Who Holds Sovereign Debt and Why It Matters*

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Abstract

This paper studies the impact of investor composition on the sovereign debt market. We construct a data set of sovereign debt holdings by foreign and domestic bank, non-bank private, and official investors for 95 countries over twenty years. Private non-bank investors absorb disproportionately more sovereign debt supply than other investors. Moreover, non-bank investor demand is most responsive to the yield. Counterfactual analysis of emerging market sovereigns shows a 10% increase in debt leads to a 6.7% increase in costs, but an out-sized 9% increase if non-bank investors are absent. We conclude that these sovereigns are vulnerable to losing non-bank investors.

JEL-Codes: F34, G11, G15, F41

Keywords: Sovereign debt, Banks and Non-banks, Advanced Economies and Emerging Markets

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Online Appendix

A Data construction

A.1 Debt and Investor Holdings

The series in the aggregate dataset are sampled at an annual frequency, covering the years between 1990 and 2018. The series are denominated in US dollars.[1] Debt for each category refers to general government debt, which consists of state, local, and central government debt.

Total Total debt holdings are measured by combining the data from the IMF Historical Public Debt Database (debt-to-GDP) and GDP series from The World Bank. While a full data series over time are available for some, there are 96 countries for which the debt-to-GDP series ends in 2015.[2] 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 calculating foreign total holdings is based on that in Avdjiev et al. (2022). We start by obtaining outstanding external liabilities of the general government sector from the International Investment Position (IIP) data. This consists of adding together liability positions from both portfolio debt securities (bonds) and other investment debt (loans). However, coverage of IIP data by sector can be sparse, especially for recent years (Avdjiev et al., 2022). So, we fill in missing values from a number of sources. First, if only data for the government sector is missing, but other sectors are reported, we fill the missing government sector internally from the IIP by subtracting the reporting sectors from the total. Then, the Quarterly External Debt Statistics (QEDS), when available (for a limited set of countries starting from 2005). To fill in remaining values, we utilize data from the Bank for International Settlements (BIS).

[1] Series that are originally reported in local currency are converted to US dollars using the end of period exchange rate from the IMF. Robustness to currency value effects are described in Section B.2

[2] 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.

To fill in missing values for outstanding amounts of externally held government bonds, we use the BIS International Debt Securities (IDS) data. The IDS consists of all debt securities issued in international markets, which target foreign investors.[3] These data are available for a wide range of countries and time periods, and include granular splits by issuer country and sector, as well as other details not utilized in this paper. Internationally issued bonds serve as a good proxy for bonds held by foreign investors, especially in the case of emerging markets.[4]

To fill in missing values for outstanding amounts of non-bond external sovereign liabilities, we use the BIS International Banking Statistics, to capture lending from foreign banks, as well as IMF credit from the IIP, which captures official lending. The foreign bank estimation is described below.

Foreign Official Foreign official holdings for advanced economies and China are taken from Arslanalp and Tsuda (2012) and Arslanalp and Tsuda (2014), consisting mostly 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. (2022). It leverages two datasets on international banking activity compiled by the BIS.

The Locational Banking Statistics (LBS) capture outstanding claims and liabilities of internationally active banks located in 44 reporting countries against counterparties residing in more than 200 countries. Banks record their positions on an unconsolidated basis, including intragroup positions between offices of the same banking group. The data are compiled based on the residency principle (as done for IIP or QEDS). The LBS capture the overwhelming majority of cross-border banking activity. The historical LBS data break down counterparties in each country into banks (bank and central bank sectors) and non-banks (corporate and government sectors).[5]

The second set of banking data is the Consolidated Banking Statistics (CBS). This differs from the LBS in that the positions of banks reporting to the BIS are aggregated by the nationality (rather than by

[3] A bond is flagged as international if the registration of the bond, the governing law of the bond, or the listing location of the bond are not the same as the bond issuer's country of residence. This classifies in essence any bond whose issuance targets investors outside of its local market.

[4] For US government bonds, when missing from IIP or QEDS, we utilize TIC data to fill in missing values, since US government bonds are issued domestically and frequently bought by foreigners.

[5] Data on total cross border claims by BIS reporting banks separated by bank and non-bank counterparties are available going back to 1978. More recent enhancements to the BIS LBS data (since 2013) provide more granular counterparty sector splits, dividing the non-bank sector into the non-bank private sector and the public sector (ie government) (Garcia Luna & Hardy, 2019).

the residence) of the reporting bank.[6] We use the CBS on an immediate counterparty basis (CBS/IC).[7] The CBS data historically provide a borrower breakdown of the Non-Bank Sector into Public and Private.

While we maintain a residence perspective when identifying holders of government debt, consistent with the LBS and IIP, the CBS have a longer time series of the breakdown between public and private borrowers, which allow for a larger and longer sample of estimates for foreign banks' lending to governments. We use the share of international bank debt for each sector from the CBS to estimate the split of the Non-Bank LBS data into Public and Private components.[8] We calculate the public sector borrowing from cross-border banks as follows:

$$\widehat{XBS}_{pub,n,t} = XBC_{nb,n,t} \frac{INTC_{pub,n,t}}{INTC_{nbp,n,t} + INTC_{pub,n,t}} \tag{A.1}$$

where npb indicates Non-Bank Private, nb indicates Non-Bank, pub indicates Public, n denotes the borrowing country, and t denotes the time period. $\widehat{XBS}$ is our estimated cross border bank holdings of debt, XBC denotes the cross border claims (from the LBS) of BIS reporting banks, and $INTC$ is international claims (from the CBS on immediate counterparty basis). The CBS international claims are defined as the sum of XBC and the local claims by foreign affiliates of these banks that are denominated in foreign currencies (LCFC).The sector breakdown in the CBS is not available for cross-border claims, only for international claims.

This construction of the split of bank debt makes the following assumptions: First, the sectoral shares for $INTC$ are the same as the sectoral shares for XBC. This is reasonable since for most countries, LCFC tends to be small relative to XBC.[9] Second, the sectoral shares for the set of banks that report LBS data (44 countries) are the same as the sectoral shares for the set of banks that report CBS data (31 countries). The 31 CBS reporting countries account for about 90% of the XBC in the LBS, and the CBS captures the activities of the subsidiaries of banks from these 31 countries worldwide. As a result, the CBS data are sufficiently representative to make the above assumption a reasonable one. Third, data

[6]For example, the positions of a French bank's subsidiary located in New York - which in the LBS are included in the positions of banks in the United States - are consolidated in the CBS with those of its parent and are included in the positions of French banks.

[7]The CBS are compiled in two different ways: by immediate counterparty and by ultimate risk. The immediate counterparty is the entity with whom the bank contracts to lend or borrow. Ultimate risk takes account of credit risk mitigants, such as collateral, guarantees and credit protection bought, which transfer the bank's credit exposure from one counterparty to another.

[8]This general approach is also used in Arslanalp and Tsuda (2012) and Arslanalp and Tsuda (2014)

[9]While for most countries, LCFC tends to be small relative to XBC, there are a small number of exceptions. For example, this is not the case in dollarized economies (e.g. Ecuador) and some emerging European economies (e.g. Hungary and Poland), where lending denominated in euro and in Swiss francs has been non-negligible.

for the CBS that allow us to estimate the split of Non-Bank into Public and Private are not available for advanced economies before 2000, and are only available on a semiannual basis for EM for the period before 2000. We linearly extrapolate the semiannual shares to Public and Private into a quarterly series for EM. For advanced economies, we assume constant shares from 2000 backwards.[10]

Recently, the BIS has released its enhanced banking data, starting in 2013. These data contain more granular borrowing sector splits - Bank, Public, and Non-Bank Private (Garcia Luna & Hardy, 2019). Avdjiev et al. (2022) use this short, recent series to establish that this methodology for estimating borrowing sector splits generates estimates that are very close to the actual (reported) figures.[11] In addition, we make a correction for Switzerland where holdings by external banks are significantly overestimated with our methodology.[12]

Foreign Non-bank The Foreign Non-bank series is computed by subtracting Foreign Official and Foreign Bank series from the Foreign Total.

Domestic Total Domestic Total series is computed by 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) data set. This data base provides the debt holdings levels from the Standardized Reporting Form (SRF) only from 2001 onwards. Therefore, debt holding 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 where the IFS data were incomplete, additional data were taken from the official websites of respective central banks.[13] For these cases, the IFS data were supplemented using the backward-looking growth rates taken from central banks' websites.

Domestic Bank These holdings were compiled using the same procedure as for the Domestic Central Bank.[14]

[10]The assumption of constant shares for advanced economies before 2000 is not too concerning, as we only extend back 4 years.

[11]Since not all LBS reporting countries have started providing the enhanced borrowing sector splits, these comparisons are based on the set of LBS reporting countries which had started reporting enhanced LBS data as of March 2016.

[12]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%. We therefore use a ratio of 15% to compute foreign bank holdings of Swiss government debt.

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

[14]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.

Domestic Non-bank The Domestic Non-bank series were computed by subtracting the 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). In these cases, the procedure produces some negative observations for residually computed groups (e.g. domestic non-banks). In general, we used the following procedures to maintain internal consistency in the dataset (i.e. the sum of the parts add up to the whole) for these special cases.

If the Foreign Official plus Foreign Bank is greater than the Foreign Total, we replaced the Foreign Total as the sum of the Foreign Bank plus the Foreign Official; that is, replace Foreign = max(Foreign total, foreign official + foreign bank).

If the sum of the Foreign total and the Domestic bank and the Domestic Central Bank is greater than the total debt, we replace total debt as this sum; that is, replace Total debt = max(Total debt, foreign total + domestic bank + domestic Central Bank)

Given these updated variables, we compute any residual categories as needed; that is, we subtract the other variables from the updated totals to measure the Foreign Non-bank, the Domestic Total, and the Domestic Non-bank.

After following this process, all of the generated data series are greater than or equal to zero, and the data are internally consistent. Further, we manually examine cases where the negative values were large to make sure that this procedure made sense. In a few cases where it appears driven by low data quality, we replace the observation with linear interpolation.

A.2 Country Groups

The final sample consists of the following 95 countries:

Advanced economies (23): Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, United Kingdom, and the United States.

Emerging markets (45): Argentina, Bahrain, Bangladesh, Belarus, Brazil, Bulgaria, Chile, China, Colombia, Croatia, Cyprus, Czech Republic, Estonia, Egypt, Hungary, India, Indonesia, Israel, Jordan, Latvia, Lithuania, Kuwait, Malaysia, Mexico, Morocco, Nigeria, Oman, Pakistan, Peru, Philippines, Poland, Qatar, Romania, Russia, Serbia, Slovak Republic, Slovenia, South Africa, South Korea, Thailand, Turkey, Uruguay, Ukraine, Venezuela, and Vietnam.

Developing economies (27): Jamaica, Paraguay, Sudan, Angola, St. Lucia, Lebanon, Bolivia, Tunisia, Papua New Guinea, Panama, Kenya, Sri Lanka, El Salvador, Ecuador, Dominican Republic, Malta, Albania, Montenegro, Costa Rica, Namibia, Gabon, Kazakhstan, Liberia, Mongolia, Guatemala, Bahamas, and Cote d'Ivoire.

A.3 Financial, Price, and Characteristics Data

We now describe the data sources for the financial data used in Section 3. The 5-year bond yields are the corresponding zero coupon yields provided by the Global Financial Data. Countries with available yields are Korea, United Kingdom, Venezuela, Sri Lanka, Iceland, Norway, Sweden, Australia, Germany, Singapore, Denmark, Japan, United States, France, Belgium, New Zealand, Canada, Spain, Finland, Hong Kong, Hungary, Portugal, Malaysia, Switzerland, Italy, India, Morocco, Philippines, Netherlands, Thailand, Ireland, Austria, Greece, South Africa, Mexico, Poland, Mauritius, Armenia, Fiji, Pakistan, Tunisia, Zambia, Belarus, Bulgaria, Bangladesh, Malta, Brazil, China, Indonesia, Vietnam, Angola, Colombia, Croatia, Israel, Peru, Qatar, Romania, Russia, Slovenia, Turkey, Egypt, Lithuania, Latvia, Uganda.

For relevant short term rates by currency, we try to obtain 3-month government bond yields where possible and, if unavailable, we use instead short term deposit rates in local currency. In particular, we implement the following procedure. First, we take the 3-month bond yields if available from Global Financial Data. Next, if missing, we use instead the short-term (most of them are 3-month) deposit rate from the Global Financial Data. Then, if short term rates are still missing, we use the deposit rate available from the World Bank (World Development Indicators, FR.INR.DPST). Finally, for the few countries where no short rates are available from these other sources, we fill in the missing data with the 1-year yield downloadable from the Global Financial Data.

Exchange rates are obtained from the World Bank (Global Economic Monitor, DPANUSSPF). Prices used for the real exchange rates are downloaded from World Bank. We use the 4th quarter Headline Consumer Price Index as the inflation of each year.

The characteristics data used are described next. We obtained real GDP growth, inflation, exports, and the GDP level from the IMF World Economic Outlook. In particular, GDP growth is from series $NGDP_RPCH$, the inflation is series PCPIEPCH, and the GDP level is from series NGDPD. The

Sovereign Ratings measure is a combination of SP Sovereign Rating and Fitch Sovereign Rating. In order to convert the discrete series to numerical levels, we follow the procedure described in Koijen and Yogo (2020).

B Marginal Investor Analysis: Additional Results

This appendix provides more detailed results for the analysis in Section 2.

B.1 Marginal investors during different circumstances

In this appendix subsection, we report robustness checks for the analysis in Section 2.3. For example, the analysis in the text treats the investor composition as constant. However, in reality, the composition of marginal investors 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 estimate Equation (2) separately when the country-year is, alternatively, (i) in a recession and not; (ii) during a banking crisis and not; and (iii) in different sub-periods.[15] We consolidate the results of these regressions into Figures B1 (panels (b) and (c)) and Figures B2, relegating detailed reporting of the regression coefficients to Tables B1, B2, and B3.

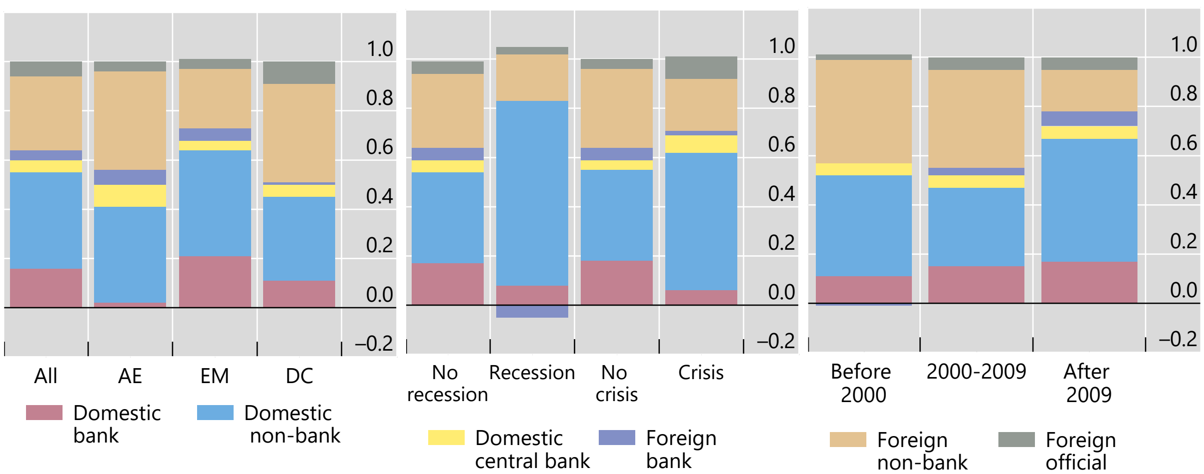
The figures highlight important patterns across geographic groups. Both Advanced Economies and Emerging Market sovereign debt show marked differences in their marginal investors across different circumstances. For example, domestic non-banks absorb more emerging market debt during recessions or banking crises, whereas domestic banks decrease their absorption. In advanced economies, the domestic central bank becomes a key investor during a crisis. After the Global Financial Crisis (GFC), both domestic banks and domestic non-banks increase the share of debt they absorb. A similar pattern holds for foreign official lenders in the case of advanced economies. This latter trend may reflect increased

[15] We define a country as in a recession if its real GDP growth rate is negative, and a country as in a banking crisis if there is or was a banking crisis in the past 3 years. Banking crises indicators follow Laeven and Valencia (2020). For the sub-periods, we break the sample up into periods around the Global Financial Crisis (GFC), in particular before 2000, from 2000-2008, and after 2009.

holdings of debt in the form of reserves by foreign central banks, particularly those in EM countries.[16]

For developing countries, the role of domestic investors expands considerably during recessions. The pattern over time is also interesting. From 2000-2009, 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.

Figure B1: Marginal Holders



(a) By country group (b) Crisis and recession (c) By time period

Note: This figure plots the regression coefficients in Equation (2) for all countries under different circumstances. Panel (a) depicts the coefficients for each investor group by country group as reported in Table 1 in the text. Panel (b) shows the coefficients for each investor group during recession and non-recession times, and during crisis and non-crisis times. A recession is defined by a negative real GDP growth rate. A crisis is identified following Laeven and Valencia (2020), which includes a banking crisis, a currency crisis, and a debt crisis. Panel (c) shows the coefficients for each investor group in three subsamples: pre-2000, 2000-2009, and post-2009.

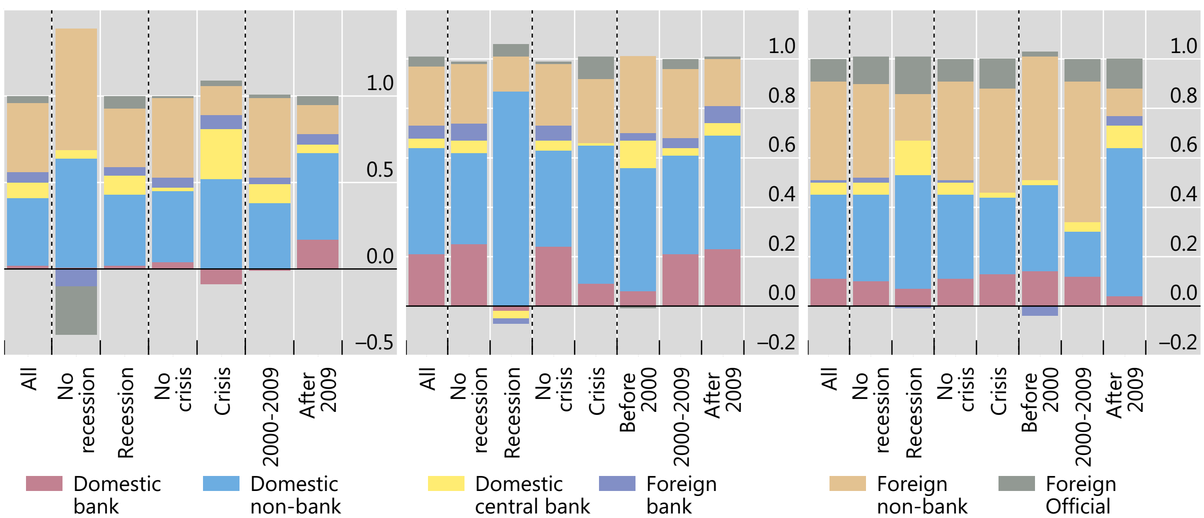
The basic finding that Non-bank investors are important marginal investors continues to hold across these different periods. The next subsections examine these relationships in more detail across investor groups.

B.1.1 Recessions and Non Recessions

Table B1 reports the regression results depicted in Figures 2 for recessions and non-recessions.

[16] 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 B2: Marginal Holders



(a) Advanced economies (b) Emerging markets (c) Developing countries

Note: This figure plots the regression coefficients in Equation (2) under different circumstances for advanced economies, emerging market economies, and developing countries in Panels (a), (b) and (c), respectively. A recession is defined by a negative real GDP growth rate. A crisis is identified following Laeven and Valencia (2020), which includes a banking crisis, a currency crisis, and a debt crisis. The regression estimates are in Tables B1, Table B2, and Table B3.

Table B1: Marginal Holders of Sovereign Debt: Recession and No Recession

	(1) Dom	(2) For	(3) DomBK	(4) DomNB	(5) DomCB	(6) ForBK	(7) ForNB	(8) ForCB
				Panel A: Recessions				
All	0.83***	0.17***	0.08	0.75***	0.00	-0.05	0.19**	0.03
	(0.05)	(0.05)	(0.05)	(0.09)	(0.01)	(0.04)	(0.09)	(0.03)
AE	0.68**	0.32	0.01	0.63**	0.05*	-0.10	0.70***	-0.28
	(0.26)	(0.26)	(0.09)	(0.23)	(0.02)	(0.11)	(0.21)	(0.20)
EM	0.82***	0.18	-0.02	0.87***	-0.03	-0.02	0.14	0.05
	(0.13)	(0.13)	(0.06)	(0.16)	(0.02)	(0.04)	(0.14)	(0.05)
DC	0.67***	0.33*	0.07	0.46*	0.14	-0.01	0.19**	0.15**
	(0.18)	(0.18)	(0.10)	(0.22)	(0.09)	(0.08)	(0.08)	(0.06)
				Panel B: Non Recessions				
All	0.60***	0.40***	0.17***	0.37***	0.05***	0.05***	0.30***	0.05***
	(0.05)	(0.05)	(0.04)	(0.06)	(0.02)	(0.02)	(0.05)	(0.01)
AE	0.54***	0.46***	0.02	0.41***	0.11	0.05**	0.34***	0.07**
	(0.11)	(0.11)	(0.03)	(0.09)	(0.07)	(0.02)	(0.10)	(0.03)
EM	0.67***	0.33***	0.25***	0.37***	0.05**	0.07***	0.24***	0.01
	(0.05)	(0.05)	(0.05)	(0.08)	(0.02)	(0.02)	(0.06)	(0.01)
DC	0.50***	0.50***	0.10***	0.35***	0.05***	0.02	0.38***	0.11***
	(0.09)	(0.09)	(0.02)	(0.08)	(0.02)	(0.02)	(0.09)	(0.03)

Note: This table reports the regression coefficients for Equation (2) for each investor group during recessions (Panel A) and non recessions (Panel B). A recession is defined as a negative real GDP growth rate. Country and year FEs are included, and standard errors are clustered at the country level and reported in the parentheses. Columns (1) and (2) represent domestic and foreign investors, respectively. Columns (3) through (8) correspond to the six investor groups described in the text.

B.1.2 Banking Crisis and No Banking Crisis

Table B2 reports the regression results depicted in Figures 2 for banking crises.

Table B2: Marginal Holders of Sovereign Debt: Banking Crisis and No Banking Crisis

	(1) Dom	(2) For	(3) DomBK	(4) DomNB	(5) DomCB	(6) ForBK	(7) ForNB	(8) ForCB
				Panel A: Banking Crisis				
All	0.69***	0.31***	0.06	0.56***	0.07	0.02	0.21**	0.09
	(0.05)	(0.05)	(0.05)	(0.07)	(0.06)	(0.02)	(0.09)	(0.06)
AE	0.72***	0.28	-0.09*	0.52***	0.29**	0.08*	0.17	0.03
	(0.19)	(0.19)	(0.05)	(0.12)	(0.11)	(0.04)	(0.25)	(0.05)
EM	0.65***	0.35***	0.09*	0.56***	0.01	0.00	0.26**	0.09
	(0.07)	(0.07)	(0.04)	(0.07)	(0.01)	(0.02)	(0.10)	(0.07)
DC	0.46***	0.54***	0.13*	0.31**	0.02	-0.00	0.42**	0.12*
	(0.12)	(0.12)	(0.06)	(0.13)	(0.02)	(0.01)	(0.17)	(0.07)
				Panel B: No Banking Crisis				
All	0.59***	0.41***	0.18***	0.37***	0.04***	0.05***	0.32***	0.04***
	(0.05)	(0.05)	(0.04)	(0.06)	(0.01)	(0.01)	(0.05)	(0.01)
AE	0.47***	0.53***	0.04*	0.41***	0.02**	0.06*	0.46***	0.01
	(0.12)	(0.12)	(0.02)	(0.11)	(0.01)	(0.03)	(0.11)	(0.03)
EM	0.67***	0.33***	0.24***	0.39***	0.04**	0.06***	0.25***	0.01
	(0.06)	(0.06)	(0.05)	(0.08)	(0.02)	(0.02)	(0.05)	(0.01)
DC	0.49***	0.51***	0.11***	0.34***	0.05**	0.01	0.40***	0.09***
	(0.11)	(0.11)	(0.04)	(0.10)	(0.02)	(0.02)	(0.11)	(0.02)

Note: This table reports the regression coefficients for Equation (2) for each investor group during times with banking crises (Panel A) and without banking crisis (Panel B). A country-year (n, t) observation is defined as if country n experienced a banking crisis in either of year $t, t-1, t-2, t-3$. Banking crisis definitions follow Laeven and Valencia (2020). For the developing countries, the definition of crisis includes not only banking crisis, but also debt crisis and currency crisis. Country and year FEs are included, and standard errors are clustered at the country level and reported in the parentheses. Columns (1) and (2) represent domestic and foreign investors, respectively. Columns (3) through (8) correspond to the six investor groups described in the text.

B.1.3 Different Subperiods

Table B3 reports the regression results depicted in Figures 2 for different subperiods.

B.2 Marginal Investors Considering Currency Valuation Effects

This section provides an analysis of the marginal holders of sovereign debt taking the currency valuation effect into consideration.

To see the potential impact of currency, we define the impact of currency valuation on holdings of sovereign debt n by investor group i as $CV_{i,t}(n)$. Then we can rewrite the general relationship for holdings as:

$$H_{i,t}(n) - H_{i,t-1}(n) = \Delta\tilde{H}_{i,t}(n) - CV_{i,t}(n) \tag{B.1}$$

where $\Delta\tilde{H}_{i,t}(n)$ is the change in holdings excluding currency valuation effects.

To compute $\Delta\tilde{H}_{i,t}(n)$, we make two assumptions. First, all domestic investors holdings of their own sovereign debt is denominated in local currency. Second, the local currency share of foreign investors may be proxied by the share of local currency among bonds issued in international financial markets, derived from the BIS international debt securities statistics. In the absence of data on the currency breakdown by investor group, we treat this share as applying equally across all foreign investors.

Under these assumptions, we then calculate the currency valuation adjustment as:

$$CV_{i,t}(n) = H_{i,t-1}(n) \times LC_{i,t-1}(n) \times \frac{S_t(n) - S_{t-1}(n)}{S_{t-1}(n)}$$

where $LC_{i,t}(n)$ is country n local currency share of debt investor group i's holding of country n's debt, and $S_t(n)$ is the price of currency n in terms of dollar, both at time t. We define the currency valuation adjusted change in total debt as $\Delta\tilde{D}_t(n) = \sum_{i=1}^{I} \Delta\tilde{H}_{i,t}(n)$. The regression Equation (2) is in turn written as

$$\frac{\Delta\tilde{H}_{i,t}(n)}{D_{t-1}(n)} = \tilde{a}_i \frac{\Delta\tilde{D}_t(n)}{D_{t-1}(n)} + \tilde{a}(n) + \tilde{a}_t + \epsilon_{i,t}(n), \quad \forall i \tag{B.2}$$

B.2.1 Unconditional Estimates

We first report the results using the Currency Valuation (CV) measure over all periods. These are reported in Table B4 below. As the results show, Non-banks continue to absorb the largest proportion of debt on the margin. Moreover, the following subsections show that these patterns continue to hold when decomposed by recessions and non-recessions in Table B5, by banking crisis in Table B6, and by different subperiods in Table B7.

Table B3: Marginal Holders of Sovereign Debt: Different Subperiods

	(1) Dom	(2) For	(3) DomBK	(4) DomNB	(5) DomCB	(6) ForBK	(7) ForNB	(8) ForCB
				Panel A: Before 2000				
All	0.57***	0.43**	0.11*	0.41**	0.05*	-0.01	0.42**	0.02
	(0.18)	(0.18)	(0.06)	(0.18)	(0.02)	(0.03)	(0.16)	(0.01)
EM	0.66**	0.34	0.06	0.50*	0.11***	0.03	0.31	-0.01
	(0.25)	(0.25)	(0.04)	(0.25)	(0.03)	(0.04)	(0.27)	(0.02)
DC	0.52*	0.48*	0.14*	0.35	0.02	-0.04	0.50**	0.02*
	(0.25)	(0.25)	(0.08)	(0.25)	(0.02)	(0.04)	(0.22)	(0.01)
				Panel B: 2000-2009				
All	0.52***	0.48***	0.15**	0.32***	0.05***	0.03	0.40***	0.05**
	(0.07)	(0.07)	(0.06)	(0.08)	(0.02)	(0.02)	(0.08)	(0.02)
AE	0.48***	0.52***	-0.01	0.38***	0.11	0.04*	0.46**	0.02
	(0.17)	(0.17)	(0.03)	(0.13)	(0.08)	(0.02)	(0.18)	(0.01)
EM	0.64***	0.36***	0.21**	0.40***	0.03*	0.04	0.28***	0.04
	(0.08)	(0.08)	(0.08)	(0.12)	(0.02)	(0.04)	(0.08)	(0.03)
DC	0.34**	0.66***	0.12	0.18*	0.04*	0.00	0.57***	0.09**
	(0.12)	(0.12)	(0.07)	(0.10)	(0.02)	(0.01)	(0.15)	(0.04)
				Panel C: After 2009				
All	0.72***	0.28***	0.17***	0.50***	0.05*	0.06***	0.17***	0.05**
	(0.04)	(0.04)	(0.04)	(0.08)	(0.03)	(0.01)	(0.03)	(0.02)
AE	0.61***	0.39***	0.11*	0.47***	0.03	0.06*	0.22**	0.11
	(0.10)	(0.10)	(0.05)	(0.09)	(0.02)	(0.03)	(0.08)	(0.09)
EM	0.73***	0.27***	0.23***	0.46***	0.05	0.07***	0.19***	0.01
	(0.05)	(0.05)	(0.05)	(0.10)	(0.03)	(0.01)	(0.05)	(0.01)
DC	0.73***	0.27**	0.04	0.60***	0.09	0.04	0.11*	0.12**
	(0.10)	(0.10)	(0.04)	(0.16)	(0.06)	(0.04)	(0.06)	(0.05)

Note: This table reports the regression coefficients for Equation (2) for each investor group before 2000 (Panel A), 2000-2009 (Panel B), and after 2009 (Panel C). Country and year FEs are included, and standard errors are clustered at the country level and reported in the parentheses. Columns (1) and (2) represent domestic and foreign investors, respectively. Columns (3) through (8) correspond to the six investor groups described in the text.

Table B4: Marginal Holders of Sovereign Debt Conditioning on Currency

	(1) Dom	(2) For	(3) DomBK	(4) DomNB	(5) DomCB	(6) ForBK	(7) ForNB	(8) ForCB
All	0.70***	0.30***	0.17***	0.46***	0.07***	0.03***	0.23***	0.04***
	(0.05)	(0.05)	(0.03)	(0.05)	(0.02)	(0.01)	(0.04)	(0.01)
AE	0.60***	0.40***	0.05**	0.46***	0.09	0.06**	0.31**	0.03
	(0.12)	(0.12)	(0.02)	(0.10)	(0.06)	(0.02)	(0.12)	(0.02)
EM	0.76***	0.24***	0.21***	0.47***	0.07***	0.04**	0.18***	0.03
	(0.05)	(0.05)	(0.04)	(0.06)	(0.02)	(0.01)	(0.04)	(0.02)
DC	0.60***	0.40***	0.11***	0.43***	0.05***	0.01	0.31***	0.07***
	(0.10)	(0.10)	(0.04)	(0.09)	(0.01)	(0.01)	(0.10)	(0.02)

Note: Panel A of the table reports the regression coefficients for Equation (B.2) for each investor group. The first two columns represent domestic and foreign investors, respectively. Columns (3) through (8) correspond to the six investor groups. Standard errors clustered at the country level are reported in the parentheses. Panel B of the table reports the average share of holding by each investor group.

B.2.2 Recessions and Non-Recessions with Currency Valuation

Table B5 report the results of estimating Equation (B.2) conditioned on recessions or no recessions.

Table B5: Marginal Holders Conditioning on Currency: Recession and Non Recession

	(1) Dom	(2) For	(3) DomBK	(4) DomNB	(5) DomCB	(6) ForBK	(7) ForNB	(8) ForCB
Panel A: Recessions								
All	0.89***	0.11**	0.17***	0.63***	0.09***	-0.01	0.11**	0.01
	(0.05)	(0.05)	(0.04)	(0.05)	(0.03)	(0.02)	(0.05)	(0.02)
AE	0.86***	0.14	0.01	0.81***	0.04	-0.08	0.40	-0.18
	(0.25)	(0.25)	(0.08)	(0.24)	(0.02)	(0.08)	(0.27)	(0.15)
EM	0.85***	0.15*	0.16***	0.56***	0.13**	0.02	0.09	0.03
	(0.07)	(0.07)	(0.04)	(0.07)	(0.04)	(0.02)	(0.07)	(0.03)
DC	0.82***	0.18	-0.07	0.78***	0.10	-0.03	0.13	0.08
	(0.17)	(0.17)	(0.09)	(0.23)	(0.07)	(0.08)	(0.10)	(0.08)
Panel B: Non Recessions								
All	0.67***	0.33***	0.17***	0.44***	0.06***	0.05***	0.24***	0.04***
	(0.05)	(0.05)	(0.03)	(0.06)	(0.01)	(0.01)	(0.05)	(0.01)
AE	0.62***	0.38***	0.07***	0.45***	0.10	0.05**	0.28**	0.05*
	(0.11)	(0.11)	(0.02)	(0.09)	(0.07)	(0.02)	(0.10)	(0.03)
EM	0.73***	0.27***	0.22***	0.45***	0.06***	0.06***	0.19***	0.01*
	(0.06)	(0.06)	(0.05)	(0.09)	(0.02)	(0.02)	(0.05)	(0.01)
DC	0.60***	0.40***	0.12***	0.42***	0.05***	0.02	0.30***	0.08***
	(0.10)	(0.10)	(0.04)	(0.08)	(0.02)	(0.01)	(0.09)	(0.02)

Note: This table reports the regression coefficients for Equation (B.2) for each investor group during recessions (Panel A) and non recessions (Panel B). A recession is defined as a negative real GDP growth rate. Country and year FEs are included, and standard errors are clustered at the country level and reported in the parentheses. Columns (1) and (2) represent domestic and foreign investors, respectively. Columns (3) through (8) correspond to the six investor groups.

B.2.3 Banking Crisis and No Banking Crisis with Currency Valuation

Table B6 reports the results of estimating Equation (B.2) conditioned on banking crisis or no banking crisis.

Table B6: Marginal Holders Conditioning on Currency: Banking Crisis and No Banking Crisis

	(1) Dom	(2) For	(3) DomBK	(4) DomNB	(5) DomCB	(6) ForBK	(7) ForNB	(8) ForCB
				Panel A: Banking Crisis				
All	0.83***	0.17**	0.13***	0.58***	0.12***	0.00	0.12*	0.05
	(0.07)	(0.07)	(0.04)	(0.04)	(0.04)	(0.02)	(0.07)	(0.04)
AE	0.85***	0.15	0.06**	0.53***	0.26***	0.07**	0.04	0.03
	(0.13)	(0.13)	(0.03)	(0.07)	(0.07)	(0.03)	(0.16)	(0.03)
EM	0.82***	0.18	0.16**	0.54***	0.13***	-0.01	0.15	0.04
	(0.11)	(0.11)	(0.06)	(0.06)	(0.04)	(0.01)	(0.10)	(0.04)
DC	0.65***	0.35**	0.05***	0.59***	0.02	0.01	0.25*	0.08**
	(0.12)	(0.12)	(0.01)	(0.12)	(0.02)	(0.01)	(0.13)	(0.04)
				Panel B: No Banking Crisis				
All	0.67***	0.33***	0.18***	0.44***	0.05***	0.04***	0.25***	0.03***
	(0.05)	(0.05)	(0.03)	(0.06)	(0.01)	(0.01)	(0.05)	(0.01)
AE	0.53***	0.47***	0.03	0.48***	0.01*	0.07**	0.40***	0.01
	(0.12)	(0.12)	(0.02)	(0.12)	(0.01)	(0.03)	(0.11)	(0.03)
EM	0.73***	0.27***	0.22***	0.45***	0.06***	0.05***	0.20***	0.02*
	(0.05)	(0.05)	(0.04)	(0.08)	(0.02)	(0.02)	(0.05)	(0.01)
DC	0.57***	0.43***	0.13**	0.39***	0.05***	0.01	0.34***	0.08***
	(0.12)	(0.12)	(0.05)	(0.10)	(0.01)	(0.02)	(0.12)	(0.02)

Note: This table reports the regression coefficients for Equation (B.2) for each investor group with during times with banking crises (Panel A) and without banking crisis (Panel B). A country-year n, t observation is defined as if country n experienced a banking crisis in either of year $t, t-1, t-2, t-3$. Banking crisis definitions follow Laeven and Valencia (2020). For the developing countries, the definition of crisis includes not only banking crisis, but also debt crisis and currency crisis. Country and year FEs are included, and standard errors are clustered at the country level and reported in the parentheses. Columns (1) and (2) represent domestic and foreign investors, respectively. Columns (3) through (8) correspond to the six investor groups in the text.

B.2.4 Different Subperiods with Currency Valuation

Table B7 reports the results of estimating Equation (B.2) over different subperiods.

Table B7: Marginal Holders Conditioning on Currency: Different Subperiods

	Dom	For	DomBK	DomNB	DomCB	ForBK	ForNB	ForCB
				Panel A: Before 2000				
All	0.60***	0.40**	0.07**	0.47***	0.06*	-0.01	0.41**	0.01
	(0.16)	(0.16)	(0.03)	(0.17)	(0.03)	(0.03)	(0.15)	(0.01)
EM	0.63**	0.37	0.10*	0.42*	0.11***	0.03	0.36	-0.01
	(0.22)	(0.22)	(0.05)	(0.24)	(0.04)	(0.03)	(0.24)	(0.02)
DC	0.57**	0.43*	0.06*	0.48*	0.02	-0.04	0.44*	0.03*
	(0.24)	(0.24)	(0.03)	(0.23)	(0.02)	(0.03)	(0.21)	(0.01)
				Panel B: 2000-2009				
All	0.65***	0.35***	0.18***	0.41***	0.06***	0.03*	0.28***	0.04**
	(0.07)	(0.07)	(0.04)	(0.07)	(0.02)	(0.02)	(0.07)	(0.02)
AE	0.58***	0.42**	0.03	0.46***	0.10	0.05**	0.36**	0.01
	(0.16)	(0.16)	(0.02)	(0.11)	(0.07)	(0.02)	(0.17)	(0.01)
EM	0.73***	0.27***	0.23***	0.44***	0.06**	0.03	0.20***	0.03
	(0.08)	(0.08)	(0.06)	(0.09)	(0.03)	(0.03)	(0.07)	(0.02)
DC	0.52***	0.48***	0.15**	0.33***	0.04**	0.01	0.41**	0.07*
	(0.16)	(0.16)	(0.06)	(0.11)	(0.01)	(0.01)	(0.17)	(0.03)
				Panel C: After 2009				
All	0.80***	0.20***	0.16***	0.56***	0.07***	0.04***	0.13***	0.03**
	(0.05)	(0.05)	(0.04)	(0.07)	(0.02)	(0.01)	(0.03)	(0.01)
AE	0.68***	0.32***	0.13*	0.55***	0.01	0.05	0.17*	0.10
	(0.11)	(0.11)	(0.07)	(0.11)	(0.02)	(0.03)	(0.09)	(0.08)
EM	0.82***	0.18***	0.20***	0.54***	0.08***	0.04***	0.13***	0.01
	(0.06)	(0.06)	(0.04)	(0.09)	(0.03)	(0.02)	(0.05)	(0.01)
DC	0.76***	0.24**	0.04	0.64***	0.08	0.05	0.10*	0.09*
	(0.09)	(0.09)	(0.03)	(0.14)	(0.05)	(0.03)	(0.06)	(0.05)

Note: This table reports the regression coefficients for Equation (B.2) for each investor group before 2000 (Panel A), 2000-2009 (Panel B), and after 2009 (Panel C). Country and year FEs are included, and standard errors are clustered at the country level and reported in the parentheses. Columns (1) and (2) represent domestic and foreign investors, respectively. Columns (3) through (8) correspond to the six investor groups.

B.3 Non-bank Regressions: Euro Area SHS, US Treasuries, and UK Gilts

In this subsection, we report the results of estimating the marginal investor decomposition Equation (2) for a disaggregated data set of Euro Area investors, US Treasuries, and UK Gilts.

B.3.1 Euro Area Data

Table B8 reports the estimates of the share of marginal Euro Area investor holdings of non-Euro Area sovereign investments, as depicted in Figure 3 in the text.

Table B8: Marginal Foreign Non-bank Investors - Euro Area

	(1) Gov	(2) Banks	(3) non-bank	(4) HH	(5) InsurPens	(6) NFC	(7) OthFin
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)

Note: This table reports regression coefficients of Equation (2) on sovereign debt issued by non-European countries for different investor groups within Europe. Columns (1) through (3) report coefficients for governments, banks and the non-bank sector. Columns (4) through (7) disaggregates non-banks into households (HH), insurance and pension funds (insurPens), non-financial corporations (NFC), and other financial institutions (OthFin). Standard errors clustered at country and year level are reported in the parentheses.

In particular, in the row labeled ”All”, this table reports the estimates of Equation (2) treating the denominator as the total holdings of Non-Euro Area sovereign debt by Euro Area investors. Similarly, in the rows labeled ”AE” and ”EM”, this denominator and related holdings breakdowns are based on total holdings by EA investors of AE and EM debt, respectively.

B.3.2 US Treasuries

Table B9 gives the estimates of Equation (2) for the US Treasuries using TIC data. In this case, for the ”All” row, the denominator is given by total holdings of US Treasuries while the numerator corresponds to holdings by the reported investor groups. In the row labeled ”Non-bank”, the denominator is the total holdings of Nonbank investors while the numerator is the subgroup of Nonbank investors given by Money Market Funds (MMFs), Hedge Funds and Households (HF/HH), Insurance and Pensions (IP), Other Financials (OthFin) and Non Financials (NonFin).As the table shows, non-bank investors are particularly important within the domestic investor group. Taken together, Money Market funds and Hedge funds/households comprise that largest component of domestic nonbanks.

Table B9: Marginal Investors in US Treasuries

	Marginal Share				Marginal Non-Bank Share				
	(1) Foreign	(2) DomCB	(3) DomBank	(4) DomNB	(5) MMFs	(6) HF/HH	(7) I&P	(8) OthFin	(9) NonFin
All	0.247***	0.132***	0.061***	0.560***					
	(0.039)	(0.040)	(0.012)	(0.049)					
Non-Bank					0.241***	0.314***	0.150***	0.122***	0.173***
					(0.037)	(0.051)	(0.034)	(0.031)	(0.058)
Constant	0.004***	0.001	-0.001**	-0.004***	0.000	-0.002**	0.001**	0.001*	-0.001
	(0.001)	(0.001)	(0.000)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	104	104	104	104	104	104	104	104	104

Note: This table reports estimates from Equation (2) for the holders of US Treasuries over 1995q1-2020q4. "HF/HH" includes Hedge funds, private equity, private trusts, and direct household holdings. "NonFin" is all non-financial holders excluding households. "OthFin" is all other financial institutions apart from funds and Insurance and Pension (I&P). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

B.3.3 UK Gilts

Table B10 reports estimates for Equation (2) where the holdings are the shares of UK Gilts.

Table B10: Marginal Investors in UK Gilts

	Marginal Share				Marginal Non-Bank Share		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Foreign	DomCB	DomBank	DomNB	Funds & Oth	I&P	NonFin
All	0.174***	0.256***	0.126***	0.443***			
	(0.029)	(0.047)	(0.025)	(0.047)			
Non-Bank					0.510***	0.481***	0.0085*
					(0.055)	(0.054)	(0.004)
Constant	0.003**	-0.000	-0.002**	-0.001	-0.003**	0.003**	-0.000
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.000)
Observations	104	104	104	104	104	104	104

Note: This table reports estimates from Equation (2) for the holders of UK Gilts over 1995q1-2020q4. "Funds & Oth" includes all financial firms besides banks, and insurance companies and pension funds (I&P). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B10 gives the estimates of Equation (2) for the UK Gilts. In the row labeled "All", the denominator is given by total holdings of UK Gilts while the numerator corresponds to holdings by the reported investor groups. In the row labeled "Non-bank", the denominator is the total holdings of Non-bank investors while the numerator is the subgroup of Nonbank investors given by "Funds and Other", Insurance and Pensions (IP), and Non Financials (NonFin). As the table shows, non-bank investors are particularly important within the domestic investor group.

C Supplemental Results for Instrument Construction

This appendix provides supplementary information for the instruments used in Section 3 of the text.

C.1 Reduced-form Estimates of IV Construction: EMs and Yields

This section reports the regression coefficients for the first-stage regression that constructs the instruments. The following Table C11 gives the results for Equation (8) for Emerging Market countries.

Table C11: Reduced-form Holding Regression: EM

	(1) DomBK	(2) DomNB	(3) DomCB	(4) ForBK	(5) ForNB	(6) ForCB
GDP	-0.18**	0.28***	-0.71***	-0.28*	-1.74***	-1.54***
	(0.09)	(0.17)	(0.32)	(0.18)	(0.29)	(0.18)
GDP Growth	-0.35	-2.22**	2.49	-3.85***	1.88	-1.32
	(0.62)	(1.12)	(2.36)	(1.18)	(1.73)	(1.20)
Inflation	-2.12***	-0.15	-1.25	-2.05***	1.12*	-0.52
	(0.24)	(0.41)	(0.78)	(0.46)	(0.64)	(0.47)
Exp-to-GDP	-0.00	-0.01	-0.43	-0.20	-0.22	0.00
	(0.10)	(0.18)	(0.34)	(0.19)	(0.35)	(0.20)
Observations	391	356	324	391	340	380
R2	0.98	0.95	0.88	0.92	0.88	0.90

Note: This table reports the reduced-form estimates of the first-stage regression of instrument construction for EMs, with country and year fixed effects. The sample spans 1996-2018 at annual frequency. The dependent variable is the logarithm of the holdings to GDP by investor group indicated in the column title to GDP. The standard errors are reported in the parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

C.2 Projected Debt-to-GDP Estimates: EMs

Table C12 reports the projections of debt-to-GDP, $d_t(n)$ for EM countries using Equation (9). As described in the text, this variable is projected on exogenous characteristics and its lag modified by the gross GDP growth. A coefficient of 0.72 indicates about a 28% of mean reversion in the level of debt-to-GDP. As described in the text, this finding may be interpreted as an average maturity of 3.6 years, which is close to the 5-year bond yield we choose in the main analysis.

Table C12: Projected Debt-to-GDP Supply: EMs

	Debt-to-GDP
Lag Debt-to-GDP	0.72***
	(0.03)
GDP Growth	-0.09
	(0.11)
Inflation	0.11***
	(0.04)
Exp-to-GDP	-0.03*
	(0.02)
Observations	362
R2	0.96

Note: This table reports the estimates of Equation (9) for emerging market economies. The sample spans 1996-2018 at annual frequency. The standard errors are reported in the parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

C.3 IV Construction: AE

This section reports the estimates used to construct the Advanced Economy instruments for Table 4 in the text. The following table gives the results of Equation (8) for Advanced Economies.

C.4 Projected Debt-to-GDP Estimates: AEs

Table C14 reports the projections of debt-to-GDP, $d_t(n)$ for AE countries using Equation (9). As described in the text, this variable is projected on exogenous characteristics and its lag modified by the gross GDP growth.

Table C13: Reduced-form holding regressions: AEs

	(1) DomBK	(2) DomNB	(3) DomCB	(4) ForBK	(5) ForNB	(6) ForCB
GDP	-0.30***	-0.92***	-2.10**	0.74***	0.66	1.09***
	(0.22)	(0.31)	(0.83)	(0.21)	(0.41)	(0.22)
GDP growth	1.76	-5.90***	3.92	-2.15*	-2.63	2.74**
	(1.23)	(1.73)	(4.43)	(1.16)	(2.19)	(1.23)
Inflation	-4.29*	-1.91	-0.13	10.16***	0.08	5.50**
	(2.43)	(3.44)	(9.11)	(2.29)	(4.32)	(2.43)
Exp-to-GDP	0.44	-0.37	2.72**	0.21	0.97*	-0.20
	(0.29)	(0.43)	(1.14)	(0.28)	(0.54)	(0.29)
Observations	341	322	312	342	326	341
R2	0.99	0.93	0.82	0.95	0.86	0.96

Note: This table reports the reduced-form estimates of the first-stage regression of instrument construction for AEs, with country and year fixed effects. The sample spans 1996-2018 at annual frequency. The dependent variable is the logarithm of holdings to GDP by the group indicated in the column title to GDP. The standard errors are reported in the parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table C14: Projected Debt-to-GDP Supply: AEs

Lag Debt-to-GDP	0.72***
	(0.03)
GDP Growth	-0.71***
	(0.23)
Inflation	-0.98**
	(0.45)
Exp-to-GDP	0.15***
	(0.05)
Observations	323
R2	0.98

Note: This table reports the estimates of Equation (9) for advanced economies. The sample spans 1996-2018 at the annual frequency. The standard errors are reported in the parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

D Supplemental Results for Demand System Estimation

In this appendix, we provide more detailed results about the demand system approach of estimation in Section 3.3 of the paper.

D.1 Predictive Regression Results

Table D15 reports the return predictive regression results for Equation (15) and (13) in the main text.

Table D15: Bond Return Predictive Regression

	(1) Domestic Excess Return	(2) Foreign Excess Return
$p_t(n)$	-0.59***	-0.75***
	(0.05)	(0.08)
$q_t(n)$		0.23***
		(0.06)
Observations	367	367
R2	0.34	0.27

As described there, $p_t(n)$ is the logarithm of the price of a 5 year zero coupon bond in local currency for country n and $q_t(n)$ is the logarithm of its real exchange rate relative to the U.S. dollar. In particular, $q_t(n) \equiv s_t(n) - z_t(n)$ where $s_t(n)$ is the logarithm of the US dollar price of currency n and $z_t(n)$ is the logarithm of the ratio of the price index of country n to the US price index.

D.2 Yield Elasticity

We next describe the derivation of the investor demand elasticity following the literature of Koijen and Yogo (2019) and Jiang et al. (2022).

D.2.1 Foreign Investors

As described above, foreign non-EM investors hold the sovereign debt of all EM countries plus an outside asset that does not include this debt. To calculate the demand elasticity relative to expected returns μ, differentiate with respect to expected returns the ratio of shares for a given country n given in Equation (11) in the text. This implies:

$$\frac{d\delta_{i,t}(n)}{d\mu_{i,t}(n)} = \frac{d(\ln \omega_{i,t}(n) - \ln(1 - \sum_{k=1}^{N} \omega_{i,t}(k)))}{d\mu_{i,t}(n)} = \frac{d \ln w_{i,t}(n)}{d\mu_{i,t}(n)} + \sum_{k} \frac{w_{i,t}(k)}{w_{i,t}(0)} \frac{d \ln w_{i,t}(k)}{d\mu_{i,t}(n)} = \lambda_{0,i} \tag{D.1}$$

Without loss of generality, consider $n = 1$ and denote $\kappa_{n,j} \equiv (d \ln w_{i,t}(n)/d\mu_{i,t}(j))$. Suppressing the investor indicator i for parsimony, the relationship can be rewritten,

$$\kappa_{11} + \frac{\omega(1)}{\omega(0)}\kappa_{11} + \sum_{k=2}^{N} \frac{\omega(k)}{\omega(0)}\kappa_{k,1} = \lambda_0 \tag{D.2}$$

Multiplying both sides by $\omega(0)$, implies:

$$(\omega(0) + \omega(1))\kappa_{1,1} + \sum_{k=2}^{N} \omega(k)\kappa_{k,1} = \lambda_0\, \omega(0) \tag{D.3}$$

Furthermore, note that for $j \neq 1$,

$$\kappa_{j,1} + \frac{\omega(1)}{\omega(0)}\kappa_{1,1} + \sum_{k=2}^{N} \frac{\omega(k)}{\omega(0)}\kappa_{k,1} = 0 \tag{D.4}$$

Multiplying both sides by $\omega(0)$, we get

$$\omega(0)\kappa_{j,1} + \omega(1)\kappa_{1,1} + \sum_{k=2}^{N} \omega(k)\kappa_{k,1} = 0 \tag{D.5}$$

From the equation above, we see that $\kappa_{j,1}$ for $j \neq 1$ does not depend on j. Therefore,

$$\kappa_{j,1} = -\frac{\omega(1)}{1 - \omega(1)}\kappa_{1,1} \text{ for } j \neq 1 \tag{D.6}$$

Substituting this variable into the above Equation (D.3) and solving for κ_{11} implies:

$$\kappa_{1,1} = \lambda_0(1 - \omega(1)) \tag{D.7}$$

Since this relationship holds for any arbitrary country n and individual investor i, then clearly the demand elasticity for foreign investors can be written more generally as:

$$\frac{d \ln H_{i,t}(n)}{d\mu_{i,t}(n)} = \frac{d \ln w_{i,t}(n)}{d\mu_{i,t}(n)} = \lambda_{0,i}(1 - \omega_{i,t}(n)) \tag{D.8}$$

D.2.2 Domestic Investors

We derive the elasticity of demand with respect to expected excess returns for domestic investors by differentiating Equation (12) in the text. In particular, we differentiate this share as in:

$$\frac{d\ln(H_{i,t}(n))}{d\mu_{i,t}(n)} = \frac{d\ln\omega_{i,t}(n)}{d\mu_{i,t}(n)} \tag{D.9}$$

subject to the constraint that the shares of wealth sum to one. In the case of domestic investors, we assume they hold no other sovereign debt so that the share for domestic investors plus the share of outside assets sum to one; that is, $\omega_{i,t}(n) = 1 - \omega_{i,t}(0,n)$. Thus, differentiating the ratio of portfolio shares in Equation (12) with respect to expected returns implies:

$$\frac{d(\ln\omega_{i,t}(n) - \ln(1-\omega_{i,t}(n))}{d\mu_{i,t}(n)} == \frac{1}{1-\omega_{i,t}} \frac{d\ln\omega_{i,t}(n)}{d\mu_{i,t}(n)} = \lambda_{0,i}$$

Therefore,

$$\frac{d\ln\omega_{i,t}(n)}{d\mu_{i,t}(n)} = \lambda_{0,i}(1-\omega_{i,t}(n)) \tag{D.10}$$

Comparing this equation with Equation (D.8) makes clear that the form of the demand elasticities are the same between foreign and domestic investors. Moreover, these demand elasticity measures are the same as Koijen and Yogo (2019) and Jiang et al. (2022).

Price elasticity. Bond price and expected excess return are linked through the predictive regression of excess returns described above. Using this relationships implies:

$$\frac{d\ln H^m_{i,t}(n)}{d\ln P_t(n)} = \lambda_{0,i}(1-\omega_{i,t}(n))\phi^i_0 \tag{D.11}$$

We lack the data to assess the response of exchange rate in response to bond price change, thus we must indirectly assume that the change of bond price does not affect demand of debt through changing exchange rate.

Yield elasticity.

$$\frac{d\ln H^m_{i,t}(n)}{dy_t(n)} = -\frac{1}{T}\lambda_{0,i}(1-\omega_{i,t}(n))\phi^i_0 \tag{D.12}$$

E Counterfactual Derivation

This section provides the detailed algebra for the calculation of counterfactual measures.

E.1 Borrowing Cost Sensitivity

We are interested in the following question: if the government wants to increase debt by one percent, how much will yield increase? To derive this measure, we start from the following equation:

$$P_t(n)D_t(n) = \sum_{i=1}^{6} P_{i,t}(n)H_{i,t}(n) \tag{E.1}$$

where $P_t(n)$ is the price of debt issued by country n and $P_{i,t}(n)$ is the price faced by investor group i. In equilibrium, $P_{i,t}(n) = P_t(n)$. Thus, the question above can be restated as: what will happen to the yield if the government issues one more percent of (market value) debt? This question can be answered by calculating the change in yield for a percentage change in the market value of debt; that is, $\xi \equiv \frac{dy_t(n)}{d\ln(P_t(n)D_t(n))}$.

To calculate this measure, note that $P_t(n) = \exp(-Ty_t(n))$. Therefore, we can rewrite this measure as:

$$\xi \equiv \frac{dy_t(n)}{d\ln\left(P_t(n)D_t(n)\right)} = \frac{dy_t(n)}{-Tdy_t(n) + d\ln D_t(n)} \tag{E.2}$$

From the market clearing condition, we can express the yield as:

$$y_t(n) = \frac{1}{T}\left(\ln D_t(n) - \ln\sum_{i=1}^{6} P_t^i(n)H_i(n)\right) \tag{E.3}$$

Differentiating with respect to the logarithm of debt then implies:

$$\frac{dy_t(n)}{d\ln D_t(n)} = \frac{1}{T} - \frac{1}{T}\left(\frac{\sum_{i=1}^{I}\frac{d\left(P_t^i(n)H_{i,t}(n)\right)}{dH_{i,t}(n)}\frac{dH_{i,t}(n)}{dD_t(n)}D_t(n)}{\sum_{i=1}^{I}P_t^i(n)H_{i,t}(n)}\right) \tag{E.4}$$

Recall that from Section 2, the investor group i's marginal financing share $\frac{dH_{i,t}(n)}{dD_t(n)} = a_i$. Moreover, define the inverse demand elasticity as $\frac{\partial y_t(n)}{\partial \ln H_{i,t}^m(n)} = \frac{1}{\tilde{\eta}_i}$. Then with these definitions, we can re-express $\frac{dy_t(n)}{d\ln D_t(n)}$ in Equation (E.4) as:

$$\tilde{\xi} \equiv \frac{dy_t(n)}{d\ln D_t(n)} = \frac{1}{T} - \frac{1}{T}\left(1 - T\sum_{i=1}^{I}\frac{a_i}{\tilde{\eta}_i}\right) = \sum_{i=1}^{I}\frac{a_i}{\tilde{\eta}_i} \tag{E.5}$$

Empirically, our estimates in Table 3 in Panel B provide the semi-elasticity of market value of holding with respect to yield. That is, we can denote our empirical estimates as:

$$\frac{1}{\eta_i} \equiv \frac{dy_t(n)}{d\ln H^m_{i,t}(n)} = \frac{dy_t(n)}{-Tdy_t(n) + d\ln H_{i,t}(n)} = \frac{1/\tilde{\eta}_i}{-T/\tilde{\eta}_i + 1}$$

Therefore, substituting these estimates into Equation (E.2) implies:

$$\xi = \frac{dy_t(n)}{d\ln\left(P_t(n)D_t(n)\right)} = \frac{dy_t(n)/d\ln D_t(n)}{-Tdy_t(n)/d\ln D_t(n) + 1} = \frac{\sum_{i=1}^{I}\frac{a_i}{\eta_i+T}}{\sum_{i=1}^{I}\frac{a_i\eta_i}{T+\eta_i}} \tag{E.6}$$

as given in equation (17) in the text. ξ is the inverse of the aggregate demand semi-elasticity with respect to yield in the EM sovereign debt market.

E.2 Sensitivity to Characteristics Changes

In this section, we derive the impact on yield implied by a change in one of the characteristics that we denote X_t. Again we start with the market clearing condition of Equation (E.1). The market clearing condition implicitly defines a function of $P_t(n) = P(X_t(n), D_t(n))$.

We first calculate how much the price of debt would change in response to a unit change in $X_t(n)$ given the book value of debt. Taking the first-derivative with respect to X_t implies:

$$D_t(n)P_t(n)\frac{d\ln P_t(n)}{dX_t(n)} = \sum_{i=1}^{I}\frac{\partial H^m_{i,t}(n)}{\partial \ln P_t(n)}\frac{d\ln P_t(n)}{dX_t(n)} + \frac{\partial H^m_{i,t}(n)}{\partial X_t(n)} \tag{E.7}$$

Rearranging terms yields:

$$\frac{d\ln P_t(n)}{dX_t(n)} = \frac{\sum_{i=1}^{I}\frac{\partial \ln H^m_{i,t}(n)}{\partial X_t(n)}\psi_i}{1 - \sum_{i=1}^{I}\frac{\partial \ln H^m_{i,t}(n)}{\partial \ln P_t(n)}\psi_i} \tag{E.8}$$

where ψ_i is the average share of debt held by investor i. We can then write the yield response to a change in a given characteristic $X_t(n)$ as:

$$\tilde{\xi} = \frac{dy_t(n)}{dX_t(n)} = -\frac{1}{T}\frac{\sum_{i=1}^{I}\frac{\partial \ln H^m_{i,t}(n)}{\partial X_t(n)}\psi_i}{1 - \sum_{i=1}^{I}\frac{\partial \ln H^m_{i,t}(n)}{\partial \ln P_t(n)}\psi_i} \tag{E.9}$$

Clearly, $\tilde{\xi}$ is the yield response to a unit change in $X_t(n)$ given the book value of debt. But the market value will change with the price response. Therefore, as above, we calculate how much the book value of debt would have to change for a given market value.

Recall that the price of debt can be written as a function of $D_t(n)$ and $X_t(n)$ as $P(D_t(n), X_t(n))$. We can rewrite the change of market value in response to a unit change in $X_t(n)$ as

$$\frac{d(\ln P(D_t(n), X_t(n)) + d\ln D_t(n)}{dX_t(n)} = \frac{\partial \ln P_t(n)}{\partial \ln D_t(n)} \frac{d\ln D_t(n)}{dX_t(n)} + \frac{\partial \ln P_t(n)}{\partial X_t(n)} + \frac{d\ln D_t(n)}{dX_t(n)} = 0 \tag{E.10}$$

We then solve for the percentage change in the book value of debt due to a change in the given characteristic as:

$$\frac{d\ln D_t(n)}{dX_t(n)} = -\frac{\partial \ln P_t(n)/\partial X_t(n)}{1 + \partial \ln P_t(n)/\partial \ln D_t(n)} = \frac{T\zeta}{1 - T\tilde{\xi}} \tag{E.11}$$

where $\tilde{\xi}$ is the inverse of aggregate demand elasticity derived in section E.1. Then defining the yield response to a unit change in characteristics $X_t(n)$ while keeping the market value of debt unchanged as ζ, this variable can be expressed as:

$$\zeta = \tilde{\zeta} + \frac{dy_t(n)}{d\ln D_t(n)} \frac{T\tilde{\zeta}}{1 - T\tilde{\xi}} = \frac{\tilde{\zeta}}{1 - T\tilde{\xi}} \tag{E.12}$$

This expression verifies Equation (18) in the text.

E.3 Spillover of Individual Holding

In this section, we derive the impact on the yield if investor i's latent demand increases by one percent. We also consider how much each investor's holdings will change. We start from the market clearing condition of Equation (E.1). The market clearing condition implicitly defines a function of $P_t(n) = P(X_t(n), D_t(n), \varepsilon_t(n))$ where $\varepsilon_t(n)$ is the vector of each investor's latent demand for debt issued by country n.

Again, we first fix the book value of debt $D_t(n)$ and take the first-derivative with respect to investor k's latent demand $\varepsilon_{k,t}(n)$, obtaining:

$$D_t(n)P_t(n)\frac{d\ln P_t(n)}{d\varepsilon_{k,t}(n)} = \sum_{i=1}^{I} \frac{\partial H^m_{i,t}(n)}{\partial \ln P_t} \frac{d\ln P_t}{d\varepsilon_{k,t}(n)} + \frac{\partial H^m_{k,t}(n)}{\partial \varepsilon_{k,t}(n)} \tag{E.13}$$

Thus, the response of price to the change in latent demand is:

$$\frac{d\ln P_t(n)}{d\varepsilon_{k,t}(n)} = \frac{\partial H^m_{k,t}(n)/\partial \varepsilon_{k,t}(n)}{D_t(n)P_t(n) - \sum_{i=1}^{I} \frac{\partial H^m_{i,t}(n)}{\partial \ln P_t(n)}} = \frac{\psi_k}{1 - \sum_{i=1}^{I} \psi_i \frac{\partial \ln H^m_{i,t}(n)}{\partial \ln P_t(n)}} \tag{E.14}$$

We can then write the yield response as

$$\tilde{\varphi} = \frac{dy_t(n)}{d\varepsilon_{k,t}(n)} = -\frac{1}{T}\frac{\psi_k}{1 + \frac{1}{T}\sum_{i=1}^{I}\psi_i\eta_i} \tag{E.15}$$

Next, we calculate how much the book value of debt would have to change in order to keep the market value of debt unchanged. This calculation implies the differential relationship:

$$\frac{d\ln(P(D_t(n), X_t(n), \varepsilon_t(n)) + d\ln D_t(n))}{d\varepsilon_{k,t}(n)} = \frac{d\ln P_t(n)}{d\ln D_t(n)}\frac{d\ln D_t(n)}{d\varepsilon_{k,t}} + \frac{d\ln P_t(n)}{d\varepsilon_t^k} + \frac{d\ln D_t(n)}{d\varepsilon_t^k} = 0 \tag{E.16}$$

Solving for the implied percentage change of book value of debt to keep the market value of debt unchanged implies:

$$\frac{d\ln D_t(n)}{d\varepsilon_{k,t}(n)} = \frac{T\tilde{\varphi}}{1 - T\xi} \tag{E.17}$$

Then, defining the object of interest as φ, this relationship can be expressed as:

$$\varphi = \frac{\tilde{\varphi}}{1 - T\tilde{\xi}} \tag{E.18}$$

This derivation verifies Equation (19) in the text.