Resolving the Mystery of Original Sin*

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Abstract

In this paper, we study how emerging market economies have become able to borrow abroad in local currency, as opposed to the "original sin" hypothesis. We empirically examine different economic variables in terms of the association with local currency debt and find three important conditions for the ability to borrow in local currency: institutional quality, domestic bond market depth, and inflation-targeting performance. Trade and financial openness, and shares in JPMorgan Government Bond Index-Emerging Markets (GBI-EM) index seem to matter as well, although the associations with local currency debt are less clear than the aforementioned three. We also conduct a similar empirical analysis on portfolio equity, which is another form of external liability safer than foreign currency debt, and confirm that equity market depth is key for the ability to attract foreign capital into domestic equity markets. Finally, we suggest a simple portfolio model based on the inelastic market hypothesis, to explain the positive correlation between capital market depth and original sin dissipation—more external liability in the form of equity or local currency debt. Broadly speaking, our analysis implies that emerging market economies with reasonably good fundamentals are not necessarily dependent on foreign currency debt. In fact, there seems to be no mystery of original sin stated in the original sin literature.

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*The views expressed herein are those of the authors and do not necessarily reflect the views of Bank of Korea.

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1 Introduction

Since the sudden stop crises in the 1990s, the reliance of emerging market economies (EMEs) on foreign currency external debts has been pointed out as a major source of the fragility of those economies. Eichengreen and Hausmann (1999) and the following series of papers by the authors (Eichengreen et al. (2002); Hausmann and Panizza (2003); and Eichengreen et al. (2007)) coined the famous term "Original Sin." Despite the evolution of the concept of original sin in those papers, broadly speaking, the original sin of peripheral economies refers to the inability of the countries to borrow abroad in their own currencies.[1] Furthermore, the papers insisted that the inability of borrowing abroad in domestic currency seems to be uncorrelated with the fundamental variables such as inflation or institutional quality and only the size of the economy matters; bigger economies have advantages in borrowing abroad in domestic currency. The original sin hypothesis has prominently influenced the literature and discussions among policymakers.

However, several forefront studies such as Du et al. (2020) or Arslanalp and Tsuda (2014) documented that EMEs have greatly improved their ability to borrow abroad in domestic (local) currency. That is, foreign investments in local currency bonds in EMEs have steadily increased since the mid-2000s. As commented by Carstens and Shin (2019), the improvement of EMEs in the ability to borrow abroad in local currency is one of the most remarkable changes in global financial market architecture since the 1990s. This paper aims to improve our understating of the prominent changes. We empirically investigate how various factors are associated with local currency debts and suggest an explanation for the most important factor using a theoretical model.

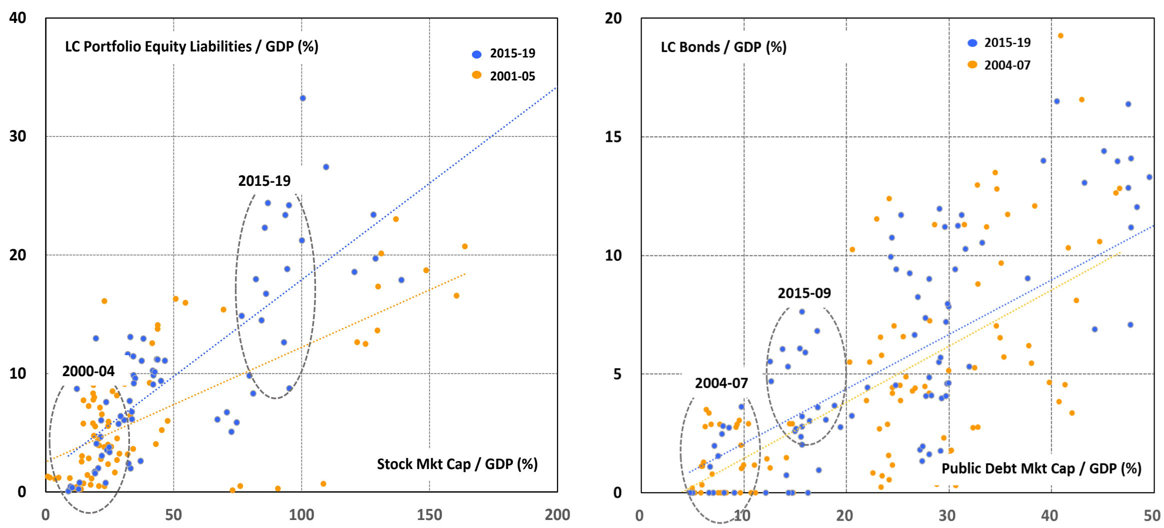
The absence of data on local currency external debts in EMEs has been one of the significant hurdles for the studies on local currency debt in EMEs. The empirical analysis in this paper deployed the newly constructed dataset in a companion paper Han (2022) and the newest version of the dataset in Arslanalp and Tsuda (2014).[2] The dataset conveys information on EMEs' local currency-denominated bonds held by foreign investors,[3] which are mostly issued in the EMEs. The dataset, of course, covers all local currency bonds, which are mostly sovereign bonds, or

[1] Eichengreen et al. (2002) also emphasized the inability of the sovereign to borrow in long-term bond even domestically, which they called "domestic" original sin. However, the following literature has focused on the inability of borrowing abroad in domestic currency

[2] The authors in the paper periodically update the dataset and post on their website. The version used in this paper is published in December 2022.

[3] Throughout this paper, foreign investments refer the investments by non-resident investors and similarly for foreign investments and foregin capital. However, nonresidents investors based on the residence are not necessarily foreigners based on nationality. Although some nonresident investors might be domestic investors; for instance, aforeign subsidiary of domestic company, we do not distinguish foreign investors from nonresident investors as it is challenging to separately identify one from the other. See Chui et al. (2016) for more related discussions.

Figure 1: Capital Market Depth and Original Sin Dissipation



Notes: The figure shows the strong correlation between the capital market depth and external liabilities in the form of portfolio equity and local currency bonds, i.e., original sin dissipation. The left panel shows the relationship between the stock market depth and portfolio equity external liability. The right panel shows the relationship between public bond market depth and local currency bond external liability. The orange-colored dots and the trend line are for the sample period of the early 2000s or mid-2000s, while the blue-colored dots and the trend line are for the sample period of the2015-2019. The comparison between the two sample periods evidences the stable relationship between the capital market depth and external liabilities in the form of equity and local currency bond.

central bank bonds (for several Asian EMEs).

Panel regressions using the aforementioned dataset uncover the factors associated with the local currency bonds. Among different variables, it turns out that the local currency bond market depth is the highest associated with the local currency bond. Simply, the larger bond markets attract more foreign investments into the markets. Other important variables are the credibility of inflation-targeting central banks, measured as the deviation of realized inflation from the inflation target, and the institutional quality indices. Other variables associated with the local currency debt, but less than the three are trade openness, measured as ratios of volume of trade to GDP, capital control on bond inflows, and the share of each EME in JPMorgan Government Bond Index-Emerging Markets (GBI-EM) index. Except for institutional quality, which a handful number of preceding papers such as Engel and Park (2022) and Devereux and Wu (2022) documented its importance, all the empirical results have not been reported to the best of our knowledge.

High correlations between bond market depth and local currency external debt are documented in a companion paper Han (2022) as depicted in Figure 1, but we formally test the association of bond market depth with local currency debts. Although some readers may regard the results as anticipated, this is not in line with the standard portfolio theory as bond market sizes vary significantly among the EMEs in the sample, even after controlling the level of development or size of the economies. However, although the correlations between bond market depth and the local currency debt are as usually predicted by ones, it still echoes our key findings in our paper: 1) capital market development has been the main driver of the original sin dissipation, i.e., borrowing abroad more in local currency, and 2) EMEs with developed capital market and reasonable institutional qualities can substantially borrow abroad in local currency: no such deeply rooted sin making EMEs fundamentally unable to borrow abroad in local currency.

The results of inflation-targeting performance are also new to the literature although a few preceding papers (Ogrokhina and Rodriguez (2018)) documented that the adoption of inflation-targeting improves the ability of the EMEs to borrow abroad in local currency. The importance of the performance of inflation targeting, which can be understood as a measure of the credibility of monetary authorities, well corresponds with the theoretical analysis (Ottonello and Perez (2019)) that emphasized the role of enhanced credibility of monetary authorities and stabilized inflation in EMEs in borrowing abroad in local currency. The significance of trade openness possibly hints that higher FX market depth attracts more foreign capital into the local currency bond markets as the bond investors evaluate their returns in foreign currency and higher FX market depth would imply less local currency depreciation during the time of foreign capital outflows. The results of shares in the GBI-EM index might show the existence of many passive funds that follow the index or the information effect as the index may inform global investors of the existence of local currency bond markets.[4]

In addition to the local currency bond, we also test how different economic variables, similar to the ones in the local currency bond regression equations, are associated with more foreign portfolio investments in equity markets in EMEs.[5] We investigate portfolio equity as it is another safer form of foreign financing, similar to local currency debt, in that the value of external liabilities decreases during a difficult time for the EME, but also as the nature of more foreign investments in equity markets in EMEs might be similar to the foreign investments in local currency bonds.

We confirm that the market size is the key to foreign portfolio investments in equity markets in EMEs: the EMEs with larger domestic equity markets can attract more foreign capital into the equity market. As discussed in Han (2022), equity portfolio flows into EMEs look like a precursor

[4]However, these are our interpretations and we do not take a strong stance on any causality regarding those variables.

[5]Readers should note that equity portfolio investments in domestic markets in EMEs is a subset of equity external liabilities in International Investment Position as the latter also covers the equities issued by EMEs' firms in foreign equity markets.

of local currency bond flows into EMEs. If our empirical results show the causality from capital market depth to foreign investments in equity and bond markets in EMEs, the preceding of the equity flows to the local currency bond flows reflect that equity developments were faster than local currency bond market developments in EMEs.

Finally, we suggest a theoretical model explaining the positive correlations between bond market depth and local currency debt and the similar positive correlations between equity market depth and equity external liability. We build a simple portfolio model, assuming the inelastic demands for assets following Inelastic Market Hypothesis (IMH) in Gabaix and Koijen (2021). To see the key insight from the model, let's think of a portfolio problem of globally investing financial intermediaries (global investors). There are recurrent shocks to the global investors' demands for assets in EMEs, which resemble different global shocks in reality, e.g., US monetary policy shocks. When global investors sell off, it must be absorbed by local investors in EMEs and the absorption must accompany drops in the asset prices as the demands from local investors are inelastic. More importantly, the magnitude of the asset price movements due to global shocks is larger in markets where global investors' market shares are higher since it will be harder for local investors to absorb the sell-off. Hence, asset with high shares of global investors in the asset markets is highly correlated with global shocks, which might be a systemic risk for global investors. Then, it is straightforward that assets in markets in which global investors' shares are high are unattractive to global investors as the assets have a poor risk-hedging property and vice versa for the markets with low shares in global investors' shares. These mechanisms give us a form of a convergence of global investors' share in capital markets in EMEs. Thus, an EME with larger capital markets compared to GDP can attract more foreign capital into the domestic equity and local currency bond markets.

To conclude from the empirical and theoretical analysis in this paper, the enhanced ability of EMEs to borrow abroad in the form of equity or local currency debt is thanks to the capital market development, credibility build-up by monetary authorities, and introduction of JP Morgan GBI-EM Index in 2005, which makes it easier to access information on EME local currency bond markets.

Related Literature Broadly speaking, this paper belongs to the literature of original sin which documented the reliance of EMEs on foreign currency debts, the causes of the reliance—original sin—, the related risk to financial stability, and the policies to deal with the risk. This paper contributes to the literature by providing evidence regarding local currency external debt—original sin dissipation—and the following interpretation of the empirical results using a theoretical model, as illustrated below.

It was Eichengreen and Hausmann (1999) who suggested the concept of "original sin" in economics, defined as a situation "in which the domestic currency cannot be used to borrow abroad or to borrow long term even domestically." In subsequent papers (Hausmann and Panizza (2003); and Eichengreen et al. (2002)), the authors separately defined the domestic original sin, situations in which domestic currency cannot be used in long-term domestic financing, and international original sin, in which domestic currency cannot be used in foreign financing. They also reported that economic fundamentals seem to be unable to explain the absence of local currency external debts in EMEs and only the sizes of the economies matter: no clear theories can explain the empirical findings and hence, the original sin is a mystery. Later, Eichengreen et al. (2005, 2007) discarded the domestic original sin, saying some EMEs seem to overcome the domestic original sin, but still cannot borrow abroad in domestic currency, which implies that substantial use of local currency in domestic markets is not a sufficient condition for the use of the local currency in external borrowing.

Despite the huge influence of the series of original sin papers, a strand of papers since the mid-2000s has documented the presence of significant foreign investments in local currency bond markets in EMEs. Burger and Warnock (2003, 2006) documented the growth of local currency bond markets in EMEs and 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 documented the gradual dissipation of original since the mid-2000s (Arslanalp and Tsuda (2014); Du and Schreger (2016); Juvenal et al. (2019); and Han (2022)). Unlike those papers, Eichengreen et al. (2022) insisted that the original sin is still persistent as the local currency foreign borrowings in EMEs are mostly limited to governments in those countries and even this cannot be applied to most frontier market economies.

Another group of papers empirically investigated the cause of original sin dissipation. Ogrokhina and Rodriguez (2018) showed that the adoption of inflation targeting can improve the ability of the EME to borrow abroad in local currency. Hale et al. (2020) investigated the local currency bond issuance by EMEs private sectors in offshore markets and concluded that global financial conditions and inflation history are important determinants of local currency external debts in EMEs. Aizenman et al. (2021) EMEs can issue more local currency bonds if the EMEs are inflation targeters. Arslanalp et al. (2020) emphasized the importance of GBI-EM index in the size of inflows into different EME local currency bond markets. Our contribution to the literature is to find fundamentals that are empirically related to the local currency external debts: bond market depth, inflation targeting performance, and shares in GBI-EM index, after examining all the fundamentals in the aforementioned papers.

The other groups of papers tried to understand the original sin dissipation using structural models. Ottonello and Perez (2019) showed that a more credible monetary policy., i.e., larger cost of deviating from the inflation target, can improve the country's ability to borrow abroad in local currency. Du et al. (2020) and Engel and Park (2022) also introduced structural models delivering a similar narrative of the importance of disciplined monetary policy on local currency borrowing. Devereux and Wu (2022) introduce a model including central bank international reserves. In the model, more international reserve holding helps governments sell more local currency bonds to foreign investors as foreign exchange market intervention using reserves lessens the exchange rate volatility. We contribute to the literature by providing evidence corresponding to the narrative of the importance of disciplined monetary policy in original sin dissipation. The history of monetary policy measured as deviations of realized inflation from the target can be a proxy for the discipline of monetary policy.

Layout The rest of this paper is organized as follows. In Section 2, we illustrate our empirical analysis and the following results. Section 3 introduces a simple model to explain the key emprical results in section 2. Section 4 concludes and discusses implications.

2 Empirical Analysis

This section illustrates our empirical analysis and then introduces the results from the analysis. We empirically investigated the associations of various economic variables with local currency debts.[6] First, we describe the local currency debt data used in the regressions and then explain our empirical strategies including the regression equations to estimate. Finally, we state our empirical results and suggest our interpretation of the results.

2.1 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 combine 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, i.e., bonds. As explained in Han (2022), we can broadly classify local currency debts into three different types: local currency FDI debts, local currency bonds, and local currency deposits. FDI local currency

[6] Henceforth, local currency debt refers external debts in denominated in local currency, ie., local currency external debt.

debts are sizable, but the currency denomination of FDI debts would be meaningless as it can be mere intercompany lending or transfers. Local currency deposits are likely to be held by foreign portfolio investors who have just sold off local currency assets but are yet to convert the proceedings to foreign currency, as discussed in Han (2022).[7] It seems that such local currency deposits are missed in the statistics of some EMEs or the foreign investors immediately convert their proceedings to foreign currency in some EMEs. Thus, we also discard local currency deposits in the analysis of local currency debt. As a result, we only consider the local currency debt securities. This coverage is similar to Arslanalp and Tsuda (2014) which covers local currency sovereign debt securities.[8] 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 voluminous in several Asian EMEs such as Thailand, Korea, and Malaysia.

Our data covers 21 EMEs. Egypt is added to the 20 EMEs in Han (2022) as the Egyptian local currency bonds have been extensively purchased by foreign investors since the late 2010s. The time span of the dataset varies along with countries. The data begins from 2002 at the earliest for Brazil or Korea, while the data begin from the late-2000s (Malaysia) or the early-2010s (Chile). The available frequency also varies along with the country. To have as many EMEs as possible, we use the annual frequency data. The detailed time span of each country can be found in the dataset posted on the website of the author, Bada Han (https://sites.google.com/view/bada-han).

2.2 Empirical Strategies

The preceding papers in the original sin literature regressed different indices of original sin on various economic variables. The issue is how to measure the magnitude of original sin or original sin dissipation. To be more specific, we need to find a ratio of local currency debt to "needs for foreign financing."

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 local currency external 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. [9]

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

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

[9] The papers in the early original sin literature used the ratio of local currency debts in international debt securities. As discussed in Onen et al. (2023), this approach might miss the local currency bonds purchased by foreign

It is not clear what is the right denominator—a measure of needs for foreign financing. 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, 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 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 also consider the ratio of local currency bonds to the total external debts, excluding FDI debts. The ratio measures the ability of the economy to borrow abroad in local currency. Later, we will show that the public bond market depth is decisive in the ability to attract foreign capital into the domestic bond markets and the importance of economic variables other than the bond market depth can be evaluated as shares of foreign investors in the local currency bond market. Thus, we also consider the foreign investors' shares in the local currency bond markets.

Consequently, the original sin dissipation indices we consider are as follows.

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

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

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

We cannot add many control variables as the number of observations is less than 300 in the regressions. We tested many economic variables, and ended up with the following variables in the regressions after the consideration of the preceding studies and our economic intuition. The included regressors are bond market depth (market value of the outstanding public bonds to GDP, trade openness, bond inflow control index, institutional quality (government effectiveness), and shares of each country's GDP in the world GDP as measures of the size of the economy. Details on the sources of each variable are relegated to Appendix A. Additionally, we consider macroeconomic variables as well. Three years' average GDP growth, ten years' average inflation, and the standard deviation of the inflation in the same time span are included in some of the regressions. Summary statistics of each of the original sin dissipation indices and

investors as the bonds are mostly issued domestically. Furthermore, international debt securities might include FDI debts, whose currency denomination is irrelevant to the discussion of original sin dissipation.

the variables can be found in Appendix A.

An important recent finding regarding the original sin dissipation 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 also add the dummy of inflation-targeting. What our approach differs from the preceding papers in the aspect of inflation targeting is that we also include a measure of the performance of inflation targeting: i.e., how the realized inflation is close to the target. More specifically, our measure of inflation targeting performance, named as ρ is

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

where π^*_{t-j} is the inflation of country i target in year $t-j$ and π_{t-j} is the realized inflation.

Hence, we deduct the deviation of three years' realized inflation from the target: the closer to the target, the higher the score.[10] We adjust the constant σ so that the worst performance at the bottom 5% is lower than 0.[11]

As a result, the regression equation is as follows.

$$os\_index\_\tau_{i,t} = \alpha_i + \beta_0 \eta_{i,t-2} + \beta_1 IT_{i,t} + \beta_2 \rho_{i,t} + \gamma' \chi_{i,t-1} + \varepsilon_{i,t} \tag{1}$$

where $\tau \in \{1,2,3\}$; η is the bond market depth; IT and ρ are the inflation targeting dummy 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 others, or macro controls; and α_i is the country-fixed effect. In some regressions, we add time-fixed effects to equation (1). As implied in the results in Hale et al. (2020), the low-interest rates in the US after the global financial crisis was one of the important reasons that foreign holding of local currency bonds in EMEs drastically increased in the early 2010s. Time-fixed effects would control such global factors. We use Driscoll-Kraay standard errors to control possible cross-country dependence. [12].

Please note all the variables are lagged by one year to lessen the concern of endogeneity. Public bond market depth is lagged by two years as there is more concern of endogeneity; for instance, the government might be tempted to issue more local currency bonds as they expect there will be more foreign investments in the bond market.

[10]The build-up of the credibility probably requires longer history. However, many EMEs adopted inflation targeting in the 2000s and the use of past three years' average is unavoidable to prevent loss of observations.

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

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

2.3 Results

We first introduce the results for original sin dissipation indices 1, 2, 3, and then introduce the results of index 4, which we argue that it is the correct specification to assess the relation between original sin dissipation and economic variables except for the public bond market depth.

OSD Index 1–3 Our first empirical results are in Table 1. Public market depth, defined as the government and central bank bond outstanding-to-GDP ratio, and government effectiveness indices show strong correlations with original sin dissipation in all different estimations. The shares in the GBI-EM index show high correlations with original sin dissipation, although the statistical significance is lost in columns (1), (2), and (5). Other variables that are statistically significant with a consistent sign in some of the estimations are trade openness, capital control index (for bond flows), inflation targeting dummy, and inflation targeting performance. The economy size is significant in some estimations, but the signs are not consistent.

OSD Index 2 is the one used in preceding papers such as Engel and Park (2022). The results in columns (3) – (5) are very close to theirs in that inflation targeting dummy and government effectiveness are significant.

OSD Index 4 In the next section, we introduce a theoretical model in which the shares of foreign investors in the local assets, i.e., equity or bond, are endogenously determined. The model shows the shares are bounded below and above. If we accept the theoretical result or follow the usual presumption that larger bond markets will naturally attract more foreign capital, then the importance of economic variables other than the bond market depth should be evaluated based on their association with the shares of foreign investors in the domestic bond market. In other words, we should regress the foreign investors' shares on different economic variables to see how the variables are associated with the ability to attract more foreign capital into the bond market. Therefore, we estimate the regression equations with the dependent variables of OSD Index 4 defined as below. The results are in Table 2. In columns (5) and (6), we excluded macroeconomic controls that are insignificant or whose signs are counterfactual. We also excluded the economy size variable (share of the EME in the world GDP) in column (7) as the variable exhibits inconsistent signs.

$$\begin{aligned} osd\_index\_4 &= \frac{Local\,Currency\,Bonds\,held\,by\,Foreing\,Investors}{Local\,Currency\,Bonds\,Outstanding} \\ &= foreign\ investors'\ share\ in\ the\ local\ currency\ bond\ market \end{aligned}$$

A notable difference in the result from Table 1 is the much stronger result for the inflation

Table 1: Results of 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$_{-2}$	0.249***	0.159***	1.222***	0.854**	0.726*	0.554***	0.320***	0.290***
	(0.042)	(0.036)	(0.305)	(0.296)	(0.368)	(0.113)	(0.072)	(0.083)
Govt Eff$_{-1}$	0.025***	0.025***	0.241***	0.202***	0.189***	0.107***	0.108***	0.090***
	(0.008)	(0.007)	(0.061)	(0.056)	(0.054)	(0.012)	(0.015)	(0.025)
IT Dummy[5)]	-0.000	-0.008	0.136***	0.118***	0.074^{+}	0.013	-0.007	0.034*
	(0.003)	(0.005)	(0.041)	(0.038)	(0.042)	(0.010)	(0.009)	(0.017)
IT Perform[5)]	0.005	0.005**	0.003	0.009	0.018^{+}	0.002	0.006*	0.005^{+}
	(0.004)	(0.002)	(0.014)	(0.010)	(0.011)	(0.005)	(0.003)	(0.003)
Economy Size$_{-1}$	0.004*	-0.005	-0.147***	-0.190***	-0.148***	0.036***	0.012^{+}	-0.000
	(0.002)	(0.004)	(0.022)	(0.016)	(0.018)	(0.006)	(0.007)	(0.019)
Trade Open$_{-1}$	0.018	0.046***	0.037	0.084	0.073	0.031	0.108**	0.081**
	(0.021)	(0.012)	(0.060)	(0.064)	(0.053)	(0.044)	(0.038)	(0.027)
Bond Inflow Control$_{-1}$	-0.018***	-0.012**	-0.035	-0.031	-0.035	-0.023	-0.012	-0.022**
	(0.004)	(0.004)	(0.031)	(0.029)	(0.046)	(0.016)	(0.017)	(0.008)
GBI-EM Index[6)]$_{-1}$	0.055	0.067	1.585***	1.692***	0.719	0.416***	0.432***	0.521***
	(0.100)	(0.095)	(0.495)	(0.456)	(0.608)	(0.132)	(0.106)	(0.133)
Avg Growth					-0.011**			-0.007***
					(0.004)			(0.002)
Avg Inf					0.648^{+}			-0.032
					(0.385)			(0.260)
IR Dif[7)]$_{-1}$					-0.234**			-0.001
					(0.092)			(0.020)
Observations	261	261	288	288	246	250	250	231
R-squared	0.271	0.185	0.308	0.267	0.287	0.297	0.222	0.302
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-R2	0.176	0.0790	0.228	0.182	0.180	0.205	0.119	0.190

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 Differences between each EME and the US.

Table 2: Results of Original Sin Dissipation Index 4

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Govt Eff_{-1}	0.147***	0.180***	0.136***	0.176***	0.126***	0.154***	0.155***
	(0.030)	(0.036)	(0.014)	(0.016)	(0.013)	(0.024)	(0.025)
IT Dummy[5)]	-0.064	-0.106	0.044*	0.009	0.006	-0.010	-0.028
	(0.051)	(0.064)	(0.023)	(0.024)	(0.036)	(0.032)	(0.027)
IT Perform[5)]	0.032***	0.028***	0.026**	0.022**	0.028**	0.024**	0.023***
	(0.006)	(0.007)	(0.011)	(0.008)	(0.011)	(0.008)	(0.008)
Economy Size_{-1}	0.063***	0.052**	0.029	-0.041**	0.034	-0.038**	
	(0.018)	(0.020)	(0.018)	(0.015)	(0.022)	(0.015)	
Trade Open_{-1}	0.053	0.122***	0.022	0.055**	-0.012	0.058***	0.060***
	(0.061)	(0.032)	(0.052)	(0.019)	(0.066)	(0.016)	(0.017)
Bond Inflow Control_{-1}	-0.050	-0.028	-0.099***	-0.038	-0.105***	-0.064***	-0.077***
	(0.048)	(0.051)	(0.024)	(0.022)	(0.022)	(0.013)	(0.014)
GBI-EM $\text{Index}^{6)}_{-1}$	-0.248	-0.238	0.884*	1.070*	0.779	0.926*	0.869*
	(0.470)	(0.433)	(0.485)	(0.521)	(0.516)	(0.456)	(0.454)
Avg Growth			-0.017***	-0.009***			
			(0.003)	(0.002)			
Avg Inf			-0.610	0.515			
			(0.506)	(0.395)			
IR $\text{Dif}^{7)}_{-1}$			0.073*	0.174***	0.032	0.206***	0.199***
			(0.038)	(0.027)	(0.040)	(0.022)	(0.023)
Observations	265	265	231	231	231	231	231
R-squared	0.118	0.140	0.370	0.348	0.217	0.299	0.288
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-R2	0.010	0.034	0.273	0.246	0.104	0.198	0.190

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 Differences between each EME and the US.

targeting performance. The inflation targeting performance is significant at least 5% level in all the estimations. It is also notable that the sign of interest rate differentials corresponds to our intuition as the signs are positive, while the sign is negative in Table 1. Trade openness and capital control index are significant in some estimations, but the significance is lost in other estimations or the sign is flipped. The GBI-EM share becomes weakly significant (10% level) with the right sign when macroeconomic controls, especially interest rate differentials, are included.

Considering foreign investments in local currency bond markets must be affected by various global factors such as global financial cycle and the right sign of interest-rate differentials, the results in columns (4),(6) and (7) should be more seriously reviewed. Accordingly, we conclude that trade openness, financial openness, and GBI-EM index share are considerable determinants of foreign investments in local currency bond markets in EMEs.

To summarize the results in Tables 1 and 2, the larger domestic bond market seems to attract more foreign investments in the local currency bonds in the market: thus, the foreign investors' shares seem to converge within a range. Better inflation-targeting performance is positively associated with higher shares of foreign investors in the market. Although the inconsistency among different estimations, higher trade openness, weaker restrictions on bond inflow, and higher shares in the GBI-EM index are positively associated with more foreign investments in the local currency bond market

Interpretation of GBI-EM Index and Inflation-targeting performance While the empirical result of inflation-targeting performance is new in the original sin dissipation literature, it well corresponds to the theoretical and quantitative analysis in preceding papers (Ottonello and Perez (2019); Engel and Park (2022); and Du et al. (2020)). Since the local currency bonds are nominal assets, the governments have a stronger incentive to inflate away the debts when more bonds are held by foreign investors. Hence, the policy authorities need to prove they do not have such incentives if they want foreign investors in their domestic local currency bond markets. In the real world where investors' rationality is bounded above and information is asymmetric, the way to prove they will do so is to build their credibility through history: realized performance of inflation-targeting.

The formal test of GBI-EM share is the first in the literature to the best of our knowledge. Arslanalp et al. (2020) documented benchmark-driven investments in local currency bond markets in EMEs. The results prove the existence of the investors following the benchmark such as GBI-EM index or others. Another possible interpretation is that the index informs global investors of the existence of the sizable bond markets in the 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, Portes and Rey (2005). If the index is a signal regarding the existence and the size of the bond market, the significance of GBI-EM index can be understood as indirect evidence of the information effects on the cross-border capital flows.

2.4 Further Empirical Analysis on Equity Portfolio Investments

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

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

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

$$osd\_index\_5 = \frac{Local\ Currency\ Equities\ and\ Bonds\ held\ by\ Foreing\ Investors}{Total\ External\ Liabilities}$$

The results of the equity regressions are close to the local currency bond regressions. Equity market or capital market depth is the key to the ability to get more foreign investments in the capital or equity market.[13] What looks odd is the negative and significant coefficients of the economy size variable—share of GDP to the world GDP. High trade openness appears to be negative and it possibly reflects higher exposures of the country to global shocks through the cross-border trade linkage. Inflation-targeting performance appears to be significant, which probably implies that monetary authority credibility is also important for equity inflows. Inflation targeting performance shows the ability of policy authorities to stabilize the macroeconomy.[14]

[13]The equity market depth loses its statistical significance one the interests-rate differential is included. That possible reflect negative correlation between equity market depth and the differential at a certain aspect.

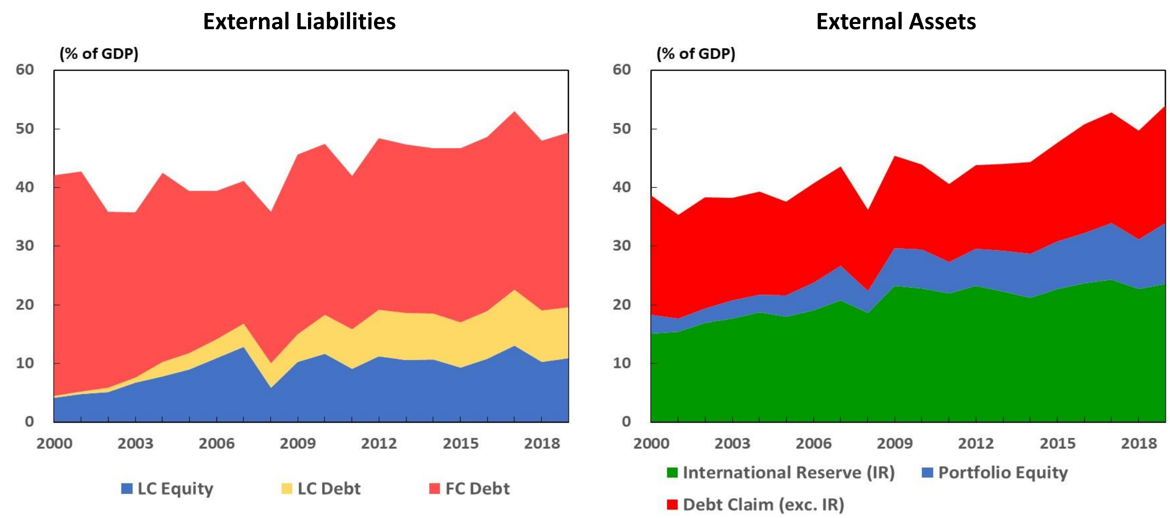
[14]Another possible interpretation is that trial to inflate away might devalue the equities in non-tradable goods sectors. Nominal depreciation to inflate away the debt causes the real depreciation of the currency. The currency depreciation can reprice equities in non-tradable goods sectors valued in foreign currency.

Table 3: Results of Equity Original Sin Dissipation Indices

Type of Index	osd_eq_index_1		osd_eq_index_2			osd_index_5		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Stock Mkt Depth$_{-2}$	0.092***	0.092***	0.047**	0.046***	0.015			
	(0.028)	(0.022)	(0.021)	(0.014)	(0.011)			
Capital Mkt Depth$_{-2}$						0.025$^+$	0.052***	0.027***
						(0.015)	(0.008)	(0.007)
IT Dummy[5)]	0.244	-1.280	-1.488*	-2.111	0.349	-1.522	-0.998	0.728$^+$
	(0.812)	(1.006)	(0.725)	(1.306)	(0.642)	(1.135)	(0.783)	(0.421)
IT Perform[5)]	0.483***	0.483***	0.496**	0.631***	0.642$^+$	0.481$^+$	0.381$^+$	0.237
	(0.100)	(0.104)	(0.183)	(0.173)	(0.504)	(0.297)	(0.239)	(0.220)
Accountability$_{-1}$	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)
Economy Size$_{-1}$	-1.871***	-2.029***	-2.151***	-2.121***	-3.317***	-2.511***	-2.344***	-2.671***
	(0.585)	(0.509)	(0.391)	(0.393)	(0.411)	(0.621)	(0.513)	(0.759)
Trade Open$_{-1}$	-2.226**	-2.056	-3.739***	-4.091*	0.899	-3.113*	-1.041	0.242
	(0.848)	(1.430)	(1.127)	(2.210)	(1.340)	(1.717)	(2.255)	(1.341)
Equity Inflow Control$_{-1}$	0.890*	-0.240	-0.817*	-1.360	-2.156			
	(0.487)	(0.645)	(0.465)	(0.834)	(1.681)			
KA Open$^{7)}_{-1}$						-1.082	-0.495	-2.950**
						(0.742)	(1.560)	(1.190)
Avg Growth					-0.052			-0.147
					(0.112)			(0.114)
Avg Inf					4.648			-25.601
					(3.071)			(15.217)
IR Dif$^{8)}_{-1}$					-18.190***			-13.455***
					(1.983)			(0.809)
Observations	352	352	352	352	282	248	248	231
R-squared	0.205	0.232	0.113	0.153	0.307	0.068	0.135	0.261
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-R2	0.136	0.166	0.0365	0.0793	0.221	-0.0509	0.0250	0.147

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) Capital Account Openness Index 8) Long-term Government Bond Interest Rate Differences between each EME and the US.

Figure 2: Capital Market Depth and Original Sin Dissipation



Notes: The figure shows the average ratio of external assets and liabilitites to GDP, as percentage, in the following categories: international reserves held be central banks, portfolio equtiy claims on nonresidents, debt claims on nonresidents, local currency debt liabilities, foreign currency debt liabilities, portfolio equiteis held by nonresident investors.

2.5 Discussion of the Evolution of EMEs' IIP

As pioneered in the seminal works by Lane and Milesi-Ferretti (2001, 2007), the sources of EMEs for foreign financing had shifted from debt to equity, portfolio equity or direct investment, in the 1990s and 2000s: the share of equity-type external liabilities to the total external liabilities in the IIP had drastically risen. At the same time, the EMEs accumulated foreign assets in the form of international reserves. Thus, the equity inflows are also important to reduce the concerns on currency mismatch and accordingly, financial stability in EMEs. (Figure 2)

Portfolio equity inflows into EMEs became slowed-down after the global financial crisis as illustrated in Han (2022), but at the same time, the local bond inflows into EMEs were expedited. Local currency bond inflows have helped EME governments with reducing currency mismatches of the governments. Also, together with direct investment inflows, the local currency bond inflows have attributed to external asset accumulation of EMEs, mainly in the form of private sector assets, unlike the 2000s when the 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 through both fewer needs to borrow abroad in foreign currency and providing sources to accumulate foreign currency assets abroad, but more through the latter.

Portfolio equity external liability and local currency external debt have been separately discussed in the literature.[15] However, equity and local currency bond inflows should be studied together. As discussed above, both more equity liability and local currency debts result in reduced currency mismatches in EMEs and thus, have similar implications for financial stability in the EMEs. More importantly, two different phenomena seem to be connected in the evolution of the national balance sheets of EMEs. Figure 2 depicts the steady increase of equities and local bonds in EMEs, held by foreign investors. One can easily see the two different time series move together and equity inflows preceded the local currency bond inflows. This probably reflects equity market developments were earlier than the local currency bond market developments.

If capital market development is the key to original sin dissipation, which now we define as reduced reliance or concerns on currency mismatch through more foreign financing in the form of equity or local currency debt, and intuitions of the significance of other relevant economic variables can be found in previous studies, the remaining work is to found a theory showing capital market depth leads to more foreign investments in the capital market. Next, we introduce a simple international portfolio model for the purpose.

3 Model

This section introduces a simple international portfolio model. The model delivers analytical results showing the importance of market depth in accommodating foreign investments in the market. We simplify the model to derive the desired analytical results and do not try to use the model for quantitative analysis.

3.1 Environments

Model setup The model is a three-period model (t=0, 1, 2). There is a global investor who allocates her money across different assets in different countries. The global investor resembles globally working financial intermediaries in reality, such as JP Morgan, BlackRock, or sizable sovereign wealth funds. While we abstract from details in assets markets in each of the countries in the model, we assume that the demands for the assets from local investors, i.e., investors based on the country in which the asset exists, are inelastic following Gabaix and Koijen (2021).[16]

Local asset markets There are N number of countries indexed by i. Thus $i \in \{1, 2, \dots. N\}$. In each country, there is a country-specific asset, which we also index by i. Note there exists a

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

[16] The literature of inelastic asset demands has a long history and the discussion backs to at least Shleifer (1986).

unique type of assest i in country i. We abstract from the exchange rate. Below, we explain how the exchange rate movements can be relevant to foreign investments in equity and local currency bonds in EMEs, in the context of our model, and also discuss how it can be related to our empirical results of trade openness. The price of asset i in period 0 is given. Let's denote the price asset i in period 0 by $q_{0,i}$. We can imagine that the asset supply is infinitely elastic at the given price in period 0. 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) and for asset i in period 1 are given by

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

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

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 demands as the equilibrium asset price is dictated by the preference and technological features regarding the asset.[17]

Since the asset demands from local investors are finitely elastic, the shocks to global investors, which will be described later, 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.

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

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 Global investor enters period 0 with her own capital $\overline{w}$ and forms her portfolio in period 0, which she cannot change the composition of the portfolio 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-averse preference. However, we model global investors in a way that we think is more realistic and consistent with the local

[17] 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 intermediary. Assumptions of myopic investors or bounded rationality also can give finitely elastic demands.

investors with inelastic demands. Global investors are risk-neutral. However, they are under 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 return defined as the expected difference between the portfolio return and the safe asset return. Let's 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

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

where $\sigma_\theta = \left(\theta'\Sigma\theta\right)^{\frac{1}{2}}$ where Σ is the covariance matrix, and $\theta, \sigma_\theta > 0$. 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 features in reality that the investors would be able to take higher risks when they expect higher returns. The specification of global investors under VaR contstraint is adopted from Hofmann et al. (2022).[18]

Another component of the model is the shock to global investors' capital. We can think of the shocks as different global shocks in reality, such as US monetary shocks or commodity price shocks, or any other global shocks that impact the balance sheet of globally working financial intermediaries. More specifically,

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

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

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

The steps to solve the portfolio problem are relegated to Appendix B. For simplicity and illustrative purpose, 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 $\{1, 2, ...N\}$.

It is important to note that global investors form their portfolio as in equation (4) in period 0. We make one more crucial assumption: the portfolio investors can change size of the portfolio

[18]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).

depending on the realization of ν, global shock, while they cannot change the shares in equation (4). This reflects features in reality that many globally investing funds may withdraw their money from EMEs, but have difficulties in adjusting their portfolio in short run or existence of many passive funds.[19]

3.2 Global Asset Market Equilibrium

Thanks to the simple structure in the model, it is easy to solve the model. Let θ_i denote the share 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 $\theta_i = \overline{\theta}_i e^{2\nu}$

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

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

Taylor approximation around ν=0 gives us

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

Imagine that driving forces of asset price in reality somehow resemble the structure in equation (7). Then an strategist or analyst in a globally working financial intermediary, who estimates a Fama equation, finds that "beta"—the exposure to the common shock—does increase in the share of GI in the local asset market.[20] We formally summarize the interpretation in the lemma below.

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

[20]This statement implicitly assumes $\kappa > \varphi$. This can be interpreted as a condition of minimal maturity of 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 minimal domestic demands for the asset market to exist.

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 high shares of foreign investors will be unattractive for an individual foreign investors as the assets have poor risk-hedging properties, and vice-versa for assets in the market with low shares of foreign investors.

Equilibrium portfolio determination With the solutions in equations (7), (8) and (4), we can solve fully characterize the inverse covariance matrix as follows.

The inverse covariance matrix is as follows[21]

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

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

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

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

The share of asset i θ_i is

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

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

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

Notice that the share of asset i is increasing in its own expected return μ_i and decreasing in

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

the expected return of other assets μ_j. More importantly, the share is decreasing in both in 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, more domestic demands κ_i leads to lower systemic risk and accordingly, attract more investments from GI: thus, stronger domestic demands results in 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 into the domestic markets so that the growth of local currency bond market must be positively associated with more capital inflows into the markets. In the conjunction with origianl sin, the equity and bond markets in EMEs, in particualr bond markets, had been really thin until mid-2000s and thus, there were just not enough local currency bonds for foreign investors. Therefore, the findings in the papers in the early original sin literature—inability of EMEs to borrow abroad in 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.[22]

To link the theoretical results to the other empirical results in the previous section, the inflation-targeting performance, institutional quality (government effectiveness) might be reflected on the idiosyncratic risk, ε_i. The successful implementation of inflation-targeting in many EMEs in the late-2000s might have contributed to more foreign investments in local bond markets in the EMEs. Capital control index can be possibly related to the return as it shall increase the cost of the investments. Trade openness might matter for the systemic risk through foreign exchange market fluctuations as discussed below.

Model with Foreign Exchange Market Recall that we have abstracted from foreign exchange market for simplicity. However, the mode can be easily extended to foreign exchange (FX) market. Let's assume that the asset in each country is denominated in domestic currency of the country, i.e., 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 exchange rate changes. Denote s_t as the spot exchange rate in period t. Following the convention,

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

a higher exchange rate indicates local currency depreciation against foreign currency. Then, the expected return in period 0 is

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

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

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

Note that the exporter (or importer) is the only participant in FX market in the country. Then foreign currency supplies or demands are inelastic, as domestic asset suppliers or demands are. Hence, capital inflows and outflows change exchange rates. In reality, there are other FX market participants other than exporters and importers. However, if their supplies and demands are inelastic as well, then our insight will survive. 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 impacts on the market bigger than the changes in the fundamentals. Considering the model in Gabaix and Maggiori (2015) is in fact an application of ithe nelastic market hypothesis to FX market, it is natural that the same mechanism emerges in the model including FX market.

In this regard, the occasional significance of trade openness in the local bond regressions might reflect that higher trade openness is positively associated with a better capacity to absorb FX market pressures from capital flows driven by global shocks and induce lower exposure of the currency to global shocks or lower currency risk in other words. A bit weak results of the trade openness also reflect that there are other market participants, in reality, other than exporters, importers and globally working investors, which implies trade openness is an imprecise measure of FX market depth.

4 Concluding Remarks

In this paper, we studied how one of the most remarkable changes in international financial architecture has occurred. By deploying the dataset in a companion paper Han (2022), which shows the size of local currency bonds in EMEs held by foreign investors, we examine how associated different economic variables are with original sin dissipation: i.e., what economic conditions strengthen the ability of EMEs to borrow abroad in local currency? It turns out that the domestic public bond market depth is key for the ability to attract more foreign investments to the bond market. Although it is already reported in preceding papers (e.g., Engel and Park (2022)), institutional quality seems to be also a crucial determinant of foreign investment in local currency bond markets. Less than the two, but the inflation-targeting performance measured as the deviation of realized inflation from the target also significantly matters for foreign investments in the bond markets. Despite being not fully consistent across different estimations, financial and trade openness, and shares in GBI-EM index seem to be under consideration by the foreign investors. The significance of GBI-EM index possibly implies the existence of passive funds following the benchmark or the information effects, which the index alarms the existence and size of the local currency bond markets to global investors.

We also examined whether similar economic variables matter for portfolio equity investments in EMEs. Although equity flows have been discussed in different literature from the original sin literature, equity external liability is also worth investigating, as it is another safer form of acquiring foreign capital, and furthermore, related to original sin dissipation—local currency debt. We confirm that equity market depth is key for attracting more foreign capital into the domestic equity market, similar to local currency bonds. Hence, the common driving force behind increases in equity portfolio flows into EMEs and local currency bond portfolio flows into EMEs is the capital market development in EMEs. Thus, the increase in equity financing of EMEs, reviewed in Lane and Milesi-Ferretti (2007), and increase in local currency debts that emerged later after the global financial crisis are connected to each other, and the reason equity financing was the precursor of the local currency debt is perhaps the equity market development was faster than local currency bond market development. Finally, we provide a simple model to explain how the capital market depth can be linked to more foreign investments in equity and local bond markets in EMEs. The model is a really simple portfolio model and we only added the ingredient of inelastic demands from domestic investors, following Gabaix and Koijen (2021). The changing demands from global investors caused by various global shocks induce fluctuations in asset prices. Markets with high shares of global investors are strongly correlated with global shocks and vice versa for markets with low shares of global investors. Then the share of global investors in the market is endogenously determined: the country with a larger capital market attracts more equity and local currency bond investments and accordingly, has less reliance on foreign currency debt or currency mismatch.

Perhaps, the empirical findings and theoretical model in this paper are not surprising if they are out of the context of original sin. It seems that likely fundamentals are related to original sin dissipation, as opposed to the assertion in Eichengreen et al. (2002). Despite the big contribution by the authors, which alarms the importance of currency denomination of external debts in understanding the root of financial instability in EMEs, the terminology of "original sin" has created the misimpression that the reliance on foreign currency debt and following currency mismatch cannot be avoided or should be overcome with huge costs such as massive international reserve accumulation. However, it turns out that EMEs with well-developed capital markets, institutional quality, and satisfactory records of monetary policy can borrow abroad in safer forms, other than foreign currency debt.

In closing, it is important to acknowledge the limitations of our study and discuss avenues for our future research. First, we used annual data for 21 EMEs, which significantly reduce the number of observations. Since we have to use stock data, the use of quarterly or monthly data will not help us much. In contrast, it will be great to extend the sample to other EMEs. More observation will enhance the reliability of our empirical analysis. Second, all the variables we used are endogenous and thus we have no causal relationship. For instance, foreign portfolio investments may expedite the development of capital market in long run. One way to overcome such a problem is to exacerbate an event in which the size of capital market increases due to exogenous reasons, such as unexpected institutional reforms. Lastly, if each type of external liability is associated with economic fundamentals, which are again associated with macroeconomic policies, one following question is what is the optimal structure of external assets and liabilities, and how to achieve the optimum? These questions are largely unexplored to the best of our knowledge.

We believe all these issues raise challenging, but interesting questions unanswered in this paper. We leave these issues to future research.

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Appendix

A Data Appendix

TBW

B Optimal portfolio of global investors

Henceforh, let's denote Global Investors by GI. Then the optimal portfolio decision by GI is as follows.

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

where $\sigma_\theta = \left(\theta'\Sigma\theta\right)^{\frac{1}{2}}$ where Σ is the Covariance matrix. $w=\overline{w}e^\nu$ where ν is a random varible. ν 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

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

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

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

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

Plugging into equation (A.1) to (A.2) yields

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

Meanwhile, we know

$$\left(\mu'\theta-\frac{2w^2}{\alpha^2}\tau\left(\theta'\mu\right)^{2\tau-1}\mu'\Sigma^{-1}\mu\right)\left(\mu'\Sigma^{-1}\mu\right)^{-1}=\mu'\theta\left(\mu'\Sigma^{-1}\mu\right)^{-1}-\frac{2w^2}{\alpha^2}\tau\left(\theta'\mu\right)^{2\tau-1} \tag{A.4}$$

Combining (A.4) and (A.3) gives us

$$\mu'\theta\left(\mu'\Sigma\mu\right)^{-1}\Sigma^{-1}=\theta \tag{A.5}$$

To see $\left(\mu'\Sigma\mu\right)$, construct a quadratic form of (A.1)

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

By manipulating the equation, we have

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

Plugging into (A.6) to (A.5) gives us

$$\theta = \frac{w^2}{\alpha^2}\left(\theta'\mu\right)^{2\tau-1}\Sigma^{-1}\mu \tag{A.7}$$

If τ is close to $\frac{1}{2}$, as we assume, then the optimal portfolio is a linear function of the inverse covariance matrix and the expected return.