# International Currencies and Capital Allocation

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We establish currency as an important factor shaping global portfolios. Using a new security-level data set, we demonstrate that investor holdings are biased toward their own currencies to such an extent that countries typically hold most of the foreign-debt securities denominated in their currency. While large firms issue in foreign currency and borrow from foreigners, most firms issue only in local currency and do not directly access foreign capital. These patterns hold broadly across countries except for the United States, as foreign investors hold significant shares of US dollar bonds. The share of dollar-denominated cross-border holdings surged after 2008.

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## I. Introduction

Capital crosses international borders far more today than only a few decades ago. In the late 1970s, almost none of the total outstanding value of US corporate debt was held by foreigners. Today, more than one-quarter is held abroad. In part due to a lack of detailed data, however, surprisingly little is known about the determinants of cross-border investment. We introduce a novel security-level data set covering, as of 2017, 32 trillion dollars in global investment positions to demonstrate that portfolios at both the macro and micro levels are driven by an often neglected aspect: the currency of denomination of assets.

We emphasize four findings. First, investors' bond portfolios exhibit strong *home-currency bias* as they disproportionately invest in bonds denominated in their own country's currency. Using micro data, we identify this effect by measuring the extent to which investors disproportionately hold bonds in their own currency relative to debt in other currencies issued by the same firm. This within-firm analysis allows us to disentangle the importance of the currency of denomination of a bond from possible confounding factors such as maturity, legal jurisdiction, and an issuer's credit risk and sector of operation. This home-currency bias holds to such an extent that countries typically own the majority of bonds denominated in their currency, even when the issuer is foreign and resides in a developed country. In fact, given the currency of denomination of a bond, knowledge of the issuer's nationality—the focus of a large and influential literature on home bias—offers very little additional information for predicting the investor's nationality. It is well known that investors dedicate a larger share of their bond portfolios to the set of domestic companies than foreign investors dedicate to those same companies. This home-country bias attenuates or even disappears if, instead of pooling all bonds together, one separately studies the portfolio shares of bonds denominated in any particular currency.

Second, home-currency bias is associated with a stark pattern of capital allocation across firms. In each country, a small number of large firms issue debt denominated in foreign currency and borrow from foreigners. By contrast, a large number of medium or smaller sized firms issue bonds only in their local currency (LC) and do not borrow substantially from foreigners. To demonstrate that this pattern does not simply reflect an unobservable characteristic of local currency borrowers that makes them

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unappealing to foreign investors, we show that these same local currency borrowers do receive equity investments from abroad. These facts suggest that the currency of issuance itself is a key factor associated with the differential receipt of foreign capital.

Third, the United States is the exception to the above patterns, with global investors uniquely willing to hold US dollars. In addition to their own currencies, foreigners invest a substantial portion of their portfolio in dollar-denominated securities when they invest in all destination countries, which we refer to as an international-currency or dollar bias. This implies that when foreigners buy US securities, they predominantly buy dollar-denominated securities, thus behaving similarly to US domestic investors. Relatedly, US firms that borrow exclusively in dollars place their bonds in domestic and foreign portfolios with comparable ease. This is not true for any other country in our data. Our work offers a novel perspective on the potential benefits that accrue to countries that issue an international currency such as the dollar: international currencies effectively open up the capital account for firms that only borrow in domestic currency.

Fourth, we uncover a striking shift in the time series of global portfolios. The US dollar appears today to be the world's only international currency. As recently as 10 years ago, however, this was not the case. While the dollar was the currency of denomination for 41% of global cross-border holdings of corporate debt in our data in 2005, the euro also accounted for a substantial amount, 38%. These shares were largely stable until the global financial crisis of 2008, after which the euro's share rapidly declined to 22%, while the dollar's share rose to 63%. This massive international portfolio reallocation is not only interesting in its own right, but also offers a unique opportunity to assess how the above cross-sectional stylized facts changed in response to variation in the international status of the dollar and the euro. In line with the time-series shift of global portfolios toward the dollar, we find that differences between foreign and domestic investors in the European Monetary Union (EMU) and in the United States, which are large in 2017, were more muted earlier in our sample.

Our security-level data set covers holdings of mutual funds and exchange-traded funds (ETFs) around the world. ETFs were rare in the early years of our data and by 2017 only constitute about 10% of the fixed-income assets under management (AUMs) that we study. For ease of exposition, therefore, we often omit mention of "ETFs" and discuss our data in what follows as covering the holdings of "mutual funds" or "funds."[1]

[1] Some fund managers report data on both mutual funds and ETFs, making it difficult to separate them in our analyses. We have confirmed, however, that all qualitative results from analyses of 2017 data also hold if we instead use data from several years earlier, when ETFs constituted an even smaller share of overall AUMs.

We confront some common but thorny issues in international financial data as well as challenges specific to our data. We use the procedure described in Coppola et al. (2020) and unwind issuance in tax havens and opaque international ownership structures in order to attribute securities to their ultimate parent firm (and its industry and country of operation), the revenues of which are used to repay the debt. We offer evidence that mutual funds domiciled in a particular country primarily invest on behalf of domestic residents, an assumption maintained throughout our analysis. Finally, we benchmark our data against other aggregates to verify that our core results are externally valid and are informative of patterns in the broader set of portfolio investments.

These new facts on the critical role of currency for understanding global capital flows have the potential to shape international macroeconomics models in much the same way that the stylized facts on home-country bias, uncovered in French and Poterba (1991), influenced the earlier theoretical literature. Our intent is to establish these four facts in a simple and transparent way, leaving it to future work to identify the exact mechanisms underlying them. There are a number of possibilities. For example, investor home-currency bias may reflect the optimal allocation if home-currency bonds are a good hedge for investors' risks. Alternatively, this bias may reflect a combination of financial frictions such as hedging costs and behavioral factors that effectively segment the market by currency. If foreign-currency debt issuance requires incurring a fixed cost and if investors exhibit a bias toward local currency, only the largest firms would access foreign capital, much like the selection into exporting in the Melitz (2003) model of trade.

Our data set includes quantities, that is, bond positions, but not prices and therefore does not allow us to directly assess the borrowing cost of issuers. As with the trade literature, estimating the real economic impact of selection into foreign-currency issuance will likely require a heavy structural apparatus. Measuring the benefits of selling bonds to foreigners or quantifying the "privilege" from issuing in a global currency such as the US dollar is beyond the scope of this paper. In light of our results, however, we believe these are worthy goals for future work.

*Related literature.*—Our work relates to a large empirical literature linking net foreign asset dynamics to the differential composition of gross assets and gross liabilities, including important contributions by Gourinchas and Rey (2007), Lane and Milesi-Ferretti (2007), and Curcuru, Dvorak, and Warnock (2008).[2] Our finding that foreigners' portfolios are underweight

[2] Other recent work includes Alfaro, Kalemli-Ozcan, and Volosovych (2008), Bertaut, Tabova, and Wong (2014), Du and Schreger (2017), and Lane and Milesi-Ferretti (2018). These papers make use of the IMF's International Investment Position (IIP) and Coordinated Portfolio Investment Survey (CPIS), the US Treasury's International Capital Flow (TIC) data, and the Debt Security Statistics and Locational Banking Statistics of the Bank for International

local-currency debt to such an extent that the external debt liabilities of countries are in large part denominated in foreign currency complements the work by Lane and Shambaugh (2010) and Bénétrix, Lane, and Shambaugh (2015). The data set of Lane and Shambaugh shows that foreign-debt liabilities are often in foreign currency, but our micro data first directly link the currency composition of those liabilities to the country composition of foreign investors. Further, we exploit security-level variation to confirm that exposure to currency itself, rather than to potentially correlated factors such as firms or industries, drives this pattern.

Our finding that home-country bias is largely attenuated within the set of local currency bonds expands on the message in Burger, Warnock, and Warnock (2017), who first found using TIC data that US foreign investment across destination countries does not appear home-country biased in the subset of debt that is dollar denominated and suggested it might apply more generally across countries and debt markets. Boermans and Vermeulen (2016) find that a common currency is an important explanatory variable in a gravity portfolio setting for EMU-based investors.

Our results on which firms select into foreign-currency borrowing and the heterogeneity across countries in such selection have analogies with both the international corporate finance literature, including Gozzi, Levine, and Schmukler (2010), Gozzi, Martinez Peria, and Schmukler (2015), and Larrain and Stumpner (2017), and the trade literature following Melitz (2003). The model of Salomao and Varela (2018) features an endogenous funding choice by heterogeneous firms that must pay a fixed cost to borrow in foreign currency. Salomao and Varela apply their framework to data on Hungarian firms and study the link between their borrowing and investment decisions. Liao (2016) shows that variation in the currency-hedged cost of debt across different currencies predicts firms' issuance: firms issue the most in those currencies in which borrowing is cheaper (including the cost of currency hedging). Bruno and Shin (2015a, 2015b) study how movements in the dollar affect capital allocation and corporate investment via a balance sheet channel, and Bruno and Shin (2017) provide evidence that the recent increase in dollar

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Settlement. A related literature studies international mutual fund data, but typically concentrates on equity flows or includes only a small subset of countries (see, e.g., Hau and Rey 2004, 2008a, 2008b; Chan, Covrig, and Ng 2005; Jotikasthira, Lundblad, and Ramadorai 2012; Raddatz and Schmukler 2012; Didier, Rigobon, and Schmukler 2013; and Forbes et al. 2016). Hau and Lai (2016) focus on European money market funds to study monetary policy. Hale and Obstfeld (2016) examine the effect of the euro on the geography of cross-border debt investment. Kalemli-Ozcan et al. (2017) use loan-level data to examine how global shocks drive capital flows to Turkey. Koijen and Yogo (2019) demonstrate how to estimate a demand system for equity investments using a data set of holdings at the institutional investor level. Our work suggests currency would be an important factor in such estimates for bond investments. Choi and Kronlund (2017) study Morningstar data on US corporate bond mutual funds.

borrowing by emerging market nonfinancial corporates is driven by these firms running a carry trade.

Our results on the special role of the dollar and its use in denominating internationally held bond contracts complements a growing body of research. The existing literature, including Caballero, Farhi, and Gourinchas (2008), Mendoza, Quadrini, and Rios-Rull (2009), Gourinchas, Govillot, and Rey (2011), Maggiori (2017), Farhi and Maggiori (2018), and He, Krishnamurthy, and Milbradt (2019), has mostly focused on the safe-haven properties of the US dollar and the lower risk-free rate it affords to US government bonds, whereas we focus on the allocation of capital among corporate borrowers and offer evidence that the US "exorbitant privilege" includes the unique ability of US corporates that only borrow in dollars to raise capital from foreigners. Our finding that most cross-border bond positions are denominated in dollars, including a large share even when neither the investor nor the issuer are based in the United States, has a mirror in the dominance of the dollar in invoicing traded goods, discussed in Goldberg and Tille (2008), Goldberg (2010), Gopinath (2016), and Gopinath and Stein (2018). It also relates to the international use of the dollar as a unit of account and means of payment modeled by Matsuyama, Kiyotaki, and Matsui (1993), Chahrour and Valchev (2017), and Doepke and Schneider (2017).

Finally, the empirical patterns that we document offer a challenge as well as new guidance for international macro models. Benchmark models cannot match our facts because they generate no bond trading, as in Lucas (1982), or because they predict that foreign investors, conditional on investing in a country, tend to take on direct exposure to the borrower's local currency, as in Alvarez, Atkeson, and Kehoe (2009), Bacchetta and van Wincoop (2010), Pavlova and Rigobon (2012), and Lustig and Verdelhan (2016).[3] A few models do generate home-currency bias either as the optimal solution of a frictionless portfolio choice as in Solnik (1974), Adler and Dumas (1983), Engel and Matsumoto (2009), and Coeurdacier and Gourinchas (2016), or exogenously by postulating that households invest abroad in bonds denominated in their own domestic currency as in Gabaix and Maggiori (2015). Even these few models, however, would struggle to match the skewed foreign capital allocation—in which foreign-currency issuers receive the bulk of foreign investment—that we show is a critical feature of the data. We conclude in section VI by elaborating on these points and suggesting how future work might generate models in which currency is critical for both debt investors and issuers and in which the US dollar plays a special global role.

[3] See also Corsetti, Dedola, and Leduc (2008), Tille and van Wincoop (2010), Colacito and Croce (2011), Devereux and Sutherland (2011), Hassan (2013), Dou and Verdelhan (2015), Hassan, Mertens, and Zhang (2016), and Colacito et al. (2018).

## II. Mutual Fund Investment Data

Morningstar, Inc., one of the world's largest providers of investment research to the asset management industry, provided us with their complete position-level data collected from mutual funds and ETFs domiciled in over 50 countries. These data are collected from open-end funds that invest in equities, fixed income, and a variety of other asset classes including commodities, convertible bonds, and housing properties.[4] The funds report all positions including stocks, bonds, cash, and alternative investments. Funds occasionally list derivative holdings, but we exclude these due to erratic reporting. Positions include a nine-digit identifier (the CUSIP) which we use to match with information on the security's characteristics such as currency, maturity, coupon, or dividend, and the security issuer's geographic location and industry. Reporting is typically monthly and, when not, is almost always quarterly. At the most disaggregate level, our data set contains millions of individual positions. For example, prior to the additional filtering done below, we observe about 5 million unique positions held by approximately 9,000 US funds and about 6 million unique positions held by approximately 52,000 funds domiciled in the rest of the world in December 2017.

### *A. Morningstar's Coverage of the Mutual Fund Industry*

Our data account for a substantial fraction of all worldwide open-end fund assets under management (AUMs). The Investment Company Institute (ICI), a major association of mutual funds and other regulated investment vehicles, reports that the US mutual fund and ETF industry had about 22 trillion dollars of AUMs as of 2017 across equity, fixed income, allocation, and money market funds. Figure 1*A* compares the total value of fixed-income funds' assets under management in US-domiciled funds in our data set and in the ICI data. From very low levels of AUMs in the 1980s, the industry grew at a rapid pace in the 1990s and 2000s, as captured in the solid line. AUMs grew slowly during the 2008 recession but rapidly recovered and expanded to their present levels. Our data, displayed as a dashed line in figure 1*A*, exhibit meaningful coverage of US-domiciled AUMs starting in the late 1990s and by 2017 account for 93% of the value reported by ICI. The appendix (available online) includes figures that plot equivalent comparisons for the value of AUMs managed by

[4] Fund managers are not required by law to report their holdings to Morningstar but choose to do so in order to be included in Morningstar's ratings and reviews. In principle, fund managers might not wish to correctly report their positions to Morningstar in order to "window dress." Morningstar's internal procedures verify the accuracy of the data against publicly available returns of the funds. Our own independent checks of the data against regulatory filings, voluntary disclosures, and other data sets of investment fund positions revealed the data to be accurate.

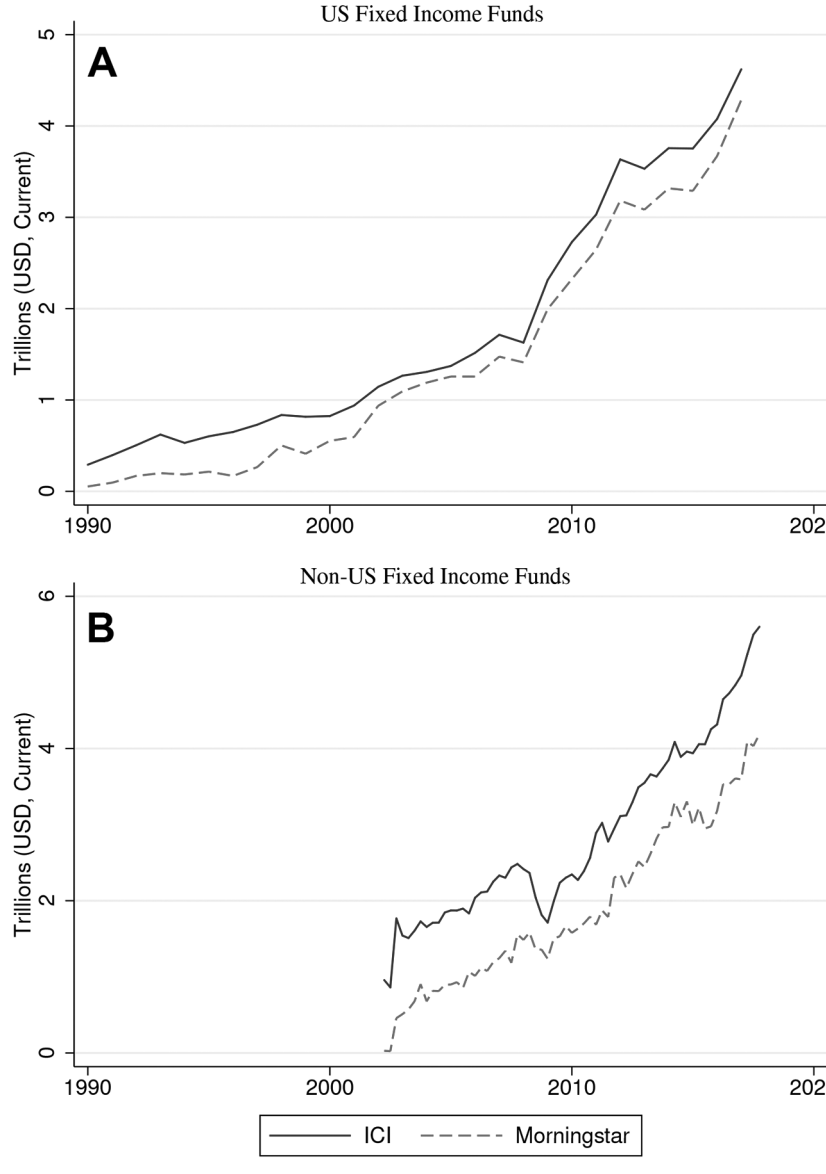


FIG. 1.—Morningstar's coverage of US mutual fund and ETF assets under management. *A*, US fixed-income funds. *B*, Non-US fixed-income funds. The graphs compare total AUMs for open-end mutual funds and ETFs in our data (*dashed lines*) with that measured by the Investment Company Institute (ICI; *solid lines*). A color version of this figure is available online.

equity and allocation (or hybrid) funds. By the end of the sample, the coverage of our data for the United States is nearly complete across all major types of funds.

Our data also include holdings of mutual funds and ETFs domiciled in more than 50 other countries. ICI reports that these countries together have 19 trillion dollars of AUMs in 2017. Substantial coverage of these funds in our data starts in the early to mid-2000s. Figure 1*B* shows that over the last decade our data capture between half and three-quarters of fixed-income AUMs outside the United States.[5] To ensure that analyses are not influenced by domiciles for which Morningstar data are unrepresentative, we work with a subsample of the data that includes those developed economies for which Morningstar's coverage of fixed-income AUMs is at least one-quarter of what ICI reports for that market at the end of 2017. These criteria select a final sample of 23 countries, 14 of which are subsumed into the EMU.[6] Table 1 lists the remaining 10 effective countries, ranked by the order of their AUMs in 2017 in our data. While the United States and EMU clearly account for the bulk of global AUMs, we observe nearly 1.5 trillion dollars in AUMs for Canada and for the United Kingdom.

### *B. Representativeness of Mutual Fund Investments*

Mutual fund and ETF data are valuable for studying global capital allocation both because funds directly constitute a sizable share of all global portfolio investments and because their investments are in many ways representative of aggregate cross-border portfolio investment. While these funds are differentially important across countries, they always constitute one of the main holders of securities. According to OECD data, the share of total bond investment in 2017 that is intermediated by investment funds is 43% in the EMU, 23% in the United States, and averages 36% across the 10 countries included in our analysis (though it varies from a low of 9% in Norway to a high of 82% in Denmark).

Comparisons with publicly available data sets suggest that, in the characteristics that we emphasize, our data appear largely representative of the broader set of portfolio investments. In the appendix, we include figures demonstrating that the country and currency shares of US outward

[5] The ICI data for non-US domiciled funds are available quarterly on their web page when they release their "Worldwide Public Tables." We were able to obtain these tables for most quarters since the first quarter of 2005 using the Internet Archive (https://web.archive.org). We log-linearly interpolate between the ICI values in the first quarter of 2005 and their values in the second quarter of 2002, which we obtained from Khorana, Servaes, and Tufano (2005).

[6] The countries included in the EMU in our data are Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, Netherlands, Portugal, Slovenia, and Spain. All countries enter our sample only after their respective adoption date of the euro.

TABLE 1
DOMICILE COUNTRIES INCLUDED IN ANALYSES

| | Country Code | AUMs in 2017 (billion USD) |
|---|---|---|
| (1) United States | USA | 21,077 |
| (2) European Monetary Union | EMU | 7,004 |
| (3) Canada | CAN | 1,437 |
| (4) United Kingdom | GBR | 1,408 |
| (5) Switzerland | CHE | 431 |
| (6) Sweden | SWE | 355 |
| (7) Australia | AUS | 313 |
| (8) Norway | NOR | 133 |
| (9) Denmark | DNK | 127 |
| (10) New Zealand | NZL | 43 |

NOTE.—This table reports total assets under management (AUMs) for the countries (i.e., domiciles of mutual funds and ETFs) that have sufficient coverage relative to the level of AUMs reported in ICI and therefore are included in our main analyses. All types of funds (equity, fixed income, allocation, and money markets) are included in the AUM figures.

investment in our data broadly match their equivalents in TIC data. Since TIC covers all portfolio investment, including positions by pensions and hedge funds, for example, this suggests that US mutual fund and ETF positions are broadly representative of US portfolios. We also report similar statistics for inward investments, which do not align well with our data. This is likely due to large foreign entities directly investing in US securities, such as government institutions in China and Japan or large European insurance companies.

To examine the representativeness of non-US mutual funds and ETFs, we compare our data with reported positions from CPIS, a survey of cross-border portfolio holdings conducted by the IMF. The appendix shows that our data align well with the bilateral country composition of foreign assets for all nine non-US economies in our sample. CPIS also includes information on the currency of foreign-debt holdings for a few countries in recent years. In the appendix, we demonstrate that the currency compositions of Canadian, Danish, Swiss, and US portfolios in 2017 are similar in our data and in CPIS, as is also the case for a number of EMU member countries. We cannot directly compare the data for the EMU as a whole since CPIS does not report a consolidated EMU figure that removes intra-EMU investment. Our data align less well with aggregates reported by the European Central Bank. For example, the European Central Bank reports the dollar share of EMU foreign bond holdings in 2017 to be 37%, below the 59% in our data. The discrepancy likely reflects the fact that Luxembourg and Ireland, countries that are disproportionately important in the mutual fund sector, have higher shares of their foreign holdings in dollars than the EMU average.

In some cases, our reporting of the currency or country composition of foreign bond liabilities differs from that in national data due to the exclusion or underrepresentation of key investor countries in our data.

For example, we do not include any Japanese-domiciled funds in our analyses and have less complete coverage of funds domiciled in the United Kingdom than of those domiciled in the United States. Similarly, we do not cover official investors such as governments or sovereign wealth funds in China. The aggregate liabilities of the EMU in our data therefore have a currency composition that overweights investment from the United States relative to investment from Japan, the United Kingdom, and China.

Finally, it is important to highlight that our analysis focuses on bond finance and therefore excludes information on bank lending.[7] According to OECD data, US nonfinancial corporations rely more heavily on bond financing (77% of total debt financing) than do European firms (17%).[8] The share of bonds in total debt financing of nonfinancial corporations is between one-third and one-half in countries such as Australia, Canada, and the United Kingdom. Despite this heterogeneity, we note that the key patterns we highlight hold similarly among all non-US countries.

### *C. Mapping Positions to Firms, Industries, and Countries*

Morningstar reports the domicile country of each fund but does not have information on the nationality of individuals who invest in each fund. In general, tax optimization and regulatory restrictions make it unlikely that investors buy mutual funds domiciled in other countries.[9] Based on this principle, we assume that the domicile of a fund is also the country of residency of its investors and we use the two concepts interchangeably in the rest of the paper. Notable exceptions are funds domiciled in Ireland and Luxembourg, which include a large number of Undertakings for Collective Investment in Transferable Securities (UCITS) funds that are designed to be sold throughout the European Union under a harmonized regulatory regime. Given our focus on currency, we pool all data for countries within the EMU, including Luxembourg and Ireland, and treat the EMU itself as a single consolidated country in our benchmark analyses.[10] We demonstrate in the appendix the robustness of our main analyses to the removal of Luxembourg, Ireland, and the EMU from our data set.

[7] Relatedly, our analysis excludes foreign-currency borrowing from banks by households, including mortgage loans, as has been documented in countries including Hungary or Iceland.

[8] See De Fiore and Uhlig (2011) for an analysis of the sources of the differential reliance on bond and loan finance in the United States and Europe.

[9] In the appendix, we provide support for this assumption using TIC data that show that US outward investment is only rarely directed to foreign funds and that foreign investment into the United States is only rarely directed to US funds.

[10] This leaves open the possibility that we misclassify investors that buy UCITS funds in Luxembourg and Ireland and are from countries inside the European Union but outside the EMU (such as Sweden or the United Kingdom).

Turning from investors to issuers, one benefit of working with security-level data is that we can trace issuers to their ultimate parent company, which allows us to associate security issuance with the industry and country that face the economic liability and deploy the borrowed capital. The raw data from Morningstar associate each portfolio position with an industry and country of issuer, but these entries are not standardized across funds and dates. We use the methodology detailed in Coppola et al. (2020) to aggregate firms to their ultimate parent as well as to make sure that we standardize the characteristics of each security across all funds that hold a particular security in our data. Coppola et al. offer an algorithm that uses several different data sources including CUSIP Global Services, Capital IQ, Securities Data Company (SDC) Platinum, Dealogic, Factset, and Orbis to associate each CUSIP nine-digit security code with a unique CUSIP six-digit code indicating the ultimate parent of the issuer. We show in the appendix that the procedure has no qualitative impact on the key patterns that are the focus of this paper.

In summary, our data track well the best publicly available information on the aggregate scale of mutual fund and ETF assets, domiciled inside and outside the United States. These data clearly represent only a subset of cross-border investment positions but a comparison with public aggregate data suggests that they are informative about many facets of non-mutual-fund and ETF-intermediated portfolio positions, such as those held by insurance companies and hedge funds. Our data are security-level, providing enhanced details that allow us to link borrowing to the industry and country of the ultimate parent of the issuer, and give insight into domestic and foreign investment by the same type of investor in many countries around the world.

## III. Investor Home-Currency Bias

In this section we demonstrate the strength of investor home-currency bias at the security, fund, and country level. Surprisingly, currency is such a strong predictor of the nationality of a security's holder that the nationality of the issuer—to date, the most powerful predictor in a voluminous literature on portfolio determination—has little additional explanatory power. We also document the extent of dollar bias, the tendency in our data of investors to disproportionately hold securities denominated in US dollars.

### *A. Country-Level Results*

We find that domestic bond investments are almost always denominated in the domestic currency. For example, when Canadian investors buy bonds issued by Canadian companies, the bonds are almost always denominated

in Canadian dollars. However, foreigners invest differently. When Australians buy bonds issued by Canadian companies, the bonds are rarely denominated in Canadian dollars.

Figure 2 plots the shares of investment that are in the issuer's currency for corporate bond portfolios in our data as of December 2017. The filled bars on the left illustrate for each country the share of all lending by that country's investors to that same country's corporate issuers that is denominated in the local currency. For example, the second filled bar from the top shows that about 95% of lending by Canadian investors to Canadian firms is denominated in Canadian dollars, as per the example above. The filled bars are all above .8 and most are quite close to 1. Unsurprisingly, and consistent with conventional modeling assumptions in the literature, all countries invest overwhelmingly in local currency when buying the bonds of domestic issuers.

More surprising, however, is our finding that foreigners invest differently. The open bars on the right of figure 2 show the same statistic but for foreign investment portfolios, that is, the share of foreign investment in each country's corporate bonds that is denominated in the issuer's currency.[11] For example, the second open bar from the top shows that about 5% of bonds purchased by non-Canadian investors and issued by Canadian companies are denominated in Canadian dollars. If foreign and domestic investors held similar portfolios in each market, then the lengths of filled and open bars would be similar in each row. On the contrary, figure 2 shows that the open bars are systematically (much) smaller than the filled bars for each row. Domestic investment is almost always in the local currency. Excluding (for now) investment in the United States, a minority of foreign investment is in the local currency.

In the appendix, we perform this same analysis for sovereign bonds and show that this pattern still holds but is more muted. The difference is perhaps not surprising since most developed countries' sovereigns issue a very limited number of foreign-currency bonds (the US government, e.g., does not issue at all in foreign currency).[12] Unlike sovereigns, many corporations issue a substantial fraction of their debt in multiple foreign currencies, thus offering investors the possibility of holding bonds issued by the same company but denominated in the currency of their

[11] The open bars on the right are calculated by simply adding up positions over multiple foreign investors that purchase from each issuer country. The relative weight of these foreign investors therefore implicitly relates to its scale of AUMs in our data and therefore may differ from equivalent values reported by national statistical agencies. We have disaggregated the open bars into the portfolios from individual investor countries and verified that these patterns hold robustly across bilateral pairs.

[12] For an analysis of determinants of the currency composition of sovereign debt, see Du, Pflueger, and Schreger (2016), Ottonello and Perez (2016), Engel and Park (2018), and Sunder-Plassmann (2018).

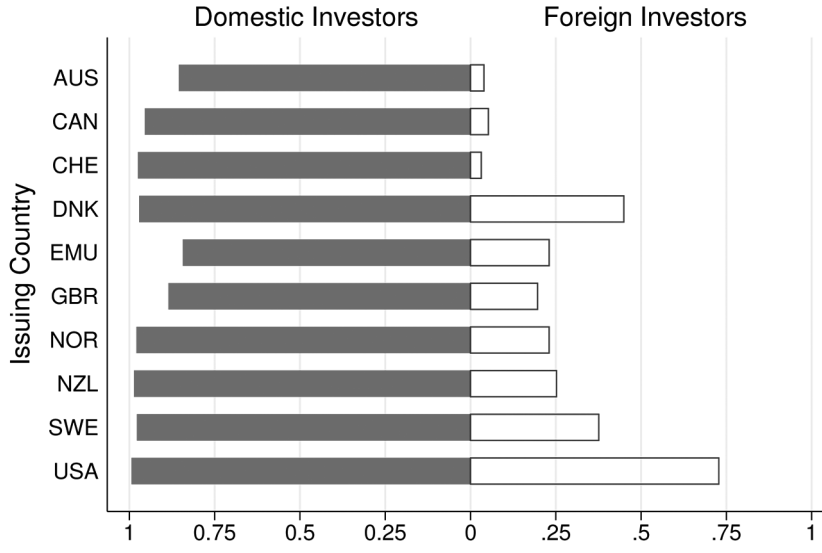


FIG. 2.—Share of corporate bond investment denominated in the issuer's local currency, 2017. The filled bars show for each issuing country the share of bonds denominated in the issuer's local currency out of all domestic investment in its corporate bonds. The open bars show for each issuing country the share of bonds denominated in the issuer's local currency out of all foreign investment in its corporate bonds. A color version of this figure is available online.

choice. Since our focus is precisely on this currency choice, both from the investor and the issuer perspective, we focus our analysis in the rest of the paper on the corporate bond market.

Rather than holding local-currency bonds, foreigners tend to hold bonds denominated either in their own domestic currency or in US dollars. Figure 3 shows the currency composition of each country's external bond investments. We exclude investment in the United States to focus purely on the international role of the dollar. The vast majority of all foreign investment is either denominated in the investing country's currency or in US dollars.

Our results imply a strong sorting of foreign investment away from local currency bonds, despite the fact that these bonds constitute the bulk of the corporate bond market in each country. This sorting underlies the importance of studying portfolio holdings and not just the stock of securities outstanding to understand the external positions of countries. For example, a naive assumption that foreign and domestic investors buy securities in each country in proportion to their market-value weights would imply that developed countries have external liabilities denominated in their own currency and external assets denominated in foreign currency

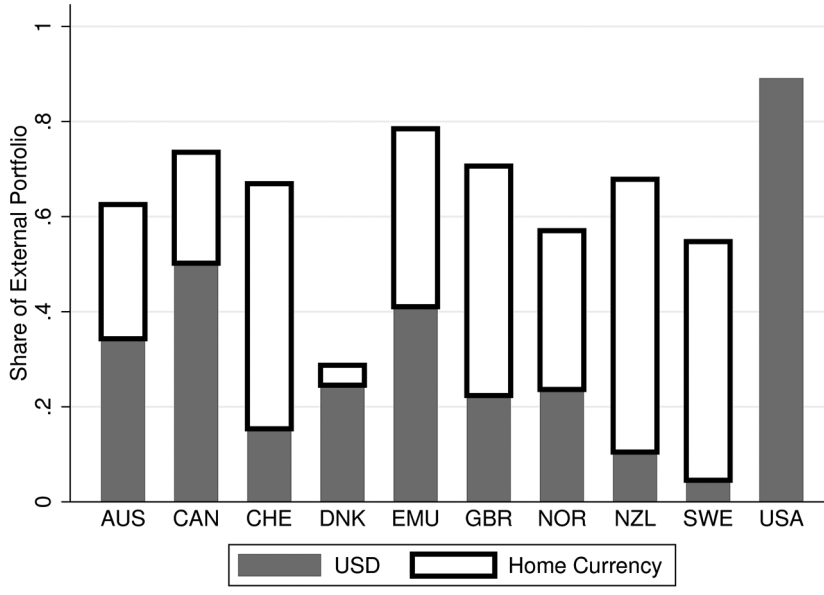


FIG. 3.—Role of home currency and the US dollar in external portfolios, 2017. The open bars show for each investor country the share of investment abroad in corporate bonds that is denominated in the investor's home currency. The filled bars show for each investor country the share of these same external investments that are denominated in US dollars. We exclude all investments directed to the United States in order to focus purely on the role of the US dollar as an international currency. A color version of this figure is available online.

to a greater extent than is in fact the case.[13] An important consequence is that a domestic currency depreciation might not have as much of a positive wealth effect as is commonly conjectured.[14]

### *B. Security-Level Results*

The above results suggest that investors exhibit "home-currency bias," in that they disproportionately hold securities denominated in their

[13] A large literature on "original sin" such as Eichengreen and Hausmann (1999, 2005) has emphasized the similar fact that emerging economies borrow from foreigners in "hard" currencies such as the US dollar, presumably due to their inflation risk, weaker institutions, or less developed internal capital markets. We show, however, that even rich and developed economies that do not suffer from these problems borrow in foreign currency from foreigners to a surprising extent via their corporate sector.

[14] The wealth effect would also be affected by the extent of hedging and the residency of the counterparties with whom the bonds are hedged, as this would determine whether the exchange rate exposure remained in the country or not. Liao (2016) offers useful evidence suggestive that firms often hedge, but the lack of systematic data on derivative use precludes us from drawing too strong a conclusion.

domestic currency, and "dollar bias," in that they disproportionately hold securities denominated in US dollars. To demonstrate that currency is a critical factor driving this pattern, we must overcome the concern that correlated and omitted factors, such as the borrower's sector, participation in international trade, and credit worthiness, or the security's maturity, coupon, legal jurisdiction, and place of issuance, are in fact the true drivers of the bias and are simply correlated with the security's currency. Our security-level data set offers sufficient variation across all these elements to allow us to affirmatively demonstrate that currency itself is an important factor.

We start by exploiting security-level variation in the currency of denomination of multiple bonds offered by the same issuer. After all, a given issuer has the same nationality, industry, and trade exposure and a very similar default risk regardless of which currency its debt is denominated in. Further, we can control for each security's maturity and coupon. If Canadians, for instance, are much more likely to hold a given UK firm's long-term Canadian dollar debt than that firm's long-term British pound debt, this would support the conclusion that currency is the true underlying factor driving that investment decision.

Let $s_{j,p,c}$ denote the share of the total holdings in our data of a particular corporate bond $c$ (i.e., a nine-digit CUSIP) issued by parent firm $p$ (i.e., a six-digit CUSIP) that is held by investors from country $j$. A value of $s_{j,p,c}$ equal to .1 means that funds domiciled in countries other than $j$ account for 90% of the investment in that security in our data. We pool all individual corporate bonds $c$ in our data and estimate the following regression separately for each investing country $j$:

$$s_{j,p,c} = \alpha_{j,p} + \beta_j \mathbf{1}_{\{\text{Currency}_c=\text{Currency}_j\}} + \text{Controls} + \varepsilon_{j,p,c}, \quad (1)$$

where $\alpha_{j,p}$ is a fixed effect for the parent firm and $\mathbf{1}_{\{\text{Currency}_c=\text{Currency}_j\}}$ is an indicator variable that equals 1 when security $c$ is denominated in the currency of the investing country $j$. We restrict the analysis to a balanced set of investor and issuer countries. The coefficient of interest is the estimate of $\beta_j$, which reports the extent to which a country disproportionately holds securities denominated in its home currency. If country $j$ had no home-currency bias then $\beta_j$ would be zero.[15] Our benchmark

[15] Our approach differs from that more commonly used in the home-bias literature in two ways. First, we use in our benchmark regressions of eq. (1) a country's share of total holdings rather than measure the ratio of the share that a security accounts for in a country's portfolio relative to the share that security accounts for in total holdings. These two measures are linear transformations of each other within countries, so regressions that use either measure as the dependent variable contain the same information. Second, whereas

estimates are run using data for 2017, are weighted by the total holdings in our data of each security, and control for maturity and coupon payment.[16]

Table 2 reports our estimates of equation (1). Looking across the first row, the $\beta_j$ coefficients are all positive, statistically significant, and large in magnitude. For example, the first row of column 2 shows that if a security is denominated in Canadian dollars, Canadian funds hold a share of the total holdings of this security that is 90 percentage points larger than what they hold of securities that are not denominated in Canadian dollars but issued by the same issuer. This implies that Canadian investors hold the vast majority of Canadian dollar securities that are issued around the world. A similar effect holds for all other countries. Even among bonds issued by the same company, investors disproportionately hold those bonds that are denominated in their home currency.

Table 3 demonstrates the robustness of our results by reporting the same $\beta_j$ coefficients from various alternative samples and specifications.[17] The first specification estimates equation (1) when we drop firms that issue only in local currency and restrict the sample to only those firms that issue in multiple currencies (MCs), since variation within these firms is what identifies the currency bias. To be included in this specification as an MC issuer, a firm must issue in the local currency of the investor country and at least one other currency. The second specification includes only foreign issuers, and the third specification additionally excludes any issuance by these firms that is done in the issuer's domestic market. The fourth and fifth specifications restrict the sample to financial and nonfinancial corporates, respectively. The sixth and seventh specifications also examine financial and nonfinancial corporates separately, but additionally restrict the sample to only include foreign firms. The eighth specification includes borrowing by local governments and municipalities, sovranationals such as the World Bank, and various structured fixed-income products. The ninth specification includes all bonds in our data set (including sovereigns). Our tenth specification distinguishes securities not only by issuer and currency but also by residence (i.e., the country where the security is issued). In particular, we add to the currency dummy in equation (1) a dummy for the security being issued in

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the literature often uses worldwide market capitalization to measure total holdings, we measure total holdings internal to our mutual fund and ETF data.

[16] We control for maturity with dummies corresponding to the following categories: less than 2 years, between 2 and 5 years, between 5 and 10 years, and greater than 10 years. We treat coupon payment similarly by using seven equally spaced buckets from below 1% to greater than 6%.

[17] We denote statistical significance using asterisks, but to improve the presentation, we do not report standard errors. Standard errors are clustered at the level of the fixed effects.

TABLE 2
HOME-CURRENCY BIAS: WITHIN-FIRM VARIATION, 2017

| | $j$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | AUS | CAN | CHE | DNK | EMU | GBR | NOR | NZL | SWE | USA |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| Currency | .607*** | .899*** | .722*** | .568*** | .559*** | .446*** | .801*** | .707*** | .640*** | .626*** |
| | (.042) | (.013) | (.011) | (.060) | (.012) | (.022) | (.028) | (.131) | (.024) | (.013) |
| Observations | 36,229 | 36,229 | 36,229 | 36,229 | 36,229 | 36,229 | 36,229 | 36,229 | 36,229 | 36,229 |
| Number of firms | 7,802 | 7,802 | 7,802 | 7,802 | 7,802 | 7,802 | 7,802 | 7,802 | 7,802 | 7,802 |
| $R^2$ | .779 | .958 | .934 | .775 | .848 | .800 | .934 | .823 | .871 | .892 |
| Firm fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

NOTE.—This table reports estimates of the regression in eq. (1). The dependent variable is the share of each security (at the CUSIP nine-digit level) bought by each country in our sample: $s_{j,p,c}$. We include fixed effects at the ultimate parent firm level. Controls include maturity and coupon bins. Standard errors in parentheses are clustered at the ultimate parent firm level.

*** $p < .01$.

the investors' country ($j$).[18] Finally, our eleventh specification similarly adds a dummy for bonds issued under the investor's country's governing law. (We only include countries with at least 100 bonds issued under their governing law.) While for some countries, the residence or legal jurisdiction of bond issuance do enter statistically significantly, these additions only modestly change the coefficient on currency. In all these analyses, despite the extensive differences in the included sample of issuers and the variation used to estimate fixed effects, the coefficient on home-currency bias remains economically large, stable, and precisely estimated.

### C. *Fund-Level Results*

The above results demonstrate that in the aggregate, investors' portfolios of foreign corporate bonds have a surprisingly large share of securities denominated in the investors' currency or in US dollars, even when investing in developed countries. We turn next to a fund-level analysis that shows that these aggregate findings are not driven by outliers. Rather, the disproportionate share of home-currency and US-dollar positions in external positions is pervasive across funds.

In figure 4*A*, we select the 300 funds in our data with the largest value of external corporate bond holdings and order them from the largest on the left to the smallest on the right.[19] We limit the analysis in the figure to 300 funds to facilitate visualization, but our appendix tables report results using the full universe of funds. Each dot represents the share of investment in foreign corporate bonds that is denominated in that fund's home currency. The large majority of funds hold either all or none of their foreign investment in their local currency. However, home-currency bias does not vary systematically with the size of funds' foreign investment. To demonstrate this, the figure plots with a solid black line the fit of a lowess regression of home-currency share on the size rank of funds' foreign investment. The line is effectively flat.

[18] For example, imagine that British investors are unaware that a local firm has a French parent and so they hold the local firm's pound debt rather than even considering the parent's euro debt. Our baseline regression would draw inference from the investor's choice between these euro and pound securities. This tenth specification addresses this concern because it separates bonds associated with the same ultimate parent into those issued locally vs. those issued abroad. A more general approach to this concern is to disregard the Coppola et al. (2020) parent-matching algorithm so the securities issued by parents and subsidiaries are never compared. The appendix shows that the $\beta_j$ coefficients all remain large and statistically significant even when estimated on data that do not use the parent-matching algorithm.

[19] These 300 funds are distributed across domiciles as follows: about 1% in Canada, 71% in the EMU, 5% in the United Kingdom, 21% in the United States, and about 3% in the other domiciles.

TABLE 3
HOME-CURRENCY BIAS: ROBUSTNESS, 2017

| | AUS | CAN | CHE | DNK | EMU | GBR | NOR | NZL | SWE | USA |
|---|---|---|---|---|---|---|---|---|---|---|
| (1) MC only: | | | | | | | | | | |
| $\beta$ | .606*** | .897*** | .721*** | .577*** | .555*** | .444*** | .800*** | .708*** | .648*** | .624*** |
| Observations | 6,472 | 5,656 | 7,475 | 896 | 15,310 | 10,818 | 3,160 | 3,161 | 3,243 | 14,686 |
| (2) Foreign: | | | | | | | | | | |
| $\beta$ | .478*** | .905*** | .714*** | .849*** | .590*** | .453*** | .829*** | .700*** | .658*** | .579*** |
| Observations | 34,814 | 33,626 | 34,835 | 35,329 | 26,309 | 33,321 | 34,417 | 36,098 | 34,878 | 22,434 |
| (3) Foreign, international: | | | | | | | | | | |
| $\beta$ | .549*** | .935*** | .769*** | .809*** | .618*** | .457*** | .895*** | .958*** | .632*** | .628*** |
| Observations | 4,586 | 4,581 | 4,369 | 4,754 | 3,503 | 4,022 | 4,647 | 4,719 | 4,691 | 3,112 |
| (4) Financial: | | | | | | | | | | |
| $\beta$ | .654*** | .885*** | .719*** | .552*** | .557*** | .408*** | .837*** | .854*** | .670*** | .615*** |
| Observations | 15,457 | 15,457 | 15,457 | 15,457 | 15,457 | 15,457 | 15,457 | 15,457 | 15,457 | 15,457 |
| (5) Nonfinancial: | | | | | | | | | | |
| $\beta$ | .534*** | .916*** | .727*** | .679*** | .560*** | .494*** | .614*** | .516** | .551*** | .638*** |
| Observations | 18,595 | 18,595 | 18,595 | 18,595 | 18,595 | 18,595 | 18,595 | 18,595 | 18,595 | 18,595 |
| (6) Foreign financial: | | | | | | | | | | |
| $\beta$ | .493*** | .877*** | .713*** | .881*** | .588*** | .406*** | .860*** | .854*** | .751*** | .564*** |
| Observations | 14,584 | 14,500 | 14,609 | 14,903 | 11,074 | 13,996 | 14,408 | 15,444 | 14,536 | 11,059 |
| (7) Foreign nonfinancial: | | | | | | | | | | |
| $\beta$ | .460*** | .932*** | .717*** | .814*** | .593*** | .501*** | .614*** | .486** | .474*** | .595*** |
| Observations | 18,159 | 17,013 | 18,124 | 18,353 | 13,909 | 17,275 | 18,138 | 18,533 | 18,211 | 9,640 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| (8) SF, SV, LS: | | | | | | | | | | |
| $\beta$ | .603*** | .900*** | .721*** | .551*** | .558*** | .445*** | .801*** | .708*** | .635*** | .625*** |
| Observations | 65,001 | 65,001 | 65,001 | 65,001 | 65,001 | 65,001 | 65,001 | 65,001 | 65,001 | 65,001 |
| (9) All bonds: | | | | | | | | | | |
| $\beta$ | .597*** | .886*** | .719*** | .552*** | .566*** | .444*** | .799*** | .699*** | .631*** | .618*** |
| Observations | 285,267 | 285,267 | 285,267 | 285,267 | 285,267 | 285,267 | 285,267 | 285,267 | 285,267 | 285,267 |
| (10) Residency: | | | | | | | | | | |
| $\beta$ | .605*** | .888*** | .721*** | .560*** | .555*** | .445*** | .792*** | .642*** | .642*** | .614*** |
| Residency | .007 | .046*** | .020 | .135** | .045** | .023 | .047** | .164* | −.020 | .091*** |
| Observations | 36,229 | 36,229 | 36,229 | 36,229 | 36,229 | 36,229 | 36,229 | 36,229 | 36,229 | 36,229 |
| (11) Own governing law: | | | | | | | | | | |
| $\beta$ | .404*** | | | | .598*** | .502*** | | | .658*** | .612*** |
| Governing law | .201*** | | | | −.017 | .002 | | | .032 | .087*** |
| Observations | 16,905 | | | | 16,905 | 16,905 | | | 16,905 | 16,905 |

NOTE.—(1) Includes only the debt of firms that issue in multiple currencies (MCs), including the local currency of the issuer. (2) Includes only foreign firms from the perspective of the investing country. (3) Includes only the international issuance of foreign firms. (4) Includes only financial firms. (5) Includes only nonfinancial firms. (6) Includes only foreign financial firms. (7) Includes only foreign nonfinancial firms. (8) In addition to corporate bonds, includes structured finance (SF), sovranational issuance (SV), and local-government debt (LS). (9) Includes all bonds. (10) Sample is the benchmark set of corporates; regression specification includes the usual dummy for the bond being denominated in the investing country's currency and also includes a dummy for the bond being issued in the investing country. (11) Similar to (10) but includes a dummy for the bond being issued under the investing country's governing law. Controls include maturity and coupon bins. Standard errors are omitted for readability, but are clustered at the ultimate parent firm level. For some specifications, there is not sufficient variation available to estimate the regression and therefore we leave those specifications blank.

* $p < .1$.

** $p < .05$.

*** $p < .01$.

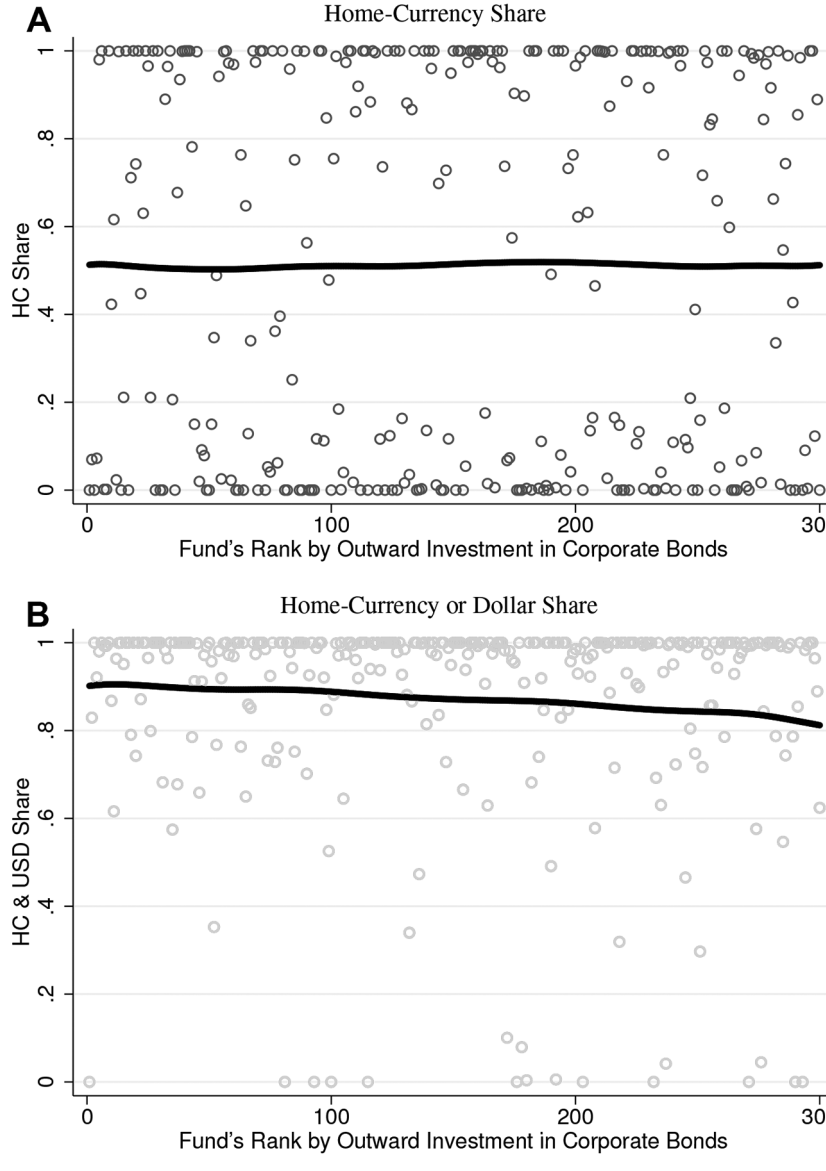


FIG. 4.—The distribution of home-currency and dollar bias across funds, 2017. *A*, Home-currency (HC) share. *B*, Home-currency or dollar share. The dots in panel A plot the share of investment in foreign corporate debt that is denominated in the fund's home currency. The dots in panel B plot the share that is denominated in the fund's home currency or the US dollar. Funds are ordered from largest (*left*) to smallest (*right*) in terms of their positions in foreign bonds. The thick black line in both panels is the fit of a lowess regression of the investment shares (the dots in each panel) on the fund rank. All data are from the end of 2017. Data are pooled for all funds in USA, EMU, GBR, CAN, CHE, AUS, SWE, DNK, NOR, and NZL. A color version of this figure is available online.

Next, consistent with our aggregate results, we demonstrate that the bulk of funds hold nearly all of their external positions in either their home currency or in US dollars. Figure 4*B* repeats the exercise but plots the share of each fund's foreign investments that is denominated in either the investor's home currency or the dollar. Indeed, the dots are now nearly universally clustered near 1, and this holds across funds of different type, investment mandate, and geographic domicile. We therefore conclude that home-currency and dollar biases are widespread and not driven by a few outlier funds.[20]

### *D. Home-Country Bias and Home-Currency Bias*

A voluminous prior literature has documented the strength and pervasive presence of home-country bias, more commonly referred to as simply "home bias." The influential work of French and Poterba (1991) found that investors disproportionately hold equity securities issued by domestic firms. The subsequent literature demonstrated that the same is true, to an even greater extent, for bonds. Furthermore, while equity home-country bias has seen a marked decline in recent years, bond home bias has declined much less, as shown in Coeurdacier and Rey (2013). Home-country bias is to date the singularly effective force for empirically characterizing global portfolios and is essential for the quantitative performance of models in international macroeconomics and finance.[21]

Our results, however, offer the intriguing possibility that home-country bias largely reflects home-currency bias, since the propensity to issue in local currency is greater for local borrowers. Indeed, Burger, Warnock, and Warnock (2017) first suggested this possibility by demonstrating with US TIC data that home-bias measures greatly attenuate when excluding nondollar securities. Ultimately, distinguishing a bias for home currency from a bias for home country requires exogenous variation in either country or currency. While we do not have such exogenous variation, we compare the relative explanatory power of country and currency by estimating equation (1), adding a home-country indicator ($\mathbf{1}_{\{\text{Country}_p=j\}}$; equal to 1 when parent issuer $p$ is located in country $j$) and dropping the firm fixed

[20] The appendix shows that patterns are similar if we plot separate versions of figs. 4*A* and 4*B* for each domicile country. We also report results from fund-level regressions of the home-currency share of external debt portfolios on fund characteristics. Funds that specialize in foreign investment, identified as those with larger shares of their total AUMs accounted for by foreign positions, hold less of their foreign portfolio in their home currency and so exhibit less home-currency bias. Less robust evidence suggests that home-currency bias also very mildly decreases as total fund size grows.

[21] In addition, see Fidora, Fratzscher, and Thimann (2007), De Moor and Vanpée (2013), Vanpée and De Moor (2013), and Adams and Barrett (2017) for studies of home-country bias in bond portfolios, and Lewis (1999), Sercu and Vanpée (2007), and Bekaert and Wang (2009) for surveys of the literature.

effects since the country and firm indicators are collinear. We run three related regressions:

$$s_{j,p,c} = \alpha_{j,0} + \gamma_{j,0}\mathbf{1}_{\{\text{Country}_p=j\}} + \varepsilon_{j,p,c}, \tag{2}$$

$$s_{j,p,c} = \alpha_{j,1} + \beta_{j,0}\mathbf{1}_{\{\text{Currency}_c=\text{Currency}_j\}} + \varepsilon_{j,p,c}, \tag{3}$$

$$s_{j,p,c} = \alpha_{j,2} + \gamma_{j,1}\mathbf{1}_{\{\text{Country}_p=j\}} + \beta_{j,1}\mathbf{1}_{\{\text{Currency}_c=\text{Currency}_j\}} + \varepsilon_{j,p,c}. \tag{4}$$

Equation (2) is a home-country bias regression that measures the extent to which a country is overweight securities issued by domestic firms. Column 1 of table 4 reports the estimates of the country dummy $\gamma_{j,0}$ from this regression. Consistent with the large literature on home-country bias, all these coefficients are positive and range from 10% to 71% depending on the country, thus confirming that countries are overweight securities issued by domestic firms.[22] The large $R^2$ values in column 2 indicate that country information alone explains roughly one-third of the variation in securities' holdings around the world.[23] Estimates of equation (2) remind the reader of why home-country bias is the focus of such a large academic literature and is considered a critical moment to match in theoretical models.

However, as we have emphasized, data limitations have meant that traditional analyses have not included information on currency. We report in columns 3 and 4 of table 4 the estimates of equation (3), in which we replace the home-country indicator from equation (2) with a home-currency indicator. The results are much stronger, with the point estimates on the home-currency indicator and the $R^2$ values both approximately twice as large as what they are in columns 1 and 2. This regression at the country level reaffirms our result from table 2, which exploited only within-firm variation: the currency of denomination of an asset on its own has surprisingly high predictive power for the nationality of the holder of the asset.

Finally, to demonstrate that the results in columns 1 and 2 are mostly driven by the correlation of issuers' countries with their securities' currencies of denomination, columns 5–7 report the estimates of equation (4),

[22] Standard errors are shown in the appendix, but nearly all reported coefficients are statistically significant at the 1% level. The only exceptions are the country coefficients ($\gamma_{j,1}$) in col. 5 for Denmark, New Zealand, and Sweden.

[23] In order to make the $R^2$ statistics easily interpretable we have removed security-level controls such as maturity and coupon payment. The controls, if included, would add minimal explanatory power.

TABLE 4
HOME-COUNTRY BIAS AND HOME-CURRENCY BIAS, 2017

| | ONLY HOME-COUNTRY INDICATOR | | ONLY HOME-CURRENCY INDICATOR | | HOME-COUNTRY AND HOME-CURRENCY INDICATORS | | |
|---|---|---|---|---|---|---|---|
| | $\gamma_{j,0}$ (1) | $R^2$ (2) | $\beta_{j,0}$ (3) | $R^2$ (4) | $\gamma_{j,1}$ (5) | $\beta_{j,1}$ (6) | $R^2$ (7) |
| AUS | .100 | .089 | .659 | .712 | .027 | .642 | .718 |
| CAN | .497 | .433 | .930 | .936 | .035 | .901 | .937 |
| CHE | .356 | .240 | .851 | .903 | .051 | .823 | .907 |
| DNK | .402 | .470 | .597 | .698 | .023 | .575 | .699 |
| EMU | .438 | .296 | .666 | .695 | .093 | .615 | .704 |
| GBR | .166 | .132 | .475 | .664 | .026 | .463 | .667 |
| NOR | .547 | .521 | .833 | .885 | .029 | .808 | .885 |
| NZL | .711 | .373 | .805 | .738 | .138 | .736 | .747 |
| SWE | .416 | .458 | .656 | .823 | .018 | .641 | .823 |
| USA | .463 | .388 | .675 | .795 | .078 | .625 | .802 |

NOTE.—Columns 1 and 2 report estimates of the regression in eq. (2). Columns 3 and 4 report estimates of the regression in eq. (3). Columns 5–7 report estimates of the regression in eq. (4). The dependent variable is the share of each security (at the CUSIP nine-digit level) bought by each country in our sample: $s_{j,p,c}$.

in which we include both the home-country and home-currency indicators. The coefficient on currency of denomination ($\beta_{j,1}$) is little changed from the corresponding variable in the univariate regression ($\beta_{j,0}$) in column 3. Likewise, the $R^2$ values are only slightly larger than those in column 4. By contrast, the coefficient on country of issuance ($\gamma_{j,1}$) is dramatically reduced from the corresponding univariate regression ($\gamma_{j,0}$) in column 1. Once we account for a security's currency of denomination, there is little additional scope for the security issuer's country to add information regarding the nationality of the holder. At least for corporate bonds, inference of home-country bias is confounded by the presence of home-currency bias. Open-economy macroeconomic models must face these new facts: whatever structural mechanism the theories are proposing, the resulting equilibrium must feature a pairing between issuers and investors that is mostly associated with the currency of denomination.

## IV. Currency Bias: The Firms' Perspective

Having documented the importance of the currency of denomination of bonds for the composition of investors' portfolios, we now turn to characterizing the implications from the perspective of borrowing firms. We show that in each country a small number of foreign-currency borrowers are typically the only firms that borrow substantially from foreigners. In each country, most firms borrow only in local currency and their debt is mostly held by domestic investors. We also show that, consistent with the country-level results in figure 2, the United States is an exception to this

rule: US firms that only borrow in dollars place their debt into foreign and domestic portfolios with comparable ease.

### A. *Foreign-Currency Issuers Borrow from Foreigners*

In most countries, only firms that issue in foreign currency place substantial shares of their bond debt in foreign portfolios. For example, figure 5*A* plots for each Canadian firm with debt in our data in 2017 the share of the total firm debt that is denominated in foreign currency, that is, currencies other than the Canadian dollar, against the share of the total firm debt that is held by foreigners. The scale of each firm's bubble captures the market value of its total bond borrowing. We have aggregated the data across all debt securities issued by each firm, including those issued by subsidiaries or other associated issuers. This plot exemplifies two common features of the data. First, a large mass of smaller (by debt) firms are at the origin or slightly above it. These are smaller Canadian firms that borrow only in Canadian dollars and almost entirely borrow from Canadian investors. Second, as firms borrow more and more in foreign currency, they borrow more and more from foreigners. The relationship is nearly one for one, with the data points clustered along the 45 degree line. Figures 5*B* and 5*C* show similar patterns for the European Monetary Union and the United Kingdom.[24]

An important caveat is that we do not observe firm loan financing by banks. Hence, our data do not rule out the possibility that local-currency firms access the international market indirectly by receiving loans from domestic banks that themselves borrow from abroad in foreign currency. Even in this case, however, local-currency firms might be adversely affected since the loans are likely to come at a premium over direct bond financing from the foreigners. An extensive corporate finance literature has indeed shown that loan financing is in general more expensive than bond financing, including Diamond (1991), Rajan (1992), Bolton and Scharfstein (1996), De Fiore and Uhlig (2011), and De Fiore and Uhlig (2015).

The relationship between foreign-currency issuance and foreign borrowing is markedly different for firms in the United States, as shown in figure 5*D*. While it is still true that foreign-currency borrowers tend to

[24] The fact that we measure foreign ownership and foreign-currency issuance from the same data set, which does not capture the universe of bonds or of investors, may impart a bias toward the 45 degree line in these plots. As a robustness check, in the appendix we present equivalent plots where instead of measuring the foreign-currency shares in our Morningstar data, we obtain them from the SDC Platinum and Dealogic databases. For Canada, the EMU, the United Kingdom, and the United States, the correlation between these foreign-currency shares in the SDC/Dealogic data and in our Morningstar data exceeds 75%. It is unsurprising, therefore, that the qualitative conclusions from these alternative figures are the same as those from fig. 5.

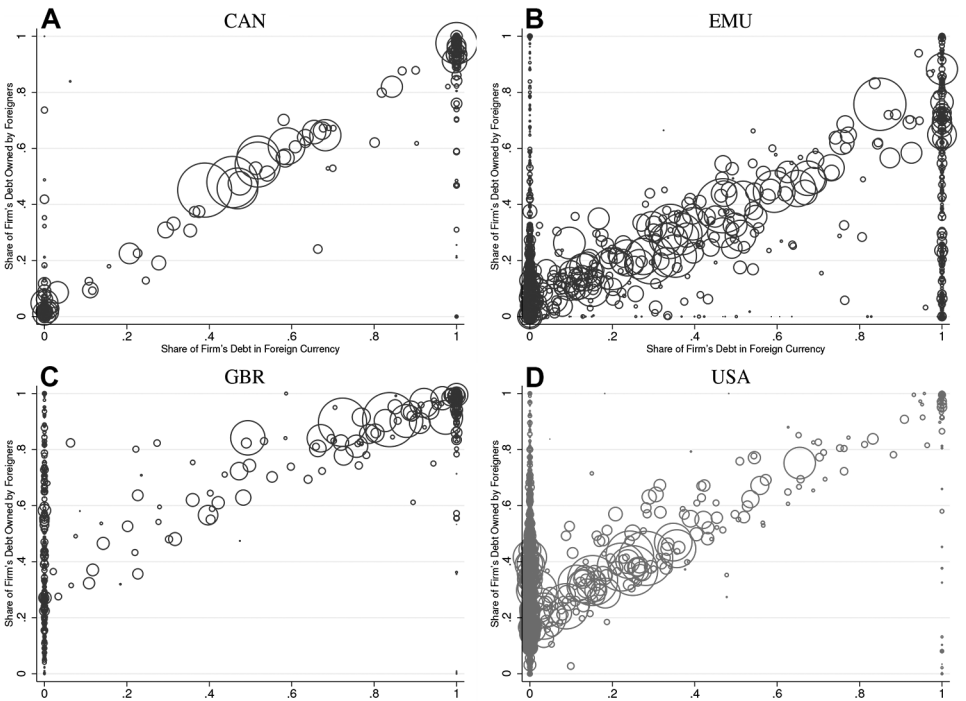


FIG. 5.—Share of corporate bond positions in foreign currency and share of borrowing from foreigners, 2017. In each panel, each bubble corresponds to a single firm based in *A*, Canada; *B*, the EMU; *C*, the United Kingdom; and *D*, the United States. The size of each bubble is proportional to the total value of bonds by that particular firm in our data. The *x*-axis plots the share of a firm's bonds that is in foreign currency, and the *y*-axis plots the share of that firm's bonds that is owned by foreign investors. Both variables are measured using the positions in the Morningstar data. A color version of this figure is available online.

borrow more from foreigners, there is a significant mass of medium-sized firms that issue only in US dollars but receive substantial financing from foreigners. One way to interpret these data is that the global taste for holding dollar debt securities effectively opens up the capital account for local currency borrowers in the United States, whereas local currency borrowers in other countries are relegated to borrowing predominantly from domestic investors.

The fact that the bubbles located away from the vertical axis in figure 5 are generally larger shows that bigger firms are more likely to borrow in foreign currencies. For example, for the case of Canada, figure 6*A* ranks firms along the *x*-axis in terms of their total borrowing, from the largest borrower on the left to the smallest borrower on the right. The *y*-axis plots the number of currencies in which the debt of each firm is denominated. Toward the right end of the plot, nearly all firms only issue bonds denominated in a single currency (which, in this case, is typically Canadian dollars). Moving to the left, as firms' borrowing increases, firms issue in an increasing number of currencies. The largest Canadian borrower in our data issues bonds denominated in seven different currencies. Figures 6*B*, 6*C*, and 6*D* show a similar pattern in the EMU, the United Kingdom, and the United States. Together with figure 5, this implies that large borrowers issue in foreign currency and borrow from abroad, whereas small and medium borrowers issue in domestic currency and borrow from domestic investors.

We can more formally analyze selection into foreign-currency borrowing by estimating on data for 2017 the following probit model:

$$\Pr\left(\mathbf{1}_{\{\mathrm{MC}_p\}} = 1\right) = \Phi\left(\alpha_j + \beta_j \mathrm{Size}_p + \gamma_{j,p}\mathrm{Industry}_p\right), \tag{5}$$

where $\mathbf{1}_{\{\mathrm{MC}_p\}}$ is an indicator for a firm $p$ having debt in foreign currency, $\mathrm{Size}_p$ is a measure of firm size, and $\mathrm{Industry}_p$ is a set of fixed effects capturing the firm's two-digit SIC code. Unlike our prior analyses, we estimate equation (5) using operating and balance sheet data from Compustat (North America and Global) and Worldscope and using bond issuance data from the SDC New Issues database.[25] We proxy for firm size using four alternative measures: total bond principal outstanding, profits (earnings before interest and tax), total assets, and revenues. We include industry fixed effects to account for differences in capital intensity, the collateral value of the firm, and propensity to be involved in export/import activity since these might in turn affect the capital structure decision by

[25] In the regressions, we use data from SDC instead of our data from Morningstar to allow for the possibility that firms may issue bonds that are not held by mutual funds or ETFs in our data set. The results are robust, however, to instead using Morningstar data. We merge the SDC database with firm-level balance sheet data using the CUSIP6 of the ultimate parent as reported in SDC.

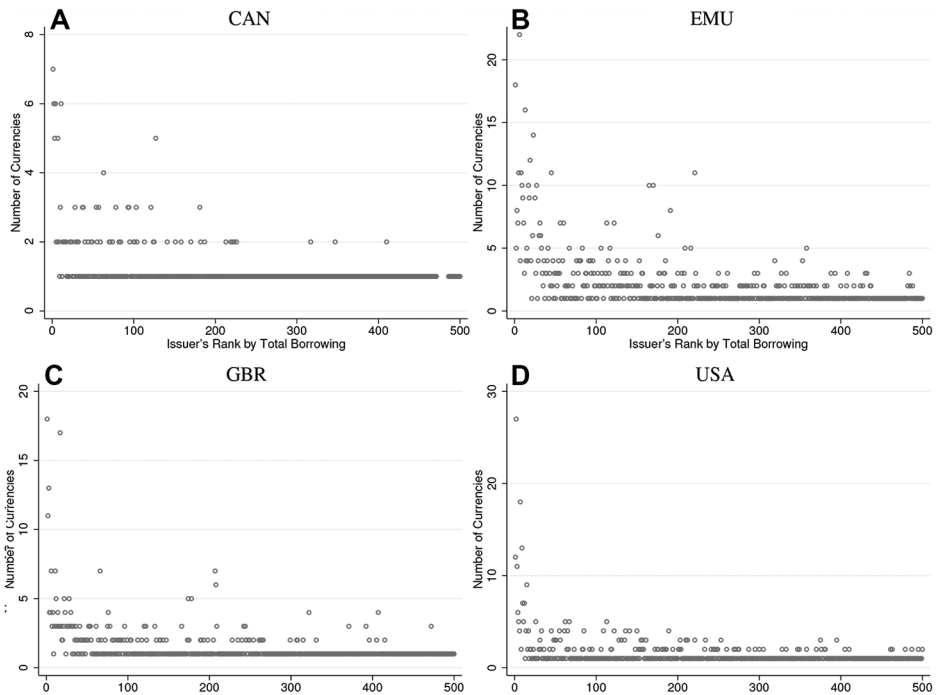


FIG. 6.—Number of currencies and firm size, 2017. In each panel, firms are ranked in order of the total value of bonds in our data, with the largest firm ranked first. The *y*-axis denotes the total number of currencies in which that particular firm has a bond that is owned by a fund in the Morningstar data. Firms are ranked within each of these four economies: *A*, Canada; *B*, the EMU; *C*, the United Kingdom; and *D*, the United States. A color version of this figure is available online.

the firm. This regression is run separately for each country in our sample, and so the intercept $\alpha_j$, the industry fixed effects $\gamma_{j,p}$, and coefficients on the different proxies for size $\beta_j$ are allowed to vary across countries.

Table 5 presents the average marginal effects for the country listed atop each column from estimates of equation (5) using each of our four size proxies. All estimates are positive and statistically significant: Bigger firms, all else equal, are more likely to issue in foreign currency. All the different measures of firm size point in the same direction. This type of size dependence is a hallmark of selection in the presence of fixed costs. Indeed, issuing in foreign currency often involves substantial setup costs. Firms need to build an enriched accounting infrastructure and arrange for and pay costs of currency hedges. This often involves establishing a more sophisticated corporate treasurer's department. Foreign-currency issuance also generally involves a relationship with an international investment bank, road shows in foreign countries, and investor meetings aimed at familiarizing foreign investors with the firm.

One possible confounding factor may be that size is correlated with participation in international trade or foreign investment, and firms with significant foreign revenues may have a greater exposure to foreign-currency risk. Their greater propensity to issue debt in foreign currency, therefore, may reflect the desire to hedge operating exposures rather than their willingness to pay a fixed issuance cost.[26] Our ability to address this possibility is limited as we only have information on the geographical distribution of sales for a small share of issuers in our data. Nonetheless, in the appendix, we replicate these results in probit estimates that also condition on the share of a firm's sales earned abroad, as measured in Thomson Reuters Worldscope segment tables. For some countries such as the United Kingdom and the United States, a higher foreign sales share is associated with a significantly greater likelihood of issuing foreign-currency debt, whereas for other countries such as Canada and the EMU the relationship is insignificant or negative. Across the vast majority of specifications, firm size remains strongly and positively correlated with the likelihood that a firm issues foreign-currency debt.

### *B. Foreign Borrowing by LC Firms and the US Dollar*

We now turn our attention to those smaller firms that borrow only in local currency, the firms in figure 5 that are located along the *y*-axis. Figure 7 demonstrates the extent to which foreign investors are underweight the

[26] We note that while large exporters may in fact wish to issue debt in foreign currency to match their foreign-currency-denominated export receipts, large importers in fact have the opposite incentive and may exacerbate currency mismatch if they issue foreign-currency debt.

TABLE 5
Firm Size and Foreign-Currency Debt Issuance

| | Measure of Size (log billion USD) | | | |
|---|---|---|---|---|
| | Bond Issuance (1) | EBITs (2) | Assets (3) | Revenue (4) |
| AUS: | | | | |
| Size | .093*** | .423*** | .092*** | .200*** |
| | (.011) | (.130) | (.030) | (.050) |
| Observations | 497 | 81 | 83 | 93 |
| CAN: | | | | |
| Size | .051*** | .226*** | .067*** | .133*** |
| | (.010) | (.064) | (.017) | (.026) |
| Observations | 675 | 381 | 384 | 410 |
| CHE: | | | | |
| Size | .018 | .321*** | .097*** | .158*** |
| | (.017) | (.041) | (.031) | (.026) |
| Observations | 211 | 50 | 50 | 56 |
| DNK: | | | | |
| Size | .128*** | | | |
| | (.017) | | | |
| Observations | 50 | | | |
| EMU: | | | | |
| Size | .031*** | .282*** | .050*** | .105*** |
| | (.005) | (.026) | (.011) | (.013) |
| Observations | 2,998 | 682 | 687 | 810 |
| GBR: | | | | |
| Size | .055*** | .268*** | .085*** | .194*** |
| | (.007) | (.075) | (.022) | (.027) |
| Observations | 1,352 | 199 | 202 | 234 |
| NOR: | | | | |
| Size | .110*** | .786* | .139*** | .277*** |
| | (.010) | (.414) | (.046) | (.065) |
| Observations | 332 | 68 | 68 | 79 |
| NZL: | | | | |
| Size | .234*** | | | |
| | (.017) | | | |
| Observations | 41 | | | |
| SWE: | | | | |
| Size | .105*** | .430*** | .159*** | .204*** |
| | (.014) | (.084) | (.037) | (.033) |
| Observations | 239 | 54 | 54 | 79 |
| USA: | | | | |
| Size | .023*** | .116*** | .050*** | .063*** |
| | (.001) | (.007) | (.003) | (.004) |
| Observations | 9,822 | 3,350 | 3,389 | 3,708 |

Note.—This table reports the results from the probit regression in eq. (5). Each row is a different regression where "size" is defined as billions of dollars of principal of bond issuance (col. 1), billions of dollars of earnings before interest and tax (EBITs; col. 2), billions of dollars of total assets (col. 3), and billions of dollars of total revenue (col. 4). Every specification includes two-digit SIC industry fixed effects. We do not run regressions with less than 20 observations. Coefficients reported are average marginal effects. Standard errors for marginal effects are calculated using the delta method. All specifications are run using data for 2017.

* $p < .1$.

*** $p < .01$.

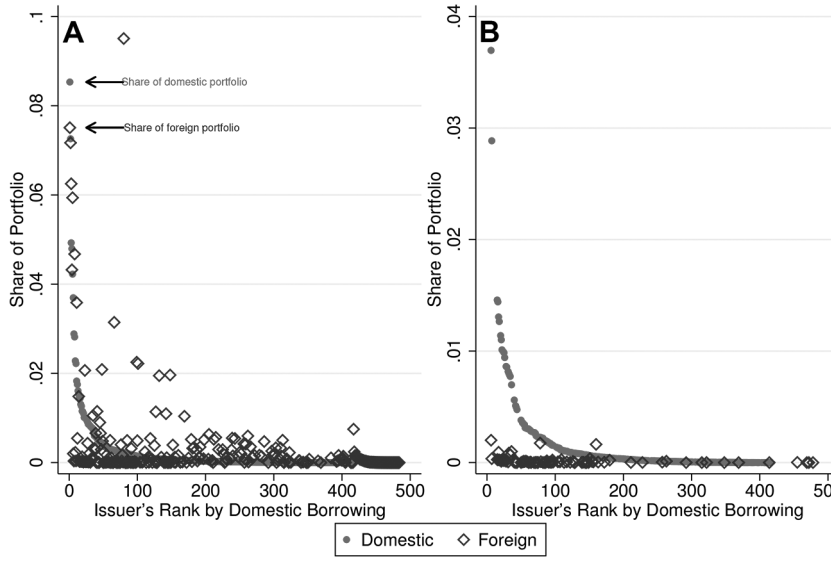


FIG. 7.—Canadian corporate bonds held in domestic and foreign portfolios, 2017. *A*, All issuers. *B*, Only firms that issue entirely in Canadian dollars, the local currency. This figure plots the corporate bond portfolio of domestic and foreign investors in Canada. The portfolio positions in each issuer are ranked according to their size in the domestic portfolio. Dots indicate the domestic positions and diamonds indicate foreign positions. A color version of this figure is available online.

bonds of Canadian firms that only issue in Canadian dollars, their local currency. To see this, start with panel A. The dots plot investment in each Canadian issuer (the parent firm) by Canadian investors in 2017 as a share of those Canadian investors' total investment in Canadian corporate bonds. Similarly, the diamonds plot investment in each Canadian issuer by foreign investors as a share of the total foreign portfolio of Canadian corporate bonds. The sum of the dots and the sum of the diamonds, therefore, each equals 1. The firms are ordered along the *x*-axis based on their shares of domestic investment in Canadian firms, as opposed to the foreign or overall holdings, so the dots monotonically decline by construction. Looking across the plot, there are some firms for which the dots are above the diamonds—indicating domestic investors are overweight relative to foreign investors—and others for which the opposite is true.

A striking pattern emerges if we remove the points corresponding to firms that issue in foreign currencies, while keeping the ranking along the *x*-axis unchanged. Panel B of figure 7 plots the exact same objects as panel A but restricts the sample to include only the subset of firms that issue only in local currency (i.e., in Canadian dollars). As noted earlier,

LC-only issuers are typically smaller, and indeed the data for the largest (i.e., leftmost) firms in panel A are missing from panel B. The difference between the dots and diamonds in panel B is clear: the dots are almost uniformly above the diamonds. Canadian firms that issue only in their local currency represent significantly larger shares of Canadian investors' portfolios than of foreign investors' portfolios.

Figure 8 conducts this same analysis of domestic and foreign investment in LC-only firms in the European Monetary Union, the United Kingdom, and the United States, as well as repeating the analysis for Canada for comparison. The dots in the plots for Canada, the European Monetary Union, and the United Kingdom are all almost uniformly above the diamonds. In those countries, LC-only issuers do not typically place their debt into foreign portfolios and therefore borrow almost exclusively from local investors. The one exception is the United States, where the dots roughly split through the center of the diamonds, indicating that LC-only firms in the United States are almost equally likely to represent a given share of domestic or foreign portfolios. US firms that borrow only in dollars, unlike LC-only firms in the other countries, borrow substantially from foreigners.[27]

Aggregating across firms, we sum the dots and diamonds from each of the subplots in figure 8 and plot in figure 9*A* the aggregate shares of LC-only issuers' debt in domestic portfolios as gray bars and the aggregate shares of LC-only issuers' debt in foreign portfolios as black bars. The gray bars are almost always dramatically taller than the black bars, confirming that LC-only firms account for a far larger share of domestic than of foreign investment portfolios. The one exception is the United States, where the gray and black bars are of similar height. US firms that issue only dollar-denominated debt account for similar shares of domestic and foreign investment portfolios.[28]

Taken together, the above results are consistent with the view that selection into foreign-currency borrowing leads to different outcomes across countries. In this view, US firms face ample demand for their bonds, both by domestic and by foreign investors, even when just borrowing in dollars. These firms, consequently, mostly borrow in dollars and only issue in foreign currency when their borrowing needs grow extremely large. Firms in countries with a smaller local-currency debt market, such as Sweden, quickly outgrow the demand for their local currency debt and

[27] In the appendix, we repeat this analysis separating issuers into financial and nonfinancial corporations as well as into the industries of consumer products, energy and utilities, IT and telecommunications, and industrials and materials. The documented patterns hold across almost all of these subsamples.

[28] Relatedly, LC-only firms account for nearly 60% of the United States' total corporate bonds in our data, whereas the equivalent value for Canada, the European Monetary Union, and the United Kingdom ranges from about 15% to 25%.

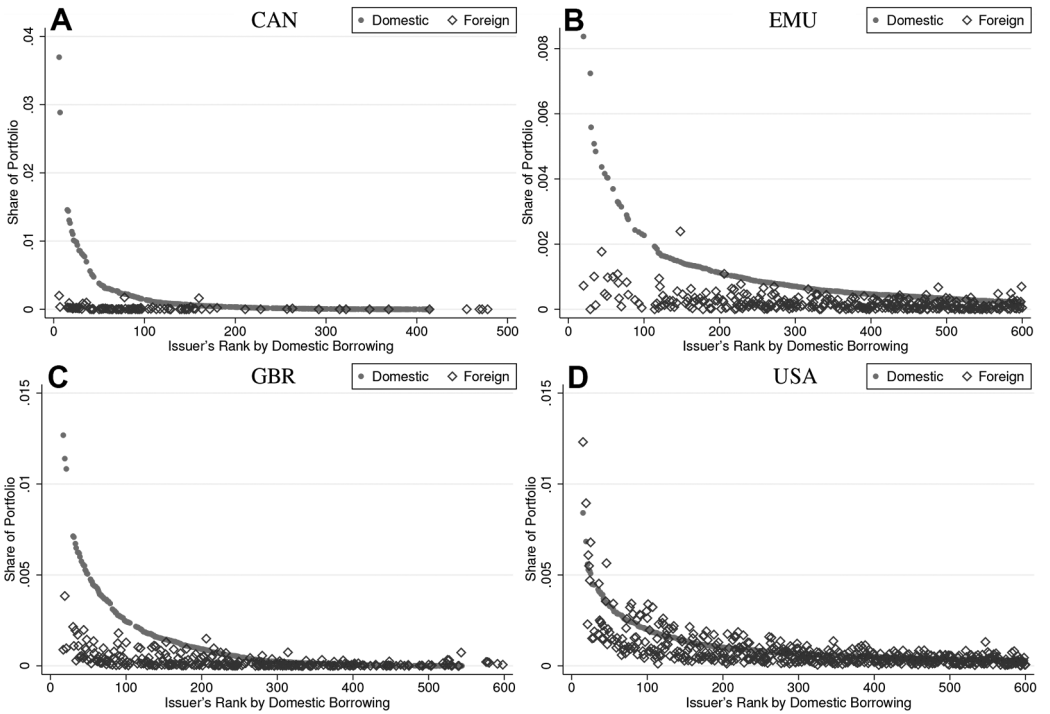


FIG. 8.—Corporate bonds from LC-only issuers in domestic and foreign portfolios, 2017. This figure plots the corporate bond portfolio of domestic and foreign investors in *A*, Canada; *B*, the EMU; *C*, the United Kingdom; and *D*, the United States. The portfolio positions in each issuer are ranked according to their size in the domestic portfolio. Each panel plots only those firms that issue entirely in the local currency. Dots indicate the domestic positions and diamonds indicate foreign positions. A color version of this figure is available online.

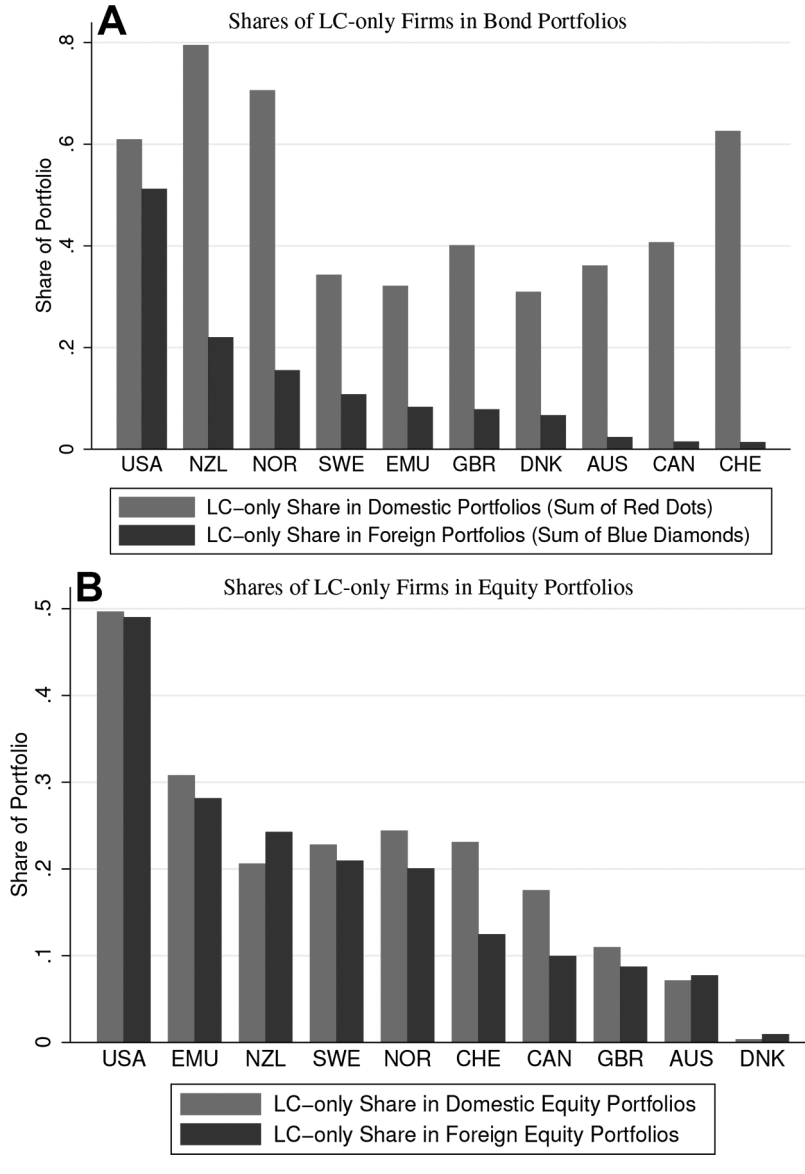


FIG. 9.—Shares of LC-only firms in domestic and foreign portfolios, 2017. *A*, The share of all bonds that is issued by firms that borrow only in local currency in domestic investors' domestic bond portfolios (*gray bars*) and in foreign investors' bond portfolios in that particular country (*black bars*). These bars are equal to the sum of the value of the dots and diamonds, respectively, in fig. 8. *B*, The same statistics, but for equity. A color version of this figure is available online.

in order to borrow more (without pushing interest rates too high) switch to foreign-currency borrowing. In these countries, even relatively small firms borrow in multiple currencies and MC firms account for most of the countries' overall borrowing. Since we lack bond-level interest rate data, we leave further investigation of this view to future research.

One might worry that the above patterns, at least for countries other than the United States, reflect differences between the local-currency and multiple-currency firms that are distinct from, though correlated with, the currency of the debt security. Perhaps local-currency firms are in industries for which foreign investors naturally lack expertise or interest. Alternatively, multiple-currency firms might be those that export a lot to foreign destinations and are therefore well known to foreign investors. To evaluate this possibility, we proxy a firm's appeal to foreign investors using the firm's equity portfolio shares. After all, though debt and equity do not offer identical payoffs, if something about a firm caused it to be a fundamentally unappealing investment for foreigners, foreign investors should avoid both the firm's equity and its debt. If equity markets are unaffected by currency-related frictions (e.g., because equities are real assets not affected by the currency of denomination), then the equity portfolio shares provide a helpful model-free benchmark for what optimal debt portfolio shares might look like in the absence of home-currency bias. Figure 9*B* considers the same LC-only firms as in figure 9*A*, but plots their share of domestic and foreign equity portfolios for that market. It is clear that the difference in LC-only firms' shares of foreign and domestic equity portfolios, if any, is far more muted than is the case for their debt securities, even for countries other than the United States. For example, there is only a small positive difference for Europe, Sweden, and Norway, and the gap is actually negative for Denmark, New Zealand, and Australia.[29]

In sum, investor home-currency bias and the firm-size dependency for foreign-currency issuance together imply that most firms issue only local-currency debt and do not borrow much from abroad. The United States, however, issues an international currency and represents an exception to these patterns. Even smaller US firms place their dollar-denominated bonds into foreign portfolios. In the United States, these LC firms account for comparable shares of domestic and foreign portfolios and for a large share of overall US borrowing.

[29] To investigate this further, the appendix explores the joint holdings of equity and debt of the same firm by foreign and domestic investors. In general, firms that attract a lot of foreign equity investment only attract a lot of foreign-debt investment if they issue in multiple currencies. The United States again constitutes an exception, with the foreign and domestic investors behaving similarly in MC and LC firms.

## V. The Rise of the Dollar and Fall of the Euro

The above results demonstrate that, as of 2017, the United States appears to be the only international currency issuer and that it receives a unique capital allocation from the rest of the world. One might understandably assume that the US dollar has had this status for many decades or more, perhaps since the advent of the Bretton Woods system following the Second World War, if not earlier. In this section, we demonstrate that in fact the euro was also used to denominate a significant share of global bonds held across borders as recently as 2007. Following the global financial and eurozone crises, however, its share fell pervasively and dramatically and this fall was mirrored by a rise in the use of the dollar. We conclude that international currency status may be less stable than is typically assumed.

Figure 10 shows the share of all cross-border corporate bond positions in our data accounted for by bonds denominated in dollars and in euros. The solid line shows that on the eve of the 2008 global financial crisis, dollar-denominated bonds represented approximately 40% of these positions in our data. The dashed line shows that euro-denominated bonds accounted for a bit above 30% at that point in time. Further, these shares had been largely stable during the preceding 4 years. No other currencies came close to representing such large shares in cross-border portfolios.

Strikingly, starting immediately after the crisis, international bond portfolios exhibited a dramatic shift away from the euro and into the dollar. The euro share of total cross-border bond positions collapsed by late 2017 to about 20% while the dollar share exceeded 60%. The currency switch is similarly apparent when one includes sovereigns, local governments, and all other bonds in our data, as shown in figure 11*A*.[30]

This pattern is not driven (directly) by something specific to investors or borrowers in the United States or the EMU. Indeed, figure 11*B* plots the currency shares in global cross-border corporate bond portfolios after excluding the United States and EMU as either the investor in or issuer of the bonds.[31] The fact that the pattern remains strong in this subset of data shows that the shift is not simply attributable to changes in the relative size of the US and EMU markets nor is it directly driven by the

[30] The International Debt Securities database of the Bank for International Settlement (BIS) collects information on the currency of securities that are issued in foreign markets (i.e., for which the nationality of the issuer and the market of issuance of the security are different). The database, therefore, excludes domestic issuance of debt securities and only captures a subset of the world debt market. Nonetheless, we demonstrate in the appendix that even in these BIS data there is a rise in the share of dollar-denominated bonds and a collapse in euro-denominated bonds that moves similarly to our measures.

[31] Figure 11*B* makes clear that the dollar and the euro are used to denominate a large share of bonds between borrowers and lenders that do not use either as their home currency. In this sense, our notion of international currency echoes that discussed in the literature on the invoicing of international trade in goods. See, e.g., Goldberg and Tille (2008), Goldberg (2010), Gopinath (2016), and Gopinath and Stein (2018).

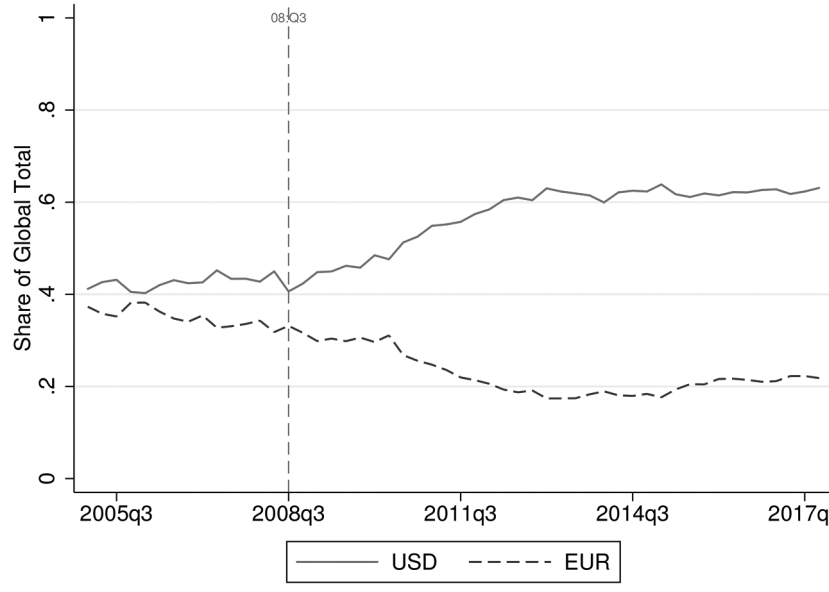


FIG. 10.—Rising dollar and falling euro shares of cross-border corporate bond positions. This figure plots the share of dollar- and euro-denominated corporate bonds in total cross-border holdings. A color version of this figure is available online.

unconventional monetary policy (quantitative easing) of the Federal Reserve System or the European Central Bank. Another possibility is that the dollar-euro exchange rate underlies these patterns, and indeed, the dollar has strengthened relative to the euro since 2008. This relative price movement, however, can directly explain only a small portion of the relative trends in the previous charts. We have verified this by regenerating figure 10 using an alternative data set constructed using exchange rates fixed at their 2005 levels.

One might be concerned that these patterns merely reflect compositional changes in our data. For example, if Canada hypothetically entered late in the data set and predominantly held dollar bonds, it would plausibly explain the above trends. To address this concern, we regress the share of euro-denominated bonds and dollar-denominated bonds in the portfolio of country $j$ invested in securities issued by $i$ on time fixed effects and country-pair (issuer $i$ and investor $j$) fixed effects. We run this regression separately for the euro and dollar, for various assets, and for various country-pair rules (such as excluding domestic investment or excluding the United States or EMU as issuers, investors, or both). The country-pair fixed effect ensures that changes in the composition of countries in our sample do not drive our inference on the time-series variation in the roles of the dollar and euro in cross-border bond portfolios. We

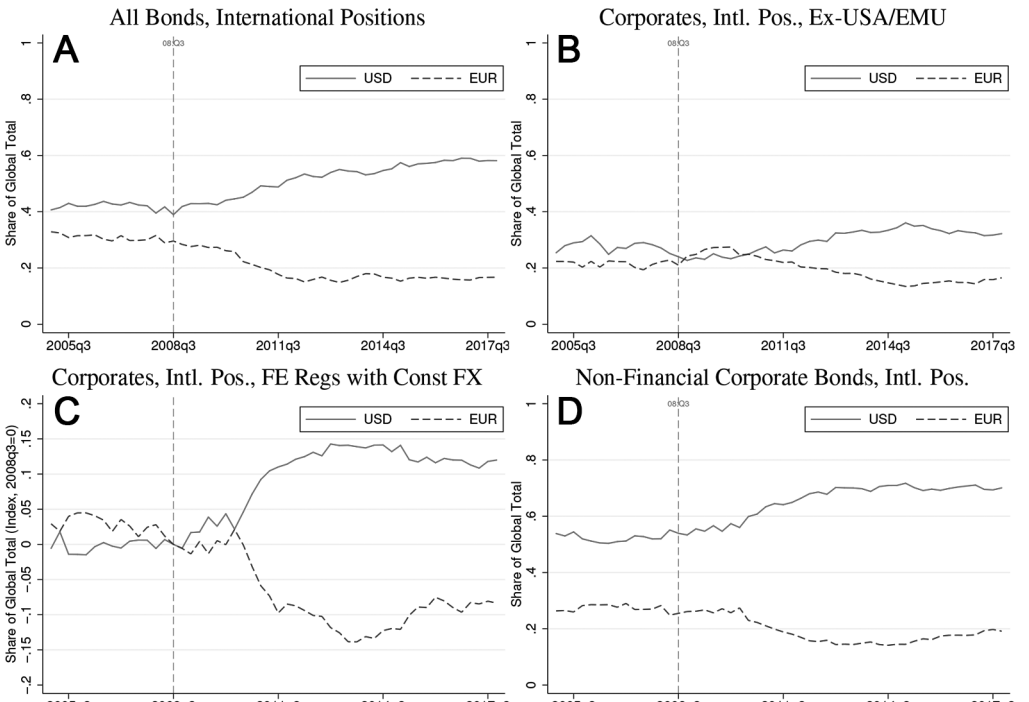


FIG. 11.—Rising dollar and falling euro shares of cross-border bond positions: robustness. *A*, Share of dollar- and euro-denominated bonds in total cross-border holdings. *B*, Analogous shares but only for corporate bonds and further excluding positions for which either the US or the EMU is either the borrower or the lender. *C*, Currency shares estimated using bilateral country fixed effects on the data set constructed with fixed exchange rates at 2005 levels and with weights reflecting the position sizes in the first quarter of 2009. *D*, Showing that these trends hold also for nonfinancial borrowers. A color version of this figure is available online.

run this regression on the baseline as well as constant exchange rate data sets and find that composition is not driving this trend. Figure 11*C* plots time fixed effects, both normalized to zero in 2005, from specifications that focus on cross-border corporate bond positions valued at constant (2005 base) exchange rates and weighted with the size of portfolios in the first quarter of 2009. The pattern remains.

Finally, one might wonder whether the shift is driven by the banking sector alone. Figure 11*D* restricts the sample to containing only nonfinancial corporate borrowers. There is a levels difference from the earlier plots as nonfinancial corporates more commonly borrow in US dollars. The shift away from euro-denominated bonds and into dollar-denominated bonds, however, is robust even after excluding financial institutions.

Table 6 summarizes this evidence on the shift in global portfolios away from euro and into dollar bonds. The table shows the euro and dollar portfolio shares for each specification in the fourth quarters of 2005, 2008, and 2017. Across most of these specifications, the share of dollar-denominated bonds rises by about 10 to 20 percentage points whereas the share of euro-denominated debt declines by about the same magnitude. The rise of the dollar and fall of the euro since 2008 as international currencies is a robust global pattern.

TABLE 6
THE RISE OF THE DOLLAR AND FALL OF THE EURO

| Specification | 2005 | 2008 | 2017 |
|---|---|---|---|
| (1) All bonds: | | | |
| USD share | .556 | .667 | .696 |
| EUR share | .312 | .219 | .161 |
| (2) All bonds held by foreigners: | | | |
| USD share | .420 | .419 | .582 |
| EUR share | .315 | .284 | .167 |
| (3) Government bonds held by foreigners: | | | |
| USD share | .457 | .441 | .497 |
| EUR share | .181 | .184 | .099 |
| (4) Corporate bonds held by foreigners: | | | |
| USD share | .405 | .423 | .631 |
| EUR share | .382 | .316 | .218 |
| (5) Financial corporate bonds by foreigners: | | | |
| USD share | .345 | .385 | .538 |
| EUR share | .439 | .335 | .254 |
| (6) Nonfinancial corporate bonds by foreigners: | | | |
| USD share | .520 | .533 | .701 |
| EUR share | .282 | .261 | .191 |
| (7) Corporate bonds by foreigners, excluding USA and EMU: | | | |
| USD share | .294 | .227 | .322 |
| EUR share | .203 | .243 | .165 |

NOTE.—This table reports the portfolio shares of euro and dollar denominated bonds at year end in 2005, 2008, and 2017. We study seven different sets of bonds and report the dollar shares in the first rows and the euro shares in the second rows.

This dramatic shift in the currency composition of global portfolios toward the US dollar has accompanied an increase in the extent to which the dollar stands out in the cross-sectional relationships emphasized above. For example, we demonstrated that the United States in 2017 is unique in that the foreign investment it receives is denominated in US dollars to an extent comparable to what it receives domestically. In the appendix, we replicate this analysis using data from 2005, when the dollar and euro shares were less dissimilar in cross-border portfolios. We find that the US dollar share of foreign investment into US corporate bonds is smaller, equal to about 40% in 2005 compared to about 75% in 2017, while the euro share of foreign investment into EMU corporate bonds was nearly 25% in 2005, close to recent levels. We similarly show that whereas in 2017 US LC firms accounted for similar shares in domestic and foreign portfolios, their relative share in domestic investment increases as we move back earlier in our data set, both in levels and relative to that for EMU LC firms. We view these results as suggestive that the roles of the dollar and euro in shaping cross-border capital allocation have changed during this period, but an important aim for future work is to identify the driver of this shift away from euros and toward the dollar and to further elaborate on the global implications.

## VI. Interpreting the Facts

Before concluding, we discuss the implications of our four facts for international macroeconomic models and suggest how they might shape the research agenda moving forward. In the same way that home-country bias in portfolios is a key calibration target in the existing literature, our evidence demands that—contrary to most current practice—models must also produce portfolios that strongly exhibit home-currency bias. Further, while home-currency bias arises in some frictionless portfolio models such as Solnik (1974) and Adler and Dumas (1983), it does not manifest in those models in the same way that we show it manifests in the data. In particular, those models do not replicate our finding that foreign investors almost entirely avoid debt exposure to firms that issue only in local currency even when they buy the equity of those same firms. Rather, with perfect markets, investors would not distort their allocation across firms and would instead adjust any undesired currency exposure in their overall portfolio using a long-short position in short-term risk-free bonds in the different currencies.

The difficulty in reconciling our facts with frictionless models comes from the insight that with complete markets and in the absence of frictions, currency risk can be traded (hedged) separately and therefore cannot be a source of distortions. Indeed, this is the logic used in van Wincoop and Warnock (2006, 2010), Engel and Matsumoto (2009), and

Coeurdacier and Gourinchas (2016) to argue that exchange-rate risk cannot be responsible for home-country bias in equities. We believe that equity markets are less affected by currency-related frictions because an equity is a claim to profits from producing and selling real goods, and indeed in the data, bilateral exchange rate movements affect the relative prices of equities across countries far less than they affect the relative prices of local-currency debt. We consequently view our results as pointing future work toward models with currency-related frictions in debt markets.

Future models will have to embed mechanisms capable of generating these patterns with differential strength across countries and currencies. Otherwise, they will be unable to capture the special role of the dollar, or to analyze the benefits that accrue to the US economy from the unique ability of its local-currency borrowers to access foreign capital. Such heterogeneity is necessary by construction to understand the rise of the dollar and the fall of the euro after the recent global financial and eurozone crises. The literature has examined many asymmetries in order to generate pricing implications consistent with the observed cross-country variation in the failure of uncovered interest parity, as discussed in Lustig and Verdelhan (2007), Colacito and Croce (2011), Hassan (2013), and Farhi and Gabaix (2016). This paper provides a new set of facts about asymmetries in portfolio allocations across countries. We view the next challenge as presenting a theory of exchange rates consistent with these observed patterns of portfolios in the same way that this earlier literature focused on matching the pricing patterns.

We think that home-currency bias reflects a combination of financial frictions, such as hedging costs, and behavioral biases that effectively segment the investor pool for firm debt by currency. One might have thought that global bond investors would be the ones hedging their currency exposures, as prescribed, for instance, by Campbell, Serfaty–de Medeiros, and Viceira (2010). Indeed, we find that investors limit their exchange rate risk by avoiding foreign-currency debt in the first place, leaving firms with the potential need to hedge. We view the size dependency of foreign-currency issuance by firms as the result of fixed costs in issuing in foreign currency, and the cost of hedging may be an important component of these fixed costs.

We do not believe that regulatory barriers preventing mutual funds from hedging can explain home-currency bias. First, the bias is found across countries with different regulatory regimes, and we do observe at least some hedging activity via derivative positions in our data. Second, the appendix documents that the shares of US outward investment allocated to large destinations like the EMU and the United Kingdom are similar in our mutual fund data and in US TIC data, which includes investment by entities that are not regulated like mutual funds are, and this holds even when we separately study portfolios of LC- or dollar-denominated

corporate debt. Finally, it may be natural for issuing firms to hedge instead of the investors. Firms need to only hedge once at issuance, keeping the position until maturity when they repay, and this is often a service bundled by the investment bank underwriting the issuance. By contrast, mutual funds frequently change their exposures, including because of withdrawals from the funds, so would likely have to incur larger associated costs.

We view our new facts as pointing to models with market segmentation by currency, as in Gabaix and Maggiori (2015), and size-based selection into foreign-currency issuance, as in Melitz (2003). Perhaps only the most productive firms choose to pay the fixed cost required to issue in foreign currency, which gives them access to more investors and a lower cost of borrowing. Perhaps the global willingness to buy US-dollar-denominated assets means this trade-off is least important for US firms. We suspect that many of our facts would emerge in such an environment, but leave it to future work to formalize the logic.

## VII. Conclusion

In this paper, we demonstrate that currency plays a crucial role in shaping global capital allocation. Other than international currencies such as the US dollar, investors take on much less currency risk when buying the debt of foreign countries than was previously thought, even when those countries are developed ones such as Canada, the EMU, or the United Kingdom. Firms can borrow from abroad by issuing in foreign currency, but evidence suggests it is costly to do so. Unless a country issues an international currency, therefore, the firms from that country issuing only in the local currency may have to do without foreign capital. This highlights a potential new benefit that the US dollar brings to the United States: it effectively opens the capital account for its local currency firms that borrow only in US dollars. Our evidence suggests that the fall of the euro and the rise of the dollar as international currencies since the global financial and eurozone crises have important consequences for the global allocation of capital.

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