International Currencies and Capital Allocation

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Abstract

The external wealth of countries has increased dramatically over the last forty years. Much is still unknown about trillions of dollars of capital allocated across the globe. Using a novel security-level dataset covering more than $27 trillion of global securities portfolios we find that the structure of global portfolios is driven, at both the macro and micro level, by an often neglected aspect: the currency of denomination of the assets. If a bond is denominated in the currency of one particular country, then investors based in that country tend to own the vast majority of that bond. This implies that the much-studied home bias in bonds primarily reflects home currency bias and that foreigners mostly finance the subset of domestic firms that issue bonds in the foreigners' currency. Further, we find that the dollar and the euro are exceptions to this pattern, with companies in the United States and Eurozone uniquely able to place local currency bonds in foreign portfolios. Finally, we uncover a large and pervasive shift in the use of these international currencies starting around the 2008 financial crisis. Cross-border portfolio holdings have starkly shifted away from euro-denominated bonds and toward dollar-denominated bonds.

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Gross cross-border capital flows have increased substantially in recent decades. Companies and governments in developed and developing countries increasingly rely on international investors for financing. However, much is still unknown about trillions of dollars worth of cross-border portfolios, especially for fixed income markets. Using a novel, security-level dataset we find that the structure of global portfolios at both the macro and micro level is driven by an often neglected aspect: the currency of denomination of the assets.

If a bond is denominated in the currency of one particular country, then investors based in that country tend to own the vast majority of that bond. Surprisingly, this is true even in the most developed countries and when controlling for other characteristics of the bond, including the nationality and type of issuer. Further, the effect is so strong that it implies that foreigners' portfolios are very different from domestic portfolios: foreigners mostly finance a subset of domestic firms, those that issue bonds in the foreigners' currency.

Only two currencies, the dollar and the euro, are exceptions to these patterns. We find that most bonds held across borders are denominated in these currencies, even when entities in the United States (US) and European Monetary Union (EMU) are neither the holder nor the issuer of the bond. The role of the dollar and euro as international currencies is well studied, but we find two novel patterns. First, the fact that the majority of foreign investment in US bonds, even excluding government bonds, is in dollar denominated bonds also implies that the allocation of foreign capital across US issuers is close to the allocation of domestic capital across US issuers. Second, in the time series the international role of the dollar has dramatically strengthened since 2008, while the role of the euro has correspondingly diminished. The currency composition of international portfolios has shifted sharply away from the euro and towards the dollar.

A detailed view of foreign investment is critical for the understanding and practice of economic theory and policy in several areas including the impact of capital account liberalization, the design of macroprudential policies such as capital controls, the modeling and measuring of the dynamics of net foreign assets and current account adjustment, and the empirical relevance of portfolio balance theories of exchange rates. Most treatments of these topics, however, rely on data that come in highly aggregated form. Instead, this paper analyzes a new dataset of global mutual fund positions and, along a number of dimensions, offers the most detailed view thus far into the forces driving global portfolio capital flows. Our positions data cover a significant share of the total assets under management in the global mutual fund industry starting in the early 2000s. By 2015 they include over 97 percent of the $16 trillion of US mutual fund assets and more than 70 percent of the additional $16 trillion domiciled in the remaining countries in our data. Positions are reported at the level of the unique security identifier, thus allowing us to bring to bear rich information about the issuer and the particular financial instrument.

We emphasize five key findings. First, international investors take on far less currency risk than standard models assume or imply. While domestic investors lend to corporations in local currency, foreign investors rarely do, even in developed economies such as the United Kingdom, Canada, and Australia. For example, nearly the entire Canadian bond position held by Canadian investors is denominated in Canadian dollars. In contrast, less than one fourth of the Canadian bond position held by the rest of the world is denominated in Canadian dollars. This extreme segmentation of international lending markets by currency means that countries' access to a foreign country's capital necessarily carries with it exposure to that foreign country's currency.

Second, we demonstrate that the tendency of investors to buy bonds in their own currency is so strong that it largely explains home country bias in our data. A voluminous literature offers explanations for why investors prefer assets in their own country, including local information advantages and many types of border frictions. But our position-level data allows us to distinguish an asset's currency from its issuer's nationality, as well as to condition on correlated factors including legal jurisdiction, maturity, coupon, and industry. We demonstrate that currency has far more predictive power for which investors hold a security than does the nationality or residency of the security's issuer.

Third, by comparing how foreign (local) currency borrowers account for dramatically higher shares of foreign (local) lenders, we demonstrate that currency has the power to shape capital allocation within a country. Firms unable to issue in foreign currency, for example, are likely to face a higher cost of capital than those unconstrained to do so. We introduce a measure of the distance between domestic and international portfolios and find scope for this force to introduce capital misallocation.

Fourth, we show that "international currencies," such as the dollar and euro, constitute exceptions to these patterns. In the US and (partly) in the Eurozone, unlike the pattern in other countries, foreign and domestic investment in local currency bonds are allocated similarly across borrowers. Issuers of international currencies, therefore, do not appear to face the same concern that foreign flows distort the allocation of capital among domestic firms. For example, nearly all US firms issue local currency bonds and appear able to access domestic and foreign lenders with comparable ease. This constitutes a previously neglected benefit from having a global currency.

Fifth, while the US dollar appears to be the dominant international currency in 2015, this was not always the case. Our distance measure of foreign and domestic portfolios suggests that the euro offered a similar benefit to Eurozone countries in the mid-2000s. We document, however, a dramatic global decline in cross-border holdings of euro-denominated assets. Starting during the global financial crisis of 2008, the composition of international portfolios across countries

and asset classes shifted starkly away from the euro and toward the dollar. We verify that the trend is not driven by changes in the relative size of US and European markets, is not driven by exchange rate movements, occurs in both financial and non-financial sectors, and does not reflect compositional changes in our sample of countries.

One might worry that mutual fund behavior is unrepresentative of the broader set of portfolio investment. We compare the allocation of US mutual fund investment across countries, asset types, and currencies with the allocation reported in the US Treasury Department's Treasury International Capital (TIC) data and demonstrate close similarities across many important dimensions. In the key patterns we emphasize, mutual fund investors appear similar to other international investors including pension, insurance, and hedge funds.

Another concern stems from our association of each mutual fund's domicile with the residence of its underlying investors. We assume mutual funds invest on behalf of local residents because international differences in securities laws and regulations make it cumbersome and disadvantageous (and, sometimes, illegal) to invest funds on behalf of foreigners. This assumption is corroborated by TIC data, which show that investment into funds (a super-set of mutual funds) generally represents a small share of total cross-border portfolio flows. Notable exceptions include mutual funds domiciled in Luxembourg and Ireland, as they accept large investments from residents of other European countries. For this reason, and given our focus on currency, we subsume these countries into the European Monetary Union (EMU) and treat this as an integrated country rather than separately analyze individual countries within the union such as Germany or France.

Our work relates to a large literature of empirical papers linking net foreign asset dynamics to the differential composition of gross assets and gross liabilities, including important contributions by Lane and Milesi-Ferretti (2007), Gourinchas and Rey (2007), and Curcuru, Dvorak and Warnock (2008). Our finding that foreigners avoid local currency bond exposure relative to the levels predicted in benchmark models complements the work by Lane and Shambaugh (2010) and Bénétrix, Lane and Shambaugh (2015). The result that home bias in our data is largely a reflection of home currency bias expands upon the message in Burger, Warnock and Warnock (2017), who first found using TIC data that the US foreign investment across destination countries does not appear home biased in the subset of debt that is dollar denominated and suggested it might apply more generally across countries and debt markets. One contribution of our analysis is to affirmatively establish this to be the case across a large number of bilateral country pairs using micro data capable of disentangling preference for geography and currency from other factors such as industry, maturity, or credit worthiness. In fact, we establish a strong home currency bias even among bonds issued in different currencies by the same firm.

Other recent work characterizing the behavior of global portfolios includes Alfaro, Kalemli-Ozcan and Volosovych (2008), Bertaut, Tabova and Wong (2013), Du and Schreger (2016), and Lane and Milesi-Ferretti (2017). These papers make use of the IMF's International Investment Position (IIP) and Coordinated Portfolio Investment Survey (CPIS), the TIC data, and the BIS's Debt Security Statistics and Locational Banking Statistics. While these sources have far greater coverage across asset classes and investor types than our data, none simultaneously offer broad coverage of bilateral country pairs, domestic investment, and information on the underlying positions or characteristics such as currency, industry, credit riskiness, and maturity.

Our focus on mutual fund positions allows us to compare domestic and international investors in a single dataset, something that cannot be done using datasets that solely report cross-border transactions. In this sense, our paper complements recent efforts in understanding the heterogeneity of capital allocations across types of investors both domestically and internationally such as Galstyan et al. (2016), Avdjiev et al. (2017), Abad et al. (2017), and Koijen et al. (2016). An earlier literature studied international mutual fund data, but typically concentrated on equity flows or included only a small subset of countries (Chan, Covrig and Ng (2005), Hau and Rey (2004, 2008*a*,*b*), Forbes et al. (2011), Jotikasthira, Lundblad and Ramadorai (2012), Raddatz and Schmukler (2012), and Didier, Rigobon and Schmukler (2013)). Hau and Lai (2016) focus on European money market funds to study monetary policy. Choi and Kronlund (2016) study Morningstar data on US corporate bond mutual funds.

We proceed as follows: Section 1 introduces the data and benchmarks it to existing public datasets; Section 2 develops the main analysis of the paper; Section 3 provides additional details and robustness on the main analysis; finally, Section 4 concludes.

1 Mutual Fund Investment Data

We assemble a novel monthly security-level dataset of worldwide mutual fund holdings. In this section we offer an overview of our data, discuss some filtering and assumptions used in organizing our data, and compare summary statistics with those from publicly available sources. The Online Appendix elaborates on our sources and methodology and offers additional comparisons to other public datasets.

1.1 Security-Level Mutual Fund Dataset

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 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. The funds report all positions including stocks, bonds, cash, and alternative investments.[1] The reporting is commonly done at the monthly frequency and, when not, is nearly always done at the quarterly frequency. Most positions include a 9-digit identifier (the CUSIP) which allows us 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.[2] At the most disaggregate level, our dataset contains millions of individual positions. For example, in December 2015 we observe 2.2 million unique positions held by approximately 8,000 US mutual funds and 4.1 million unique positions held by the approximately 47,000 mutual funds domiciled in the rest of the world.

Mutual 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. These reviews are widely used by investment advisors and individual investors in choosing which mutual funds to invest in. Morningstar requires significant disclosure from the mutual funds it covers so that it can generate comprehensive performance analyses and provide its clients with assessments of each fund's strategies and risk exposures. Given Morningstar's large market share in the investment research industry, most mutual funds opt into this process.

In principle, fund managers might not wish to correctly report their positions to Morningstar in order to "window dress".[3] However, Morningstar has in place a series of checks to ensure the quality of the reporting (and, therefore, of their analysis). When mutual funds are legally required to disclose their positions publicly, Morningstar compares those holdings with positions reported to them to verify their similarity. Furthermore, Morningstar routinely checks for consistency between the publicly available realized returns (daily frequency) of each fund and its portfolio positions data. Finally, Morningstar's clients, who as investors or investment managers are often aware of the exact positions held by funds that they own, on rare occasions expose reporting errors, and Morningstar has an internal processes to improve data based on such feedback. A fund manager making systematic reporting errors to Morningstar would likely be discovered and run the risk of having Morningstar discontinue its research coverage

[1] In some cases funds also report derivatives, but the reporting and accounting often appears to be fund specific. We therefore exclude all derivatives positions from our analysis.

[2] Even for positions that lack a CUSIP, Morningstar itself generally provides related information including the country of the issuer and currency of denomination. Furthermore, we performed a fuzzy merge to recover the CUSIP for individual records that could be matched to other records within our data that included a CUSIP. See Online Appendix for full details.

[3] In some cases, fund managers might request that Morningstar redact sensitive information on some of its specific holdings, generally for 90 days. In such cases, once the requested time lag has elapsed, Morningstar backfills its databases with that information. All but the most recent months of our data, therefore, are unaffected by this issue.

of that fund or assign it a low rating. We have performed a number of independent checks of the Morningstar data against regulatory filings, voluntarily disclosed data by specific funds, and data provided by other third party data vendors. As reported in the Online Appendix, in all cases we have confirmed the reliability of the data.

Domicile of Funds and Residency of Investors. Our data include information on the domicile of each mutual fund, but we do not have information on the residency of the investors in each fund. In general, tax optimization and regulatory restrictions make it unlikely that investors buy foreign mutual funds. Based on this principle, we assume that the domicile of a mutual fund is also the country of residency of the investors in that fund. For example, we assume that all US domiciled funds invest on behalf of US residents. A notable exception 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. As a result, these countries are two of the world largest mutual fund centers and our assumption attributing their AUM to local residents breaks down in their cases. Given our focus on currency, we pool all data for countries within the European Monetary Union (EMU), including Luxembourg and Ireland, and treat the EMU itself as a single consolidated country in all our analyses. Section 3 discusses in detail the assumptions that we make on the residency of investors in mutual funds and provides evidence to support these assumptions.

Nationality and Residency of Issuers. Morningstar data are self-reported by each mutual fund. Different reporting choices across funds can induce discrepancies in fields such as the nationality of the issuer of a security. Consider a firm with factories and workers in Brazil that issues a bond via a Cayman Islands financial subsidiary. One fund may choose to report the country of the issuer based on the residency principle, hence reporting Cayman Islands. Another fund may choose to report based on the nationality principle, hence reporting Brazil. Corporate structures can be very complex with multiple financial and operational subsidiaries located across a number of jurisdictions, including tax havens. From an economics perspective, we want to analyze our data based on the nationality principle, as that better reflects which country faces the economic liability and deploys the borrowed capital.

In other words, the security in the example above should be classified as being issued by a Brazilian (and not a Cayman) corporation. To maximize the likelihood that this occurs, and to standardize the data across all funds, we have performed several data merges and consistency checks. We assign each individual security to the ultimate parent company using four external

datasets: the CUSIP/CINS_db Combined Master Issue File, the CUSIP/CINS_db Combined Master Issuer File, the CUSIP Global Services Associated Issuer Master File, and the Capital IQ dataset. The first three datasets are used to assign each security to a unique firm. The last dataset is used to unwind multiple layers (up to 10) of ownerships within and across countries of these legal entities to find the ultimate parent company. Online Appendix A.1 provides details about the data cleaning and cross-checking procedures that we employed as well as robustness checks. The ultimate result is the ability to perform our study at either the residency level or the ultimate parent nationality level for each security. This level of analysis is at the forefront of national statistics practice: traditionally, national statistics (and most of the publicly available data) are based on the residency principle, but recently most agencies attempt to provide statistics based on the nationality principle.

1.2 Representativeness of the Data

In this subsection, we describe our coverage relative to the overall mutual fund industry, outline the share of mutual funds in cross-border portfolio investment, and relate portfolio investment to overall gross assets and liabilities that additionally include bank lending and direct investment.

Our data account for a substantial fraction of all worldwide open-end mutual fund assets under management (AUM).[4] The Investment Company Institute (ICI), a major association of mutual funds and other regulated investment vehicles, reports that the US mutual fund industry has about $16 trillion of AUM as of 2015 across equity, fixed income, allocation, and money market funds.[5] The total market value of securities held by all US-domiciled mutual funds in our data is only marginally below this aggregate number. Figure 1 compares the total value of assets under management in US-domiciled mutual funds in our dataset and in the national ICI data. From very low levels of AUM in the 1980s, the industry grew at a rapid pace in the 1990s. Assets under management moderately declined in value in the 2001 and 2008 recessions 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 funds starting in the mid-1990s and by 2015 account for 97 percent of the value reported by ICI. Figures 1(b), 1(c), and 1(d) plot equivalent comparisons for the value of AUM broken down by funds specializing in equity, fixed income, and allocation (or hybrid), respectively. The coverage of our data is nearly complete across all major types of funds.[6]

[4] Our data exclude closed-end funds and exchange traded funds (ETFs).

[5] These numbers exclude funds-of-funds to avoid double counting the AUM. The ICI statistics are essentially identical to AUM reported for the mutual fund sector in the US Flow of Funds data by the Federal Reserve.

[6] Fund classifications as equity, bond, or allocation vary across our data and ICI so it is entirely plausible that some allocation funds, a category for which AUM in our data exceed those reported by ICI, are classified as either bond

Our data also include holdings of mutual funds domiciled in 50 other countries. ICI reports that these countries together have $16 trillion of AUM in 2015. Substantial coverage of these funds in our data starts in the early-to-mid 2000s. Figures 2(a) and 2(b) show that over the last decade our data capture between half and two-thirds of equity and fixed-income funds outside the US. Figures 2(c) and 2(d) further show that our data on funds domiciled in the Eurozone and the UK closely track the equivalent aggregates provided by ICI over time.[7]

Having concluded that our data provide good coverage of the overall mutual fund industry, we now assess how large a share of foreign investment is attributable to mutual funds as opposed to investments such as bank lending and direct investment. We focus on the US foreign investment since US data are by far the most detailed and high-quality publicly-available sources to benchmark the external validity of our data. Figure 3 shows the external assets of the US for the years 2005, 2010, and 2015. Portfolio security investment, represented by the red rectangles (shaded plus unshaded) atop each bar, accounts on average for about 40 percent of total external investment. This share has been growing over time across most countries (Shin (2014), Lane and Milesi-Ferretti (2017)), thus making the study of global security portfolios an increasingly pressing policy and academic concern.

We estimate the share of portfolio investment attributable to mutual funds by first computing the share of US-domiciled mutual fund assets that are invested abroad in our data and then multiplying that share by the US mutual fund industry total AUM reported by ICI. We conclude that mutual funds account for 35 percent of US outward portfolio-securities investment; a fraction that we illustrate in Figure 3 by the shaded red regions. Our calculations are consistent with recently released TIC data showing that 64 percent of US outward investment in 2015 was undertaken by institutions classified as "Other financial corporations - Of which: Other", a category the bulk of which is accounted for by mutual funds but that also includes hedge funds and other investment vehicles. The remaining 36 percent owes to holdings by insurance and pension funds (20 percent), non-financial corporations (12 percent), and banks (4 percent).

As shown above, our data account directly for a sizable share of cross-border portfolio security investment. We further show that our data are in some important dimensions also representative of non-mutual fund portfolio investment. For example, Figures 4(a) and 4(b) compare the portfolio shares of foreign countries in US outward investment in equities and fixed income

or equity funds in ICI. ICI only reports country aggregates, so that it is not possible to reconcile the differences at the individual fund level.

[7]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).

in our data and in TIC data on foreign long-term securities held by financial organizations other than depository institutions. We plot data from 2005, 2010, and 2013 and combine the relevant countries into a single EMU aggregate for comparability with the rest of our analysis. In Figure 4(a), which plots the US portfolio in foreign equities, nearly all countries lie closely along the solid 45 degree line across all three years, indicating that our mutual fund data is highly representative of the entire US foreign equity portfolio. The similarity in each country-destination share in the two data sets suggests that US insurers and pension funds invest similar shares of their equity portfolios across foreign countries as do US mutual funds.[8] The data in Figure 4(b) also cluster around the 45 degree line, but some important countries, including Great Britain and Canada, have larger portfolio shares in TIC than in our data, likely reflecting the disproportionate importance of those countries in the bond purchases by US banks, hedge funds, and insurance companies. Online Appendix A.2 further confirms the overall representativeness of our data by investigating these patterns while restricting attention to those countries (the vast majority) that account individually for less than 2 percent of the US foreign portfolio in TIC.

Figures 4(c) and 4(d) plot inward investment to the US in equities and fixed income from each foreign country as a percentage of total inward investment from the rest of the world.[9] Countries in the EMU constitute a much larger source of inward investment to the US in our mutual fund data than in the TIC data, while China and the Cayman Islands constitute a larger source in the TIC data. These large discrepancies are to be expected. For example, Chinese holdings of US treasuries are as large as $6 trillion, but almost none of these holdings are accounted for by China-domiciled mutual funds; rather, the official sector in China holds these securities. As a consequence, our mutual fund share of total Chinese outward investment in the US is negligible. Similarly, Cayman Island holdings in the US largely come from opaque investment vehicles (often reputed to be actually held by US residents) and not from open-end mutual funds.

For US outward investment in foreign fixed income, we can further decompose the TIC holdings into four categories capturing whether the bonds are denominated in US dollars or local currency (LCU) and whether the bonds are issued by sovereigns or corporates. Figure 5 plots the corresponding portfolio shares. Within all four categories there is a very strong

[8] Among the few data points that lie away from the line are Bermuda (BMU) and the Cayman Islands (CYM), major tax havens for the United States. Most equity security holdings of US residents in Bermuda and Cayman Islands are actually fund shares rather than common equity. The equity category in TIC data include not only common shares but also investment trusts and other investment vehicles, thus resulting in the higher share of these countries in TIC.

[9] Online Appendix Figure A.2 plots these same relationships but among countries with smaller shares of the inward portfolio.

positive correlation between the portfolio shares in the TIC and in our mutual fund data.[10]

In summary, our data tracks well the best publicly available information on the aggregate scale of mutual fund assets, domiciled inside and outside the US. These data clearly represent only a subset of cross-border investment positions but a comparison with US TIC data suggests they are informative about many facets of non-mutual fund intermediated portfolio positions, such as those held by insurance companies and hedge funds. Importantly, our data are representative even when focusing on tighter subsets that distinguish between government and corporate debt, and dollar or local currency denominated debt.

1.3 Final Sample Selection

Our benchmark analysis in the rest of the paper is performed on a sample of countries and years for which Morningstar's coverage of AUM at the country level is sufficiently comprehensive.[11] Table 1 shows the domicile countries that we retain after applying this filter along with the dates for which they enter in our sample, and their total AUM in our data.

Our criteria select a final sample of 25 countries that have sufficient coverage to meet our standard, and about half of which are subsumed into the EMU. Table 1 therefore lists the remaining 14 effective countries, ranked by the order of their AUM in 2015 in our data. While the US and EMU clearly account for the bulk of AUM, we observe about $1 trillion or more in AUM for each of the the UK, China, Brazil, and Canada.[12]

2 The Importance of Currency in Global Portfolios

We introduce here the notation for portfolio shares used throughout the paper. Denote the US dollar value of a position held by a mutual fund domiciled in country j and invested in country i at time t as:

$$Q^t_{i,j,k},$$

[10] Burger and Warnock (2007), Burger, Warnock and Warnock (2012), Burger et al. (2015) examine American participation in foreign local currency bonds markets.

[11] We use the simple criterion that AUM in Morningstar for fixed-income funds should be between one-quarter and twice the scale of those reported by ICI. The purpose of this selection is to ensure that analyses are not influenced by domiciles for which Morningstar data are unrepresentative. We intend in future drafts, however, to add back dropped countries, scaling them by their AUM in ICI.

[12] The Chinese mutual fund industry has grown very rapidly in recent years. The industry is mostly composed of money market funds that invest domestically and target Chinese retail clients. Hachem and Song (2016) point out that these funds are akin to shadow banking and their AUM growth has been spurred by regulatory tightening in traditional credit sectors.

where the index k denotes the security type. The index k can take the values B (all bonds), BC (corporate bonds), BS (sovereign bonds), and E (equities). We add a subscript to k to clarify the security's currency. For example, $k = BS_{\text{EUR}}$ denotes euro-denominated sovereign bonds, $k = BC_i$ denotes destination country i local currency denominated corporate bonds, $k = BC_j$ denotes corporate bonds that are denominated in the investor country's currency.

We denote the complement of X by using $-X$ in the relevant subscript such that $k = B_{-i}$ denotes bonds denominated in a currency other than the local currency of country i, and $k = B_{-\text{USD}}$ denotes bonds denominated in a currency other than the US dollar. If we sum over all elements of an index, we replace the index with Ω. For example, bond positions by all Japanese funds in 2010 are denoted by $Q^{2010}_{\Omega,JPN,B}$, UK funds' foreign equity positions in 2015 are denoted by $Q^{2015}_{-GBR,GBR,E}$, and US funds' positions in Mexico in 2005 are denoted by $Q^{2005}_{MEX,USA,\Omega}$.

Portfolio positions are denoted with uppercase Q's and portfolio shares are denoted with lowercase q's. For example, the share of the EMU bond portfolio that is invested in the US in 2010 is denoted by:

$$q^{2010}_{USA/\Omega,EMU,B} = \frac{Q^{2010}_{USA,EMU,B}}{Q^{2010}_{\Omega,EMU,B}} = \frac{Q^{2010}_{USA,EMU,B}}{\sum_i Q^{2010}_{i,EMU,B}},$$

and the share of the US's foreign equity portfolio that is invested in Mexico in 2015 is denoted by:

$$q^{2015}_{MEX/-USA,USA,E} = \frac{Q^{2015}_{MEX,USA,E}}{Q^{2015}_{-USA,USA,E}} = \frac{Q^{2015}_{MEX,USA,E}}{\sum_{i\neq USA} Q^{2015}_{i,USA,E}}.$$

The share of EMU holdings of EMU sovereign bonds that are dollar denominated in 2005 is denoted by:

$$q^{2005}_{EMU,EMU,BS_{USD}/BS} = \frac{Q^{2005}_{EMU,EMU,BS_{USD}}}{Q^{2005}_{EMU,EMU,BS}}.$$

A number of our analyses require additional subscripts to denote the borrowing firm p (for parent, identified with the CUSIP 6-digit code) within an (i,j,k) bundle or to denote a specific security c (for CUSIP 9-digit code) within an (i,j,k,p) bundle.[13] Further, we sometimes add subscripts p to i to capture the country of the borrowing firm and add subscripts c to k to capture the currency of the security. For example, consider $p =$ General Electric (GE), which is a US

[13]The reader should think of p as capturing the CUSIP 6-digit code. We associate multiple CUSIP 6-digit codes to a given parent to overcome the issue that firms often issue debt in the names of multiple subsidiaries and that some frequent issuers are associated with more than one CUSIP 6-digit code. The Online Appendix details how we merge our data with both the CUSIP Master File, the CUSIP Associated Issuer File, and Capital IQ, to recover for each CUSIP 9-digit a unique (master) CUSIP 6-digit of the parent issuer.

firm, so $i_{GE} = USA$ in this case. We would use:

$$q^t_{i_{GE},EMU,BC,GE/\Omega,\Omega}$$

to denote GE's share of the EMU portfolio of US corporate bonds, or we would use:

$$q^t_{i_{GE},EMU,BC,GE/\Omega,c/\Omega}$$

to capture the share of a particular GE bond in that same portfolio.

2.1 Foreign Investors Portfolios Are Biased Against Local Currency

In our data foreign investors differ significantly from a country's domestic investors in that they are far less likely to invest in that country's local-currency-denominated bonds and far more likely to invest in that country's foreign-currency denominated bonds. Using the notation introduced above, this fact can be described as:

$$q_{i,-i,B_i/B} << q_{i,i,B_i/B} \quad \text{and} \quad q_{i,j,B_j/B} >> q_{i,i,B_j/B}.$$

The original sin literature (Eichengreen and Hausmann (1999, 2005)) has documented a similar fact in the case of foreign investors from developed economies investing in bonds issued by emerging markets, presumably reflecting inflation risk, weaker institutions, or less developed capital markets. We find, however, that this is a far broader phenomenon that even applies within groups of developed economies less affected by these issues.

The shaded red bars on the left of Figure 6(a) plot for each country i listed on the y-axis the share of locally-domiciled portfolios of domestic corporate bonds that is denominated in the local currency, $q_{i,i,BC_i/BC}$, as of December 2015.[14] The bars are all above 0.8 and most are quite close to 1.0. Unsurprisingly, and consistent with conventional modeling assumptions in the literature, all countries invest overwhelmingly in local currency bonds when lending to domestic corporations.

The hollow blue bars on the right of Figure 6(a) show the share of foreign investment in i's corporate bonds that is in i's currency, $q_{i,-i,BC_i/BC}$. If foreign and domestic investors held similar portfolios of domestic securities, then the length of red and blue bars would be identical in each row. On the contrary, Figure 6(a) shows that the blue bars are systematically (much) smaller

[14] We focus here and elsewhere on corporate bonds because most (though not all) developed country sovereign bonds are issued in the domestic currency. The Online Appendix provides the equivalent analysis for sovereigns and for all bonds.

than the red bars for each row. Excluding (for now) investment in the United States, foreigners from countries $j \neq i$ choose a dramatically smaller share of their bond investment in country i to be in i's currency compared to domestic investors. The first bar from the top, for example, shows that whereas Australia's portfolio of Australian corporate bonds is overwhelmingly in Australian dollars, the rest of the world almost exclusively invests in bonds denominated in other currencies when buying Australian corporate bonds.[15]

One might naturally wonder if this pattern is driven by a global preference for an international currency such as the US dollar. To evaluate the extent to which the dollar's special role underlies this global pattern, Figure 6(b) simply replicates these calculations after dropping all dollar-denominated debt positions. By construction, all bars grow toward one since the numerators for both sides, Q_{i,i,BC_i} and $Q_{i,-i,BC_i}$, are unaffected but the denominators are lowered by the amounts $Q_{i,i,BC_{USD}}$ and $Q_{i,-i,BC_{USD}}$, respectively. Strikingly, the bars on the right hand side all remain much smaller than the bars on the left.

Figure 7 confirms that the pattern is not driven by the financial sector of each country. We repeat the analysis in Figure 6(a) but first split the sample of corporate bonds based on whether the issuer is a financial or non-financial corporation. Figure 7(a) shows that for each country, while the domestic investors' portfolio in bonds issued by financial corporations is overwhelmingly in local currency, the foreign investors' portfolio in bonds issued by financial corporations is overwhelmingly in foreign currency. Figure 7(b) confirms the same pattern for non-financial corporations.

Figure 8 disaggregates the blue bars from Figure 6(a) into the portfolios from individual investor countries and shows that these patterns hold robustly across bilateral pairs. It additionally considers not just corporate bonds but also sovereign bonds and the union of corporate and sovereign bonds ("all bonds"). For example, Figure 8(a) shows the shares of investment from various countries in eurozone bonds that are denominated in euro. The leftmost bar, shaded in red, shows that 90 percent of the EMU's bond portfolio in itself is denominated in euros. By contrast, the other countries listed along the x-axis, even when investing in EMU debt, rarely take that level of euro exposure. Less than 30 percent of US holdings of EMU bonds, and about 40 percent of the investments in EMU bonds by the UK, Canada, and Switzerland, are

[15]The hollow blue bars on the right are calculated by simply adding up positions over multiple countries $j \neq i$ that invest in i. The relative weight of each country j therefore implicitly relates to its scale of AUM in our data. Heterogeneous coverage in our data may imply a divergence between the reported numbers in these plots and equivalent multilateral numbers reported by national statistical agencies. For example, suppose our coverage of mutual funds domiciled in New Zealand was lowest of the countries in our data. To the extent New Zealand funds invest entirely in euro-denominated bonds issued by Italian corporations, the hollow blue bar in Figure 6 corresponding to the EMU row would be too small. Future drafts will consider weighting based on the size of countries' mutual fund industries, but we do not anticipate an impact on the qualitative results presented here.

denominated in euros.[16] Figure 8(b) shows that this same pattern holds for investments in the UK.

Figures 8(c) to 8(f) highlight that while the pattern is clearly most stark for corporate bonds, it also holds qualitatively for sovereigns. Sovereign debt markets, particularly in developed countries, tend to have most bonds denominated in the local currency of the issuer. Our data show that foreigners are still much more likely than domestic investors to hold those (few) sovereign bonds denominated in foreign currency, but the effect is quantitatively smaller than in corporate markets.

Our findings offer new stylized facts for theories of international portfolio choice. Benchmark symmetric models based on the classic analysis of Lucas (1982) fail to match the data in as much as they provide no rationale for non-zero bond holdings in addition to equity. Most models that account for gross debt positions across countries tend to imply that foreign bond investors take on direct exposure to the currency of the destination country (for example, Alvarez, Atkeson and Kehoe (2009), Bacchetta and Van Wincoop (2010), Pavlova and Rigobon (2012), Lustig and Verdelhan (2016)).[17]

Engel and Matsumoto (2009) and Coeurdacier and Gourinchas (2016) demonstrate that in models that allow for both bond and equity trading real exchange rate risk is predominantly hedged via the bond and not the equity international positions.[18] Interestingly, Engel and Matsumoto (2009) lament a lack of data and stylized facts on the currency composition of international portfolios to guide further theory development. To account for our new facts, we need new models with two key ingredients: heterogeneity in the currency of bond issuance (across and within issuers) within each country and demand for foreign bonds denominated in one's own currency.

Home Currency Bias at the Security Level. The above results suggest investors exhibit "home currency bias" in that they disproportionally hold securities denominated in their home currency. To demonstrate that currency is the critical factor driving this patterns we must overcome the concern that correlated and omitted factors such as the issuer's sector, participation in international trade, and credit worthiness, or the security's maturity, coupon, and legal jurisdiction are in fact the true drivers of the bias.

[16] Denmark, a small country with a hard peg to the euro and strong economic links to the eurozone economies, has a significantly share of its investment in the eurozone denominated in euro.

[17] For recent models of international portfolio choice see also: Corsetti, Dedola and Leduc (2008), Tille and Van Wincoop (2010), Devereux and Sutherland (2011), Dou and Verdelhan (2015), Colacito and Croce (2011), Colacito et al. (2015), Hassan (2013), Hassan, Mertens and Zhang (2015), Gabaix and Maggiori (2015).

[18] Broadly speaking, in this type of models it is possible to generate a home currency bias if the home currency tends to hedge home risks (i.e. appreciate when marginal utility is high at home).

We isolate the effect of currency of denomination on the holding patterns in our data by exploiting security-level variation in the currency of denomination of multiple bonds offered by the same issuer. We estimate the following regression:

$$s_{i_p,j,p,c} = \alpha_j + \gamma_{j,p} + \beta_j \mathbf{1}_{\{LC_c = LC_j\}} + Controls + \varepsilon_{i_p,j,p,c}, \tag{1}$$

where here and below we omit the subscript $k = BC$ since all regressions in this section are run only on our data on corporate bond positions. We report our results using two different left-hand side variables for $s_{i_p,j,p,c}$. The first measure is country j's share of the total global holdings of each security c, a 9-digit CUSIP, in our data, i.e. $q_{i_p,j/\Omega,p,c} = Q_{i,j,p,c}/Q_{i,\Omega,p,c}$. The second measure is a commonly-used proxy for portfolio home bias defined as a security's share in country j's portfolio relative to the security's share in the global portfolio:[19]

$$PB_{i_p,j,p,c} \equiv \frac{q_{\Omega,j,BC,p/\Omega,c/\Omega}}{q_{\Omega,\Omega,BC,p/\Omega,c/\Omega}}. \tag{2}$$

The two measures contain similar information: indeed, they are affine transformations of each other within each country j. The security share specification has the advantage of a simple interpretation, while the portfolio bias specification has the advantage that it is closer to the measure used to calculate home bias in the existing literature (French and Poterba (1991), Lewis (1999), Sercu and Vanpée (2007), Coeurdacier and Rey (2013), Bekaert and Wang (2009), Burger, Warnock and Warnock (2017)).

The term $\gamma_{j,p}$ in equation (1) is a fixed effect for the issuer of the bond and $\mathbf{1}_{\{LC_c = LC_j\}}$ is an indicator variable that equals one when security c is denominated in the currency of country j. The estimate of β_j is the coefficient of interest and exploits within-issuer variation to capture the extent to which country j holds a disproportionate amount of securities that are denominated in its own currency. For example, imagine that British Petroleum (BP), a UK firm, issues both a pound denominated bond and a euro denominated bond. To the extent that the GBR portfolio is overweight BP's pound bond or the EMU portfolio is overweight BP's euro bond, these would contribute to positive estimates of β_{GBR} and β_{EMU}. Since both bonds are associated with the same borrower, differences in portfolio weights cannot reflect differences in the borrower's industry, credit risk, or export-import activity. We additionally include controls for the maturity and coupon of the security since firms might plausibly tend to offer different types of instruments in different currencies.

[19] Note that we are using in the denominator the share that the security accounts for in the global mutual fund portfolio in our data. If our data included all investors worldwide this value would correspond, by market clearing, to the market capitalization weight of the security.

Table 2 reports estimates of equation (1) using the security share measure as the dependent variable and is run separately for each country $j \in \{\text{CAN, CHE, EMU, GBR, SWE, USA}\}$. We use the total market value of security c in our data as weights (Table A.1 gives the unweighted estimation results).[20] Looking across the top row, the β_j coefficients are uniformly positive, statistically significant, and large in magnitude. For example, the top row of column one shows that if a security is denominated in Canadian dollars, Canadian mutual funds hold 91 percentage points more of this security than they do of securities not denominated in Canadian dollars. Since a given country typically owns a very small share of the total holdings of any security, this implies that, all else equal, most Canadian dollar securities are held by Canadian investors. A similar effect holds for all other countries. Even among bonds issued by the same issuer, investors disproportionally hold those bonds that are denominated in their home currency.

Table 3 reports our estimates using the portfolio bias measure. The β_j coefficient signs and R^2 values are by construction identical to those in Table 2 since the two left hand side variables are affine transformation of each other. The magnitudes of the coefficients using this portfolio bias measure, however, have a different interpretation. The coefficient in column one, for instance, demonstrates that the share of a security in the Canadian portfolio relative to the global portfolio increases by nearly thirty if the security is denominated in Canadian dollars. By contrast, the 1.094 point estimate on the home currency dummy for the US means that the portfolio bias measure increases by slightly more than one for the US if the security is denominated in dollars. This seemingly large difference in magnitudes occurs even though Canadians and Americans own relatively similar shares of debt securities issued in their respective currencies. Canada is such a tiny share of the global portfolio that by owning the majority of securities issued in its currency, Canada's portfolio is far more overweight Canadian dollars relative to the global portfolio than the US is overweight US dollars. We reiterate that these results cannot reflect a bias toward securities issued by domestic firms since we include issuer fixed effects and any given issuer firm can only be located in a single country. Rather, we identify the effect only from variation in the securities' currencies.

We compare the strength of the home-currency bias to that of the home-country bias by estimating the following regression:

$$s_{i_p,j,k,c} = \alpha_j + \beta_j \mathbf{1}_{\{LC_c = LC_j\}} + \gamma_j \mathbf{1}_{\{i_p = j\}} + \delta_j \mathbf{1}_{\{LC_c = LC_j\}} \times \mathbf{1}_{\{i_p = j\}} + Controls + \eta_{i_p,j/\Omega,p,c}. \quad (3)$$

The indicator variable $\mathbf{1}_{\{i_p=j\}}$ equals one when the firm issuing the security c is also located

[20] We control for maturity with dummies corresponding to the categories: less than 2 years, between 2 and 5 years, between 5 and 10 years, and greater than 10 years. We treat coupon similarly, but use seven equally spaced buckets from below 1 percent to greater than 6 percent.

in country j and we add it to the regression on its own as well as interacted with the home currency indicator $\mathbf{1}_{\{LC_c=LC_j\}}$. We include the same controls and use the same weighting as in our estimation of equation (1). Here, we omit the parent company fixed effects to allow for some identification of the home country effect to come from comparisons of positions in securities from home and foreign issuers that are in the same currency.

Tables 4 and 5 report the results for each of the two measures (Table A.2 reports the unweighted results). The top rows show the estimate on the indicator for home country, which generally has a positive and statistically significant impact. However, this effect is much smaller than the impact of currency as shown in the second row of each panel. Even conditional on controlling for country, the currency of denomination remains the single most important factor associated with the share of total issuance held by any given country. This result is consistent with Burger, Warnock and Warnock (2017) who show using US foreign investment across destination countries that the US holds close to market weight of dollar denominated bonds, but is underweight foreign currency denominated bonds.

Finally, we demonstrate how home bias regressions that omit information on currency lead to misleading conclusions on the role of issuer's country. To do this, we first run a univariate regression with only a home country indicator variable as the covariate. This is meant to parallel the vast majority of analyses which study home bias from aggregate data sources that omit information on currency. Second, we run an identical regression but include only a home currency indicator instead of the home country indicator. Third, we allow for both sets of indicators. We estimate the three specifications:

$$s_{i_p,j,p,c} = \alpha_{j,0} + \gamma_{j,0}\mathbf{1}_{\{i_p=j\}} + \varepsilon_{i_p,j/\Omega,p,c}, \tag{4}$$

$$s_{i_p,j,p,c} = \alpha_{j,1} + \beta_{j,0}\mathbf{1}_{\{LC_c=LC_j\}} + \varepsilon_{i_p,j/\Omega,p,c}, \tag{5}$$

$$s_{i_p,j,p,c} = \alpha_{j,2} + \beta_{j,1}\mathbf{1}_{\{LC_c=LC_j\}} + \gamma_{j,1}\mathbf{1}_{\{i_p=j\}} + \varepsilon_{i_p,j/\Omega,p,c}. \tag{6}$$

Each row of Table 6 shows our estimates for a given country when using the security share as the dependent variable. Panel A reports the estimates of equation (4) and shows that country indicators on their own have significant power for explaining securities' portfolio weights. The estimates of the country dummy $\gamma_{j,0}$ are all positive, significant, and range from about 20 percent to 50 percent depending on the country, thus confirming that countries are overweight securities that are domestic. Country information alone generally explains about 40 percent of the variation in securities' holdings around the world, as seen in the R^2 values in the third column.[21] These regressions recover in our sample the well-studied phenomenon of home bias.

[21] All coefficients in the table are statistically significant at the one percent level and, in order to ease the comparison

Indeed, an extensive literature documented that countries are overweight domestic securities (both equity and bonds) compared to market capitalization weights (French and Poterba (1991), Fidora, Fratzscher and Thimann (2007), De Moor and Vanpée (2013*b*,*a*); for review papers see Lewis (1999), Sercu and Vanpée (2007), Coeurdacier and Rey (2013)).

Panel B reports the estimates of equation (5), in which we replace the home-country indicator from equation (4) with a home-currency indicator. The results are much stronger, with the point estimates on the indicators and the R^2s both approximately twice what they were in Panel A. This univariate regression at the country level re-affirms our result in Table 2 which exploited instead within-firm variation: the sole information of the currency of denomination of an asset has a surprisingly high predictive power for the nationality of the holder of that asset.

Finally, to demonstrate that the results in Panel A are mostly driven by the correlation of issuers' countries with their securities' currencies of denomination, Panel C reports the estimates of equation (6), where we include both indicators. The coefficient on currency of denomination ($\beta_{j,1}$) is little changed from the corresponding univariate regression ($\beta_{j,0}$) and the R^2 shows only modest increases over the univariate regression with currency information (equation (5)). By contrast, the coefficient on country of issuance ($\gamma_{j,1}$) is dramatically reduced from the corresponding univariate regression ($\gamma_{j,0}$). Once we account for a security's currency of denomination, there is little additional scope for the security issuer's country to inform which countries hold larger shares of that security. Home bias regressions for bonds are confounded by the fact that most domestic bonds are denominated in domestic currency. Given that portfolios are overweight bonds denominated in the investors' domestic currencies, they are also overweight bonds issued in the investors' countries.

In addition to the country-by-country regressions, the bottom row of each panel reports the R^2 from a corresponding regression that pools the data and includes country fixed-effects and country fixed-effects interacted with the country and/or currency dummies in the three specifications. These panel regressions recover the same within-country coefficients as reported in the rows above, but allow us to infer the total global variation explained by currency. The R^2 of the pooled regression rises from 0.632 in Panel A to 0.827 in Panel B, and then barely increases to 0.839 in Panel C, corroborating our earlier conclusion from the country-by-country cases. Given knowledge of the currency in which a bond is issued, additional knowledge of the country that issues the security provides almost no additional explanatory power.

Table 3 performs this same exercise using the portfolio bias measure as the dependent variable and yields similar results. The Appendix further expands on the results in Tables 2 - 7 and shows that the results hold if we separately consider securities issued by financial or by non-

across specifications, we do not report standard errors in this table.

financial corporations and if we separately analyze the impact of the nationality of the issuer from the country in which a security is issued. Our security-level analyses suggest that home currency bias is stronger than home bond bias and that, indeed, bond home bias measures from aggregate data are largely capturing a by-product of home currency bias.

2.2 Capital (Mis-)Allocation at the Firm Level: The Impact of Currency

We documented above that cross-border investment is highly skewed towards the investing country's local currency. In this section, we explore implications of this currency bias by looking at how individual firms fit differently into domestic and foreign portfolios based on the currency denomination of the bonds they offer. We find that foreign and domestic investors to a large extent fund different firms, which suggests that currency bias might in fact lead to capital misallocation in the economies receiving foreign inflows.

Nearly all firms in a country issue in their domestic currency but only a small share issue in foreign currency. Those that do not issue in foreign currency generally do not receive much foreign lending. To see this, start with Figure 9(a), which shows US and UK investment in 2015 in UK corporate issuers of bonds denominated in either dollars or pounds. The plot ranks issuers along the x-axis by their share of the domestic (UK) investor's portfolio and preserves that ordering when studying the foreign portfolio shares. Solid red dots show the portfolio share of the domestic investors dedicated to particular borrowers while the hollow blue diamonds show their corresponding shares in the foreign portfolios. Since the rank is determined only by the domestic portfolio, the red dots decrease monotonically by construction. For example, bonds issued by Lloyds and its subsidiaries, firms in the insurance industry, account for the largest position in the British portfolio of UK corporate borrowers and therefore is the firm ranked 1st, appearing on the far left of the plot. It accounts for 5 percent of British holdings and 9 percent of US holdings of UK corporate debt in 2015.

Figure 9(c) plots a strict subset of the data that includes those British issuers that only issue in pounds and not in dollars. For example, it is easy to see that it excludes Lloyds (ranked 1st on the x-axis) since Lloyds issues bonds in both currencies. Other large borrowers like Barclays and Aviva are also excluded as they issue bonds in both currencies. Instead, the first non-dollar borrower along the x-axis of Figure 9(c) is Legal & General Group and its subsidiaries, a British multinational financial services firm. It is ranked 6th and received nearly 2 percent of the British portfolio of UK corporate bonds, whereas it received almost none of the US porftolio of UK bonds. This example is highly representative. Comparing British and American portfolios in Figure 9(c), it is clear that the foreign portfolio underweights firms that only issue in domestic currency.

By contrast, Figure 9(e) plots a strict subset of the data that includes those British issuers that only issue in US dollars and not in pounds. For example, the 191st ranked firm is International Game Technology, a multinational gaming company that accounts for more than 1 percent of the US portfolio and almost none of the British one. Again, this example is highly representative. Foreigners hold a much greater share of their UK portfolio in these non-local currency issuers than domestic investors do. Figures 9(b), 9(d), and 9(f) show that these patterns are qualitatively identical when comparing US and EMU positions in the corporate debt of EMU firms.

These plots first expose the notion that foreign capital is allocated differently among borrowing firms than domestic capital and emphasize that currency appears to lie at the heart of the difference. We find intriguing the possibility that these results expose a pattern of misallocation brought by foreign inflows. Perhaps foreigners' distaste for local currency causes them to invest predominantly in the small subset of domestic firms that issue in foreign currency. Relative to an undistorted equilibrium in which capital flows across firms to equalize the risk-adjusted marginal product of capital, this currency-induced difference in the foreign capital allocations might be inefficient. In this light, we find it important that the patterns highlighted above for all bonds are equally present, perhaps even more so, when restricting the attention to bonds issued by non-financial corporations. Figures 10 and 11 present results analogous to Figure 9 but restrict the sample to only include bonds by financial and non-financial corporates, respectively.

The stark difference from domestic portfolios that characterize foreign portfolios provides support for the foundations of macro prudential policies such as capital controls, studied recently in Farhi and Werning (2013, 2017) and Schmitt-Grohé and Uribe (2016). It also points this literature toward incorporating a previously under-investigated factor: domestic firms' will be more reliant on funding from countries in the currency of which these firms issue. For example, the exposure of European firms to Canadian investors is strongly associated with the share of their bonds that is denominated in Canadian dollar.

2.3 International Currencies: The Rise of the Dollar and Fall of the Euro

As emphasized above, foreign investors generally do not hold securities denominated in foreign currencies. In this section, however, we document that the dollar and euro are prominent exceptions to this rule. Issuers of these "international currencies" appear uniquely able to place local currency denominated debt in foreign portfolios and thereby minimize any potential currency-driven misallocation of the kind discussed above. Further, while the euro and dollar were both meaningful international currencies in the mid-2000s, we document a striking shift in international bond portfolios away from the euro and toward the dollar starting with the 2008 financial crisis. By 2015, the dollar was clearly the world's dominant international currency according to

our measure.

Foreign Capital Allocation for International Currency Issuers. Figure 6(a) clearly highlights the important role of the dollar: the only country in 2015 where foreigners buy most of their corporate (and sovereign) bonds in local currency is the US. In fact, investors often hold dollar bonds even when both the investor and the issuer are not located in the US (see Figure 6(b)) .

These aggregate patterns suggest that in the micro data we should find the foreign capital allocations across US issuers to be more similar to domestic capital allocations than was the case for issuers of non-international currencies. Indeed, whereas our earlier results demonstrated that local currency bond issuers in the UK and the Eurozone in 2015 did not receive much financing from the US, the same is not true for US local currency bond issuers trying to receive financing from UK and Eurozone investors. Figures 12(a) and 12(b) are exact inversions of Figures 9(c) and 9(d) shown earlier and show foreign and domestic positions in US issuers that only issue dollar denominated bonds. There are certainly differences in the portfolios, but unlike the cases for the UK and EMU, the domestic portfolio shares (represented by the red dots) are not systemically above nor below the foreign portfolio shares. US dollar-only issuers attract domestic and foreign capital equally. Figure 13 further shows that this special allocation to US-based dollar borrowers holds across both financial and non-financial borrowers.

To confirm that the bilateral patterns highlighted in these figures hold more broadly, we propose a quantitative country-level measure of portfolio differences between foreign and domestic investors:

$$||q_{i,-i,p/\Omega,\Omega} - q_{i,i,p/\Omega,\Omega}||_2 = \left(\sum_{p=1}^{N} \left(q_{i,-i,p/\Omega,\Omega} - q_{i,i,p/\Omega,\Omega} \right)^2 \right)^{\frac{1}{2}}, \tag{7}$$

where we again drop the subscript $k = BC$ since we only perform this calculation on corporate bonds. Here, we pool all foreign investors into a single foreign portfolio. This measure, the Euclidean distance, computes the squared difference between the portfolio shares allocated to specific issuers (combining all of the individual bonds they have outstanding) by domestic investors and by foreign investors.

Figure 14 plots this distance measure for several countries at the end of 2015. Foreign and domestic portfolios are generally quite different across countries. To the extent that this distance measure proxies a cost associated with foreign investment in domestic firms, this figure suggests the cost is minimized for the US, the issuer of the dominant international currency. In this sense, our work introduces the possibility of a previously unstudied benefit to issuing a global currency

like the US dollar.[22]

The Shifting Role of the Euro and Dollar as International Currencies. Figure 15(a) shows the share of all cross-border bond positions in our data accounted for by bonds denominated in dollars and in euros. The solid red line shows that, on the eve of the 2008 global financial crisis, dollar denominated bonds represented approximately 50 percent of these positions in our data. The dashed blue line shows that euro-denominated bonds accounted for 25 percent at that point in time. Further, these shares had been stable during the preceding four years. No other currencies come close to representing such large shares in cross-border portfolios. These patterns are not uncommon in international data and have lead commentators to label the euro and the dollar as international currencies.

Strikingly, starting immediately after the crisis, these international bond portfolios exhibit a dramatic shift away from the euro and into the dollar. The euro share of total cross border bonds collapsed by late 2015 to about 15 percent while the dollar share exceeded 60 percent.[23] The currency switch is more pronounced when restricting attention to corporate bonds. Figure 15(b) shows that during the 2004-2008 period, the dollar and euro represented 50 and 30 percent, respectively, of cross-border corporate bond positions in our data. By 2015, however, the value of dollar denominated corporate bonds held across borders reached well over three times the value of euro denominated corporate bonds held across borders.[24]

Figure 15(c) plots the currency shares in global cross-border corporate bond portfolios after excluding the US and EMU as either the source (lender) or destination (borrower) of the positions.[25] 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 unconventional monetary policy (quantitative easing) of the Fed or the ECB. Fig-

[22]We think of this potential cost as akin to the aggregate misallocation and inefficiency generated when firms have heterogeneous access to credit, as in Restuccia and Rogerson (2008), Hsieh and Klenow (2009), and Banerjee and Moll (2010). Avoiding such misallocation would complement additional arguments on the gains to issuers of reserve currencies as analyzed recently by Caballero, Farhi and Gourinchas (2008), Gourinchas, Govillot and Rey (2011), Maggiori (2017), and Farhi and Maggiori (2017).

[23]The effect is not mechanical since the two shares do not have to sum to one due to the presence of many other currencies. Figure A.7 also reports the share of bonds in pound and yen.

[24]The BIS International Debt Securities database 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). While this is a somewhat selected sample and certainly much smaller than the total world debt market, nonetheless Appendix Figure A.8 demonstrates that even in these data there is a rise in the share of dollar-denominated bonds and a collapse in euro-denominated bonds that evolves together with our measures.

[25]The dollar and the euro are used to denominate a large share of bonds between borrowers and lenders which 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, for instance, Goldberg and Tille (2008), Gopinath (2015).

ures A.9 and A.12 in the Online Appendix demonstrate that these patterns are pervasive across bilateral country pairs.

The dollar exchange rate has broadly strengthened relative to the euro since 2008, but this relative price movement can only directly explain a small portion of the relative trends in the previous charts.[26] We formally show the muted effect of nominal exchange rate changes by re-building our dataset with exchange rates fixed at their 2005 levels.

Finally, one might be concerned that these patterns merely reflect compositional changes in our data. For example, imagine Canada and Mexico enter late in the dataset and predominantly hold dollar bonds. This might 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 (borrower i and lender j) fixed effects:

$$q^t_{i,j,k_x/k} = \gamma^t_x + \alpha_{i,j} + \varepsilon^t_{i,j,x}. \tag{8}$$

We run this regression separately for $x \in \{EUR, USD\}$, for various assets k, and for various country pair rules (such as $i \neq j$ or $i, j \neq \{USA, EMU\}$). The country-pair fixed effect $\alpha_{i,j}$ 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 run this regression on the baseline as well as constant exchange rate data sets and find that composition is not driving this trend. Figure 15(d) plots time fixed effects, γ^t_{EUR} and γ^t_{USD}, both normalized to zero in 2005, from specifications that focus on cross-border corporate bond positions valued at constant (2005 base) exchange rates . The rise of the dollar and fall of the euro in international portfolios appears as a robust global pattern.

Figures 16 and 17 present analyses analogous to those in Figure 15 but restrict the sample to only contain financial and non-financial corporate borrowers, respectively. There is a level difference in the currency composition of international bond portfolios across the two sectors, with non-financial corporate bonds more commonly denominated in dollars. The shift away from euro-denominated bonds and into dollar-denominated bonds, however, is clearly present in both sectors.

Table 8 summarizes all the above evidence and the robustness of the portfolio switch away from euro and into dollar bonds. Column 5 of the table shows the difference in the euro and dollar portfolio share for each specification between the fourth quarter of 2005 and the fourth quarter of 2015. Across most of these specifications, the share of dollar denominated bonds

[26] Some simple accounting: the euro weakened approximately 15 percent over this period relative to the dollar. Applying this depreciation rate to the share of euro denominated bonds in cross-border corporate debt positions, which was 25 percent in 2008, the exchange rate accounts at most for 5 of the more than 20 percentage point increase in the gap between the dollar and euro shares of cross-border corporate positions in 2015.

rises by 10 to 20 percentage points whereas the share of euro denominated debt declines by about the same magnitude.

Does this reduction in cross-border holdings of euro-denominated assets relative to dollar-denominated assets show up in our measure of the distance between domestic and foreign portfolios? Figure 18 shows a time series of our measure, equation (7), of the foreign-domestic portfolio difference for several countries. Around the time of the 2008 global crisis, the difference between foreign and domestic portfolios in the US declines relative to that difference in the Eurozone. To the extent this measure quantifies the extent to which currency of denomination of the assets distorts capital allocation, Figure 18 captures how the US increasingly benefitted (relative to the Eurozone) from being the issuer of a global currency.

3 Key Assumptions, Extensions, and Next Steps

Domicile of Funds and Residency of Investors. Our data include information on the domicile of each mutual fund, but data on the residency of the investors in each fund are not currently available to researchers. In general, tax optimization and regulatory restrictions make it unlikely that investors buy foreign mutual funds. Based on this principle, we have equated throughout the paper the domicile of a mutual fund with the country of residency of the investors in that fund. We now provide supportive evidence for this assumption.

Table 9 reports data from TIC and shows the fraction of US outward portfolio securities investment by destination country that is accounted for by fund shares, a category which not only includes open-end debt and equity mutual fund shares but also other investment funds including, say, hedge funds. Fund shares rarely account for more than 2.5 percent of US outward portfolios, consistent with our assumption that US investors do not make substantial investments in funds abroad.[27] The portfolio shares of funds in foreign inward investment to the US is similarly small, generally around 5 percent aside from fiscal paradises and Canada and Mexico, likely due to their proximity to the US.

We next turn to the mutual fund industry in Europe and in particular to the role of Ireland and Luxembourg, two of the world's largest mutual fund centers. These two countries represent exceptions to our equating fund domicile with investor residence in that they are home to many UCITS funds that can be sold to any investor within the European Union under a harmonized regulatory regime. For that reason, we always group funds domiciled in the EMU together and

[27] Notable exceptions are fiscal paradises such as the Cayman Islands. In 2015, 48 percent of US investment in the Caymans was in fund shares. Cayman funds, however, are generally not open-end mutual funds and therefore not directly relevant for our study.

treat it as a country.

CPIS data for Luxembourg corroborates this imiplicit assumption that that the bulk of foreign investment into its funds comes from within the EMU. From 2000 to 2015, the EMU share of foreign investment in Luxembourg's equity and fund shares ranges from 70 to 80 percent, with Japanese, UK, and US investment flows representing very small shares. Switzerland is the only non-EMU holder of a moderate share of Luxembourg's fund shares, though their percentage is less than 10 percent for most years covered in our data.[28] The CPIS data for Luxembourg have notable shortcomings, namely the fact that reported claims by the rest of the world on Luxembourg are far smaller than the claims that Luxembourg reports on the rest of world, by about $1 trillion in 2015. Nonetheless, they suggest our attribution of all Luxembourg fund holdings to EMU residents is a reasonable approximation of reality.

Ireland presents a more complex case given the reasonable concern that UK residents might invest in funds domiciled in Ireland. We cannot evaluate this as we did for Luxembourg because CPIS data do not separate common equity of a company from fund shares. While, the market capitalization of fund shares in Luxembourg far outweighs that of the local equity market, the same is not necessarily true for Ireland. We are still exploring a number of potential robustness checks including: (i) attributing funds to different domiciles based on the currency in which they are marketed (for example, attributing all investments by a fund domiciled in Ireland to UK-residents if the fund shares are denominated in pounds); (ii) obtaining further data on the countries in which each fund is legally registered for sale and/or marketed.

Financial Derivatives Usage. In this paper we have focused on portfolios in securities such as bonds and equities. Since our results have highlighted the crucial role of currency of denomination in shaping global bond portfolios, a reasonable question is the extent to which our conclusions and interpretations are sensitive to the use of foreign exchange derivatives. Detailed data for derivatives' usage for almost any financial players, especially at the country level, are generally not available. Within our data derivatives reporting is too sporadic and inconsistent across funds to allow a systematic analysis.

Inspection of a few bond funds points us to the possibility that funds hedge what little foreign currency exposure they do have in their bond positions, usually using one month forward contracts. For example, we found instances of US-domiciled funds in our data that buy mostly dollar-denominated corporate bonds in the EMU and do appear to use currency forwards to hedge the euro exposure created by its positions in euro-denominated EMU sovereign bonds.

[28] There is an open possibility that some of the Swiss claims actually reflect investments of European residents via their off-shore bank accounts in Switzerland (Zucman (2013)).

Future work is necessary to systematically assess the impact of derivatives on interpretation of our results.

4 Conclusion

We document that foreign investors hold remarkably different portfolios than domestic investors. Foreign investors' portfolios are heavily concentrated in bonds denominated in their own home currency, and this is true even when investing in developed economies. We show that, at the security level, the currency of denomination of an asset has remarkable power at determining the nationality of the investors that hold that asset.

This home currency bias is in fact quantitatively more important than home country bias and implies that firms that issue bonds only in domestic currency – the majority of firms in most countries – receive comparatively little investment from foreigners. As a result, the capital allocation of foreign investment across firms is skewed toward large issuers, that issue in multiple foreign currencies, and smaller issuers that issue predominantly in foreign currency.

Further, we show that international currencies such as the dollar and euro represent exceptions to this rule. Foreign investors do include dollar and euro denominated bonds in their cross-border portfolios, even when lending to countries other than the US and EMU. Currency-driven differences in capital allocation by foreign compared with domestic investors, which may imply a cost in terms of efficiency, is therefore the most muted for these countries.

Finally, we document a dramatic and pervasive shift in the share of these cross-border bond holdings. Whereas securities denominated in dollars and euros each accounted for stable shares of cross-border portfolios in the mid-2000s, the dollar has experienced a marked rise and the euro an equally significant fall since the 2008 global crisis.

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Table 1: Countries Included in Analysis

		Country Code	Start Year	End Year	AUM in 2015 *($ Billions)*
(1)	United States	USA	2005	2015	15,397
(2)	European Monetary Union	EMU	2005	2015	5,072
(3)	United Kingdom	GBR	2005	2015	1,229
(4)	China	CHN	2007	2015	1,136
(5)	Brazil	BRA	2011	2015	1,007
(6)	Canada	CAN	2005	2015	973
(7)	Switzerland	CHE	2005	2015	374
(8)	Australia	AUS	2007	2015	327
(9)	Sweden	SWE	2005	2015	299
(10)	Denmark	DNK	2005	2015	116
(11)	Mexico	MEX	2008	2015	111
(12)	Norway	NOR	2005	2015	103
(13)	Chile	CHL	2009	2015	39
(14)	New Zealand	NZL	2005	2015	22

Note: This table reports summary statistics for the countries (i.e. domiciles of mutual funds) that have sufficient coverage relative to the levels AUM reported in ICI and therefore are included in our main analyses.

Table 2: Currency of Denomination and Nationality of Investors, Security Share

	CAN	**CHE**	**EMU**	**GBR**	**SWE**	**USA**
Currency	0.919***	0.661***	0.585***	0.538***	0.798***	0.626***
	(0.010)	(0.010)	(0.007)	(0.014)	(0.013)	(0.007)
Constant	0.010***	0.009***	0.225***	-0.009***	-0.001	0.139***
	(0.001)	(0.001)	(0.006)	(0.002)	(0.001)	(0.008)
Obs.	153,660	153,660	153,660	153,660	153,660	153,660
R^2	0.935	0.934	0.841	0.835	0.955	0.885
CUSIP6 FE	Yes	Yes	Yes	Yes	Yes	Yes
WLS	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Note: Table reports estimates of the regression in equation (1). The dependent variable is the share of each security (at the CUSIP 9-digit level) bought by each country in our sample: $q_{i_p,j/\Omega,BC,p,c}$. We include fixed effects at the ultimate-parent firm level. Controls include maturity and coupon bins. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Currency of Denomination and Nationality of Investors, Portfolio Bias

	CAN	**CHE**	**EMU**	**GBR**	**SWE**	**USA**
Currency	26.903***	29.678***	2.045***	11.623***	55.771***	1.094***
	(0.294)	(0.437)	(0.025)	(0.298)	(0.907)	(0.012)
Constant	0.289***	0.384***	0.788***	-0.194***	-0.068	0.243***
	(0.034)	(0.044)	(0.021)	(0.046)	(0.055)	(0.014)
Obs.	153,660	153,660	153,660	153,660	153,660	153,660
R^2	0.935	0.934	0.841	0.835	0.955	0.885
CUSIP6 FE	Yes	Yes	Yes	Yes	Yes	Yes
WLS	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Note: Table reports estimates of the regression in equation (1). The dependent variable is a measure for portfolio bias defined as the ratio of the share that a security accounts for in the country's portfolio relative to the share that the same security accounts for in the global portfolio (see equation (2)). We include fixed effects at the ultimate-parent firm level. Controls include maturity and coupon bins. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Currency of Denomination, Nationality of Issuer and Investors, Security Share

	CAN	**CHE**	**EMU**	**GBR**	**SWE**	**USA**
Country	0.048***	0.003**	0.124***	0.031***	0.024***	0.000
	(0.008)	(0.001)	(0.007)	(0.003)	(0.005)	(0.007)
Currency	0.942***	0.591***	0.654***	0.532***	0.741***	0.583***
	(0.009)	(0.065)	(0.006)	(0.015)	(0.020)	(0.005)
Country x Currency	-0.045***	0.356***	-0.092***	0.039*	0.061**	0.209***
	(0.014)	(0.066)	(0.009)	(0.021)	(0.025)	(0.009)
Constant	0.005***	0.008***	0.188***	-0.019***	-0.001	0.082***
	(0.001)	(0.001)	(0.006)	(0.002)	(0.001)	(0.005)
Observations	153,660	153,660	153,660	153,660	153,660	153,660
R^2	0.899	0.873	0.663	0.687	0.925	0.783
Controls	Yes	Yes	Yes	Yes	Yes	Yes
WLS	Yes	Yes	Yes	Yes	Yes	Yes

Note: Table reports estimates of the regression in equation (3). The dependent variable is the share of each security (at the CUSIP 9-digit level) bought by each country in our sample: $q_{i_{p,}j/\Omega,BC,p,c}$. Controls include maturity and coupon bins. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Currency of Denomination, Nationality of Issuer and Investors, Portfolio Bias

	CAN	**CHE**	**EMU**	**GBR**	**SWE**	**USA**
Country	1.404***	0.156**	0.432***	0.671***	1.693***	0.000
	(0.225)	(0.066)	(0.024)	(0.073)	(0.370)	(0.012)
Currency	27.557***	26.512***	2.286***	11.498***	51.802***	1.020***
	(0.276)	(2.900)	(0.020)	(0.328)	(1.418)	(0.009)
Country x Currency	-1.313***	15.964***	-0.322***	0.844*	4.254**	0.366***
	(0.408)	(2.973)	(0.031)	(0.451)	(1.716)	(0.015)
Constant	0.144***	0.345***	0.657***	-0.413***	-0.048	0.144***
	(0.021)	(0.066)	(0.019)	(0.044)	(0.051)	(0.009)
Observations	153,660	153,660	153,660	153,660	153,660	153,660
R^2	0.899	0.873	0.663	0.687	0.925	0.783
Controls	Yes	Yes	Yes	Yes	Yes	Yes
WLS	Yes	Yes	Yes	Yes	Yes	Yes

Note: Table reports estimates of the regression in equation (3). The dependent variable is a measure for portfolio bias defined as the ratio of the share that a security accounts for in the country's portfolio relative to the share that the same security accounts for in the global portfolio (see equation (2)). Controls include maturity and coupon bins. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: The Relative Importance of Currency of Denomination and Nationality of Issuer, Security Share

	Panel A: Only Country Indicators		**Panel B: Only Currency Indicators**		**Panel C: Country and Currency Indicators**		
	$\gamma_{j,0}$	R^2	$\beta_{j,0}$	R^2	$\gamma_{j,1}$	$\beta_{j,1}$	R^2
CAN	0.517	0.400	0.943	0.894	0.042	0.911	0.895
CHE	0.369	0.232	0.766	0.825	0.095	0.722	0.838
EMU	0.465	0.274	0.715	0.607	0.108	0.651	0.617
GBR	0.247	0.161	0.567	0.671	0.042	0.547	0.675
SWE	0.535	0.516	0.812	0.923	0.039	0.780	0.924
USA	0.554	0.457	0.757	0.719	0.204	0.620	0.757
Pooled		0.632		0.827			0.839

Note: Panel A reports estimates of the regression in equation (4). Panel B reports estimates of the regression in equation (5). Panel C reports estimates of the regression in equation (6). The dependent variable is the share of each security (at the CUSIP 9-digit level) bought by each country in our sample: $q_{i_p,j/\Omega,BC,p,c}$. The last row in each panel reports the R^2 of a pooled regression with country fixed effects and country fixed effects interacted with the home country dummy (Panel A), home currency dummy (Panel B), and both home country and home currency dummies (Panel C). Standard errors not reported, all coefficients are significant at one percent level.

Table 7: The Relative Importance of Currency of Denomination and Nationality of Issuer, Portfolio Bias

	Panel A: Only Country Indicators		**Panel B: Only Currency Indicators**		**Panel C: Country and Currency Indicators**		
	$\gamma_{j,0}$	R^2	$\beta_{j,0}$	R^2	$\gamma_{j,1}$	$\beta_{j,1}$	R^2
CAN	15.124	0.400	27.609	0.894	1.238	26.648	0.895
CHE	16.545	0.232	34.384	0.825	4.258	32.427	0.838
EMU	1.627	0.274	2.498	0.607	0.378	2.277	0.617
GBR	5.339	0.161	12.257	0.671	0.913	11.825	0.675
SWE	37.391	0.516	56.757	0.923	2.712	54.535	0.924
USA	0.968	0.457	1.323	0.719	0.356	1.084	0.757
Pooled		0.389		0.865			0.870

Note: Panel A reports estimates of the regression in equation (4). Panel B reports estimates of the regression in equation (5). Panel C reports estimates of the regression in equation (6). The dependent variable is a measure for portfolio bias defined as the ratio of the share that a security accounts for in the country's portfolio relative to the share that the same security accounts for in the global portfolio (see equation (2)). The last row in each panel reports the R^2 of a pooled regression with country fixed effects and country fixed effects interacted with the home country dummy (Panel A), home currency dummy (Panel B), and both home country and home currency dummies (Panel C). Standard errors not reported, all coefficients are significant at one percent level.

Table 8: International Currencies: The Rise of the Dollar and Fall of the Euro

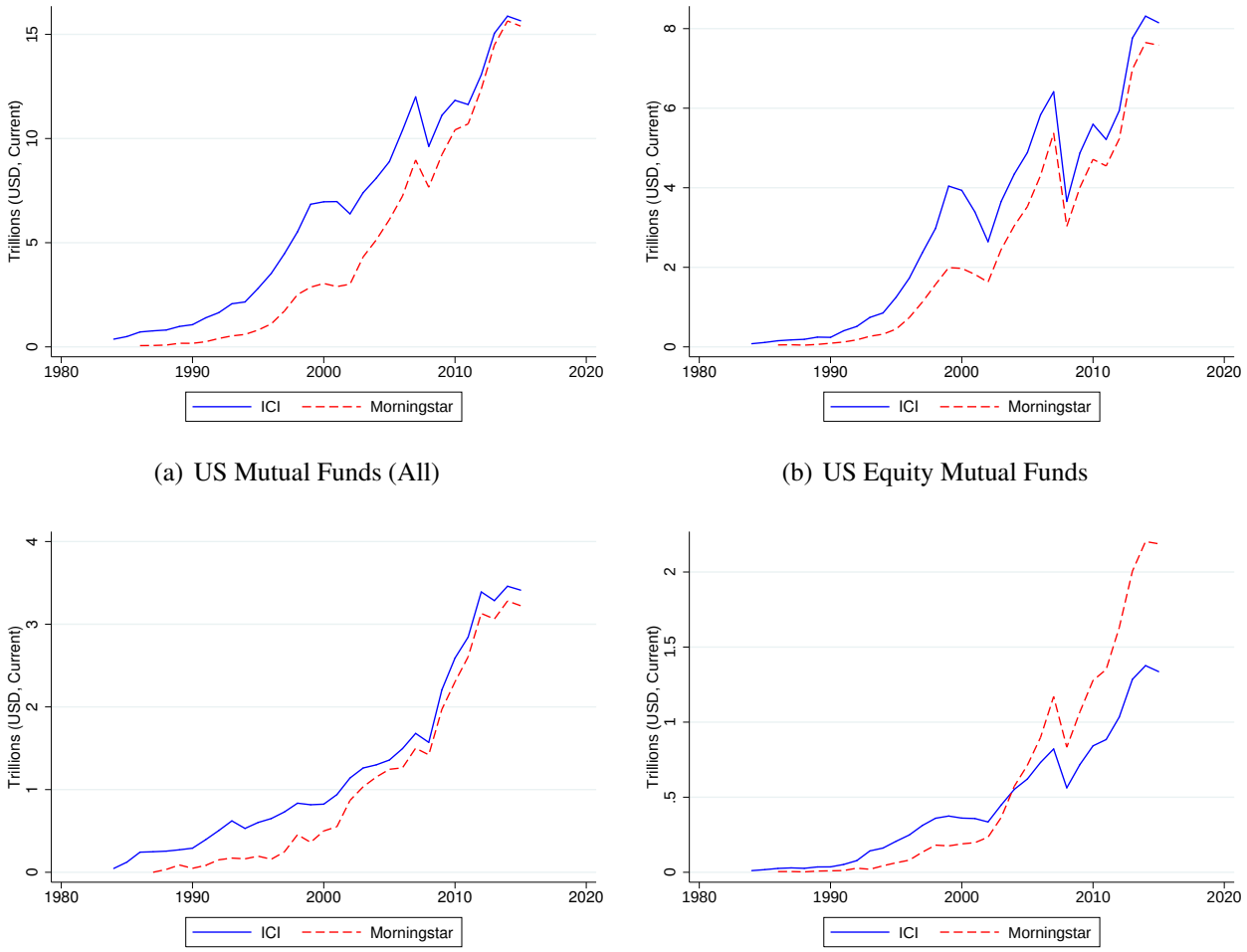
Specification	**2005q4**	**2008q4**	**2015q4**	**Long Difference**
(1) *All Bonds*				
$q_{\Omega,\Omega,B_{USD}/B}$	0.579	0.676	0.650	0.072
$q_{\Omega,\Omega,B_{EUR}/B}$	0.294	0.201	0.145	-0.148
(2) *All Bonds Held by Foreigners*				
$q_{-i,i,B_{USD}/B}$	0.477	0.463	0.607	0.130
$q_{-i,i,B_{EUR}/B}$	0.271	0.256	0.150	-0.122
(3) *Govt Bonds Held by Foreigners*				
$q_{-i,i,BS_{USD}/BS}$	0.466	0.428	0.496	0.030
$q_{-i,i,BS_{EUR}/BS}$	0.173	0.189	0.108	-0.065
(4) *Corp Bonds Held by Foreigners*				
$q_{-i,i,BC_{USD}/BC}$	0.484	0.480	0.661	0.178
$q_{-i,i,BC_{EUR}/BC}$	0.325	0.288	0.170	-0.155
(5) *Financial Corp Bonds by Foreigners*				
$q_{-i,i,BC_{USD}/BC}$	0.398	0.456	0.668	0.270
$q_{-i,i,BC_{EUR}/BC}$	0.359	0.273	0.170	-0.189
(6) *Non-Financial Corp Bonds by Foreigners*				
$q_{-i,i,BC_{USD}/BC}$	0.680	0.658	0.814	0.135
$q_{-i,i,BC_{EUR}/BC}$	0.192	0.198	0.094	-0.098
(7) *Corp Bonds by Foreigners, Ex-USA/EMU*				
$q_{-i,i,BC_{USD}/BC}$	0.252	0.219	0.363	0.111
$q_{-i,i,BC_{EUR}/BC}$	0.173	0.201	0.115	-0.058

Note: Table reports the portfolio shares of euro and dollar denominated bonds at year end in 2005, 2008, and 2015, as well as the difference between the 2015 and 2005 share (last column). We study seven different portfolio configurations. For each configuration the dollar share is reported in the first row and the euro share in the second row.

Table 9: Cross Border Investment in Fund Shares

	Destination / Source Country	Foreign Fund Share of U.S. Outward Investment		U.S. Fund Share of Foreign Inward Investment	
		2005	*2015*	*2005*	*2015*
(1)	AUS	0.1	5.3	2.4	6.8
(2)	BMU	0.7	7.8	4.4	14.8
(3)	BRA	0.0	0.4	2.6	0.9
(4)	CAN	1.3	1.4	10.4	10.7
(5)	CHE	0.0	0.2	9.7	9.0
(6)	CYM	6.2	67.1	3.7	10.5
(7)	EMU	0.8	2.2	4.7	3.9
(8)	GBR	0.2	2.5	4.6	4.3
(9)	JPN	0.2	0.7	1.5	2.6
(10)	MEX	0.3	2.4	7.4	24.9
(11)	NOR	0.0	0.1	1.5	3.0
(12)	ROW	0.8	6.9	4.5	5.8

Note: Table reports investment in fund shares as a fraction of investment in equity and bonds. Columns 2 and 3 report fund shares as a fraction of US outward investment in each of eleven destination countries, with row twelve reporting all US outward investment. Columns 4 and 5 report fund shares as a fraction of US inward investment from each of eleven source countries, with row twelve reporting all inward investment in the US. Source: Treasury International Capital.



(a) US Mutual Funds (All)

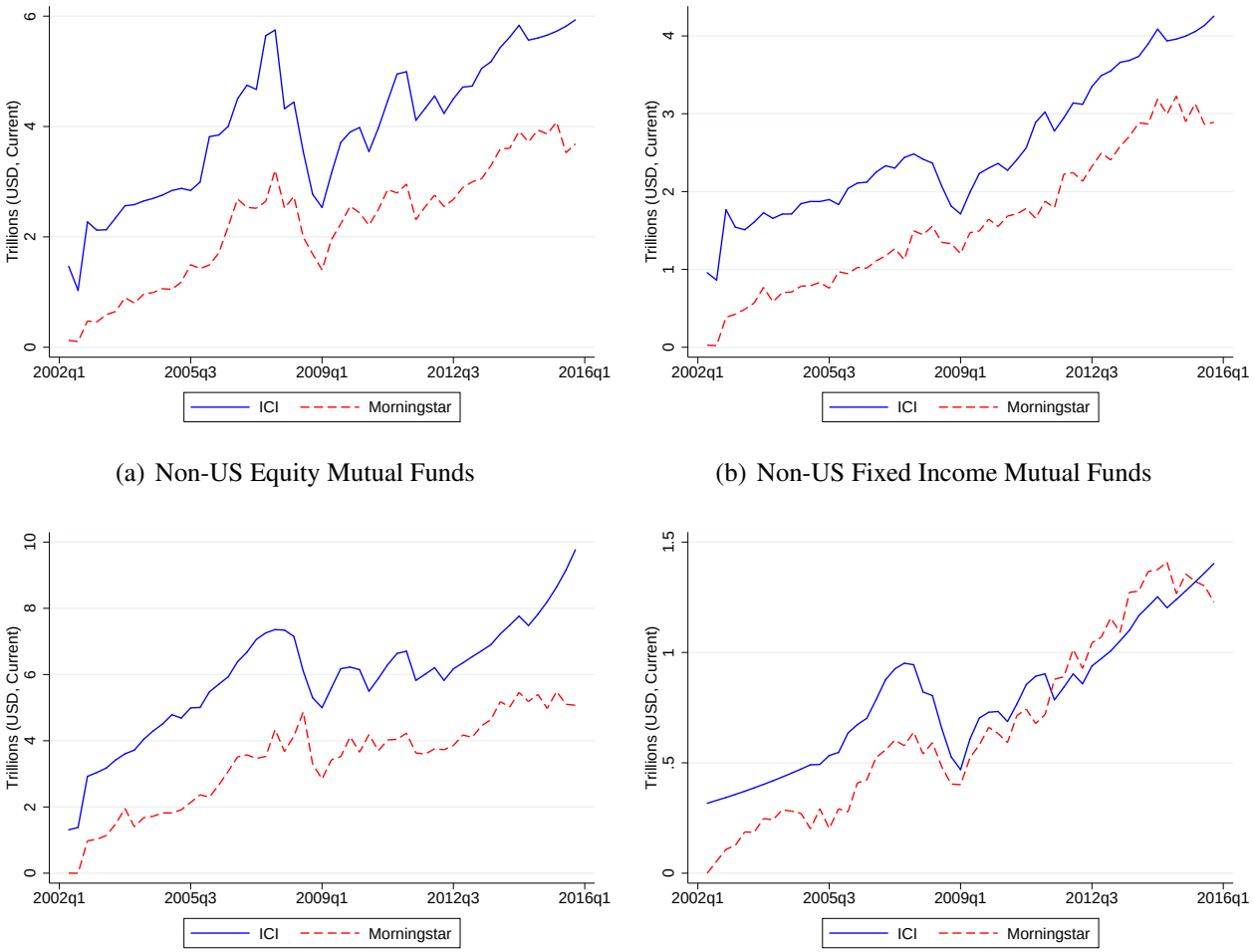
(b) US Equity Mutual Funds

(c) US Fixed-Income Mutual Funds

(d) US Allocation / Hybrid Mutual Funds

Figure 1: Morningstar's Coverage of US Mutual Fund Assets Under Management

Note: The graphs plot total Asset Under Management (AUM) for open-end mutual funds domiciled in the US. The blue solid line plots data on total AUM provided by the Investment Company Institute (ICI). The red dashed line reports the total AUM in our data. Panel (a) includes all type of mutual funds (equity, fixed income, allocation, money market funds). Panels (b),(c),(d) focus separately on each type of fund.



(a) Non-US Equity Mutual Funds

(b) Non-US Fixed Income Mutual Funds

(c) EMU Mutual Funds (All)

(d) GBR Mutual Funds (All)

Figure 2: Morningstar's Coverage of Non-US Mutual Fund Assets Under Management

Note: The graphs plot total Asset Under Management (AUM) for open-end mutual funds domiciled outside the US (Panels (a) and (b)), in the EMU (Panel (c)), and in Great Britain (Panel (d)). The blue solid line plots data on total AUM provided by the Investment Company Institute (ICI). The red dashed line reports the total AUM in our data. Panel (a) includes only equity focused mutual funds. Panel (b) includes only fixed-income mutual funds. Panels (c) and (d) include all types of funds (equity, fixed income, allocation, money market funds).

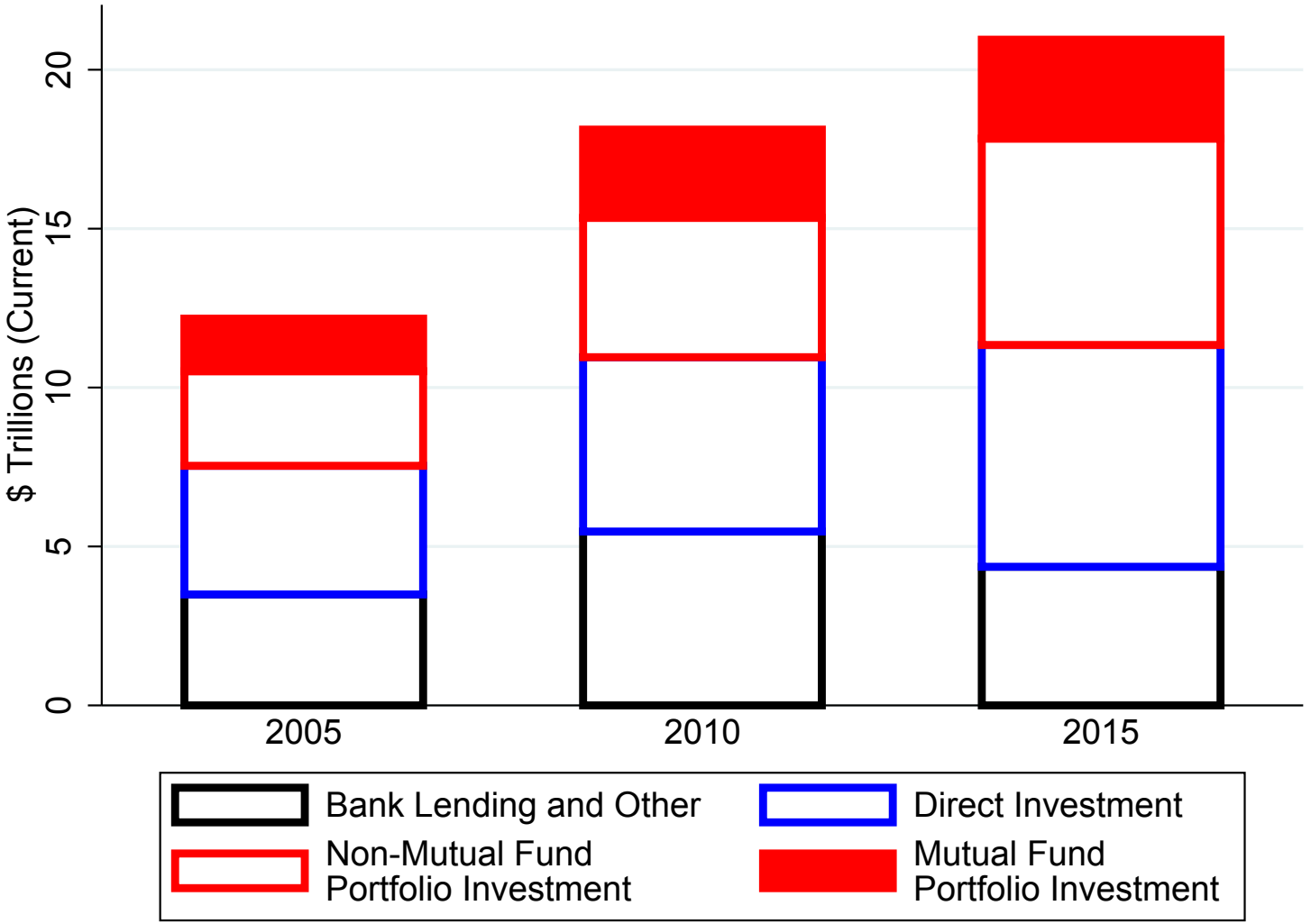
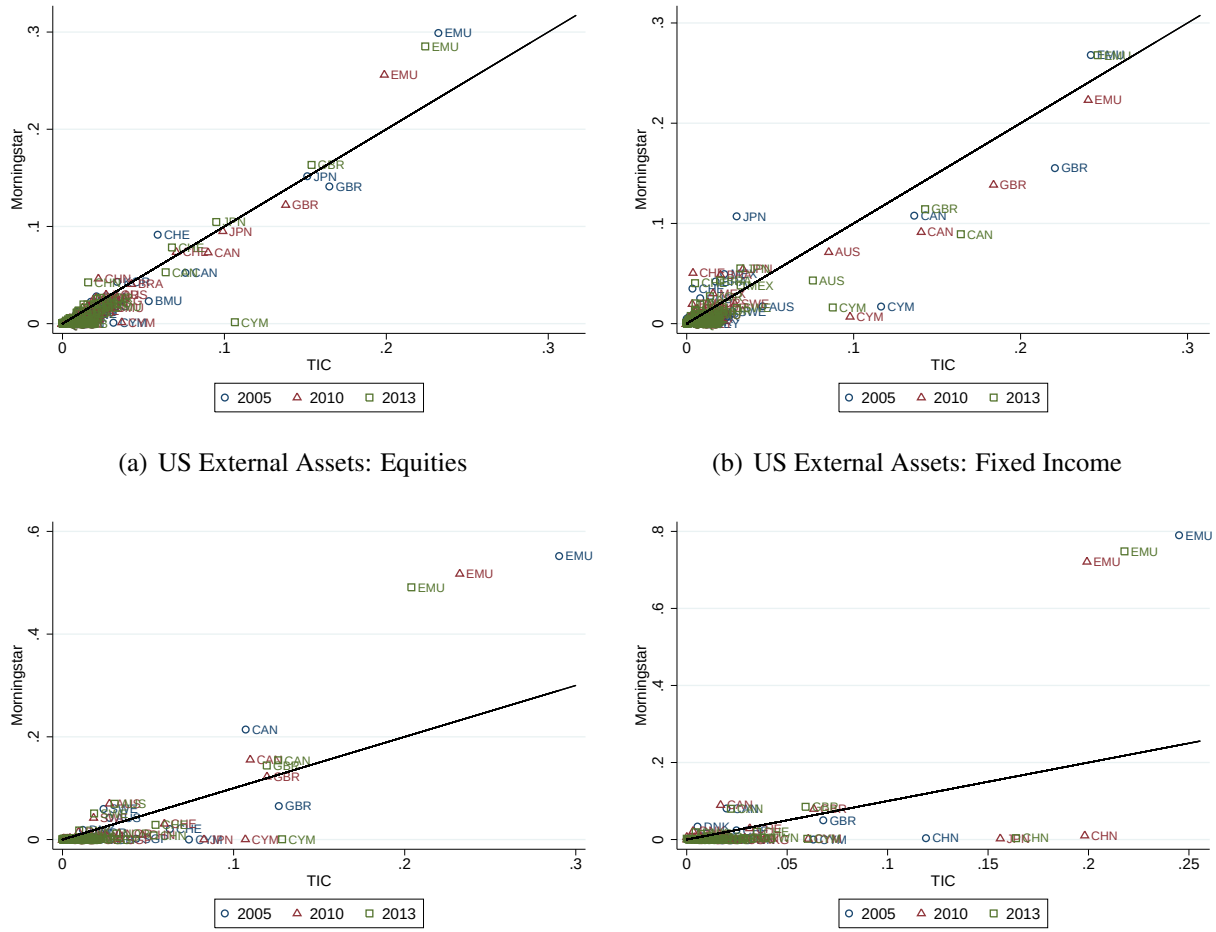


Figure 3: US External Assets by Type of International Investment Position

Note: The graphs plots the US foreign assets from the International Investment Position data (source: Bureau of Economic Analysis). The bottom (black) rectangle represents bank landing from the US to the rest of the world. The middle (blue) rectangle represents direct investment from the US to the rest of the world. The top (red) rectangle represents portfolio security investment from the US to the rest of the world. The solid (red) shaded area in the top rectangle represents the value of positions observable in our data. This value is obtained by summing up individual positions in our data for which the holding fund is domiciled in the US and the investment is in a security issued abroad; this value is then scaled by our coverage of mutual funds in the ICI database.



(a) US External Assets: Equities

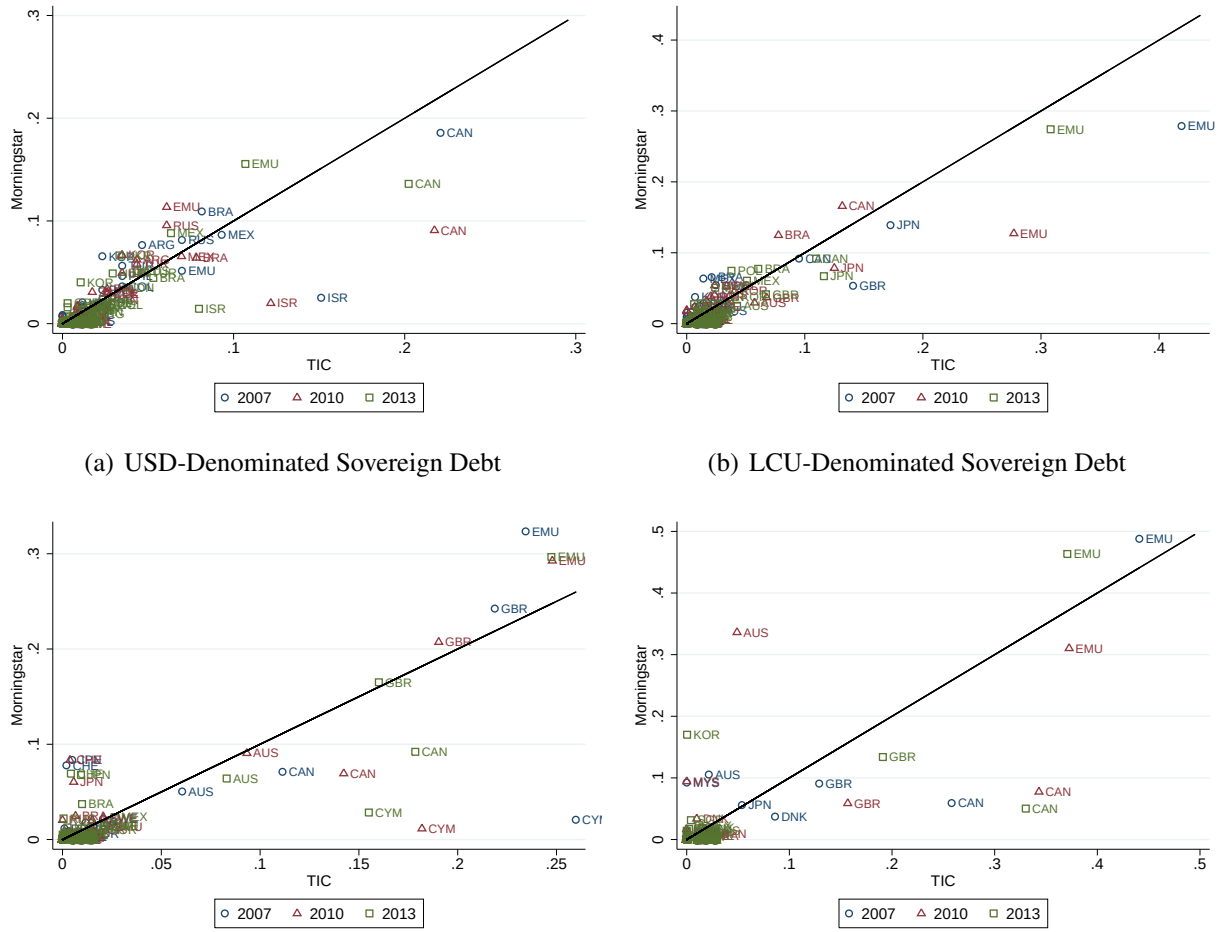
(b) US External Assets: Fixed Income

(c) US External Liabilities: Equities

(d) US External Liabilities: Fixed Income

Figure 4: US TIC and Mutual Fund Data Comparison: Bilateral Portfolio Shares

Note: The graphs compare the US foreign assets and liabilities from the Treasury International Capital data (source: US Treasury Department) with estimates from our data. Panel (a) plots each foreign country (destination) share of the total US investment in foreign equity securities. Panel (b) plots each foreign country (destination) share of the total US investment in foreign fixed-income securities. Panel (c) plots each foreign country (source) share of the total US foreign liabilities in equity securities. Panel (c) plots each foreign country (source) share of the total US foreign liabilities in fixed-income securities. In all panels the horizontal axis represents the shares obtained using TIC data. In all panels the vertical axis represents the corresponding shares estimated with our data. The black line is the 45 degree line.



(a) USD-Denominated Sovereign Debt

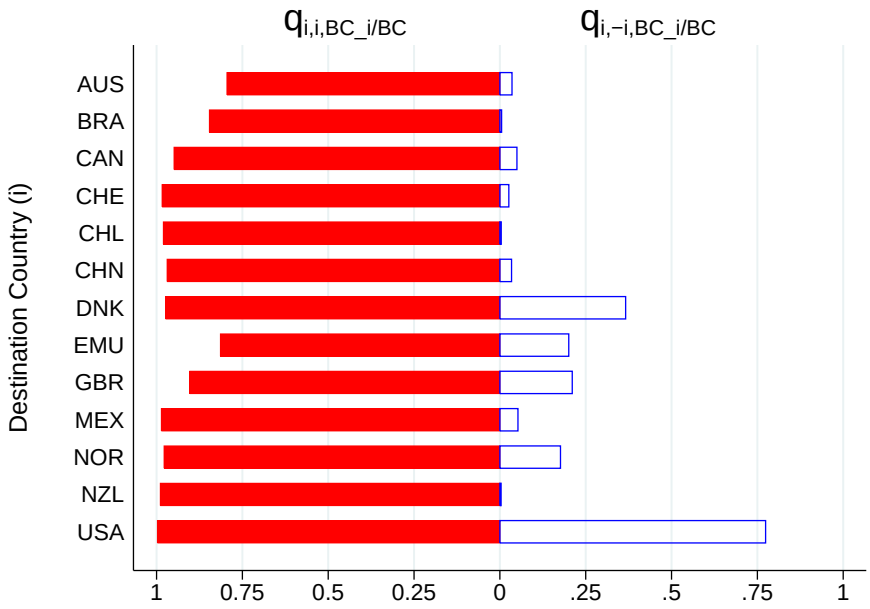
(b) LCU-Denominated Sovereign Debt

(c) USD-Denominated Corporate Debt

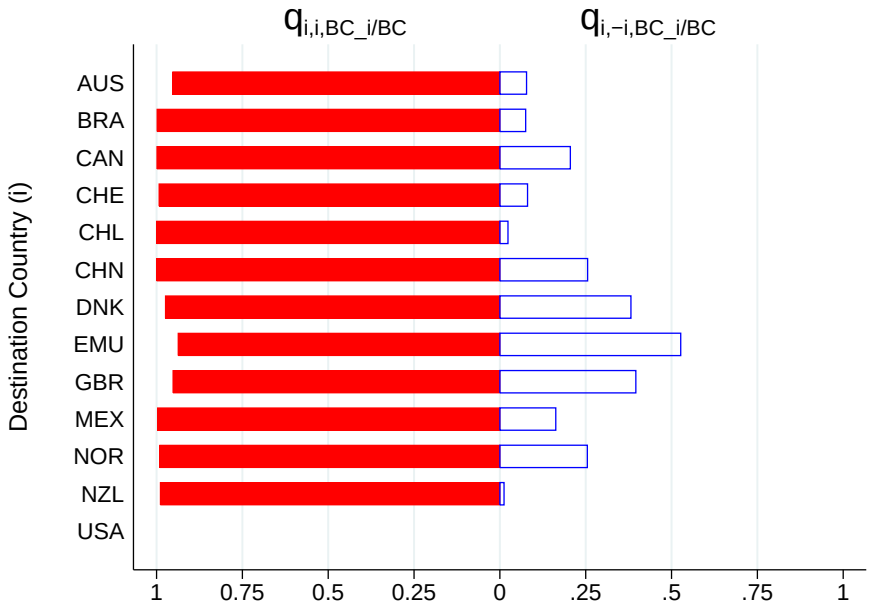
(d) LCU-Denominated Corporate Debt

Figure 5: Bilateral Shares of Outward Portfolios from the United States, by Type and Currency

Note: The graphs compare the US foreign assets from the Treasury International Capital data (source: US Treasury Department) with estimates from our data. Panel (a) plots each foreign country (destination) share of the total US investment in foreign dollar-denominated sovereign debt. Panel (b) plots each foreign country (destination) share of the total US investment in foreign lcu-denominated sovereign debt. Panel Panel (c) plots each foreign country (destination) share of the total US investment in foreign dollar-denominated corporate debt. Panel (d) plots each foreign country (destination) share of the total US investment in foreign lcu-denominated corporate debt. In all panels the horizontal axis represents the shares obtained using TIC data. In all panels the vertical axis represents the corresponding shares estimated with our data. The black line is the 45 degree line.



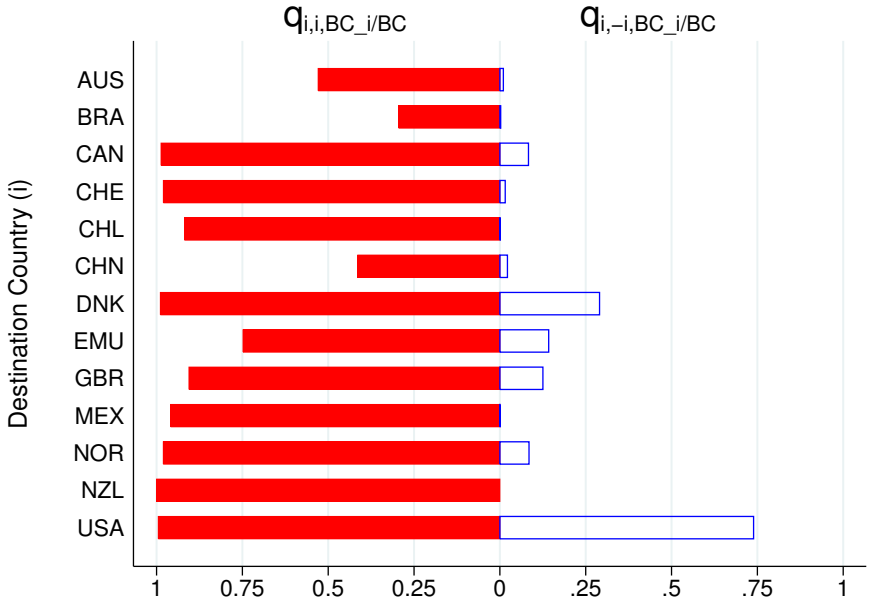
(a) All Currencies



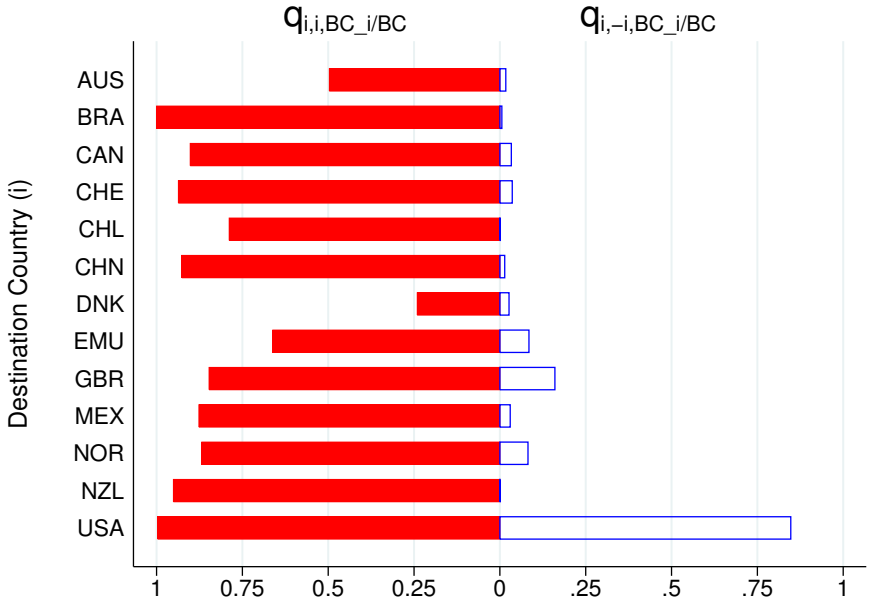
(b) Excluding US Dollars

Figure 6: Share of Investment in Country *i*'s Corporate Debt Denominated in *i*'s Currency, 2015

Note: In Panel (a) the solid red shaded bars show for each country *i* the share of bonds denominated in *i*'s local currency out of all domestic investment in corporate bonds. In Panel (a) the hollow blue bars show for each (destination) country *i* the share of bonds denominated in *i*'s local currency out of all foreign investment in *i*'s corporate bonds. Panel (b) reports the same statistics as Panel (a) except that all dollar-denominated bonds are excluded from the calculations.



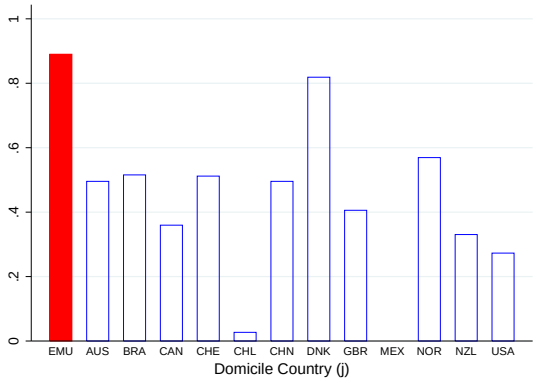
(a) All Currencies, Financial Corporations



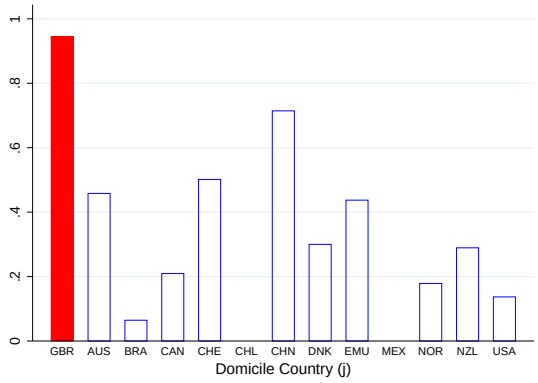
(b) All Currencies, Non-Financial Corporations

Figure 7: Share of Investment in Country *i*'s Corporate Debt Denominated in *i*'s Currency, By Industry, 2015

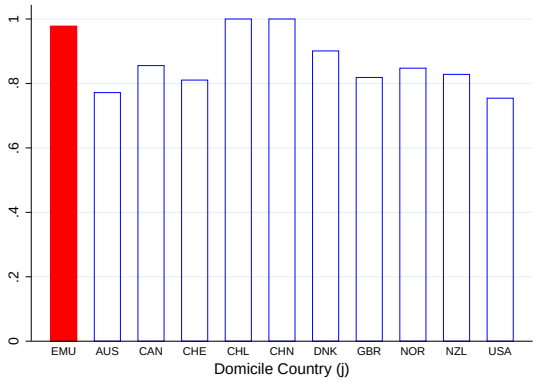
Note: Both panels are analogous to Panel (a) in Figure 6, except that the industry of the issuer is restricted to be the financial industry in Panel (a), and all other industries in Panel (b).



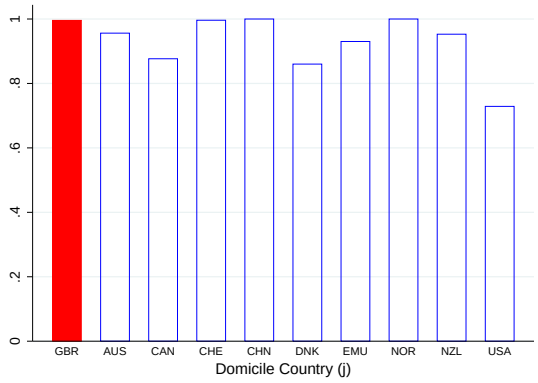
(a) EMU (i), All Bonds



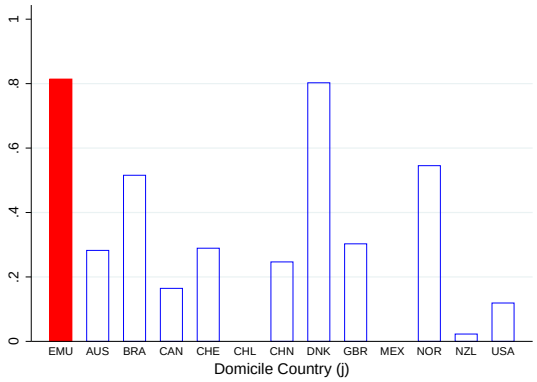
(b) GBR (i), All Bonds



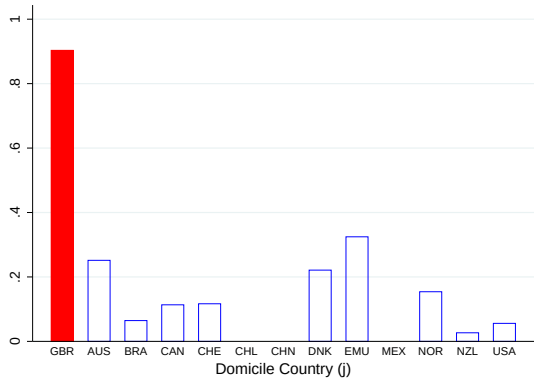
(c) EMU (i), Sovereign Bonds



(d) GBR (i), Sovereign Bonds



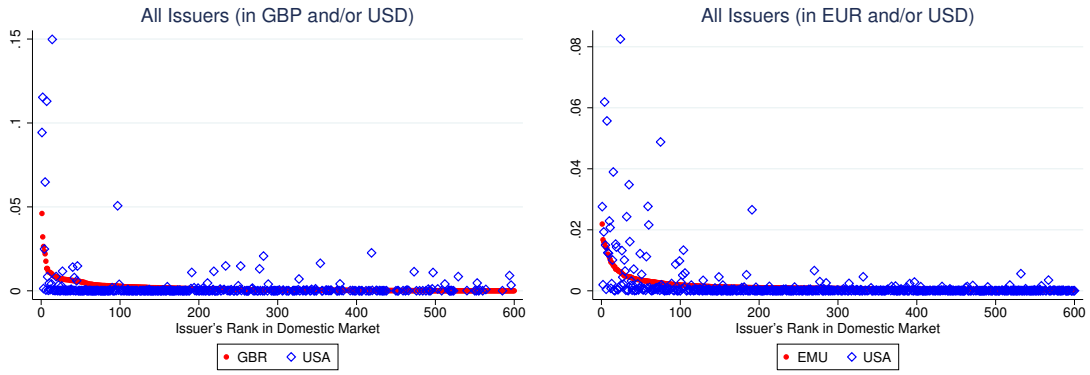
(e) EMU (i), Corporate Bonds



(f) GBR (i), Corporate Bonds

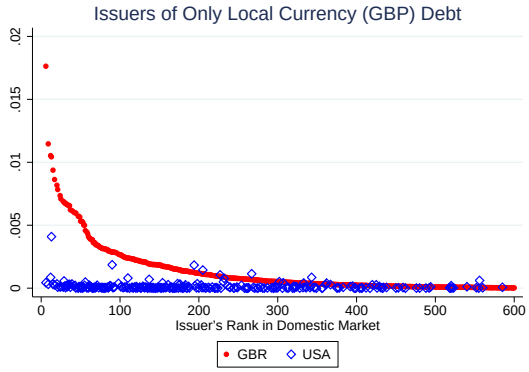
Figure 8: Shares of Inward Investment Denominated in Local Currency, 2015

Note: The solid red shaded bar in each plot shows the share of country i's domestic investment denominated in i's local currency. Hollow blue bars show the share of individual foreign countries' investment in country i that is denominated in i's local currency. Top panels include all bonds; middle panels include only sovereign bonds; bottom panels include only corporate bonds.

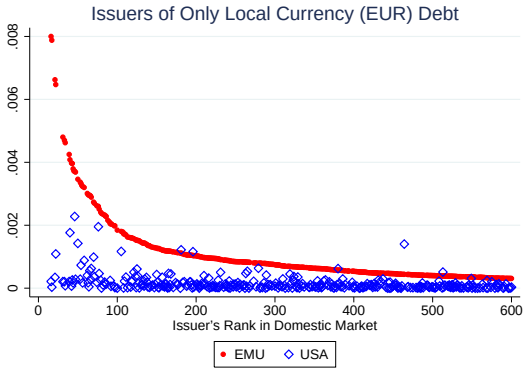


(a) USA and GBR Investment in GBR

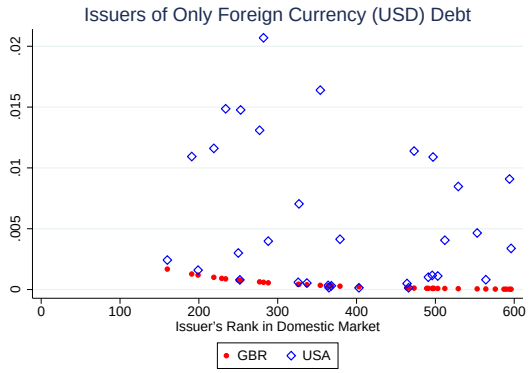
(b) USA and EMU Investment in EMU



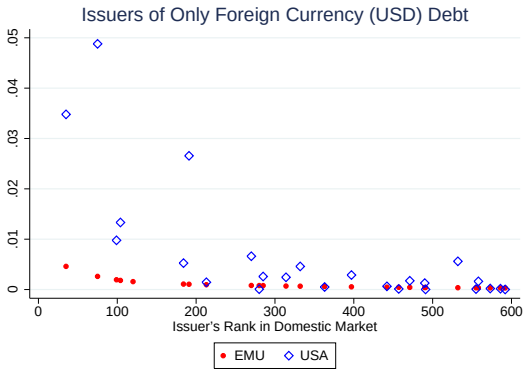
(c) USA and GBR Investment in GBR



(d) USA and EMU Investment in EMU



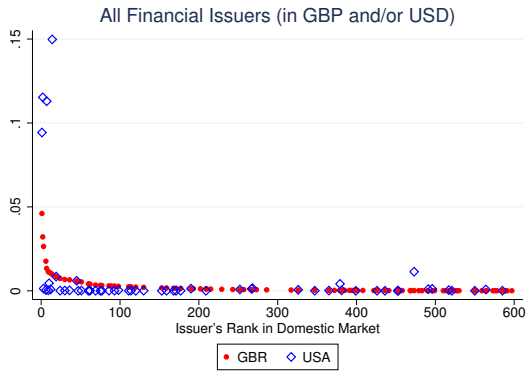
(e) USA and GBR Investment in GBR



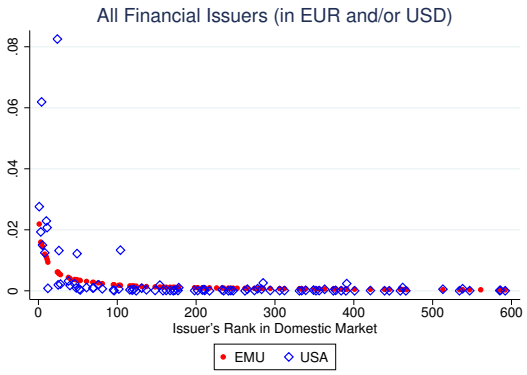
(f) USA and EMU Investment in EMU

Figure 9: Share of Issuers in Domestic and Foreign Portfolio By Currency of Bonds, 2015

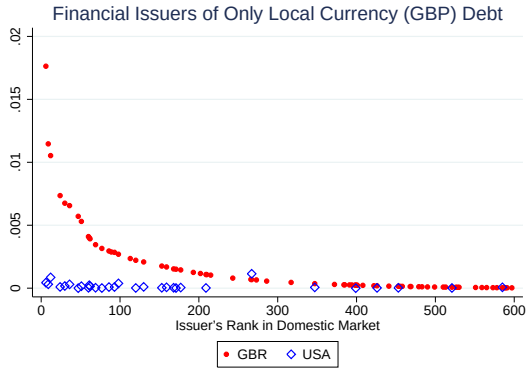
Note: Each panel plots the corporate bond portfolio of domestic and foreign investors with the portfolio positions in each issuer ranked according to their size in the domestic portfolio. Panels (a) and (b) consider all issuers. Panels (c) and (d) consider only issuers that do not issue foreign currency debt. Panels (e) and (f) consider only issuers that only issue dollar-denominated debt.



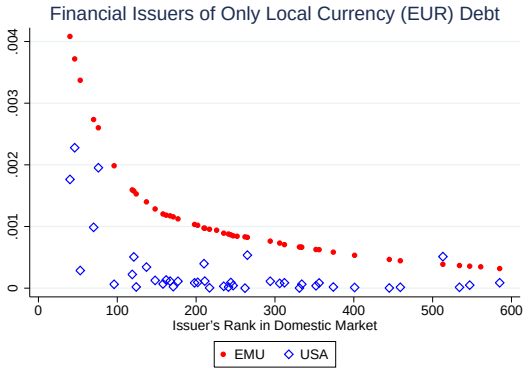
(a) USA and GBR Investment in GBR



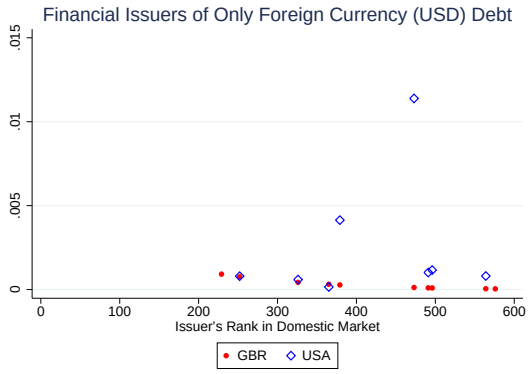
(b) USA and EMU Investment in EMU



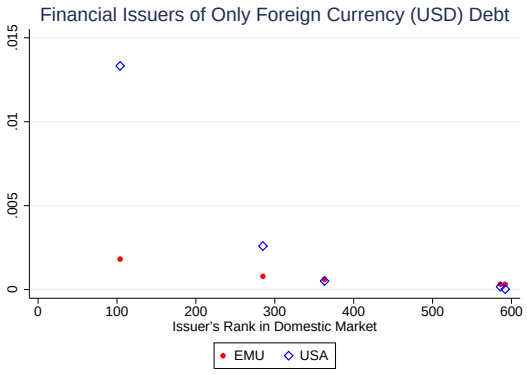
(c) USA and GBR Investment in GBR



(d) USA and EMU Investment in EMU



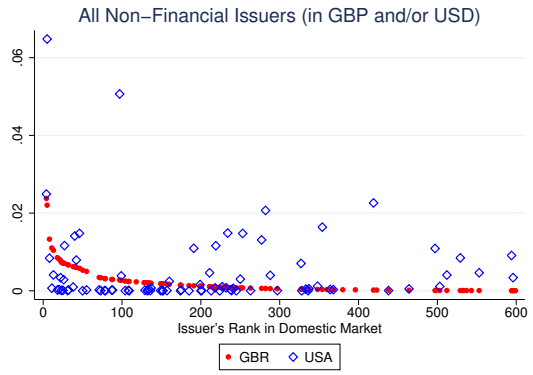
(e) USA and GBR Investment in GBR



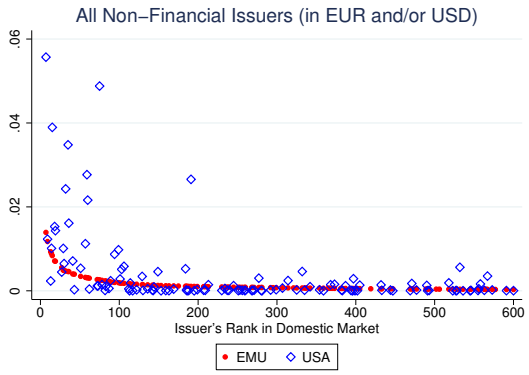
(f) USA and EMU Investment in EMU

Figure 10: Share of Issuers in Domestic and Foreign Portfolio By Currency of Bonds, Financial Corporations Only, 2015

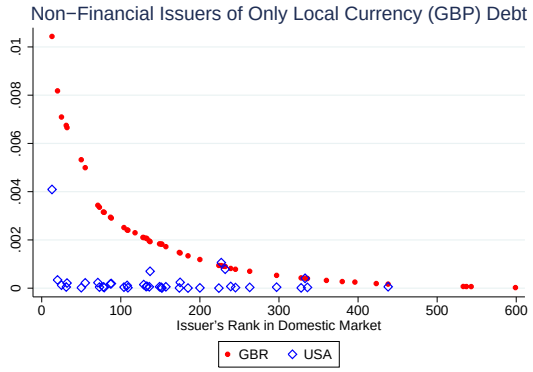
Note: All panels are analogous to those in Figure 9 except only bonds issued by financial corporations are considered in the analysis.



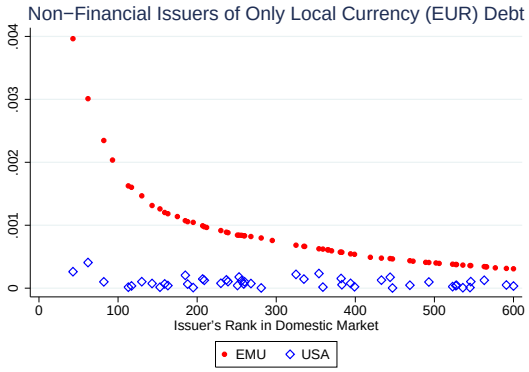
(a) USA and GBR Investment in GBR



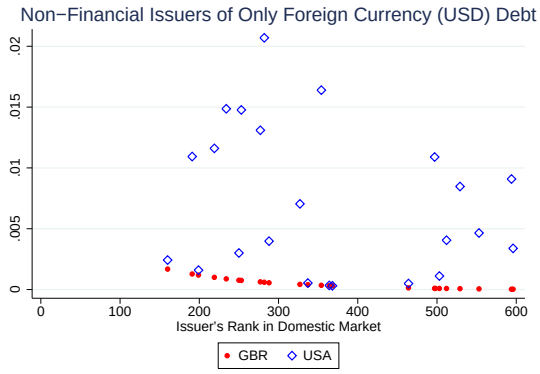
(b) USA and EMU Investment in EMU



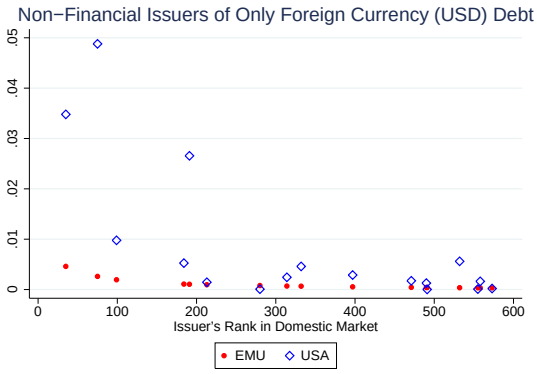
(c) USA and GBR Investment in GBR



(d) USA and EMU Investment in EMU



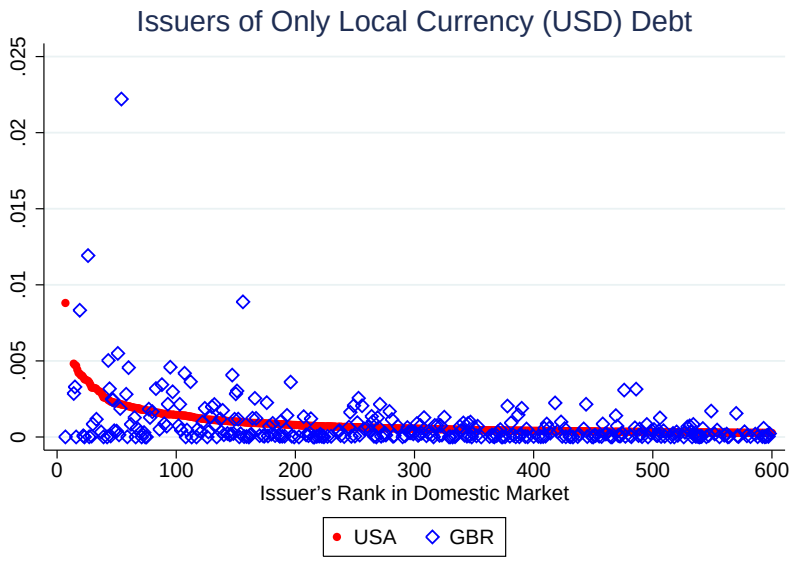
(e) USA and GBR Investment in GBR



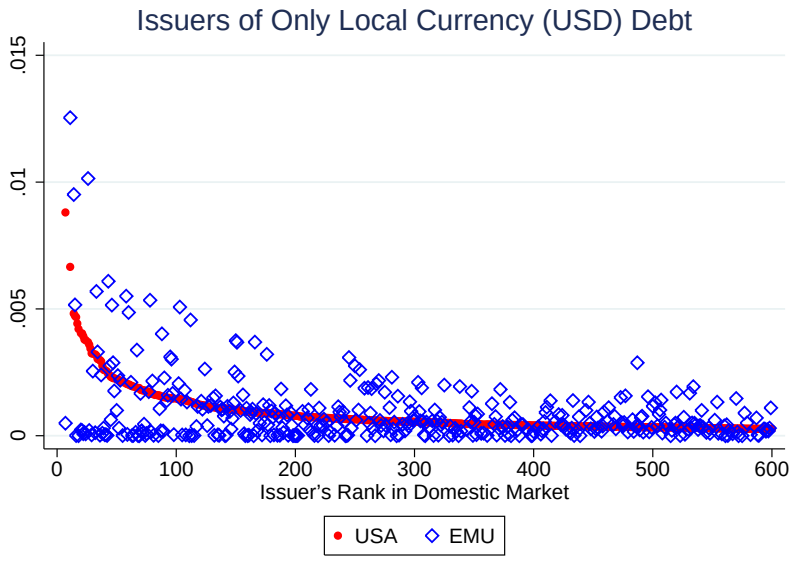
(f) USA and EMU Investment in EMU

Figure 11: Share of Issuers in Domestic and Foreign Portfolio By Currency of Bonds, Non-Financial Corporations Only, 2015

Note: All panels are analogous to those in Figure 9 except only bonds issued by non-financial corporations are considered in the analysis.



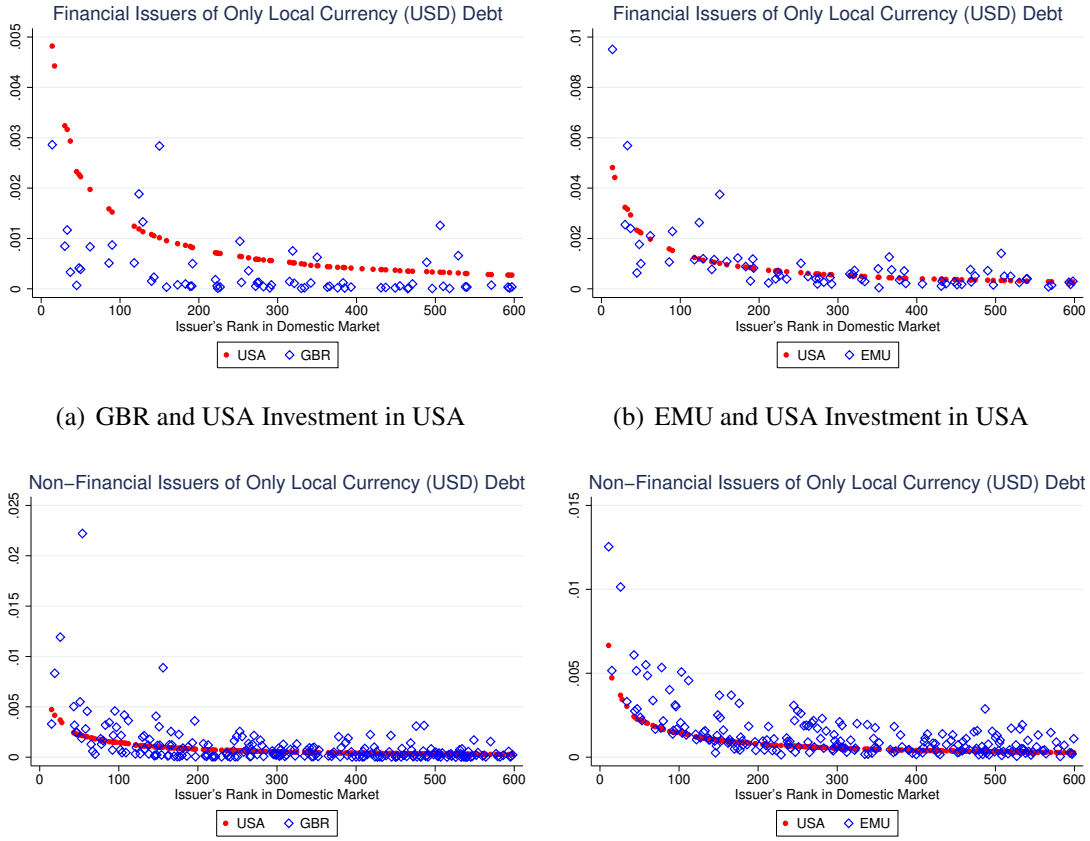
(a) GBR and USA Investment in USA



(b) EMU and USA Investment in USA

Figure 12: Share of Issuers in Domestic and Foreign Portfolio By Currency of Bonds, 2015

Note: Each panel plots the corporate bond portfolio of domestic and foreign investors as in Figure 9. Both panels only include those issuers that issue only in local currency (the US dollar).



(a) GBR and USA Investment in USA

(b) EMU and USA Investment in USA

(c) GBR and USA Investment in USA

(d) EMU and USA Investment in USA

Figure 13: Share of Issuers in Domestic and Foreign Portfolio By Currency of Bonds and By Industry, 2015

Note: All panels are analogous to those in Figure 12 except only bonds issued by financial corporations are considered in the top panels and only bonds issued by non-financial corporations are considered in the bottom panels.

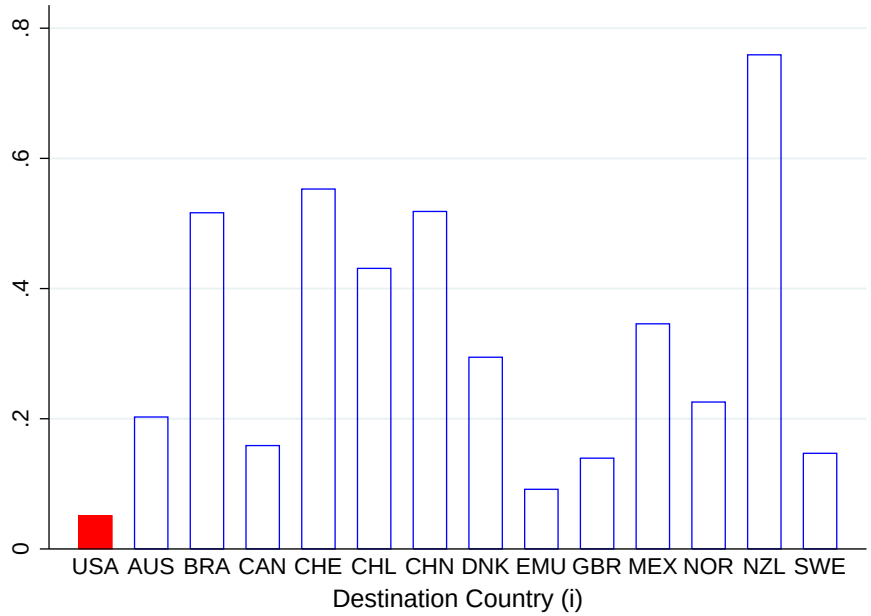
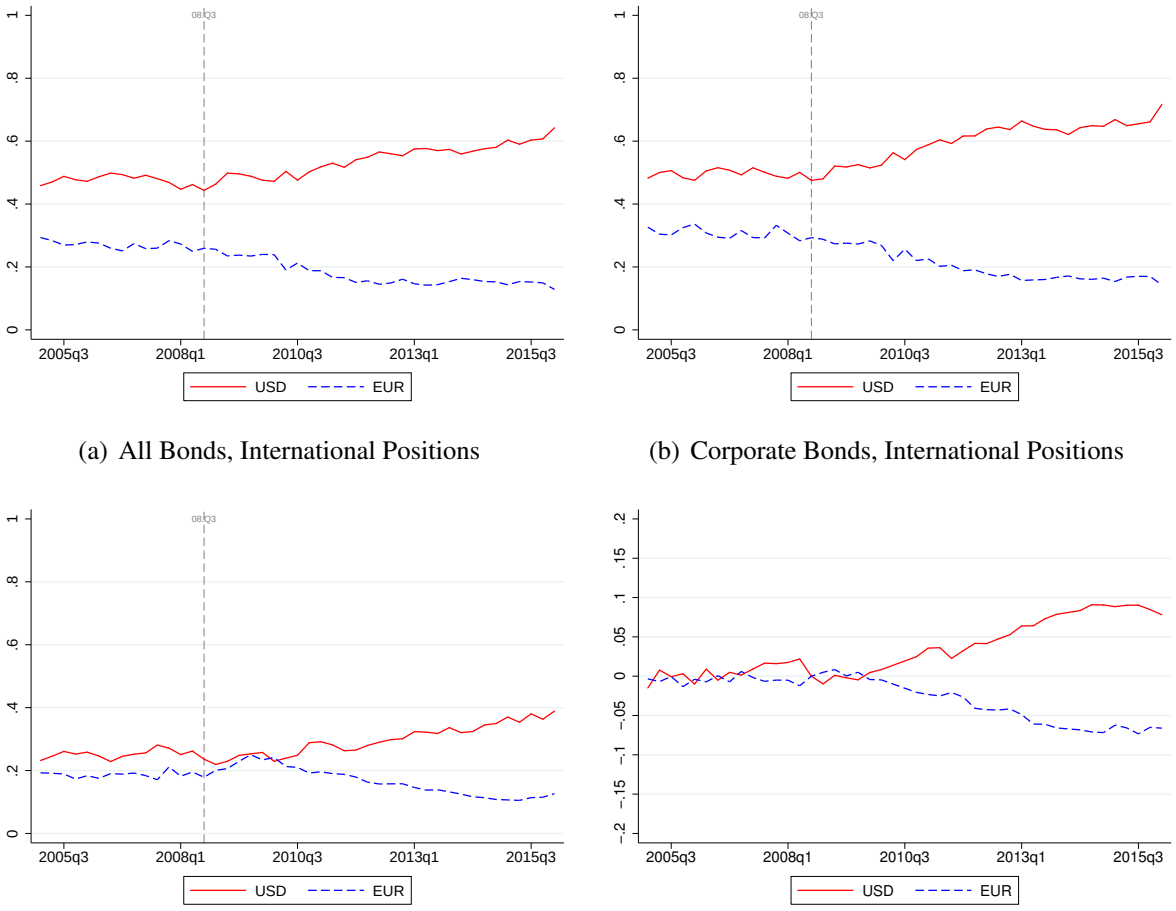


Figure 14: Difference Between Domestic and Foreign Corporate Portfolio, 2015

Note: The figure plots the distance between domestic and (multilateral) foreign portfolio holdings as defined in (7). The data are for December 2015 and the countries on the horizontal axis are the destination of the investment (i.e. *i*).



(a) All Bonds, International Positions

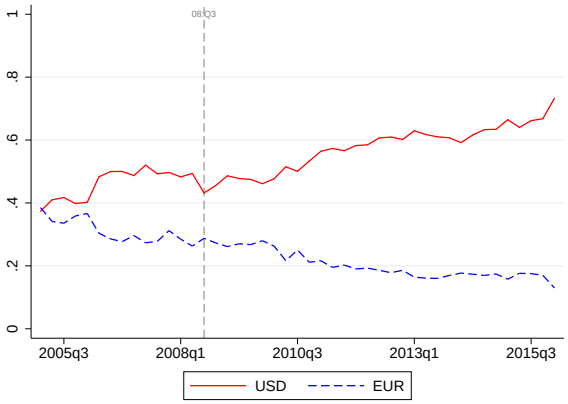
(b) Corporate Bonds, International Positions

(c) Corporates, Intl. Pos., Ex-USA/EMU

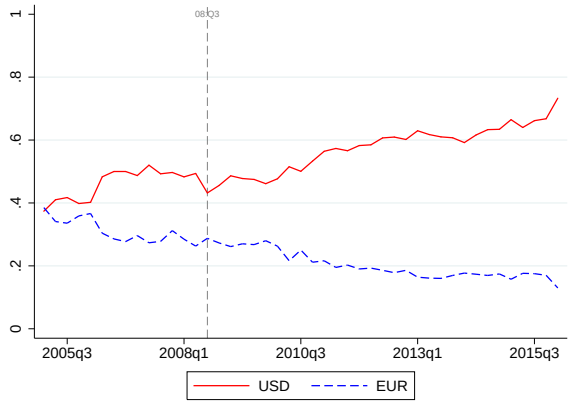
(d) Corporates, Intl. Pos., FE Regs with Const FX

Figure 15: International Currencies: The Rise of the Dollar and Fall of the Euro in Cross-Border Asset Trade

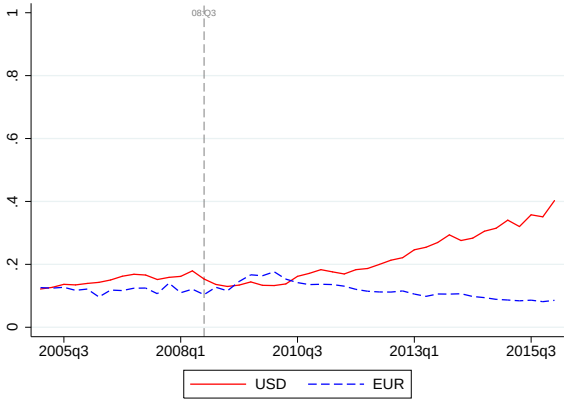
Note: Panels (a) plots the share of dollar and euro denominated bonds in total cross-border holdings (i.e. $i \neq j$). Panels (b) plots analogous shares but only includes corporate bonds. Panel (c) further excludes positions for which either the US or the EMU are either the borrower or the lender (i.e. $i, j \neq \{USA, EMU\}$). Panel (d) plots the fixed effects estimated using equation (8) on the dataset constructed with fixed exchange rates at 2015 levels.



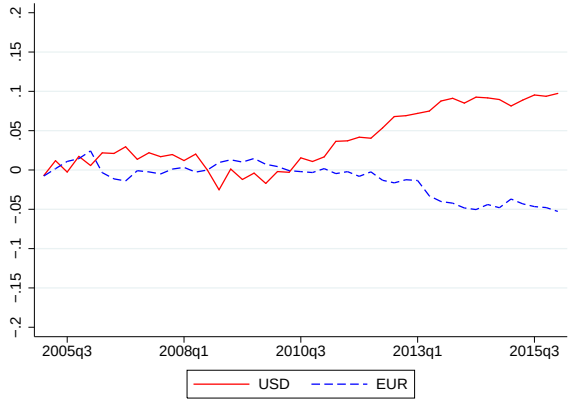
(a) All Bonds, International Positions, Financial Corporations



(b) Corporate Bonds, International Positions, Financial Corporations



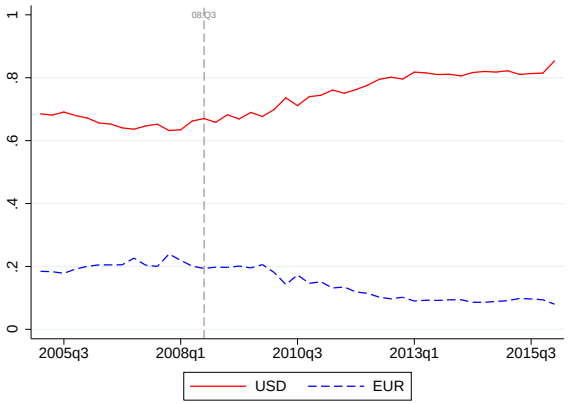
(c) Corporates, Intl. Pos., Ex-USA/EMU, Financial Corporations



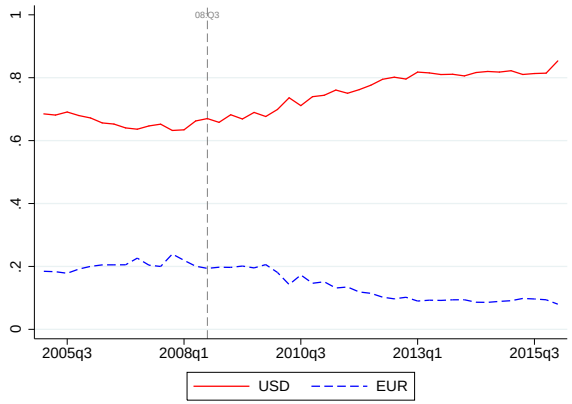
(d) Corporates, Intl. Pos., FE Regs with Const FX, Financial Corporations

Figure 16: International Currencies: The Rise of the Dollar and Fall of the Euro in Cross-Border Asset Trade, Financial Corporations

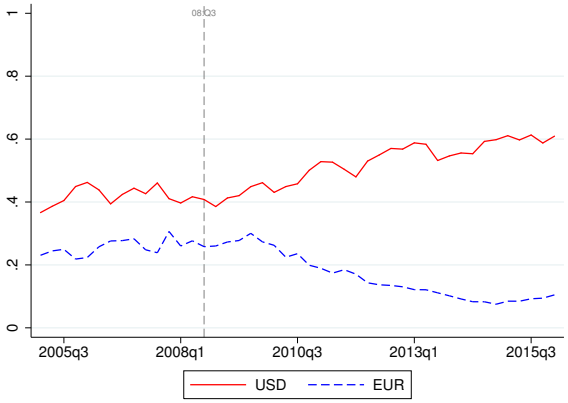
Note: All panels are analogous to those in Figure 15 except only bonds issued by financial corporations are considered in the analysis.



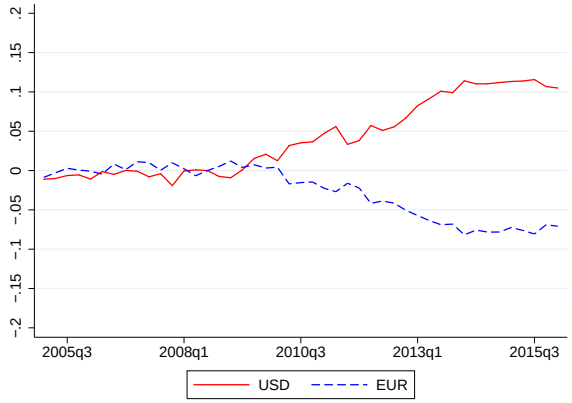
(a) All Bonds, International Positions, Non-Financial Corporations



(b) Corporate Bonds, International Positions, Non-Financial Corporations



(c) Corporates, Intl. Pos., Ex-USA/EMU, Non-Financial Corporations



(d) Corporates, Intl. Pos., FE Regs with Const FX, Non-Financial Corporations

Figure 17: International Currencies: The Rise of the Dollar and Fall of the Euro in Cross-Border Asset Trade, Non-Financial Corporations

Note: All panels are analogous to those in Figure 15 except only bonds issued by non-financial corporations are considered in the analysis.

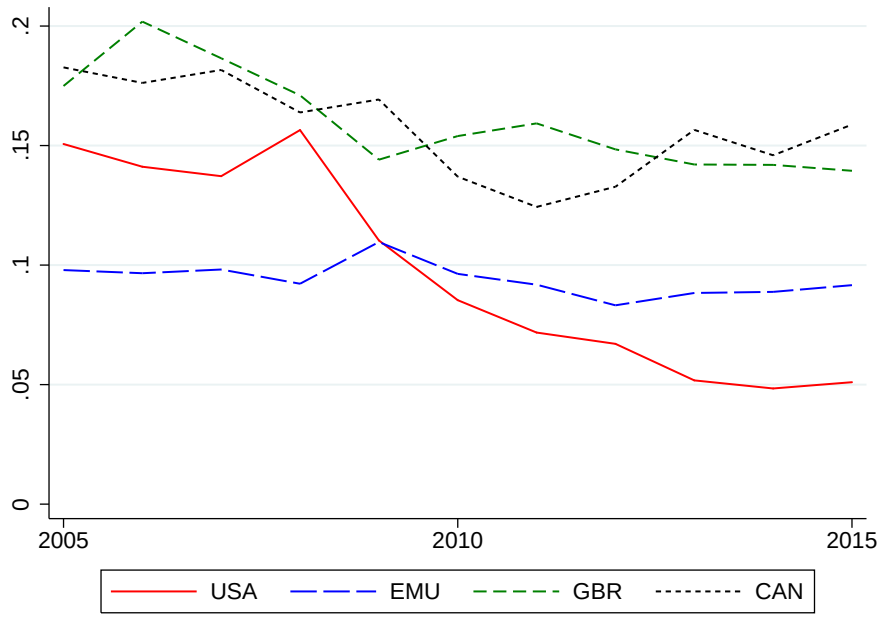


Figure 18: Difference Between Domestic and Foreign Corporate Portfolio, 2005-2015

Note: The figure plots the time series evolution of the distance between domestic and (multilateral) foreign portfolio holdings for selected countries as defined in (7).