau\theta'\Sigma\theta}{\frac{w}{\alpha}(\theta\mu)^{\tau}\theta'\Sigma\theta} \qquad \text{(A.4)}$$

Plugging into equation (A.3) to (A.4) yields

$$\frac{2}{\alpha\lambda}\frac{w}{\alpha}(\theta'\mu)^{\tau}\Sigma^{-1}\mu + \frac{2w^2}{\alpha^2}\tau(\theta'\mu)^{2\tau-1}\Sigma^{-1}\mu = \theta \qquad \text{(A.5)}$$

Meanwhile, we know

$$\left(\mu'\theta - \frac{2w^2}{\alpha^2}\tau(\theta'\mu)^{2\tau-1}\mu'\Sigma^{-1}\mu\right)(\mu'\Sigma^{-1}\mu)^{-1} = \mu'\theta(\mu'\Sigma^{-1}\mu)^{-1} - \frac{2w^2}{\alpha^2}\tau(\theta'\mu)^{2\tau-1} \qquad \text{(A.6)}$$

Combining (A.6) and (A.5) gives us

$$\mu'\theta(\mu'\Sigma^{-1}\mu)^{-1}\Sigma^{-1} = \theta \qquad \text{(A.7)}$$

To see $\mu'\Sigma^{-1}\mu$, construct a quadratic form of (A.3)

$$(1 + \lambda w(\theta'\mu)^{\tau-1}\tau)^2\frac{4}{\alpha^2\lambda^2}(\theta'\Sigma\theta)\mu'\Sigma^{-1}\Sigma\Sigma^{-1}\mu = \theta'\Sigma^{-1}\theta$$

[38] The algebra in this section is heavily borrowed from Hofmann et al. (2022)

By manipulating the equation, we have

$$\frac{w^2}{\alpha^2}(\theta'\mu)^{-2\tau+2} = \mu'\Sigma^{-1}\mu \tag{A.8}$$

Plugging into (A.8) to (A.7) gives us

$$\theta = \frac{w^2}{\alpha^2}(\theta'\mu)^{2\tau-1}\Sigma^{-1}\mu \tag{A.9}$$

If τ is close to 0.5, as we assume, then the optimal portfolio is a linear function of the inverse covariance matrix and the expected return

Annex D. Results from Arslanalp and Tsuda Data

Below, we introduce the results of the regressions using the data from Arslanalp and Tsuda (2014). We replace our local currency bond data with the local currency government bond data in the dataset from Arslanalp and Tsuda (2014). We adjust the bond market depth by excluding central bank bonds for applicable EMEs. We replicate the results of osd_index_1 and osd_index_1 in Table 1, and column (5) - (7) in Table 3.

The results are close to our baseline results in Table 1 and 3, although the results of trade openness and inflation targeting variables are more sensible in our baseline estimations using the data in Han (2022)

Table D.1: Results from Arslanalp and Tsuda Data

Type of Index	osd_index_1		osd_index_2			osd_index_3		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bond Mkt Depth$_{-2}$	0.250***	0.195***	0.353***	0.215**	0.235***			
	(0.045)	(0.031)	(0.105)	(0.099)	(0.077)			
Govt E f f$_{-1}$	0.034***	0.028***	0.104***	0.103***	0.093***	0.147***	0.141***	
	(0.005)	(0.006)	(0.013)	(0.021)	(0.027)	(0.012)	(0.024)	
IT Dummy 5)	-0.014***	-0.019***	-0.017*	-0.034**	0.001	-0.001	-0.010	0.024
	(0.004)	(0.006)	(0.008)	(0.012)	(0.010)	(0.017)	(0.021)	(0.027)
*IT Perform*5)	0.004	0.003	0.009	0.008+	0.006	0.025**	0.018**	0.028***
	(0.003)	(0.002)	(0.006)	(0.005)	(0.005)	(0.011)	(0.008)	(0.007)
TradeOpen$_{-1}$	-0.026*	−0.019+	-0.034	0.018	-0.003	-0.104*	-0.044	
	(0.013)	(0.011)	(0.032)	(0.033)	(0.023)	(0.051)	(0.031)	
Bond Inf low Control$_{-1}$	-0.006	-0.007	-0.008	-0.007	-0.017	-0.064*	-0.047*	
	(0.008)	(0.006)	(0.017)	(0.018)	(0.016)	(0.031)	(0.022)	
*GBI − EMIndex*6)	-0.002	0.020	0.258**	0.250**	0.246*	0.406	0.590+	
	(0.074)	(0.089)	(0.101)	(0.109)	(0.115)	(0.339)	(0.370)	
Avg Growth					-0.008***			
					(0.002)			
Avg Inf					-0.328*			
					(0.168)			
IRDi f 7)					0.014	0.010	0.164***	0.141***
					(0.023)	(0.032)	(0.031)	(0.022)
*Comp*8)	0.043**		0.146***			0.205***		
	(0.015)		(0.031)			(0.049)		
US Reer 9)	0.156***		0.470***			0.710***		
	(0.024)		(0.053)			(0.083)		
Obs.	277	277	250	250	231	246	246	262
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	N	Y	N	Y	Y	N	Y	Y
Macro control	N	N	N	N	Y	Y	Y	Y
Adj R-squared	0.261	0.101	0.217	0.0586	0.141	0.174	0.116	-0.0128

Notes: 1) Annual data from 2005 to 2019; the sample is shorter for some EMEs. 2) Detailed sample period for each EMEs available in Annex A. 3) Driscoll-Kraay standard errors in brackets. 4) +, *, **, and *** indicate statistical significance at the 15%, 10%, 5%, and 1% levels, respectively. 5) IT refers to Inflation Targeting. 6) Share of EME in JP Morgan GBI-EM Index. 7) Long-term government bond interest rate differentials between each EME and the US. 8) Log of commodity price index. 9) Log of US real effective exchange rate.

PUBLICATIONS

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