Who Holds Sovereign Debt and Why It Matters?[*]

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Abstract

The composition and behavior of the investors in sovereign debt can have important implications for the ability of governments to borrow during distress periods, such as the on-going Covid crisis. To study this issue, we construct an aggregate data set of sovereign debt holdings by foreign and domestic investors, further disaggregated into banks and non-bank private, and official investors for 95 countries over 1996-2018. We document several important empirical regularities that are useful for guiding future research. First, private non-bank investors pick up most of the sovereign debt when it increases. This contrasts with a large literature that presumes banks are the marginal investors for sovereign debt. Second, currency of debt and exchange rate movements can drive different patterns for investors in emerging market (EM) debt. Third, macroeconomic and financial factors in the sovereign's country comove differently with the debt holdings of these different groups, and these relationships are different for advanced economies (AEs) and EMs. We also document similar responses to global shocks across AEs and EMs, but different responses across investor groups. Utilizing a more granular dataset of euro area investors, we find that investment funds play the largest role among private non-bank investors, rather than insurance and pension funds or non-financial investors.

JEL-Codes: F34, G11, G15, F41
Keywords: Sovereign debt, Banks and Nonbanks, Advanced Economies and Emerging Markets

1 Introduction

The ability to issue debt is an important instrument at the government's disposal. Sovereign borrowing can help buffer the economy from the impact of adverse macroeconomic shocks. Conversely, indebtedness can also make a country vulnerable to financial distress as crisis episodes have illustrated. Indeed, the sharp increase in fiscal expenditures and debt issuance during Covid-19 has brought more urgency to answering questions surrounding whether and how a government can borrow. Overlaying these questions are corresponding questions about the willingness of investors to extend credit to sovereigns.

Due to the importance of this issue, a long literature has studied the ability of governments to raise debt that is willingly held by investors. Moreover, the presumed identity of those investors has largely depended upon the type of government issuing the debt. This literature has bifurcated according to two types of government debt: first, risky government debt often associated with Emerging Markets (EM) and, second, safe government debt related to Advanced Economies (AE). For EMs, foreign banks have often been the presumed investor base in a line of work beginning with Eaton and Gersovitz (1981).[1] By contrast, for safe AE debt, the presumed investors have been a mix of foreign and domestic banks who fly to safety during global economic downturns.[2] Indeed, the ability of countries like the United States to issue safe haven government debt has been central to questions of the international role of these issuers.[3] According to these two types of government debt literatures, therefore, the motivations for different types of investors to hold the debt is a key consideration to its sustainability.

In this paper, we document the investor base of government debt around the world in order to provide new empirical regularities that may guide these lines of research. For this purpose, we first assemble a dataset with a balanced sample of 95 countries spanning 1996-

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[1]More recent papers using this assumption include Aguiar and Gopinath (2007), Arellano (2008), and Morelli, Ottonello, and Perez (2020), for example.

[2]See for example, Krishnamurthy and Vissing-Jorgensen (2012), Jiang, Krishnamurthy, and Lustig (2018), Avdjiev, Bruno, Koch, and Shin (2019a) and Miranda-Agrippino and Rey (2021).

[3]See for example, Gourinchas and Rey (2007), Gourinchas, Rey, and Govillot (2017), and Atkeson, Heathcote, and Perri (2021).

2018 that distinguishes the holders of each country's sovereign debt by foreign vs domestic investors.[4] Moreover, within these foreign and domestic groups, the data set categorizes investors into banks versus other private investors that we term "non-banks".[5] Looking at how the shares of investor groups change with the supply of debt allows us to investigate several important questions we describe below.

To motivate these questions, Figure 1 illustrates both the growing importance of government debt as well as how the domestic versus foreign investor base has changed. Specifically, Panel a shows that aggregate government debt as a proportion of GDP has increased to the highest levels in recent history, spurred on by the Covid-19 pandemic for both for advanced and emerging economies. As pandemic-related borrowing continues, the question of repayment of this large increase in debt will come to the fore.

Figure 1: Trends in Sovereign Debt
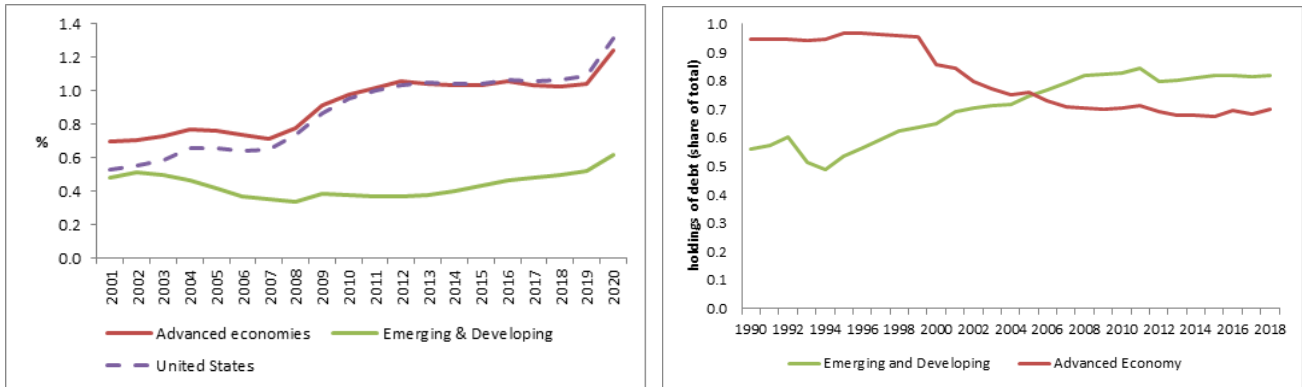
(a) Public Debt to GDP

(b) Domestic Investor Share

Furthermore, the types of investors have changed significantly over time. For example, as Panel b shows, the share of domestic versus foreign investors has evolved with marked differences between advanced economies (AEs) and emerging markets (EMs). In particular, the share of aggregate debt holdings by foreigners has increased for AEs while that same share has decreased for EMs. Moreover, during the Global Financial Crisis (GFC) and the Covid-19 pandemic, domestic central bank purchases of advanced economy sovereign debt

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[4]The full, unbalanced sample includes 152 sovereigns over 1991-2018.

[5]We also provide a creditor group based upon official creditors that include central banks, as we discuss below. This decomposition follows that of Arslanalp and Tsuda (2012) and Arslanalp and Tsuda (2014).

has dramatically expanded, shifting the composition of the investor base towards official creditors. These relationships highlight how the investor base may change over time.

To document such changes, we use our data to decompose the changes in debt into how much is absorbed by each of six aggregate investor groups: Foreign Bank, Foreign Non-Bank, Foreign Official, Domestic Bank, and Domestic Non-Bank, and Domestic Official. We also document the sensitivity of each group's holdings to various macroeconomic and financial variables. Here we find four basic sets of results at this aggregate level.

First, and most strikingly, we find that the marginal investors - the investor group whose holdings increase the most when total debt increases - are Non-Bank private investors, rather than Banks. Across all countries, we find that an increase in debt held by foreigners is associated with 75% of that extra debt held by non-banks while only 10% is absorbed by Banks. This pattern holds in subsamples of AEs and EMs separately. Thus, the responses of Private Non-Bank investors play a significant role in the government debt market.

Second, we find that currency denomination and exchange rate movements play different roles across private investors. We explore various characteristics that drive these distinct investor groups, based upon variables noted to be important in the EM and AE sovereign debt literature. One feature of the EM literature has been the question of the currency denomination of debt. While Eichengreen, Hausmann, and Panizza (2003) noted that many EMs denominated their debt in foreign currency, Du and Schreger (2016a) have shown an increase in local currency debt by many sovereigns over time. We therefore examine which investor group is related to holding more of the government debt of countries that expand their local currency-denominated share of debt issued in international markets. Here we find that for EMs that increase this share of local currency-denominated debt, there are significant increases in holdings by domestic private non-bank investors. By contrast, domestic banks and foreign private non-bank investors decrease their holdings. At the same time, domestic banks are more likely to expand their holdings of own government debt in response to depreciations in their local currency.[6] In countries where the exchange rate is more stable,

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[6]Although we do not have direct evidence on who holds these increases in foreign currency denominated

there is a greater share of foreign investors, driven by foreign non-banks (and lower shares of domestic non-banks).

Third, macroeconomic and financial factors in the sovereign's country comove differently with the debt holdings of these different groups, and these relationships are different for AEs and EMs. For example, better quality institutions are associated with a higher share of foreign bank holdings in AEs and lower holdings for domestic non-banks, while in EMs foreign non-banks make up a larger share with better institutions with lower shares from other private investors. When yields on long-term bonds rise, private domestic investors increase their holdings of AE sovereign debt and private foreign investors decrease theirs, but in EMs domestic banks decrease their holdings. These results can help guide research that incorporates differences in behavior among investor groups of sovereign debt .[7]

Fourth, we find that changes in global factors (such as the strength of the US dollar or global risk aversion measures like the VIX) relate differently by holder group, but with similar patterns across AEs and EMs. The impact of global uncertainty has been noted in a number of papers including Miranda-Agrippino and Rey (2021) and Forbes and Warnock (2012) for AE and EM countries, respectively. For both AE and EM countries, higher VIX is related to greater holdings of government debt by domestic investors, while a stronger dollar correlates with lower holdings of all investor groups except for domestic non-bank private investors. This pattern is consistent with the view that a stronger dollar increases the leverage of global banks, constraining their lending including to domestic banks.[8] Although the importance of financial intermediary constraints have become noted in other settings, our results suggest that these same frictions are important in the government debt market as well.

debt, our results do suggest how variations in foreign currency debt covary with the overall holdings by investor group. As such, it relates to the literature on how domestic versus foreign investors relate to local currency debt issuances including Du and Schreger (2016b), and Ottonello and Perez (2019), among others.

[7]For example, some papers treat the drivers of equilibrium debt characteristics as being the interplay of domestic households and banks (e.g., Bocola and Lorenzoni (2020)) while others focus on the role of large global banks facing heterogeneous sovereign borrowers (e.g., Morelli et al. (2020)).

[8]Intermediary liquidity constraints such as these have been proposed to help explain exchange rate and credit markets more generally. See for example, include He and Krishnamurthy (2013)),Bruno and Shin (2015), Gabaix and Maggiori (2015), and Fang and Liu (2020).

All of these findings are based upon an aggregate decomposition of banks versus non-bank private investors. However, the set of non-bank private investors - key in this market, as we show - represents a heterogeneous group of institutions with potentially disparate motivations. Therefore, in order to understand the possible motives within this investor group, we turn to a more granular data set of securities investors in the euro area. This data set allows us to disaggregate the Non-Bank investor group into non-financial corporations, pensions and insurance companies, households, and a category of other financial institutions, largely representing investment funds. With this more disaggregated group of investors, we repeat our decomposition of the marginal investor group of sovereign debt holdings for non-Euro area debt. We find once again the importance of Non-bank private investors, particularly for EM countries. More importantly, our analysis indicates that within this group, investment funds and other financial institutions are the largest marginal investors for increases in holdings of sovereign debt outside of the Euro Area, with insurance and pension playing the next largest role. By contrast, households and non-financial corporations appear to play little to no part in sovereign debt holdings. Overall, this finding underscores the view that non-bank financial institutions, particularly investment funds, play an important role in global sovereign debt markets.

Given these findings, we set up a conceptual framework to understand the supply of government debt and the demand from different investor groups. This framework provides a basis for interpreting some of the basic features in our analysis and evaluating counterfactuals such as the impact of increases in government debt. *This section is in progress in the current draft.*

The structure of the papers is as follows. Section 2 describes the data and some basic stylized facts. This section provides general reduced form relationships showing which investor groups absorb increases in the supply of government debt. Section 3 examines how the holdings of sovereign debt of different investor groups varies according to macro, financial, and global factors. Section 4 digs deeper into the role of non-bank investors using data

from euro area investors. Section 5 sets up a simple conceptual framework to illustrate how the results may be used to interpret the evolution of the endogenous supply and investor demand in the sovereign debt market. Concluding remarks follow.

2 Evolving Composition of Sovereign Debt Investor Groups

We begin with a general discussion of the investor groups, their definitions, and the data construction. This section then demonstrates some basic empirical regularities about how government debt ownership varies with issuances.

2.1 Investor Group Definitions

In order to focus on the evolving behavior of foreign and domestic holders of government debt, we consider three basic investor groups categorized as: (1) banks; (2) private non-banks; and (3) official creditors. These investors are ordered throughout the paper below as: $i = 1, 2, 3$. We describe briefly these three categories below before detailing their construction in the data.

The first investment group identified by $i = 1$ is comprised of private banks. These institutions are often considered primary intermediaries for debt markets and have therefore been the focus of both the Emerging Market (EM) and Advanced Economy (AE) branches of sovereign debt studies. In the literature on emerging market borrowing, foreign global banks are often modeled as the primary creditor. In advanced economies, capital regulation typically incentivizes domestic banks to hold domestic government debt due to their zero risk weight.[9] It has been argued that these holdings give rise to the bank-sovereign doom loop (Fahri & Tirole, 2018). Below, we call these investors "Foreign Banks" and "Domestic Banks", accordingly. For expositional purposes, we define the bank holdings of the debt of country j as H_j^1 for domestic "Home" banks and as F_j^1 for "Foreign" banks.

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[9]Bank regulation typically uses risk-weighted assets to compute capital ratios. So, acquiring an asset with a zero risk weight does not reduce the bank's regulatory capital ratios, though it can affect other bank constraints like the leverage ratio.

A second group of private investors identified by $i = 2$ is a combination of all private investors who are not banks. These investors are not subject to the regulatory restrictions that banks face. This investor group encompasses financial institutions such as pension funds and insurance firms, endowments, hedge funds, other non-bank financial companies, as well as non-financial entities like corporations and households. In this paper, we refer to this diverse investor group simply as "Foreign Non-Banks" and "Domestic Non-Banks". Similarly, using the notational convention above, the private non-bank holdings of the debt of country j are defined as H_j^2 for "Home" non-bank investors and as F_j^2 for "Foreign" non-banks.[10]

Finally, we look at official creditors, primarily central banks, an investor group we identify as $i = 3$. The home official creditor is clearly the "Domestic Central Bank" while the "Foreign Official" investor group includes both foreign central banks, other governments, and international organizations such as the World Bank and International Monetary Fund. Holdings of country j's debt by this investor group is defined as H_j^3 for the "Home" central bank and as F_j^3 for the "Foreign" official creditors. Since this group of investors is likely motivated by different incentives than the private creditors, we largely focus on the other two investor groups in the rest of the paper. Nevertheless, this group comprises an important part of sovereign holdings and we therefore document its behavior in this section.

The investor groups for the government debt of a given country j can then be aggregated across these three groups to provide a measure of the holdings of the Home and Foreign creditors, respectively, as:

$$\overline{H}_j \equiv \sum_{i=1}^{3} H_j^i \tag{1}$$
$$\overline{F}_j \equiv \sum_{i=1}^{3} F_j^i$$

Moreover, since these holdings account for the outstanding debt of sovereign j, the total supply of debt D_j must equal the holdings of debt held by Home and Foreign investors

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[10]Below, we study these individual groups on a more disaggregated basis using data for euro area investors.

through the accounting identity:

$$D_j = \overline{H}_j + \overline{F}_j, \forall j \tag{2}$$

Thus, these holdings allow for a decomposition of domestic and foreign investor groups using the shares of banks, non-banks, and official holdings. Specifically, letting lower cases refer to the shares of each sovereign's debt held by investor group i as

$$h_j^i \equiv \frac{H_j^i}{D_j}; \ f_j^i \equiv \frac{F_j^i}{D_j}, \tag{3}$$

then clearly these investor shares sum to the share held by home and foreign creditors and the totals sum to one. That is,

$$
\begin{aligned}
1 &\equiv \frac{\overline{H}_j}{D_j} + \frac{\overline{F}_j}{D_j} \\
&= \sum_{i=1} h_j^i + \sum_{i=1}^{3} f_j^i
\end{aligned}
\tag{4}
$$

We will use the decompositions of the shares in equations (3) and (4) below to uncover the changing patterns of ownership over time. Before doing so, we first describe the data.

2.2 Data

The annual data series for the debt and holding groups come from various sources. Here we describe the overall approach in constructing these series. This approach follows the work of Arslanalp and Tsuda (2012) and Arslanalp and Tsuda (2014). We make some deviations from their methodology in order to broaden the time period and sample of countries, but we point interested researchers to their database, which is regularly updated and includes a quarterly frequency subsample.[11] A more complete discussion of our data construction is in Appendix A.

The overall total debt levels D_j are derived primarily from the IMF Historical Public Debt Database (HPDD), which has debt-to-GDP for a large number of countries over a long time horizon. To recover the value of debt in current USD, we multiply this series by GDP from

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[11]See here for emerging market data and here for advanced economy data.

the World Bank. For some countries, the HPDD data stops in 2015. For these countries, we obtain post-2015 values by applying the growth rate in total debt from the Quarterly Public Debt Statistics (QPSD), which has excellent coverage of the recent period, to the last available level from the HPDD. The foreign total holdings $\overline{F}$ are constructed following the methodology in Avdjiev, Hardy, Şebnem Kalemli-Özcan, and Servén (2018) (AHKS), which relies on data such as the IMF International Investment Position (IIP) data, the Quarterly External Debt Statistics (QEDS), and the BIS international banking and international debt securities statistics. The domestic total holdings $\overline{H}$ are the complement of this series to total debt, and are computed as the difference between total debt and foreign debt.

The holdings of the domestic and foreign debt are further decomposed into the three groups described above. Data for foreign bank holdings, F_j^1, are estimated using the approach in AHKS. Foreign official holdings, F_j^3, for advanced economies and China are taken directly from Arslanalp and Tsuda (2012, 2014), capturing the use of such debt as foreign reserves. For other countries, we use the sum of bilateral and multilateral lending from the World Bank Debtor Reporting System (DRS). Foreign Non-Bank holdings F_j^2 are the difference between these measures and total foreign holdings.

Turning to domestic investors, domestic sovereign debt holdings of domestic banks, H_j^1, and domestic central banks, H_j^3, are taken from the IMF's International Financial Statistics (IFS) dataset, supplemented with data from the official websites of central banks when the data was incomplete. The domestic total is computed as the difference between the total debt and the foreign-held debt. Domestic Non-Bank holdings, H_j^2, are computed as the residual between the domestic total and the sum of domestic banks and domestic central banks. We express all data in current US dollars.

Overall, this construction provides a balanced sample of 95 countries from 1996 to 2018 and a full unbalanced sample beginning in 1991 for 152 countries. For the analysis, we split the sovereigns into 3 groups: advanced economies (AEs), emerging markets (EMs), and developing countries (DCs). Details of the countries in each group can be found in the

appendix.

2.3 Investor Trends and Marginal Holders

Given these definitions, we now examine the relative behavior of each investor group's holdings as government debt changes. Figure 2a begins by showing the average holdings to GDP shares of advanced economy (AE) investors while Figure 2b shows the same for the emerging and developing economies (EMDC). These figures show distinctive differences within the groups. For both groups, the foreign bank and non-bank shares have been stable, though small, over time.[12] However, the proportion of foreign official holdings has become larger for AEs, as central banks have increased their holdings of safe haven government debt as reserves, while that proportion has declined for emerging markets. Strikingly, the share of domestic non-banks has increased over time for EMs relative to AEs, perhaps reflecting growing financial development within these economies. By contrast, the AE holdings of domestic central banks has expanded over time, likely due to the use of unconventional monetary policies.

Figure 2: Trends in Sovereign Debt

(a) AEs   (b) EMs and DCs
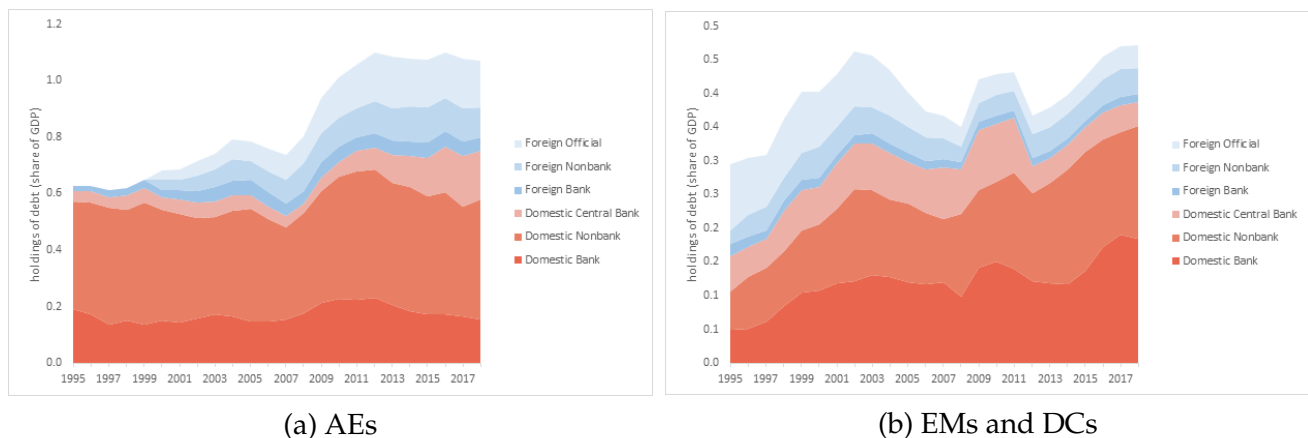
These trends raise an important question. When the size of debt increases, which investors absorb the additional amount? In other words, who are the marginal investors for

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[12]Foreign official data for advanced economies are not available until 2000, so foreign holdings are not fully reported before that point.

the sovereign? To explore this question, we regress the change in debt held by each investor group on the change in total debt:

$$\frac{H^i_{jt} - H^i_{jt-1}}{D_{jt-1}} = \alpha_j + \alpha_t + \beta^i_0 \frac{D_{jt} - D_{jt-1}}{D_{jt-1}} + \epsilon^i_{jt}, \quad \forall i \tag{5}$$

$$\frac{F^i_{jt} - F^i_{jt-1}}{D_{jt-1}} = a_j + a_t + b^i_0 \frac{D_{jt} - D_{jt-1}}{D_{jt-1}} + e^i_{jt}, \quad \forall i$$

where the subscripts $t, t-1$ indicate time, α_j, a_j represent country fixed effects and and α_t, a_t represent time fixed effects. Note that since the sum of the investor groups add up to the total, the growth rate of debt is reflected in the accounting identity:

$$\frac{D_{jt} - D_{jt-1}}{D_{jt-1}} = \sum_{i=1}^{3} \frac{H^i_{jt} - H^i_{jt-1}}{D_{jt-1}} + \sum_{i=1}^{3} \frac{F^i_{jt} - F^i_{jt-1}}{D_{jt-1}}. \tag{6}$$

Therefore, the coefficients estimated from this regression will sum to 1 (all of the debt is absorbed by some investor): $\sum_{i=1}^{3} \beta^i_0 + \sum_{i=1}^{3} b^i_0 = 1$. As a result, each coefficient reflects the marginal holding response of each investor group to variations in the supply of debt.

Table 1 shows the results of this regression. Panel A provides a baseline estimate labeled "All" based upon a balanced sample of countries (i.e. each country-year observation has data for all 6 investor groups).[13] The first two columns provide these results for an aggregated domestic and foreign group of investors. Columns (1) and (2) show that on average for every one additional dollar of debt supplied, $0.60 is absorbed by domestic investors while the other $0.40 is picked up by foreign investors. In AEs and DCs, this split is roughly equal, whereas for EMs domestic investors take over two-thirds of additional debt.

Breaking down foreign and domestic investors by type in columns (3) through (8) reveals additional insights. For the "All" country estimates, non-bank investors tend to be the most important, taking $0.39 and $0.30 of each additional dollar for domestic and foreign entities, respectively. As reported in the following rows, decomposing estimates into country groups shows the relative importance of investor groups across these countries. In particular, foreign non-banks are more important for AEs and DCs, while domestic non-banks matter more for EMs.

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[13]See Table B1 in the appendix for results utilizing an unbalanced sample.

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More important for the relevant literatures, however, is the role of investor groups relative to each other. Here, the importance of Non-bank investors demonstrate the most striking results. For example, Foreign Non-banks play a much stronger role in the takeup of new debt to EMs, picking up 24% of the increased debt supply, in contrast to only 5% to foreign banks. These findings are in stark contrast to the view that foreign banks play the biggest role in the EM debt market. And lastly, foreign official investors are more important as marginal investors for DCs, where they serve as an important source of financing (9% of the increased supply). These patterns are illustrated in panel (a) of Figure 3.

Table 1: Marginal Holders of Sovereign Debt

	(1) Dom	(2) For	(3) Dom Bank	(4) Dom NB	(5) Dom CB	(6) For Bank	(7) For NB	(8) For Off
Panel A: Baseline								
All	0.60***	0.40***	0.16***	0.39***	0.05***	0.04***	0.30***	0.06***
	(0.05)	(0.05)	(0.04)	(0.05)	(0.01)	(0.01)	(0.05)	(0.02)
AE	0.50***	0.50***	0.02	0.39***	0.09	0.06**	0.40***	0.04
	(0.12)	(0.12)	(0.03)	(0.09)	(0.07)	(0.02)	(0.12)	(0.03)
EM	0.68***	0.32***	0.21***	0.43***	0.04**	0.05***	0.24***	0.04
	(0.05)	(0.05)	(0.05)	(0.07)	(0.02)	(0.02)	(0.05)	(0.03)
DC	0.50***	0.50***	0.11***	0.34***	0.05***	0.01	0.40***	0.09***
	(0.09)	(0.09)	(0.03)	(0.09)	(0.02)	(0.02)	(0.10)	(0.02)
Panel B: Weighted by D_{jt-1}								
All	0.71***	0.29***	0.18***	0.49***	0.05**	0.04***	0.21***	0.04**
	(0.06)	(0.06)	(0.03)	(0.05)	(0.02)	(0.01)	(0.06)	(0.02)
AE	0.69***	0.31***	0.19***	0.48***	0.02	0.06***	0.19**	0.06
	(0.09)	(0.09)	(0.05)	(0.06)	(0.02)	(0.02)	(0.07)	(0.03)
EM	0.80***	0.20**	0.17**	0.56***	0.08***	0.01*	0.17**	0.01
	(0.08)	(0.08)	(0.06)	(0.10)	(0.02)	(0.01)	(0.08)	(0.01)
DC	0.30***	0.70***	0.09**	0.19**	0.02*	0.01	0.64***	0.05***
	(0.10)	(0.10)	(0.04)	(0.08)	(0.01)	(0.01)	(0.11)	(0.02)

These results consider the average relationship across countries, treating all the same regardless of their size. Panel B reports the results of this regression weighted by the total value of debt in each country. This approach provides estimates that reflect more accurately the behavior of large government issuers such as the US, UK, Japan, and France. With this estimation, domestic investors play a larger role relative to foreigners in absorbing increases in the aggregate supply of government debt. A notable difference for AEs is that domestic banks' role is larger, reflecting their importance for the sovereign debt markets in major advanced economies. In EMs, domestic non-banks' participation is the main driver. In contrast in DCs, domestic investors play a smaller role.

2.4 Marginal investors during different circumstances

While these relationships consider the responses of investor holdings over all periods, the marginal investor may change depending on the time period or circumstance. Indeed, the literature on marginal investors has highlighted their importance and differences during crises and recessions (e.g., Bruno and Shin (2015) and Miranda-Agrippino and Rey (2021).) During these times, banks may cut back lending and central banks may intervene to stabilize the economy. Moreover, these cut-backs may impact the overall responses of investor holdings of government debt. Therefore, we examine the sensitivity of investor group holdings to crises and other special circumstances. To examine marginal investor responses during these time periods, we augment the regression above to test for interactions with these events, illustrated for domestic holders in the following equation:

$$\frac{H^i_{jt} - H^i_{jt-1}}{D_{jt-1}} = \alpha_j + \alpha_t + \beta_0 \frac{D_{jt} - D_{jt-1}}{D_{jt-1}} + \beta_1 I_{jt} + \beta_2 \underbrace{\left(\frac{D_{jt} - D_{jt-1}}{D_{jt-1}} \times I_{jt} \right)}_{\text{interactions}} + \epsilon^i_{jt}, \ \forall i \quad (7)$$

where I_{jt} are indicator variables that identify whether the country faced a recession, a recent banking crisis, or are dummies for different time periods in our sample (e.g. before vs after the Global Financial Crisis (GFC) of 2008-09). We consolidate the results of these regressions into Figure 4.[14] Advanced economies show marked differences in the marginal investors

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[14]Tables for these regressions are found in the appendix.

across different circumstances. During recessions or banking crises, domestic investors absorb much more of the debt, driven by non-banks and a notably large role of central banks. By contrast, domestic banks decrease their holdings of their sovereign's debt during a banking crisis. After the GFC, both domestic banks and domestic non-banks increase the share of debt they absorb, as well as foreign official lenders. This latter trend may reflect increased holdings of foreign reserves by foreign central banks, particularly those in EM countries.[15]

Patterns in EMs are somewhat different. Domestic investors play a smaller role during a recession. Domestic banks' share actually increases, but the domestic non-bank sector absorbs a much smaller share of any increased debt. Foreign banks and non-banks pick up the remaining slack. During a banking crisis, the foreign versus domestic investor split remains unchanged, but foreign and domestic banks participate less while domestic non-banks and foreign official lenders participate more. Like AEs, EMs do see an increase in domestic absorption after the GFC, but the change is smaller due to an already high domestic share.

For DCs, the role of domestic investors also expands during recessions although banking crises do not show much of a difference. The pattern in marginal investors in these markets over time is also interesting. After 2000, foreign investors play a larger role in picking up debt issued by DC sovereigns, but after the GFC domestic investors' share increases substantially as foreign non-bank investors contract. The share of foreign official has been increasing over time.

Overall, despite differences over crisis periods, the basic finding that Non-bank investors are important marginal investors continues to hold over these periods. During banking crises, domestic and foreign non-bank investors take on a larger share of the government debt though they retreat from those holdings during general recessions. Moreover, in the period since the GFC, the holdings by this investor group has expanded. We next examine how different characteristics of sovereigns and their debt relate to the composition of these investor groups.

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[15]If these data were extended through 2020, we might see a much higher marginal share for the domestic central bank, as some in AEs purchased amounts roughly equal to the net issuance of debt during that year. See the IMF Fiscal Monitor.

Figure 3: Marginal Holders

(a) By country group   (b) Recent banking crisis   (c) By time period
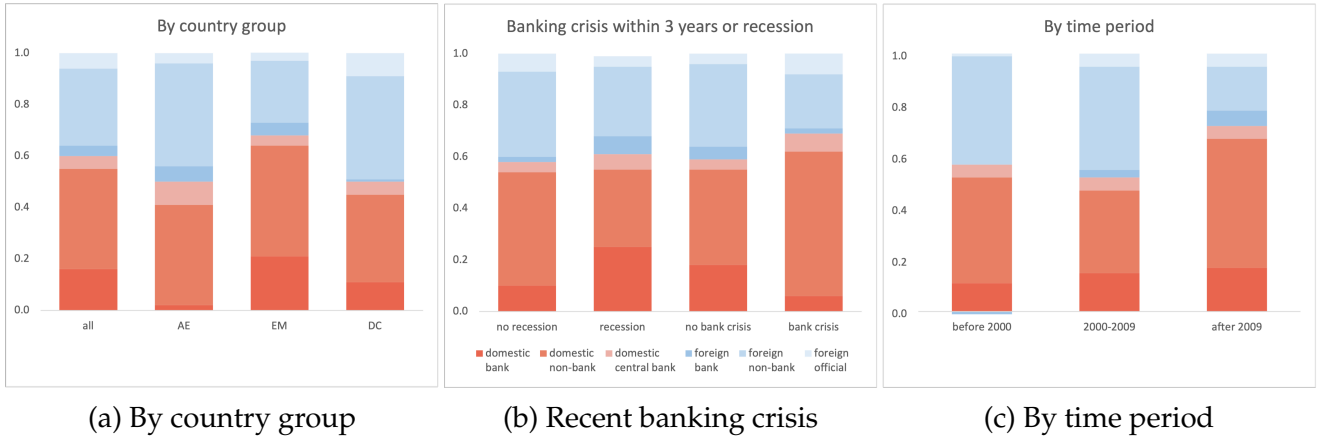
Figure 4: Marginal Holders

(a) Advanced economies   (b) Emerging market economies   (c) Developing countries
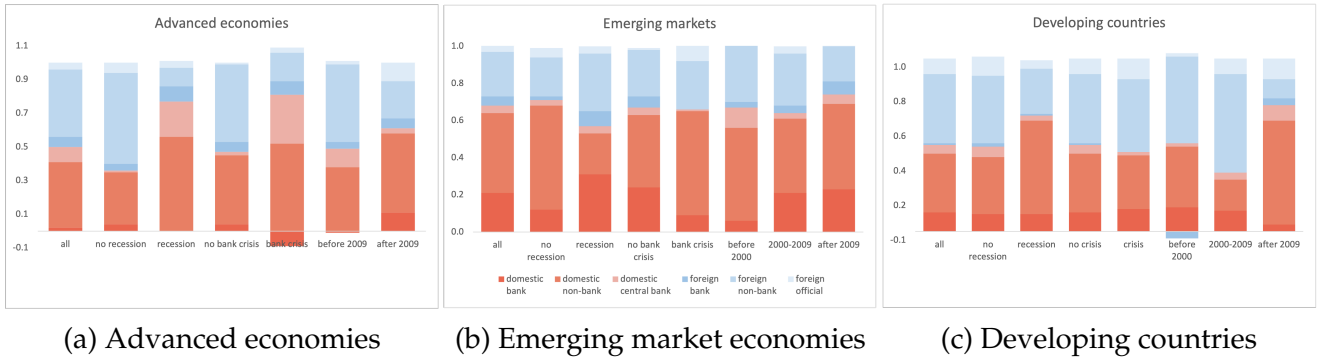
3 Investors and Characteristics of Sovereign Debt

The analysis above demonstrates how the composition of investor holdings in sovereign debt vary across the types of issuers, showing the importance of the Non-bank private investor group. In this section, we explore the characteristics that drive these distinct investor groups, based upon variables noted to be important in the EM and AE literature. As one example, Du and Schreger (2016a) have shown that the currency composition of externally-held debt of emerging market sovereigns has significantly shifted toward local currency rather than dollars or other global currencies. Although the literature so far has presumed that these changes represent the preferences of issuing countries, the results above highlight the potential differences in responses across investor groups, as well.

Therefore, in this section, we examine the empirical relationship between characteristics

and holders to understand how investors relate to these measures. We focus only on the private sector holdings because central bank and other official sector holdings are likely determined by quite distinct policy-related motives. We also exclude the U.S. from the group of AE countries, given its special status as the global safe asset. Clearly, even though the focus is on private investor holdings, we cannot say whether these patterns are driven by investor demand or issuer supply. Nevertheless, they provide an important look into the investor behavior in this market and how it differs across different types of investors. Section 5 seeks to provide economic intuition for some of these relationships.

For this investigation, we again turn to different parts of the literature. First, one set of papers has studied how investor groups respond to different macroeconomic variables including country-level economic growth and openness (e.g. Koijen and Yogo (2020)). Therefore, Section 3.1 begins by examining the impact of variations in these macro variables on investor holdings. Next, Section 3.2 relates these holdings to variations in country-level financial variables as factors driving investor holdings. Finally, Section 3.3 considers the impact of global shocks on the differences in investor holdings. The behavior of these shocks have been central to discussion of how investors in both AE and EM government debt respond to global uncertainty (e.g., Miranda-Agrippino and Rey (2021), Gourinchas and Rey (2007), Aguiar and Gopinath (2007)).

3.1 Relationships between holdings and country-level macro factors

We begin by looking at the overall cross-section relationship between investor holdings and macro factors. In order to capture the time-variation in investor holdings in response to these macro factors, we use the Fama and MacBeth (1973) approach of regressing the holdings on the macro variables for each year and then averaging the coefficients over time, correcting for time-series correlation. Tables 2 and 3 report these basic cross-sectional relationships of investor holdings of AE and EM country sovereign debt, respectively. The tables report the responses of investor group holdings in response to a set of macro variables: GDP growth, exchange rate stability, institutional quality, capital account openness,

and trade openness (trade/GDP).[16] Including measures of trade and capital account openness follows Koijen and Yogo (2020).

Comparing investor responses across Advanced and Emerging Market countries in Tables 2 and 3 highlights interesting similarities and differences. Columns (1) and (2) show that both AE and EM foreign investor groups generally increase their holdings of sovereign government debt when the exchange rate is stable, institutional quality is high and capital accounts are more open. By contrast, foreigners tend to increase holdings when the growth rate is high for AE countries, though that relationship is negative (albeit insignificant) for EM countries. More strikingly, AE domestic investors tend to decrease their holdings of their own government debt while EM domestic investors increase these holdings when the real GDP growth is high. Columns (3) and (4) consider aggregations of investor groups into Total Banks and Total Non Banks as the sum of Domestic and Foreign investors in these categories, while columns (5) to (8) report these groups separately. This illuminates, for instance, that with better institutions, foreign banks' share increases most consistently (statistically significantly) in AEs, but in EMs foreign non-banks drive the patterns. Foreign banks' share responds positively to exchange rate stability in AEs, but not in EMs. In both sets, domestic banks drive the domestic patterns with real GDP growth, but with a decreasing share in AEs and an increasing share in EMs.

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[16]Institutional quality is proxied by the Polity V index, which captures democratic and autocratic tendencies in governments. Capital account openness and exchange rate stability are indices ranging from 0 to 1, taken from Aizenman, Chinn, and Ito (2010).

Table 2: Investor Holdings and Macro Factors - Advanced Economies

	(1) Dom Priv	(2) For Priv	(3) Bank Total	(4) NonBank Total	(5) Dom Bank	(6) Dom NonBank	(7) For Bank	(8) For NonBank
Real GDP growth$_{it}$	-2.794**	3.816***	-1.906***	2.928**	-1.970**	-0.824	0.0641	3.752***
	(1.133)	(1.162)	(0.617)	(1.045)	(0.745)	(0.677)	(0.328)	(0.954)
Exports/GDP$_{it}$	-0.0573	-0.00867	0.0326	-0.0985	0.0119	-0.0692	0.0207	-0.0293
	(0.0480)	(0.0763)	(0.0348)	(0.0818)	(0.0327)	(0.0484)	(0.0249)	(0.0902)
Capital account openness$_{it}$	80.51***	23.73	29.25**	74.98***	43.99***	36.52***	-14.74*	38.46*
	(14.00)	(22.95)	(11.71)	(15.26)	(5.126)	(12.52)	(7.715)	(20.31)
Exchange rate stability$_{it}$	-37.15***	34.43***	10.66***	-13.38***	1.291	-38.44***	9.365***	25.06***
	(3.482)	(2.962)	(3.031)	(3.181)	(2.167)	(2.190)	(2.147)	(2.782)
Institutional quality$_{it}$	-3.279***	2.339*	0.441	-1.380	-0.162	-3.117***	0.602***	1.736
	(0.957)	(1.192)	(0.312)	(1.099)	(0.312)	(0.850)	(0.206)	(1.319)
Constant	37.85**	-45.43***	-6.991	-0.583	-17.21**	55.06***	10.22	-55.64***
	(15.23)	(12.35)	(13.93)	(6.808)	(6.862)	(14.59)	(8.844)	(11.47)
Observations	358	358	358	358	358	358	358	358
R^2	0.601	0.532	0.253	0.376	0.192	0.548	0.503	0.486

Fama-MacBeth estimates. Observations are at the country level. Dependent variable is the share of sovereign debt held by the group indicated in the column title. Standard errors are Newey-West adjusted.
* p < 0.10, ** p < 0.05, *** p < 0.01

Table 3: Investor Holdings and Macro Factors - Emerging Markets

	(1) Dom Priv	(2) For Priv	(3) Bank Total	(4) NonBank Total	(5) Dom Bank	(6) Dom NonBank	(7) For Bank	(8) For NonBank
Real GDP growth$_{it}$	0.874*	-0.455	0.112	0.307	0.339*	0.536	-0.226***	-0.229
	(0.494)	(0.358)	(0.175)	(0.365)	(0.193)	(0.501)	(0.0712)	(0.316)
Exports/GDP$_{it}$	0.155**	0.159***	0.0724	0.241***	0.0428	0.112***	0.0295	0.129***
	(0.0597)	(0.0485)	(0.0427)	(0.0405)	(0.0460)	(0.0397)	(0.0194)	(0.0386)
Capital account openness$_{it}$	-1.141	13.39***	10.15***	2.102	4.343*	-5.483*	5.809***	7.585***
	(3.407)	(2.339)	(2.600)	(2.994)	(2.279)	(3.096)	(0.610)	(1.888)
Exchange rate stability$_{it}$	-32.06***	10.60***	-7.407	-14.04***	-7.769	-24.29***	0.362	10.24***
	(5.861)	(3.531)	(5.144)	(4.005)	(4.549)	(5.890)	(1.067)	(3.374)
Institutional quality$_{it}$	-1.261***	0.989***	-1.094***	0.822***	-0.980***	-0.282*	-0.114*	1.103***
	(0.199)	(0.141)	(0.112)	(0.106)	(0.126)	(0.155)	(0.0580)	(0.126)
Constant	71.08***	-1.426	31.47***	38.18***	29.20***	41.88***	2.270*	-3.696
	(3.721)	(3.132)	(2.208)	(2.962)	(2.579)	(3.694)	(1.183)	(3.163)
Observations	800	800	800	800	800	800	800	800
R^2	0.314	0.459	0.289	0.234	0.253	0.243	0.353	0.415

Fama-MacBeth estimates. Observations are at the country level. Dependent variable is the share of sovereign debt held by the group indicated in the column title. Standard errors are Newey-West adjusted.
* p < 0.10, ** p < 0.05, *** p < 0.01

These relationships demonstrate how the holdings of sovereign debt by various investor groups relate to fixed or slow-moving macro variables over the full period. However, this may obscure shorter term variations in these holdings. Therefore, we next examine in a panel-data setup changes in holdings as a share of debt, as in Section 2, on variables that exhibit more variation; in particular, changes in inflation and exports/GDP in addition to GDP growth. These results are reported in Tables 4 and 5 for AE and EMs, respectively. Although these regressions produce smaller R-squareds - here, reported as the within R-squared of a fixed effects regression - they confirm in a dynamics setting the previous result that for investors of AE government debt, domestic investors reduce holdings in response to GDP growth in AEs and foreigners increase these holdings, while the opposite occurs in EMs.

Table 4: Changes in Investor Holdings and Macro Factors - Advanced Economies

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| | | Dom | For | Bank | NonBank | Dom | Dom | For | For |
	All	Priv	Priv	Total	Total	Bank	NonBank	Bank	NonBank
Real GDP growth$_{it}$	-0.747	-0.421**	0.143	0.128	-0.307	0.0519	-0.347*	0.0817	0.112
	(0.486)	(0.183)	(0.421)	(0.207)	(0.426)	(0.128)	(0.173)	(0.0946)	(0.358)
Δ Inflation$_{it}$	120.7	94.82**	-22.80	-3.958	71.98	-30.10	89.79**	21.65*	-48.72
	(95.30)	(39.25)	(42.39)	(14.02)	(76.09)	(21.83)	(41.07)	(11.69)	(29.47)
Δ Exports/GDP$_{it}$	-0.384**	-0.252**	-0.0776	0.0466	-0.362***	0.0746	-0.327***	-0.0408*	-0.0403
	(0.151)	(0.116)	(0.0846)	(0.0992)	(0.111)	(0.0784)	(0.0791)	(0.0222)	(0.0760)
Observations	355	355	355	355	355	355	355	355	355
R^2	0.0544	0.0483	0.00398	0.00449	0.0276	0.0174	0.0535	0.0240	0.0114
Countries	22	22	22	22	22	22	22	22	22
CountryFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TimeFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Balanced panel regression estimates. Sample spans 2001-2017. Dependent variable is the change in holdings of the group indicated in the column title, normalized by lagged total debt of the sovereign. Errors are clustered at the country level. * p < 0.10, ** p < 0.05, *** p < 0.01

Table 5: Changes in Investor Holdings and Macro Factors - Emerging Markets

	(1) All	(2) Dom Priv	(3) For Priv	(4) Bank Total	(5) NonBank Total	(6) Dom Bank	(7) Dom NonBank	(8) For Bank	(9) For NonBank
Real GDP growth$_{it}$	-0.444	0.0655	-0.282*	0.0117	-0.280	-0.0318	0.109	0.0623**	-0.305**
	(0.334)	(0.255)	(0.143)	(0.107)	(0.260)	(0.0794)	(0.223)	(0.0251)	(0.142)
Δ Inflation$_{it}$	5.669	7.611	-6.073	-23.68***	29.87	-23.30***	27.32	-0.452	-5.749
	(21.81)	(18.40)	(10.16)	(6.233)	(19.50)	(5.748)	(17.69)	(1.472)	(9.400)
Δ Exports/GDP$_{it}$	-0.648**	-0.445**	-0.123	-0.0754	-0.521**	-0.0472	-0.393***	-0.0142	-0.0979
	(0.254)	(0.176)	(0.113)	(0.0726)	(0.205)	(0.0509)	(0.145)	(0.0206)	(0.104)
Observations	755	755	755	755	755	755	755	755	755
R^2	0.0330	0.0229	0.0167	0.0324	0.0295	0.0365	0.0263	0.00810	0.0187
Countries	44	44	44	44	44	44	44	44	44
CountryFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TimeFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Balanced panel regression estimates. Sample spans 1997-2017. Dependent variable is the change in holdings of the group indicated in the column title, normalized by lagged total debt of the sovereign. Errors are clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In summary, these patterns suggest that foreign versus domestic investors are significantly motivated by different macro factors depending upon whether the issuer is AE or EM. More strikingly, these differences may not follow the expected pattern. For instance, In EMs (and in the EM literature), higher GDP growth signals better economic conditions and opportunities, inviting more foreign investment. Informing this, we find that high GDP growth countries have higher participation by domestic banks, though transitory increases in GDP growth may attract some foreign banks. Patterns for AE investors are quite difference along these lines.

3.2 Relationships between holdings and country-level financial factors

In addition to macro variables, country-level financial factors may drive investor decisions. We therefore analyze a set of these variables. In particular, a driver in standard models of government debt is the yield on the outstanding sovereign debt itself.[17] In addition, we examine the local currency rate of exchange rate depreciation and the gross return on the country stock market. These three variables relate to country-level returns in local bonds, equity, and currency markets, and so represent various country-specific investor returns at the country level.

The results for these financial factors in AEs are in Table 6. As with macro factors, the differences between domestic and foreign investors is particularly striking for investors of AE government debt. As shown in columns (2) and (3), increases in the long term government bond yield is significantly related to increases in domestic holdings but decreases in foreign holdings. Moreover, these differences are not related to total banks versus non-banks as columns (4) and (5) indicate, but rather the differences between the domestic versus foreign counterparts of these institutions.[18] Exchange rate depreciation, by contrast, is related to a

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[17]We consider changes in the 10-year yields on sovereign bonds. When data for 10 year yields is not available, we use changes in 5-year yields.

[18]One potential explanation of this pattern is the "flight to safety" incentive by global investors. When global investors are in need of safe assets, they rush to hold AE government debt, which suppresses the yields to these securities. That is, the causality in the relationship could run from changes in investor holdings to the yields themselves.

decline in government debt issuance, largely associated with decreased holdings by foreigners. Changes in investor holdings of AE sovereign debt appear to be relatively insensitive to gross stock returns.

Table 6: Changes in Investor Holdings and Financial Factors - Advanced Economies

	(1) All	(2) Dom Priv	(3) For Priv	(4) Bank Total	(5) NonBank Total	(6) Dom Bank	(7) Dom NonBank	(8) For Bank	(9) For NonBank
Δ LT Yield$_{it}$	52.81	147.3***	-150.0***	33.87	-27.99	52.11**	117.0**	-20.45**	-136.3***
	(48.62)	(36.36)	(42.36)	(29.06)	(58.29)	(23.88)	(42.58)	(8.378)	(34.52)
Δ Exchange rate$_{it}$	-32.91***	7.486	-35.66***	-14.56*	-13.33	-7.083	13.19	-7.873**	-27.58**
	(10.55)	(10.57)	(12.39)	(7.066)	(10.57)	(5.799)	(9.534)	(3.487)	(10.09)
Δ Stock market index$_{it}$	-0.421	-1.879	-3.496	2.365	-5.707	2.861	-4.190	-0.394	-2.633
	(5.197)	(3.914)	(5.991)	(2.403)	(5.280)	(1.955)	(3.596)	(1.458)	(4.827)
Observations	343	343	343	343	343	343	343	343	343
R^2	0.0480	0.0723	0.118	0.0692	0.0107	0.0699	0.0724	0.0527	0.106
Countries	21	21	21	21	21	21	21	21	21
CountryFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TimeFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Balanced panel regression estimates. Sample spans 2001-2017. Dependent variable is the change in holdings of the group indicated in the column title, normalized by lagged total debt of the sovereign. Errors are clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

We next consider these same financial factors to an investor holding EM debt. As above, we explore these relationships over time using a balanced panel regression. In addition to the changes in yields, exchange rates, and stock market indices, we include another variable - the change in the local currency-denominated share of debt issued in international markets.[19] Local currency sovereign debt held by foreigners has increased over time for many emerging markets, as noted by Du and Schreger (2016a) and studied by a number of papers including Du and Schreger (2016b) and Ottonello and Perez (2019). Thus, although we do not have data on the currency denomination of debt held by investor group, we can examine how the investor group holdings overall co-move with any changes in this local currency debt share.

The results are in Table 7. Unlike investors in the AE market, columns (2) and (3) show that domestic versus foreign EM investors are relatively unrelated to the changes in the long term yield or to the exchange rate depreciation. Rather, as reported in columns (4) through (6), increases in the yield and exchange rate depreciation lead to significant declines in domestic bank investor holdings. This may suggest reduced domestic bank holdings during perceived risky times. As with AE, sovereign debt holdings are generally unrelated to increases in the stock market, although here domestic non-banks reduce their holdings of debt, potentially reflecting a rebalancing toward equities.

The table also shows how changes in the share of local currency-denominated debt in international markets relates to overall holdings by group. As column (3) shows, during periods when the local currency share increased, the holdings by foreign investors significantly declined. Column (9) indicates that this decline is significantly related to changes in holdings by foreign non-banks; foreign banks increase their holdings but insignificantly so. Columns (6) and (7) show that domestic banks and non-banks have opposing responses, with non-banks increasing holdings and banks decreasing them.

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[19]This figures is calculated from the BIS International Debt Securities statistics. This may not necessarily equal the total local currency share of outstanding government debt, but it does capture the share of government debt marketed to foreigners that is in domestic currency.

Table 7: Changes in Investor Holdings and Financial Factors - Emerging Markets

	(1) All	(2) Dom Priv	(3) For Priv	(4) Bank Total	(5) NonBank Total	(6) Dom Bank	(7) Dom NonBank	(8) For Bank	(9) For NonBank
Δ LT Yield$_{it}$	24.27	-16.19	19.45	-40.83**	63.72	-45.85**	34.07	4.765	10.67
	(60.94)	(44.05)	(28.26)	(17.29)	(50.35)	(16.56)	(47.10)	(3.910)	(27.50)
Δ Exchange rate$_{it}$	-8.340	1.724	-3.572	-12.62**	11.80	-10.19**	13.10	-1.991	-1.523
	(8.728)	(7.858)	(4.840)	(4.599)	(11.23)	(4.265)	(9.861)	(1.450)	(5.454)
Δ Stock market index$_{it}$	-3.071	-5.810*	2.162	0.861	-3.142	1.295	-6.401**	-0.355	2.332
	(4.247)	(3.319)	(1.716)	(1.597)	(3.676)	(1.412)	(2.975)	(0.422)	(1.811)
Δ Local curr share$_{it}$	-15.94	4.241	-15.15**	-17.44*	6.555	-21.63**	26.31*	4.337	-19.52**
	(14.68)	(19.40)	(7.056)	(9.317)	(10.09)	(7.976)	(13.39)	(3.924)	(9.368)
Observations	353	353	353	353	353	353	353	353	353
R^2	0.0108	0.0228	0.0179	0.152	0.0599	0.164	0.104	0.0291	0.0171
Countries	28	28	28	28	28	28	28	28	28
CountryFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TimeFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Balanced panel regression estimates. Sample spans 1997-2017. Dependent variable is the change in holdings of the group indicated in the column title, normalized by lagged total debt of the sovereign. Errors are clustered at the country level. * p < 0.10, ** p < 0.05, *** p < 0.01

Taken together, these results point to important data patterns with implications for standard theories along the lines of both the advanced economy and emerging market literatures. These findings suggest the investor group decompositions that are the most empirically relevant for building theoretical models. For example, some papers focus on the differences of foreign and domestic investor groups, while others focus on internal differences in domestic investor groups.[20] Our results suggest that the relevant focus depends upon whether the country is EM or AE and whether the marginal investor is presumed to be a bank or non-bank private investor.

Additionally, within the group of investors holding EM debt, we show that domestic investor group holdings of government debt co-move with the variations in the local-currency-denominated share of internationally issued bonds. In particular, domestic banks reduce, while domestic non-bank investors increase, their debt holdings. Strikingly, foreign non-bank investors significantly reduce their holdings of a country's sovereign debt during periods when the local currency share increases.

These two sets of general findings relate holdings of government debt by investor group to variations of country-level factors. We next consider the impact of global shocks.

3.3 Investors and Responses to Global Financial Shocks

Fluctuations in global financial markets can have a large effect on cross-border financial flows and the behavior of all financial investors.[21] In this section, we again examine variations in holdings across investor groups but now relate them to global financial shocks. As has been argued in a large literature since the Global Financial Crisis (GFC) of 2008-09, intermediation constraints are likely to be binding during periods of global credit tightness. Conversely, during periods of strong global financial growth, these constraints are less severe. To examine the relationship between these global conditions and changes in holdings,

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[20] As noted in the introduction, some papers treat the drivers of equilibrium debt to be the interactions between domestic households and banks (e.g.,Bocola and Lorenzoni (2020) while others focus on the role of large global banks facing heterogeneous sovereign borrowers (e.g., Morelli et al. (2020).

[21] See for example, Miranda-Agrippino and Rey (2021).

we run the following regression:

$$\frac{H^i_{jt} - H^i_{jt-1}}{D_{jt-1}} = \alpha_j + \beta Global_t + \gamma WorldGDPgrowth_t + \epsilon^i_{jt}, \qquad \forall i \qquad (8)$$

where $Global_t$ is a measure of global financial conditions and $WorldGDPgrowth_t$ is a measure of global prosperity proxied by world GDP growth. For $Global_t$, we use growth in the broad dollar index (see Avdjiev, Bruno, Koch, and Shin (2019b)) as well as the growth in the VIX index. An increase in either is an indication that global financial conditions are tighter, although they can capture different aspects/roots of such a tightening. For instance, the VIX is typically thought to capture global risk aversion or investor sentiment, whereas rises in the dollar may generate binding financial constraints for global intermediaries exposed to many different currencies (Bruno and Shin (2015)).

Tables 8 and 9 display the results of these regressions for the AE and EM debt holders, respectively. In contrast to the country-level relationships, the responses of AE and EM investors are broadly similar. For example, when the dollar appreciates, sovereign debt holdings generally decline with the exception of the domestic non-bank investor group. Moreover, when the VIX increases, investors across groups increase their holdings of government debt, with the exception of foreign non-bank holdings of EM debt. By contrast, increases in world GDP growth is relatively unrelated to government debt holdings with the exception of domestic bank investors who reduce their holdings. Again, this pattern holds across both AE and EM debt holders.

Table 8: Changes in Investor Holdings and Global Factors - Advanced Economies

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| | | Dom | For | Bank | NonBank | Dom | Dom | For | For |
	All	Priv	Priv	Total	Total	Bank	NonBank	Bank	NonBank
Broad Dollar growth$_t$	-84.03***	-14.20*	-47.17***	-44.92***	-15.60*	-31.67***	17.55**	-12.82***	-34.24***
	(5.558)	(7.731)	(6.765)	(4.919)	(8.025)	(3.557)	(8.070)	(2.891)	(5.439)
$\Delta \log(\text{VIX}_t)$	9.137***	7.499***	1.347	1.056	8.086***	1.022*	6.205***	-0.00393	1.239
	(1.791)	(0.864)	(1.437)	(0.634)	(1.783)	(0.524)	(0.731)	(0.284)	(1.284)
World GDP growth$_t$	-0.763	-0.195	-0.684	-1.266***	0.263	-0.967***	0.783**	-0.280*	-0.362
	(0.600)	(0.365)	(0.547)	(0.187)	(0.520)	(0.206)	(0.290)	(0.136)	(0.420)
Observations	366	366	366	366	366	366	366	366	366
R^2	0.130	0.0692	0.103	0.305	0.0699	0.272	0.118	0.0959	0.0689
Countries	22	22	22	22	22	22	22	22	22
CountryFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TimeFE	No	No	No	No	No	No	No	No	No

Balanced panel regression estimates. Sample spans 2001-2017. Dependent variable is the change in holdings of the group indicated in the column title, normalized by lagged total debt of the sovereign. Errors are clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Changes in Investor Holdings and Global Factors- Emerging Markets

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| | | Dom | For | Bank | NonBank | Dom | Dom | For | For |
	All	Priv	Priv	Total	Total	Bank	NonBank	Bank	NonBank
Broad Dollar growth$_t$	-40.98***	-6.976	-23.86***	-22.71***	-7.841	-17.48***	10.16	-5.050***	-19.26***
	(10.98)	(7.339)	(5.749)	(5.074)	(8.878)	(4.426)	(6.375)	(1.567)	(5.715)
$\Delta \log(VIX_t)$	3.684*	4.639**	-1.428*	-0.938	4.091**	-0.732	5.453***	-0.146	-1.299**
	(1.893)	(1.728)	(0.746)	(0.781)	(1.521)	(0.656)	(1.569)	(0.351)	(0.643)
World GDP growth$_t$	-0.997**	-0.252	0.0306	-0.629***	0.433	-0.589***	0.515	0.0161	0.0373
	(0.433)	(0.316)	(0.224)	(0.204)	(0.420)	(0.164)	(0.319)	(0.0789)	(0.226)
Observations	779	779	779	779	779	779	779	779	779
R^2	0.0301	0.0166	0.0494	0.0845	0.0161	0.0768	0.0549	0.0177	0.0380
Countries	45	45	45	45	45	45	45	45	45
CountryFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TimeFE	No	No	No	No	No	No	No	No	No

Balanced panel regression estimates. Sample spans 2001-2017. Dependent variable is the change in holdings of the group indicated in the column title, normalized by lagged total debt of the sovereign. Errors are clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Thus, we find that holdings of AE and EM investor groups respond relatively similarly to global factors. These factors change financing conditions generally, rather than in specific countries, which may explain why patterns across countries are different. Still, these results are important in highlighting the difference in behavior across investor groups, which sheds further light on the ways in which e.g. the global financial cycle affects financial investments and decisions.

4   The Role of Non-Bank Investors

As we showed above, private investors who are not banks play an important role in the sovereign debt market. Strikingly, Section 2 showed that changes in sovereign debt outstanding corresponded to a significantly higher response in ownership by this investor group over any others. Then Section 3 demonstrated that holdings of this investor group responded differently to country-level macro and financial factors than domestic banks, particularly for EM countries. Moreover, investor holdings respond fairly similarly in response to changes in global factor shocks across investor groups, with the exception of foreign non-bank investors. A common thread in these results is the importance of non-bank private investors.

The important role of non-bank private investors implied by these results raises the obvious questions: who are these investors and what are their motivations in holding debt? To shed light on this, we turn to a more disaggregated data set: the Euro area securities holding statistics produced by the European Central Bank. In particular, this data set provides data on the holdings of securities by sector of the holder, by the type and sector of the security, and by the residence of the security issuer. Thus, we can observe the holdings of individual government debt for all Euro area investors within a given holder group. For our purposes, the non-bank sector in this data has a more granular breakdown: (a) households and non-profits, (b) insurance and pensions, (c) non-financial corporations; and (d) "other financial institutions" which includes entities like hedge funds and mutual funds. As above,

we also study the holdings by banks and the official sector (in this data, just the government, excluding the central bank). These data are quarterly and span 2013q4-2020q3.

4.1 Disaggregated Marginal Investor Groups

In order to better understand the role of non-bank investors, we replicate the decomposition of marginal investors in the government debt market by estimating equation (5). One issue that is different from the aggregate data, however, is that the data are collected for the Euro area as a group. Therefore, there is no natural counterpart to domestic investors. For this reason, we focus only on holdings by Euro area investors of sovereign debt by countries outside of the Euro area. So, this relates to the foreign non-bank part of the aggregated data presented previously. Moreover, since the Euro area investors only hold a portion of total government debt by these countries, we aggregate across debt holdings within the area to measure total debt. Thus, the estimates provide a decomposition of overall holdings by Euro area investors only, and do not represent the aggregate debt outstanding.[22]

Table 10 shows the results of the regression. Similar to the aggregate data, Columns (1) to (3) show that Non Bank private investors generally take on additional sovereign debt held in the Euro area. For the base case of all countries, $0.77 of every additional $1 of sovereign debt is held by NonBanks, while only $0.23 is held by Banks, and that amount is *de minimis* for Governments. These general patterns hold for all cases except for Advanced Economies in the baseline estimates in Panel A, where banks seem to absorb the largest share of the increase. However, when we weight by size in Panel B, non-banks are again the larger marginal investor in aggregate among this set of Euro area investors. This difference can be driven by the large role played by banks in Europe, as well as increasing holdings of U.S. Treasuries by euro area non-banks.

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[22]As with Section 2, we include all countries (of the sovereign) in the decomposition, including the US. For the Euro area investors, the US provides an important potential Advanced Economy for debt holdings.

Table 10: Marginal Holders of Sovereign Debt - Euro Area

	(1) Gov	(2) Banks	(3) NonBank	(4) HH	(5) InsurPens	(6) NFC	(7) OthFin
Panel A: Baseline							
All	0.00***	0.23***	0.77***	0.01	0.14**	0.00*	0.85***
	(0.00)	(0.07)	(0.07)	(0.01)	(0.06)	(0.00)	(0.12)
AE	0.00	0.53***	0.47***	0.02	0.12*	0.01	0.85**
	(0.00)	(0.14)	(0.14)	(0.01)	(0.06)	(0.01)	(0.29)
EM	0.00***	0.10*	0.90***	0.01	0.14*	0.00	0.85***
	(0.00)	(0.05)	(0.05)	(0.01)	(0.07)	(0.00)	(0.12)
Panel B: Weighted by D_{jt-1}							
All	0.01	0.23***	0.77***	0.01	0.07***	0.03	0.89***
	(0.00)	(0.06)	(0.06)	(0.00)	(0.02)	(0.03)	(0.11)
AE	0.01	0.27**	0.73***	0.00	0.06**	0.04	0.89***
	(0.01)	(0.09)	(0.09)	(0.00)	(0.02)	(0.04)	(0.17)
EM	0.01***	0.11**	0.89***	0.02	0.10***	0.00*	0.88***
	(0.00)	(0.04)	(0.04)	(0.01)	(0.03)	(0.00)	(0.06)

Importantly, columns (4) to (7) provide a decomposition within the Non-bank investor group. In the Baseline case, Insurance and Pensions take on roughly 14% of the additional debt. However, these holdings are dwarfed by the 85% absorbed by the "other financial institutions" such as hedge funds and mutual funds. By contrast, the other two categories of Households and Non-financial companies essentially take on little to none of the additional government debt. This is similar across both AEs and EMs.

4.2 Non Bank Investors and Financial Factors

This more granular look at non bank investors allows us to re-evaluate the relationships between holdings and asset market factors. Given our shorter data set and higher frequency, we focus in particular on the changes in financial factors and global factors.

Tables 11 and 12 report for AE and EM, respectively, the panel regression estimates for the change in the investor group holdings and financial factors considered in the aggregate analysis. The overall relationships reported in columns (1) to (4) broadly follow the aggregate analysis above. For example, local currency depreciation is related to a decline in holdings, primarily driven by Non Banks for both AE and EM. Moreover, investor group holdings are relatively unrelated to increases in the yield with the exception of Non Bank holdings of EM debt. Finally, increases in the share of local currency-denominated debt in international markets co-move with a decline in Euro area holdings, led by a decline in Non Bank investors. Once again, therefore, this group of investors represents important patterns that drives the overall sovereign debt holdings.

Columns (5) to (8) in these same tables provide a more disaggregated look at the patterns. First, the exchange rate depreciation correlation with decline in holdings is driven by Other Financial institutions for both AE and EM countries. Moreover, the decomposition shows that the increase in Non Bank holdings of EM debt noted in Column (4) is due to outsized increases by Other Financials, as Households contract. Thus, within the Non Bank investor universe, many of the important patterns are driven by the Other Financial investors, largely comprised of hedge funds and mutual funds.

The change in the share of local currency denominated debt for EM countries represents one exception. In this case, increases in this share is related to declines in holdings across Households, Insurance and Pensions, and Other Financials alike.

Therefore, this evidence from the Euro area suggests that financial institutions that are mutual funds and hedge fund related to important patterns in the overall Non Bank investor group. This is also consistent with insurance and pension investors largely being less active in trading and aimed more at holding assets for longer periods.

Table 11: Changes in Euro Area Holdings and Financial Factors - Advanced Economies

	(1) All	(2) Gov	(3) Banks	(4) NonBank	(5) HH	(6) InsurPens	(7) NFC	(8) OthFin
Δ LT Yield$_{it}$	-7.847*	0.306	-1.980	-6.174	-0.004	-0.551	-0.037	-5.582
	(3.761)	(0.196)	(2.219)	(4.572)	(0.168)	(0.364)	(0.114)	(4.344)
Δ Exchange rate$_{it}$	-0.594**	-0.014	-0.012	-0.569***	-0.010	0.005	-0.011	-0.553***
	(0.184)	(0.015)	(0.087)	(0.146)	(0.009)	(0.038)	(0.008)	(0.153)
Δ Stock market index$_{it}$	0.202	-0.006	0.177**	0.031	0.001	0.016	-0.000	0.015
	(0.132)	(0.010)	(0.072)	(0.081)	(0.003)	(0.012)	(0.003)	(0.077)
Observations	152	152	152	152	152	152	152	152
R^2	0.049	0.024	0.017	0.069	0.012	0.003	0.010	0.075
Countries	8	8	8	8	8	8	8	8
CountryFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TimeFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Balanced panel regression estimates. Sample spans 2013-2018. Dependent variable is the change in holdings of the group indicated in the column title, normalized by lagged total debt of the sovereign. Errors are clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.3 Non Bank Investors and Global Factors

We now re-examine the relationship between global shocks and this more granular set of Non Bank investor groups. Tables 13 reports the panel regression results using, as before, the growth of the dollar and the VIX. Once again, the importance of the Non Bank investment group and, within that, the Other Financial group stands out. As Columns (1) to (3) show, increases in the VIX and declines in the dollar are generally related to declines in holdings, but only significantly so for Non Banks. Moreover, the disaggregated group of investors in Columns (4) to (7) highlight once again that these patterns are driven by Other Financial investors. With the exception of Non Financial Corporations responses to

Table 12: Changes in Euro Area Holdings and Financial Factors - Emerging Markets

	(1) All	(2) Gov	(3) Banks	(4) NonBank	(5) HH	(6) InsurPens	(7) NFC	(8) OthFin
Δ LT Yield$_{it}$	0.239	-0.002	0.014	0.228*	-0.025***	-0.042	-0.001	0.296**
	(0.153)	(0.007)	(0.074)	(0.127)	(0.006)	(0.101)	(0.002)	(0.122)
Δ Exchange rate$_{it}$	-0.247**	-0.007**	-0.017	-0.223*	0.003	0.052	0.000	-0.278***
	(0.112)	(0.002)	(0.019)	(0.115)	(0.003)	(0.070)	(0.001)	(0.082)
Δ Stock market index$_{it}$	-0.036	-0.003	-0.010	-0.022	0.003*	0.040	-0.000	-0.065*
	(0.038)	(0.002)	(0.017)	(0.040)	(0.002)	(0.043)	(0.001)	(0.037)
Δ Local curr share$_{it}$	-1.092***	-0.073***	0.002	-1.020***	-0.028***	-0.841***	0.003	-0.155*
	(0.073)	(0.003)	(0.027)	(0.078)	(0.004)	(0.023)	(0.003)	(0.082)
Observations	280	280	280	280	280	280	280	280
R^2	0.029	0.090	0.001	0.033	0.008	0.088	0.000	0.024
Countries	15	15	15	15	15	15	15	15
CountryFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TimeFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Balanced panel regression estimates. Sample spans 2013-2018. Dependent variable is the change in holdings of the group indicated in the column title, normalized by lagged total debt of the sovereign. Errors are clustered at the country level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

the dollar appreciation rate as reported in Column (6), no other subgroup of investors has a significant relationship with the global shock measures.

Overall, this section has looked at the investor groups at a more disaggregated level by examining the relationships for the Euro area portion of the sovereign debt investor universe. This analysis has demonstrated that the broad findings in the aggregate level continue to hold; that is, Non Bank investors appear to be the most responsive to variations in overall sovereign debt holdings. More importantly, however, it has provided a peek into who are the relevant investors within this large group. Here we have shown that the group of investors that appears most important to explain comovements is "Other Financial institutions" representing entities like hedge funds and mutual funds.

In the next section, we begin to sketch a conceptual framework to evaluate these results.

5 Conceptual framework - IN PROGRESS

Above, we have documented above a number of important empirical regularities between investor groups and sovereign issuers. While our purpose in this paper is solely to document these relationships for future research, it is instructive to provide a conceptual frame-

Table 13: Global financial conditions and euro area investment in sovereign debt

	(1) Gov	(2) Banks	(3) NonBank	(4) HH	(5) InsurPens	(6) NFC	(7) OthFin
Panel A: All Countries							
Broad Dollar growth$_t$	0.002	0.094*	0.229***	0.004	0.001	0.005**	0.218***
	(0.003)	(0.052)	(0.056)	(0.003)	(0.015)	(0.002)	(0.058)
$\Delta \log(VIX_t)$	-0.000	-0.010	-0.052***	-0.002	-0.005*	0.001	-0.045***
	(0.000)	(0.009)	(0.013)	(0.001)	(0.003)	(0.001)	(0.012)
Panel B: AE Countries Only							
Broad Dollar growth$_t$	0.005	0.155	0.265**	0.000	-0.006	0.011*	0.259**
	(0.007)	(0.130)	(0.082)	(0.002)	(0.026)	(0.005)	(0.080)
$\Delta \log(VIX_t)$	0.000	-0.017	-0.020	-0.000	-0.005	0.001	-0.016
	(0.000)	(0.026)	(0.012)	(0.001)	(0.006)	(0.001)	(0.012)
Panel C: EM Countries Only							
Broad Dollar growth$_t$	0.000	0.061	0.208**	0.006	0.005	0.002	0.195**
	(0.003)	(0.040)	(0.076)	(0.004)	(0.019)	(0.001)	(0.081)
$\Delta \log(VIX_t)$	-0.001	-0.006	-0.068***	-0.002	-0.005*	0.000	-0.061***
	(0.000)	(0.005)	(0.018)	(0.002)	(0.003)	(0.001)	(0.015)

work to interpret these relationships in light of the data structure above.

To formalize these ideas, we purposefully do not develop a full equilibrium model but rather a structure that treats both the demand and supply side of the sovereign debt market as being driven by the same factors analyzed above. Given this structure, we intend to provide comparative statics to provide context to the questions surrounding increasing government debt described in the introduction.

5.1 Investors

Investors "demand" sovereign debt holdings over all countries according to the availability of debt with these same characteristics, $\mathbf{Z}_{j,t}$, as well as the macroeconomic variables that may reflect the credit-worthiness of the borrowers, $\mathbf{X}_{j,t}$. This demand may be summarized generally as the outcome of a general two-step portfolio decision. In the first step, investors

decide their allocation to sovereign debt as a share of total assets. In the second step, they decide which sovereigns to invest in.[23] As described below, one implication of this two step process is that investors decide overall debt and equity portfolio shares before country-specific asset allocations. As such, holdings of sovereign debt of a country may be largely independent of country-level stock returns, a pattern we observed in the analysis above.

To explain in more detail what this two-step process means at the investor group level, we illustrate the example with the decisions of the foreign investor groups. The domestic investors generally follow the same format, although with important differences in interpretation as described later.

First consider the decision of the investors to hold an allocation of their portfolio in sovereign debt compared to other assets. Defining the net wealth of foreign investor group i as N^i_{Ft}, this share is given as:

$$f^{i,N}_t \equiv F^i_t / N^i_{Ft} \tag{9}$$

Specifically, the superscript N signifies that this variable represents total holdings by the investor group as a share of its total net wealth. Similarly, the portfolio share of country j sovereign debt as a share of total sovereign debt holdings by foreign investor i is defined as the share:

$$f^{i,F}_{jt} \equiv F^i_{jt} / F^i_t \tag{10}$$

In this case, the superscript F denotes that this variable is a share of the overall holdings of sovereign debt by this investor group. Using these two share definitions, it is clear that the holdings of each investor group can be rewritten as:

$$F^i_{jt} \equiv f^{i,N}_t f^{i,F}_{j,t} N^i_{F,t}. \tag{11}$$

We next use these definitions to consider some of the economic relationships that have been described in the literature. Although our analysis does not depend upon these specifi-

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[23]Koijen and Yogo (2020) use a similar two- step decision to summarize investor decisions at the country level across an allocation into total short term debt, long term debt, and equity.

cations, we provide them as an illustration.

For that purpose, consider the first decision, the decision to hold sovereign debt. Following the literature, we postulate that foreign investors allocate their overall portfolio to sovereign bonds depending upon "global factors" $\mathbf{X}_t^w$.[24] That is, the desired portfolio share of sovereign bonds for foreign investor of group i has the form:

$$f_t^{i,N} = f^{i,N}[\mathbf{X}_t^w] \tag{12}$$

At the same time, the decision for holdings of country j government debt by that same investor *within* the sovereign allocation depends upon country-specific macro-variables and the characteristics of the debt.

$$f_{j,t}^{i,F} = f^{i,F}[\mathbf{X}_{j,t}, \mathbf{Z}_{j,t}; \mathbf{X}_t^w] \tag{13}$$

To illustrate, consider $i = 1$ *"Global Banks."* These banks make loans and take deposits. They may hold sovereign debt as reserves (e.g., AEs) but also make loans internationally. Their overall allocation to this asset group depends upon factors such as the spread between deposits and loans as well as capital restrictions. Thus, their demand decisions may be summarized as:

$$f_t^{1,N} = f^{1,N}[\mathbf{X}_t^w] \tag{14}$$

where, as defined above, $\mathbf{X}_t^w$ is a vector of global variables that impact banks willingness to hold sovereign debt relative to other assets such as private debt or cash. By contrast, the global banks' holdings to country debt with specific characteristics j within this government debt allocation is given by:

$$f_{j,t}^{1,F} = f^{1,F}[\mathbf{X}_{j,t}, \mathbf{Z}_{j,t}; \mathbf{X}_t^w] \tag{15}$$

Thus, the holdings of country j debt by foreign banks can be written as the combination of this two-step decision process:

$$F_{1,t}^i \equiv f^{1,N}[\mathbf{X}_t^w] f^{1,F}[\mathbf{X}_{j,t}, \mathbf{Z}_{j,t}; \mathbf{X}_t^w] N_{F,t}^1 \tag{16}$$

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[24]See for example Gabaix and Maggiori (2015), Fang and Liu (2020), and Morelli et al. (2020).

Consider next the demand by *"Global Non-Banks"* identified by $i = 2$. These investors comprise a large and potentially diverse group of institutional investors. However, the Euro Area data analyzed in Section 4 suggest that the behavior of these Non-Banks are largely driven by mutual funds and hedge funds.[25]

We can summarize the decision along the same dimensions as the two-step analysis as summarized in equation (10) above with similar variables but different responses given by:

$$f_t^{2,N} = f^{2,N}[\mathbf{X}_t^w] \tag{17}$$

and by demand for country debt with specific characteristics j given by:

$$f_{j,t}^{2,F} = f^{2,F}[\mathbf{X}_{j,t}, \mathbf{Z}_{j,t}; \mathbf{X}_t^w] \tag{18}$$

Finally, we consider the investor group $i = 3$ "Foreign Official.", For this group, the motivations are likely to be very different than those of private investors. Nevertheless, we summarize the process in the same way. Official holders are combinations of foreign central banks who may hold sovereign debt for reserve reasons. However, the reserve demand by central banks is largely limited to Advanced Economies.[26] For Emerging Markets, the official demand is likely to be driven by international aid considerations during crisis times (e.g., IMF and World Bank bailouts.) These institutions may also implicitly incorporate target allocations for countries that mimic a portfolio decision process. Thus, this framework provides a natural framework to assess these relationships in the data.

The domestic investors differ from the foreign investors in that these sovereign debt holdings reflect their own government debt. Thus, rather than the two-step decision process above, they decide these shares directly as a consequence of local macro variables, conditional on global variables. Defining the net wealth of domestic "home" investor group i as N_{Ht}^i, this share is defined as:

$$h_t^{i,N} \equiv H_t^i / N_{Ht}^i = h^{i,N}[\mathbf{X}_{j,t}, \mathbf{Z}_{j,t}; \mathbf{X}_t^w], \tag{19}$$

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[25]In ongoing work, we are working on breaking apart the heterogeneity within this aggregate group using dis-aggregated data on funds and institutions.

[26]See Gamba, Hakobyan, Lusinyan, Meads, and Wu (2021).

where as above the superscript N signifies that this variable represents total holdings by the investor group as a share of its total net wealth.

Domestic creditor groups require a different interpretation of the relationships above. Consider first the holdings $h_t^{1,N}$ for $i = 1$ *"Domestic Banks."* These banks typically hold domestic government debt either in response to capital requirements or other macroprudential policies (as they are generally safer, more liquid assets) or even due to financial repression with direct governmental actions. They may hold sovereign debt as reserves (e.g., AEs) but can also make other investments such as loans or holding risky sovereign debt.[27] Next, consider the holdings $h_t^{2,N}$ for $i = 2$ *"Domestic Non-Banks."* As noted previously, these financial institutions are a heterogeneous group of private investors. Nevertheless, we can summarize their aggregate holdings and responses to changes in the issuances of their own country debt. Finally, the holdings, $h_t^{3,N}$ for $i = 3$ *"Domestic Central Banks"* give the shares of their own government debt in the central bank balance sheets. During Quantitative Easing policy actions, this share increased for Advanced Economies.

As this description highlights, the holdings by both foreign and domestic investors can be summarized by the functions, $h_t^{i,N}$ and $f_t^{i,N}$ that depend upon a vector of country-level variables and global shocks.

5.2 Issuers

Government borrowers provide the "supply" of sovereign debt. Although this statement is clearly true in general, it will prove convenient to illustrate the relationship in the context of the emerging market debt literature. In this literature beginning with Eaton and Gersovitz (1981) and adapted by Arellano (2008), the government conducts all borrowing for the economy. Under the additional assumption that all debt is one period, then the aggregate per period resource constraint of the government can be written as:

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[27]Note that while these banks may also hold foreign government debt, our aggregate data does not provide information on those holdings. As such, domestic banks for some advanced economies may also be foreign banks for other countries.

$$C_{j,t} + B_{j,t-1} = Y_{j,t} + q_{j,t}B_{j,t} \tag{20}$$

where for country j, $C_{j,t}$ and $Y_{j,t}$ are consumption and output, respectively, and where $B_{j,t}$ is an internationally traded pure discount bond and q_t^j is the price of that bond. Allowing for longer term coupon debt as in Arellano and Ramanarayanan (2012), Bai, Kehoe, and Perri (2019) generalize this relationship by specifying that the government pays out existing debt as a coupon payment given by: ϕB_t for the first period, $\phi(1 - \phi)B_t$ for the second period, $\phi(1 - \phi)^2 B_t$ for the third period, etc. This stylized approach includes as special cases the one period debt above as $\phi = 1$ and, on the other extreme, a perpetuity as $\phi = 0$. In this case, the budget constraint becomes:

$$C_{j,t} + [q_{j,t}(1 - \phi_j) + \phi_j]B_{j,t-1} = Y_{j,t} + q_{j,t}B_{j,t} \tag{21}$$

Thus, consumption is income $Y_{j,t}$ net of paying current borrowing obligations from the prior period $\phi_j B_{t-1}^j$ and rolling over next period debt with new borrowings, $B_{j,t} - (1 - \phi_j)B_{j,t-1}$ at price q_j. More generally, allowing for investment, government spending, and net exports, the basic balance of payments identity in equation (21) can be generalized to include investment and government spending. For this more general aggregate budget constraint, we can redefine C as domestic absorption and recognize that net current account balances equal the change in the value of bond holdings. We use this interpretation in our empirical measures of openness below.

Consider now an economy in steady state, and thus paying off debt if $B_{j,t} > 0$. Dividing equation (21) by lagged income, defining the ratio to output for any variable X as $x_t \equiv X_t/Y_t$ and dropping j subscripts for parsimony, the relationship can be rewritten as:

$$q_t b_t(1 + \eta_t) - b_{t-1} = (c_t - 1)(1 + \eta_t) \tag{22}$$

where η_t is the growth rate of output, $\ln(Y_t/Y_{t-1})$ Moreover, defining the change in the value of the net foreign position as $\widetilde{D}_t - \widetilde{D}_{t-1} = q_t B_t - [q_t(1 - \phi) + \phi]B_{t-1}$ implies that the

value of the country debt raised per period is:

$$\widetilde{d}_t = (c_t - 1) + \widetilde{d}_{t-1}(1 + \eta_t)^{-1} \tag{23}$$

Note that this debt includes the total debt of the economy so that sovereign and private debt may offset each other; that is, private debt-to-GDP = $\widetilde{d}_t - d_t$. Indeed, some have argued that sovereign debt may play important roles in ameliorating or exacerbating welfare costs of private debt.[28]

These equilibrium relationships imply that the supply of sovereign debt depends upon a number of country-specific macroeconomic variables that we define as a vector process at time t as: $\mathbf{X}_{j,t}$. In particular, this set of variables is a vector of country-specific characteristics that may impact the desire to borrow, including the growth rate of the economy, η_t, and prior sovereign debt-to-output share d_{t-1}.

Another set of variables that impact sovereign debt supply relates to the price of borrowing and the characteristics of these obligations. Clearly, the supply of debt depends negatively upon the direct cost of borrowing. In addition, however, borrowing may entail indirect costs if the debt must be repaid in foreign currency or at undesirable maturity durations. Indeed, recent literature has argued that domestic sovereigns preferred to borrow in their own local currencies rather than foreign currency borrowing that entails greater exchange rate risk.[29] Similarly, countries may face a trade-off of lower borrowing costs in short term maturities that incur greater roll-over risk versus a higher cost of borrowing long term.[30] We combine these direct and indirect costs of borrowing in a vector of pricing variables defined as: $\mathbf{Z}_{j,t}$. Thus, this vector includes, not only the direct cost of debt, $q_{j,t}$, but also indirect costs such as a disadvantageous maturity of debt $\phi_{j,t}$, a higher share of debt denominated in foreign currency, and a higher value of foreign currency that impacts that share.

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[28]See for example, Bocola (2016), Du and Schreger (2016b) and Bocola and Lorenzoni (2020).

[29]See for example Ottonello and Perez (2019), Arellano, Bai, and Mihalache (2020), and Du, Pflueger, and Schreger (2020).

[30]See Arellano and Ramanarayanan (2012) for a development of this argument.

Overall these basic relationships can be then summarized in a general supply of debt-to-GDP relationship:

$$d_t \equiv d(\mathbf{X}_{j,t}; \mathbf{Z}_{j,t}) \tag{24}$$

That is, the share of government debt to output depends upon a vector of country-specific macro-economic variables, $\mathbf{X}_{j,t}$, and borrowing cost characteristics, $Z_{j,t}$. Clearly, then, the supply of debt by country can be written as:

$$D_{j,t} \equiv d(\mathbf{X}_{j,t}; \mathbf{Z}_{j,t})Y_{j,t} \tag{25}$$

We next consider the investor demand for these assets.

5.3 Combining Investors and Issuers

The two sets of measures of total debt implies three relationships that summarize the impact of the country-specific and global variables.

First, to examine the market-clearing condition for debt from each country, we equate the supply of debt in equations (25) to the sum of demand by holders in equation (12) and (13) as well as their counterparts for domestic holders. These equations imply a relationship between the total debt-to-GDP of country j and the total debt held by investors weighted by their own net wealth as:

$$
\begin{aligned}
D_{j,t} &\equiv d(\mathbf{X}_{j,t}; \mathbf{Z}_{j,t})Y_{j,t} = \overline{H}_{j,t} + \overline{F}_{j,t} \\
&= \sum_{i=1}^{3} f^{i,N}[\mathbf{X}_t^w] f^{i,F}[\mathbf{X}_{j,t}, \mathbf{Z}_{j,t}; \mathbf{X}_t^w] N_{F,t}^i + \sum_{i=1}^{3} h^{i,N}[\mathbf{X}_{j,t}, \mathbf{Z}_{j,t}; \mathbf{X}_t^w] N_{H,t}^i
\end{aligned} \tag{26}
$$

Since both the supply and demand for this country-specific debt debts upon the characteristics of the debt, $\mathbf{Z}_t^j$, then these variables are endogenous as well.

Second, we examine the portfolio holdings of each investor i. Summing the demands for each foreign investor's allocation across countries recovers the allocation to sovereigns in equation (12):

$$\sum_{j=1}^{J} F_{it}^j = f_{it}^N N_{it} \sum_{j=1}^{J} f_{it}^{jH} = f_i^N[\mathbf{X}_t^w] N_{it} \tag{27}$$

46

That is, the total sovereign debt by foreign investor *i* is independent of country *j* character-istics.

Last, putting these two relationships together implies:

$$d(\mathbf{X}_t^j; \mathbf{Z}_t^j)Y_t^j = \sum_{i=1}^{3} f_i^H[[\mathbf{X}_t^j, \mathbf{Z}_t^j; \mathbf{X}_t^w] * \widetilde{F}_{it} + \sum_{i=1}^{3} h_i^N[[\mathbf{X}_t^j, \mathbf{Z}_t^j; \mathbf{X}_t^w] * \widetilde{H}_{it} \qquad (28)$$

where $\widetilde{F}$ and $\widetilde{H}$ are the aggregated dollar holdings in sovereign bonds by each investor group. Thus, the demand for each country's debt is the sum of portfolio shares of the investors weighted by their holdings of government debt. Thus, we have used these basic relationships above to consider the impact of variations in holdings and characteristics over time.

This relationship provides a mapping between the investor groups on the one hand and the issuing countries on the other hand. In a full equilibrium model, the factors driving the country-level factors would evolve endogenously along with debt levels. Nevertheless, to provide an interpretation of the results above, we can consider counterfactuals based on identifying assumptions. For example, if the debt levels change given holdings, we can ask: how would yields or other characteristics of the debt have to adjust? **These and other questions will be examined in this framework in the next version of the paper.**

6   Concluding Remarks

The rising levels of government debt worldwide in the wake of the Covid-crisis have made urgent the answers to questions about their repayment. At the front of those questions is: who holds this debt currently and what does that imply for the behavior of this market? In this paper, we have begun to address these questions by analyzing a unique data set that decomposes sovereign debt for a large number of countries over almost three decades. This analysis not only provides important results relevant for the current policy discussion, but also highlights significant issues for on-going academic research on sovereign debt.

Although the analysis in this paper is not finalized, several main points stand out so

far. First, for both Advanced Economies and Emerging Markets, private financial institutions that are not banks, a group called "Non-Banks" above, absorb more of the variation in the outstanding government debt, than other investor groups. Moreover, this group is important both for domestic investors as well as foreign investors. Further decomposing this group for the Euro Area into insurance and pensions, other non-bank financials like hedge funds, non-financial corporations, and households, we find that these institutions vary significantly in their responses to increases of government debt. In particular, investment funds and insurance and pensions appear to adjust their portfolios most. Since much of the literature has focused upon banks, these findings point to the importance of these other institutional investors as potential marginal investors.

We also analyze how investor groups respond to variations in macro, financial and global factors, finding striking differences in patterns across investor groups. For example, non bank investors are more likely to reduce holdings of the EM sovereign debt of countries that increase their share of local-currency denominated debt. We describe how patterns such as these point to differences among investors that may be important to the sovereign debt market.

Finally, we set up a conceptual framework to evaluate our empirical results. While the task of relating our results to this framework remains to be done, we anticipate providing interesting counterfactuals about the impact of debt on pricing and other characteristics.

Overall, the results in our paper provide important empirical regularities for future research.

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A Data construction

The dataset is annual, it covers the years between 1990 and 2018, denominated in US dollars.[31] Debt for each category refers to general government debt, which consists of state, local, and central government debt.

[Explanation/definition of backcasting here, along with rationale for doing so.]

Total   Total debt holdings are estimated by combing the data from the IMF Historical Public Debt Database (debt-to-GDP) and GDP series from The World Bank. In addition, there are 96 countries[32] for which the debt-to-GDP series ends in 2015. For these countries, we forecast the total debt level using the forward-looking growth rates from QPSD total debt series in years 2016-2018.

Foreign Total   The methodology for estimating foreign total holdings is based on that in Avdjiev et al. (2018). This is derived first from international investment position (IIP) data (sum of external portfolio debt liabilities and external other investment debt liabilities for the general government sector), complemented when missing with data from the Quarterly External Debt Statistics (QEDS) (external debt of general government), and the remaining missing values being filled by estimates derived from the BIS international banking statistics (IBS) and BIS international debt securities (IDS) datasets.

Foreign Official   Foreign official holdings for advanced economies and China are taken from Arslanalp and Tsuda (2012) and Arslanalp and Tsuda (2014), which consists mostly

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[31] If data was reported in local currency, it is converted to US dollars using the end of period exchange rate from the IMF.

[32] Afghanistan, Algeria, Angola, Anguilla, Antigua and Barbuda, Argentina, Armenia, Aruba, Azerbaijan, Bahamas, Bahrain, Belize, Benin, Bermuda, Bhutan, Bolivia, Botswana, Brunei Darussalam, Burkina Faso, Burundi, Cabo Verde, Cameroon, Cayman Islands, Central African Republic, Chad, Comoros, Republic of Congo, Cote d'Ivoire, Curacao, Djibouti, Dominica, Ecuador, Republic of Equatorial Guinea, Eritrea, Eswatini, Gabon, Gambia, Ghana, Grenada, Guinea, Guinea-Bissau, Guyana, Haiti, Hong Kong SAR, Iran, Iraq, Jamaica, Jordan, Kenya, Kuwait, Lao People's Democratic Republic, Lesotho, Liberia, Libya, Liechtenstein, Macao SAR, Madagascar, Malawi, Maldives, Mali, Mauritania, Morocco, Mozambique, Myanmar, Namibia, Nepal, New Zealand, Niger, Oman, Pakistan, Papua New Guinea, Qatar, Rwanda, Samoa, San Marino, São Tomé and Príncipe, Saudi Arabia, Senegal, Sierra Leone, Singapore, Solomon Islands, South Africa, Sri Lanka, Sudan, Suriname, Syrian Arab Rep., Togo, Tonga, Trinidad and Tobago, Tunisia, Uganda, Uruguay, Vanuatu, Venezuela, Zambia, Zimbabwe.

of foreign official reserves held abroad. The remaining countries are populated with the data from the World Bank debtor reporting system (DRS) data on bilateral and multilateral official lending to emerging and developing economy governments.

Foreign Bank   The methodology for estimating foreign bank holdings is based on Avdjiev et al. (2018). We compute estimates for share of official holdings from international claims in CBS and apply that share to cross-border bank lending from the LBS. In addition, we make a correction for Switzerland where holdings by external banks are significantly overestimated with our methodology.[33]

Foreign Nonbank   Foreign Nonbank series is computed as a residual from subtracting Foreign Official and Foreign Bank series from the Foreign Total.

Domestic Total   Domestic Total series is computed as a residual from subtracting Foreign Total from the Total.

Domestic Central Bank   For the most part, domestic central bank holdings are taken from the IMF's International Financial Statistics (IFS) dataset. This data has the debt level from the standardized reporting form (SRF) immediately available but only from 2001 onwards. In turn, debt levels prior to 2001 are backcasted with annual growth rate taken from the non-standardized reporting form (non-SRF) in the same dataset. For the countries[34] where the IFS data was incomplete, additional data was taken from the official websites of respective central banks. For these cases, the IFS data was supplemented using the backward-looking growth rates taken from central banks' websites.

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[33]Specifically, the ratio from consolidated banking statistics (CBS) is close to 30% around 2014, while updated data from the locational banking statistics (LBS), which includes a sector breakdown for government lending in recent years, suggests the true ratio is closer to 10%, but not more than 20%.

[34]Austria, Belgium, Bulgaria, Finland, France, Germany, Greece, Iceland, Ireland, Korea, Latvia, Portugal, Spain, Sweden, UK.

Domestic Bank Same procedure as for Domestic Central Bank.[35]

Domestic Nonbank Domestic Nonbank series is computed as a residual from subtracting Domestic Central Bank and Domestic Bank series from the Domestic Total.

Inconsistencies and Cleaning When combining data across different sources, inconsistencies are inevitable. While most of the dataset fits together, there are some cases where the sum of some of the components (e.g. domestic central bank and domestic bank) add to more than the total (e.g. domestic total). This produces some negative observations for residually computed groups (e.g. domestic non-banks). In general, we followed the following procedure in order to ensure there were no negative observations and maintain internal consistency in the dataset (i.e. the sum of the parts add up to the whole).

- If foreign official + foreign bank ¿ foreign total → replace foreign total = foreign bank + foreign official

    - E.g. replace Foreign = maxForeign total, foreign official + foreign bank

- If foreign total + domestic bank + domestic CB ¿ total debt → replace total debt = foreign total + domestic bank + domestic central bank

    - E.g. replace Total debt = maxTotal debt, foreign total + domestic bank + domestic CB

- Then, compute the residual categories (Foreign non-bank, domestic total, domestic non-bank)

After doing this, then all of our data series will be greater than or equal to zero, including the residual categories, and the data will be internally consistent. Before applying this procedure en masse, we manually examine cases where the negative values were large to make

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[35]The list of countries for which additional data from the official Central Bank websites was used: Belgium, Finland, France, Germany, Korea, Luxembourg, Mexico, Netherlands, Portugal, Serbia, Spain, Sweden.

sure that this procedure made since, as this implicitly assumes that the negative values are 0s. In a few cases where it appears driven by low data quality, we replace the observation with linear interpolation.

B Additional Results

Table B1: Marginal Holders of Sovereign Debt - Unrestricted Sample

	(1) Dom	(2) Dom Bank	(3) Dom NB	(4) Dom CB	(5) For	(6) For Bank	(7) For NB	(8) For Off
All	0.48***	0.13**	0.41***	0.26*	0.52***	0.03	0.28***	0.10***
	(0.13)	(0.06)	(0.04)	(0.15)	(0.13)	(0.02)	(0.05)	(0.03)
AE	0.07	0.08	0.33***	0.04	0.93***	0.04	0.39***	0.04
	(0.17)	(0.09)	(0.08)	(0.03)	(0.17)	(0.04)	(0.12)	(0.03)
EM	0.75***	0.10	0.44***	0.12*	0.25***	0.02	0.22***	0.04*
	(0.06)	(0.10)	(0.07)	(0.06)	(0.06)	(0.03)	(0.04)	(0.02)
DC	0.54***	0.15*	0.40***	0.31*	0.46***	0.03***	0.37***	0.12***
	(0.05)	(0.09)	(0.06)	(0.18)	(0.05)	(0.01)	(0.10)	(0.04)

Table B2: Sovereign Debt Holders and Global Cycles

	(1) Dom	(2) Dom Bank	(3) Dom NB	(4) Dom CB	(5) For	(6) For Bank	(7) For NB	(8) For Off
Panel A: All Countries								
vix_gr	0.021***	-0.010***	0.034***	-0.003**	-0.013***	-0.003***	-0.006**	-0.006***
	(0.004)	(0.002)	(0.005)	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)
r_gdp_gr	0.152**	0.050	0.065	0.023	0.013	0.013	0.027	0.000
	(0.074)	(0.044)	(0.064)	(0.021)	(0.064)	(0.017)	(0.059)	(0.025)
N	1574	1607	1571	1606	1587	1609	1552	1574
Adj. R^2	0.04	0.02	0.07	0.00	0.02	0.01	0.00	0.01
Panel B: AE Countries								
vix_gr	0.048***	-0.009***	0.064***	-0.008***	-0.018**	-0.003*	-0.008	-0.009**
	(0.009)	(0.003)	(0.010)	(0.002)	(0.007)	(0.002)	(0.006)	(0.004)
r_gdp_gr	-0.087	-0.040	-0.067	0.026	-0.083	-0.075	0.020	-0.015
	(0.175)	(0.082)	(0.190)	(0.051)	(0.146)	(0.050)	(0.103)	(0.061)
N	383	382	382	383	383	383	362	362
Adj. R^2	0.10	0.02	0.15	0.04	0.03	0.02	0.01	0.02
Panel C: EM Countries								
vix_gr	0.014**	-0.011***	0.026***	-0.001	-0.014***	-0.003***	-0.006**	-0.004***
	(0.006)	(0.003)	(0.006)	(0.001)	(0.003)	(0.001)	(0.002)	(0.001)
r_gdp_gr	0.186**	0.022	0.150*	0.002	0.004	0.015	0.004	-0.007
	(0.078)	(0.032)	(0.081)	(0.027)	(0.038)	(0.009)	(0.028)	(0.021)
N	748	768	746	766	759	769	747	757
Adj. R^2	0.03	0.03	0.05	0.00	0.04	0.02	0.01	0.02
Panel D: DC Countries								
vix_gr	0.007	-0.007**	0.018**	-0.000	-0.006	-0.002	-0.001	-0.004*
	(0.008)	(0.003)	(0.008)	(0.003)	(0.007)	(0.002)	(0.007)	(0.002)
r_gdp_gr	0.217	0.147	-0.010	0.058	0.076	0.050	0.073	0.019
	(0.177)	(0.125)	(0.126)	(0.040)	(0.186)	(0.044)	(0.183)	(0.067)
N	443	457	443	457	445	457	443	455
Adj. R^2	0.02	0.02	0.02	0.00	0.00	0.01	0.00	0.00

Table B3: Global financial conditions and euro area investment in sovereign debt

	(1) Nonbanks	(2) InsurPens	(3) OthFin	(4) NFC	(5) HH	(6) Gov
Panel A: EA borrowers						
vix_gr	-0.004	-0.003**	-0.003	0.001	-0.001*	0.001
	(0.003)	(0.002)	(0.002)	(0.001)	(0.000)	(0.001)
N	414	414	414	414	414	414
Adj. R^2	0.00	0.01	0.00	0.00	0.00	0.00
Panel B: non-EA borrowers, AE countries						
vix_gr	-0.002**	-0.001***	-0.001	-0.000	-0.000	-0.000
	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
N	207	207	207	207	207	207
Adj. R^2	0.01	0.06	0.00	0.00	0.01	0.00
Panel B: non-EA borrowers, EM countries						
vix_gr	-0.004**	-0.000	-0.004**	0.000	-0.000	-0.000
	(0.002)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)
N	391	391	391	391	391	391
Adj. R^2	0.02	0.00	0.03	0.02	0.00	0.00