NBER WORKING PAPER SERIES

CURRENCY MATTERS: ANALYZING INTERNATIONAL BOND PORTFOLIOS

John D. Burger
Francis E. Warnock
Veronica Cacdac Warnock

Working Paper 23175
http://www.nber.org/papers/w23175

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
February 2017, Revised November 2017

The authors thank Anderson Silva of the World Bank for GEMLOC investability data, Branimir Grui of BIS for data on the size of local currency and USD-denominated bond markets, McKinsey Global Institute for data on the size of global financial assets and John Rogers, Chiara Scotti and Jonathan Wright for their unconventional monetary policy shocks data. We also thank for helpful comments Carol Bertaut, Brent Neiman, Eric Swanson and participants at workshops at BIS/IADB, Federal Reserve Board, George Washington University, Wake Forest University and NBER IFM. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

Currency Matters: Analyzing International Bond Portfolios
John D. Burger, Francis E. Warnock, and Veronica Cacdac Warnock
NBER Working Paper No. 23175
February 2017, Revised November 2017
JEL No. F3,G1

ABSTRACT

Currency denomination is a prominent feature in the analysis of the structure of international bond markets, but is largely absent from analyses of cross-border investment in debt securities. This omission owes in part to the limitations of widely used datasets such as the IMF's CPIS data (on positions) and its BOP data (on flows): Neither identifies the currency denomination of the underlying bonds and both combine bonds of various currencies in a single data point. In this paper we show that bonds denominated in the investor's currency are special. We show this indirectly in a global dataset of bilateral bond holdings—indirectly because the global holdings dataset does not differentiate by currency denomination—and then more directly in datasets of US holdings of foreign bonds that do differentiate by currency. We find that the share of a country's bonds denominated in investors' currencies is an important determinant of the amount of cross-border investment it receives; factors associated with greater (or less) cross-border investment in bonds differ by currency denomination; and one phenomenon of international portfolios—the ever-present home bias—in some cases actually disappears when bonds are denominated in the investor's currency, suggesting that the home bias is to some extent a home currency bias.

John D. Burger
Loyola University Maryland
4501 N. Charles Street
Baltimore MD 21210-2699
jburger@loyola.edu

Francis E. Warnock
Darden Business School
University of Virginia
Charlottesville, VA 22906-6550
and NBER
warnockf@darden.virginia.edu

Veronica Cacdac Warnock
Darden Business School
University of Virginia
Box 6550
Charlottesville, VA 22906-6550
vwarnock@virginia.edu

1. Introduction

Currency denomination is a prominent feature in the analysis of the *structure* of international bond markets. For example, Burger and Warnock (2006), Claessens, Klingebiel and Schmukler (2007) and the entire original sin literature (e.g. Eichengreen and Hausmann 1999, 2004; Goldstein and Turner 2004) are all based on differentiating bonds denominated in the local currency from bonds denominated in a foreign currency.[1] And it is well understood that the currency denomination of a country's bonds has important implications—not the least, financial stability implications—for a local economy. The inclusion of the currency denomination of bonds is now standard when analyzing the *structure* of international bond markets.

In sharp contrast, currency denomination is almost never featured in the analysis of international *investment* in bonds for one very basic reason: Most datasets on cross-border bond investment do not distinguish bonds by currency denomination. Neither the IMF's Coordinated Portfolio Investment Survey (CPIS) data on positions nor its Balance of Payments (BOP) data on flows, both widely used, differentiate investment by the currency denomination of the underlying bonds; both combine bonds of various currencies into a single data point.[2] As a result, papers on international bond holdings (see, among others, Lane (2006) and Fidora, Fratzscher and Thimann (2007)) and papers that analyze bond flows—from Chuhan, Claessens and Mamingi (1998) to the more recent Fratzscher (2012), Fratzscher, Lo Duca and Straub (2016), IMF (2011), Lim, Mohapatra and Stoker (2014), Cerutti, Claessens and Puy (2016) and Chari, Dilts and Lundblad (2016)—tend to do so without differentiating by currency denomination. Indeed, we know of no analysis of international bond *flows* that differentiates by currency denomination.

[1] More recent papers on the structure of bond markets that incorporate information on the currency denomination of bonds include Du and Schreger (2016), Hale and Spiegel (2012) and Hale, Jones and Spiegel (2017), among others.
[2] The IMF has recently started to report aggregate, but not bilateral, data on currency composition in their CPIS dataset. For an analysis, see Galstyan, Mehigan and Mercado (2017).

Our main points can be made using four regional graphs (Figure 1) and the simple home bias measure *relative weight*.[3] For US investors, the relative weight of asset *i* (for the purpose of this example, call *i* a region's bonds) is its weight in US portfolios relative to its weight in global markets. A relative weight of less than one indicates that the investors underweight a particular region's bonds. Our main points are as follows:

1. Investor-currency bonds are special. In their portfolios, investors greatly underweight bonds not denominated in their currency. For example, US investors' relative weights on the local currency bonds of both advanced economies (AEs) and emerging market economies (EMEs) are very low, in some cases near zero (Figure 1a). But portfolio weights on foreign bonds denominated in US investors' home currency are much closer to market weights. Relative weights are quite high on USD-denominated bonds issued by foreign entities (Figure 1b); US investors hold some regions' USD-denominated bonds at market portfolio weights; and for all regions the relative weights on USD-denominated bonds are substantially higher than those on local currency bonds.

2. *The share of bonds issued in foreign investors' currencies varies across countries and through time.* Figure 1c shows the share of each region's bonds that are denominated in US dollars. Some regions, such as Latin America and "EME Other", issue a higher share of their bonds in US dollars than others.[4]

3. *Together, the above two points suggest that countries that issue a larger proportion of bonds in foreign investors' currencies will receive more foreign investment.* US investors' relative weight on all bonds (i.e., bonds of all currency denominations) from each region are

[3] There is a vast literature on home bias; see, among many others, Lewis (1999) and Cooper, Sercu and Vanpee (2012) and cites therein.
[4] EME Other in Figure 1 is Czech Republic, Hungary, Poland, Russia, South Africa and Turkey. Other AEs are Australia, Denmark, Hong Kong, Japan, New Zealand, Singapore, Korea and Sweden.

shown in Figure 1d. Relative weight is higher in regions that tend to issue more USD-denominated bonds (Latin America and 'EME Other') and lowest in the regions that issue the least USD-denominated bonds.[5]

The rest of the paper provides details and supporting evidence for those main points: Investor-currency bonds are special and the share of investor-currency bonds varies across countries (and through time) in a way that influences top-line aggregate bond flows and international bond positions.

We start with a global bilateral bond holdings dataset—the IMF's CPIS dataset—that does not differentiate by the currency denomination of the underlying bonds. In regressions that include two bilateral explanatory variables highlighted in the literature (trade linkages and exchange rate volatility) as well as a full set of source country and destination country fixed effects, the proportion of a country's bonds denominated in the currency of the investor is positive and highly significant. Bilateral trade linkages are still important: The greater trade is between two countries, the greater are bilateral bond holdings (similar to the Lane and Milesi-Ferretti (2008) finding for equities). But once the share of a destination country's bonds denominated in the investor's currency is included as a control, another established result is greatly weakened: After controlling for the strong positive impact of investor currency issuance on bilateral holdings, we no longer find that greater exchange rate volatility is associated with less cross-border bond investment (counter to Fidora et al. 2007). The exchange rate volatility result does reappear if the sample is limited to AE source/AE destination pairs; perhaps hedging costs are related to volatility in this set of countries and higher hedging costs make cross-border

[5] A few words on terminology that we use in this paper. Regarding investment levels, home bias is a bias for home securities (and against foreign securities), as in Lewis (1999), and home currency bias is a bias for securities denominated in the investor's home currency. Regarding the currency denomination of bond issuance, local currency bonds are denominated in the issuer's currency and foreign currency bonds are denominated in other currencies (including, possibly, the foreign investor's currency).

investment less attractive. But the main finding from the CPIS analysis is that when analyzing cross-border bond holdings for which the currency denomination of the underlying bond is not identified, it is difficult to differentiate a preference of one country's investors for another country's bonds from a propensity of a destination country to issue bonds in the investor's currency.

We then turn to analysis of US investment data that do identify the bond's currency denomination. For reasons explained in Section 2, we use two US-based datasets. One, broad and short, includes 40 countries (21 AEs, 19 EMEs) and spans 2006 to 2011. The other is longer (2006 to 2015) and includes 15 EMEs. Before doing any statistical analysis, one observation is immediately evident in both datasets: Bonds denominated in the currency of the investor are fundamentally different than bonds denominated in other currencies. Indeed, for bonds denominated in the investor's currency there is little or no home bias—many such bonds enter investors' portfolios with market weights—while the familiar home bias is evident for foreign currency bonds.

In regression analysis of the US data—regressions that aim to explain US portfolio reallocations and include a full set of local "pull" factors and global "push" factors—the most striking results are when we lump together bonds of all currencies (as would be done in CPIS data), in effect pretending that the bonds' currency denomination is not identified in the holdings dataset. In such regressions, the coefficient on the share of bonds denominated in the investor's currency (in the US-based datasets, this is the US dollar) is highly significant. Moreover, this strong relationship between US investment and the currency denomination of bonds is apparent in both AEs and EMEs and both in the cross-section (i.e., across countries) and within countries through time. In the longer sample we are able to use a two-stage instrumental variables (IV) approach. The instrumented share of investor-currency bonds is still positive and significant.

Interestingly, the IV results also suggest that the impact of US unconventional monetary policy is primarily through an increase in the share of EME bonds denominated in USD.

Separating bonds by currency denomination provides additional insights. In the broad, short sample, some factors are significant determinants of the amount of US investment in both USD and local currency bonds. For example, countries with greater trade linkages with the US have more US investment in both local currency and USD bonds. But the effects of other factors differ by the currency denomination of the underlying bonds. Our bond-specific measure of financial account openness is highly significant for USD bonds, but not for local currency bonds; perhaps US investors fear that capital controls are more likely to be imposed on foreign currency rather than local currency bonds. The effect of US long rates also varies by currency denomination: Lower US Treasury yields are associated with greater investment in local currency denominated bonds but not in USD-denominated bonds.

The simple facts depicted in Figure 1 and supported by regression analysis of three datasets have important implications. The first is straightforward: Investor-currency bonds and bonds denominated in other currencies seem to be fundamentally different to investors *and* their shares vary across countries, implying that off-the-shelf flows and positions data mix very different asset classes in ways (i.e. weights) that vary across countries. Empirical analysis of any cross-border bond investment dataset that does not indicate the currency of the underlying bonds should include a measure of the currency composition of recipient-countries' bonds, otherwise it risks omitting an important variable. The second implication of our analysis is also straightforward but a bit deeper. The US data present a simple but striking fact: For foreign bonds denominated in USD, the ever-present home bias in asset holdings often disappears. Our results, coupled with others' work on international bond investment—Maggiori, Neiman and Schreger (2017) and Boermans and Vermeulen (2016a, 2016b) find that the preference for bonds

issued in the investor's currency extends beyond US investors—indicate that currency denomination is an important factor behind the home bias in international bond portfolios.[6] Coupled with the Edison and Warnock (2004) results on the effects of cross-listing on equity portfolios, our results and those of others suggest that home bias is at least in part a *home currency bias*.

Our exploration of the role that currency denomination plays in global bond markets begins in Section 2 with a discussion of the strengths and limitations of available data sets. In Section 3 we briefly explore the CPIS dataset, which does not identify the currency denomination of bilateral bond holdings, before turning in Section 4 to data on US cross-border holdings that do identify currency denomination. Section 5 extends the analysis to model the currency composition of bond markets, while Section 6 concludes.

2. Descriptive Analysis: The Amount and Currency Composition of Outstanding Bonds

As a first step to understanding the relationship between currency denomination and international portfolios we look to data on the stock of outstanding bonds. To be useful for our purposes, such data must identify the currency denomination of the underlying bonds and should also provide an indication of the maturity of the underlying securities.[7]

A good source for such information has been unpublished Bank for International Settlements (BIS) data on outstanding bonds by country and currency, placed both domestically and internationally. Methodology for the BIS bonds data bonds changed materially in 2012, so

[6] Other papers that use cross-border data on bond positions that differentiate by currency include Burger and Warnock (2007), Burger, Warnock and Warnock (2012), Burger, Sengupta, Warnock and Warnock (2015) and Bertaut, Tabova and Wong (2014).

[7] Maturity indication is important so that bonds (original maturity greater than one year) can be separated from short-term debt securities such as money market instruments and commercial paper. Even if one wanted to focus on all debt securities, including very short-term paper, a dataset that does not specify the maturity of the underlying securities may well include just long-term debt for some countries and a mix of short- and long-term for other countries. To avoid this, maturity should be explicitly recorded in the dataset.

before presenting basic analyses based on two datasets—the pre-2012 vintage and the current vintage—we briefly describe them and some challenges.

2.1 BIS Bond Data (pre-2012 vintage)

Prior to 2012, BIS bond data came in two complementary datasets on domestic debt and international bonds. The first dataset came from the *BIS Quarterly Review* "Table 16A. Domestic Debt Securities". The BIS defined domestic debt as local currency bonds issued by locals in the local market (i.e., not placed directly abroad). To focus on debt securities with original maturity longer than one year, one needed to request from the BIS the data underlying Table 16A to separate bonds from short-term notes and commercial paper.[8] The complementary dataset came from *BIS Quarterly Review* "Table 14B. International Bonds and Notes by Country of Residence", which defined international bonds as those bonds issued either in a different currency or in a different market. The data underlying that table also had to be requested from the BIS in order to identify issuance by currency and country, a decomposition not published in the *BIS Quarterly Review*. Combined, the two datasets on long-term domestic debt and international bonds provided a complete picture of the outstanding stock of long-term debt securities issued by currency denomination.

Table 1 shows the size and currency composition of bond markets in 25 advanced economies and 21 emerging market economies for two years, 2001 and 2011, data analyzed in Burger and Warnock (2006) and Burger et al. (2015). A number of salient facts emerge from the pre-2012 vintage BIS data. In dollar terms, at the end of 2011 the global bond market (defined by

[8] The split between bonds/notes and short-term paper can be important. Consider, for example, Brazil. A large proportion of Brazilian debt securities are short-term; see Leal and Carvalhal da Silva (2008) for a detailed analysis. In the old BIS database, Brazilian debt securities were broken out by maturity (and currency denomination), and it showed that, as of end-2011, about $1 trillion of its $1.5 trillion in domestic debt securities were short-term instruments (e.g., money market). Using the old dataset, one can omit Brazilian short-term instruments and focus on Brazilian domestic long-term debt securities (which totaled $0.5 trillion at end-2011).

this set of 46 countries) was $82.5 trillion—$75.9 trillion in AEs, $6.7 trillion in EMEs—which is almost triple the $30 trillion in 2001. The local currency portion of these bond markets grew faster than nominal GDP in all AEs except Switzerland and in just over half the EMEs. By 2011 most bonds in this set of countries—91% of AE bonds and 88% of EME bonds—were local currency denominated. Local currency bond markets were, as a percent of GDP, much larger in AEs (161% of GDP) than in EMEs (29% of GDP) but had grown faster in EMEs: EME local currency bonds increased as a share of the total global bond market from 3.3% in 2001 to 7.1% in 2011. With larger local currency bond markets, EMEs exhibited less reliance on foreign currency borrowing; the share of EME bonds denominated in a foreign currency fell from 29% in 2001 to only 12% in 2011. The development of local currency bond markets has been particularly striking in Latin America: In 2001 nearly half of Latin American bonds were denominated in foreign currency, but by 2011 local currency bond markets had grown such that only one quarter of bonds in the region were denominated in foreign currency.

2.2 BIS Bond Data (current vintage)

BIS changed its methodology for the debt securities data in 2012; see Gruić and Wooldridge (2012). The new methodology aims to improve data quality along some dimensions—and indeed the current vintage of data are not consistent with earlier vintages, precluding an expansion of the above historical analysis beyond 2011—but also impedes our inquiry mainly because, in practical terms, it reduces the number of countries. Under the new methodology, many countries report debt securities data without the domestic and international breakdown and/or without the breakdown by maturity; for these countries, information on currency denomination and maturity are concealed in the aggregated statistics.[9] For analysis like

[9] Details about countries' reporting practices are at http://www.bis.org/statistics/coverage.pdf.

ours that requires currency and maturity information, the new BIS data has much fewer countries: only 9 AEs (none from the euro area) and 15 EMEs (but not China or Brazil, the two with the largest bond markets) provide the BIS with information on domestic debt securities by residence, sector of issuer and original maturity. Given that there are so few AEs with complete data in the new BIS bonds data, when using a sample that goes beyond 2011 we include only EMEs, for which there are data for a reasonable number of countries, but not AEs.

Table 2 present aggregate summary statistics for the 13 EMEs that have complete data for both 2009 and 2015: the Latin American EMEs Chile, Colombia, Mexico and Peru; Asian EMEs South Korea, Malaysia, Pakistan, Philippines and Thailand; and other EMEs Israel, Russia, South Africa and Turkey. For these 13 countries, local currency bond markets grew from $2289 billion in 2009 to $3281 billion in 2015. As a percent of local GDP, their size increased modestly from about 42% to 46% and their weight in the global bond market increased from 2.7% to 3.5%.[10] Foreign-currency-denominated bonds for this set of EMEs also increased, from $436 billion to $851 billion, increasing from 8.0% to 11.8% of local GDP and nearly doubling its weight in the global bond market (from 0.5% to 0.9%). Of the foreign-currency-denominated bonds, in 2015 most are USD denominated ($714 billion out of $851 billion).

Figures 2a and 2b provide some country-by-country information on the evolution of EME bond markets for the 13 EMEs in Table 2 plus India and Hungary (whose BIS data begin after 2009). Local currency bonds as a percent of GDP (Figure 2a) has increased smartly since 2006 in Asia and Latin America (especially in Chile, Mexico, South Korea, Malaysia and Thailand). Local currency bonds as a share of all bonds (Figure 2b) has increased (or at least maintained high levels) in Asian EMEs. In Latin American countries and some other EMEs, the share of

[10] According to data from McKinsey Global Institute, at the end of 2015, the size of global bond markets was $95 trillion.

bonds denominated in the local currency has declined recently, but when compared to data in Table 1 is still much higher than in 2001.[11]

To summarize, global bond markets have grown substantially over the past 15 years; EME bond markets have become a larger share of the global bond market; and within EMEs the vast majority of bonds are now local currency denominated, a recent increase in foreign currency denominated bonds notwithstanding.

3. Currency Denomination and International Bond Portfolios: A First Glance Using Portfolio Data that Do Not Identify Currency Denomination

Most capital flows and international investment datasets do not differentiate by currency denomination, so as a first pass we will use one such dataset—the IMF's CPIS dataset—to illustrate that currency denomination may well be important when analyzing international bond portfolios and, by extension, bond capital flows. Our analysis, using a roughly 40-by-40 cross-section of bilateral bond investment (i.e., the bilateral bond holdings between 40 investor/source countries and 40 investment/destination countries), will be through simple two-way fixed effects regressions as in Lane and Milesi-Ferretti (2008) and Fidora et al. (2007). The question we ask: Might the currency composition of outstanding bonds be an important factor to consider when analyzing bilateral international bond investment?

Before presenting results from the global CPIS dataset, we first highlight some limitations. One, its bilateral holdings do not differentiate by the currency denomination of the bond. Two, it has a well-known financial center bias, especially when residents use non-resident intermediaries for their cross-border bond investments. Table 3 depicts this financial center bias using 2006 CPIS data on the Eurozone. Eurozone countries whose residents tend to use foreign

[11] We note parenthetically that the decline over the past few years in local currency share in Latin America and "other" EMEs is primarily due to an increase in foreign currency issuance by the private sector.

(in this case, Luxembourg) intermediaries show enormous positions in that foreign country. On cross-border equity holdings, the CPIS reports the following shares of investors the Luxembourg market: 122% by the French, 329% by the Germans and 381% by the Italians. In sum, eurozone residents held 1199% of the Luxembourg market, which cannot be true. The explanation for the reported foreign holdings being much greater than the stock of existing Luxembourg equities lies in the following: the CPIS counts the cross-border holdings of mutual funds as "equities", which is technically correct, yet misleading for the purpose of mapping bilateral international investment. Felettigh and Monti (2008) point to this third country "mutual fund effect", focusing on Italy and finding that more than 90% of Italian "equity" investment in Luxembourg (which itself amounts to half of all reported Italian international equity investment) is actually in mutual funds. Moreover, they estimate that perhaps two-thirds of those Italian mutual fund investments is actually in bond funds. Felettigh and Monti do not provide information on where those bond funds are invested, but guess that much are in US bonds, German bonds, Japanese bonds, and the bonds of many other countries (and perhaps even some of Luxembourg). A common fix implemented by Lane and Milesi-Ferretti (2008) and others when working with the bilateral CPIS data is to omit financial centers in the analysis. However, in the process, this might leave out a large amount of bond investment (which are labeled as equities in the CPIS) of countries whose residents tend to use third-country intermediaries.

The above discussion argues for one choice we make: Because of its limiting features, we examine just one particular cross-section of CPIS data, that from 2003, rather than attempting to collect more recent data (or analyzing a panel dataset). This choice is reasonable because the period is roughly the same vintage as Lane (2006), Lane and Milesi-Ferretti (2008) and Fidora et al (2007). Moreover, using a cross-section of CPIS data even when multiple years of data are available has precedence. For example, Fidora et al (2007, pg. 643) stated that "[s]ince the time

dimension of the data is limited and, moreover, changes over time are very small and mainly reflect valuation changes rather than cross-border investment flows we use averaged data over the period 2001-2003 and thus estimate a pure cross-section", and Lane and Milesi-Ferretti (2008, pg. 540) stated the following: "We rely on data…reporting holdings at end-2001. … The survey is now annual, with data now also available for 2002-2006. However, in contrast to the 2001 survey, subsequent data are not derived from benchmark surveys in all countries—for instance, the United States did not conduct a comprehensive survey in all of those years. [I]n light of the very high correlation of bilateral investment patterns across 2001-2006, we opted to focus on the cross-section dimension."

Following Lane and Milesi-Ferretti (2008) and Fidora et al (2007), we include a full set of source and destination country fixed effects. Together these will account for much of the variation, capturing (as Lane and Milesi-Ferretti (2008) note) national characteristics that explain why some countries are more attractive than others to all investors and features that explain why some countries generally hold larger outward investment positions than others. Our dependent variable—the share of source country foreign bond holdings issued by each destination country—is bounded by zero and one, so we use a Tobit estimator. According to our regressions, about 14 percent of the sample is left-censored (62% of which are EME source countries) and none is right-censored. For bilateral variables we include two highlighted in the literature: *Volatility*, emphasized in Fidora et al (2007), calculated here as the standard deviation over a 10-year period of bilateral exchange rate changes, and *Linkages*, emphasized by Lane (2006) and Lane and Milesi-Ferretti (2008), calculated here as the share of imports from the destination country in all of the investor's country's imports. We also include as a bilateral variable *Issuance*, defined as the share of the destination country's bonds that are denominated in the investor's currency. We group regression results in Table 4 by the type of the investor's country

(all, AE or EME) and then, for AE and EME investors, by type of destination country (AE or EME).

In the full global set of countries, trade linkages are very important (Table 4, column 1). The greater the amount of trade between two countries is, the greater the bilateral bond holdings are. (This is the main finding, albeit in an equity setting, of Lane and Milesi-Ferretti (2008)). The share of the destination country's bonds denominated in the investor's currency is also positive and significant: the more a country's bonds are denominated in the foreign investor's currency, the greater are the bilateral bond holdings. The coefficient on *Volatility* is negative but insignificant; if regressions were estimated with *Volatility* as the only bilateral explanatory variable, but still with a full set of source and destination dummies (similar to Fidora et al. 2007), exchange rate volatility would be negative and significant.

Splitting the sample by type of source country sheds more light. Limiting the sample to the bilateral bond holdings of advanced economies (shown in columns 2-4) illustrates (again) that trade linkages and the currency denomination of bonds are very important. And it is only for one slice of the dataset—from AE to AE (source-destination) country pairs (column 3)—that the coefficient for *Volatility* is negative and significant; perhaps hedging costs are related to exchange rate volatility in this set of countries and higher hedging costs make cross-border investment less attractive. Finally, turning to regressions limited to EMEs as source (columns 5-7), trade linkages and the currency composition of bonds are important; exchange rate volatility is only significant in one slice (from EME to EME), where it is positive rather than negative.

The *Issuance* results in Table 4 are not solely due to the global reserve status of the US dollar. If we omit the US as a source country (untabulated), the only material change in the regressions is in column 4, where the magnitude of the coefficient does not change but the

standard error increases enough to lose significance. If we were to omit both the US and the entire Eurozone as source countries, *Issuance* is positive but not significant in the sub-split samples (columns 3 and 4), but remains positive and significant elsewhere.

Results in Table 4 raise the possibility that exchange rate volatility, negative and significant in previous CPIS-based studies, may have acted as a proxy for issuance. Countries that issue a significant fraction of their debt in a particular foreign currency have a strong incentive to limit fluctuations in the value of the home currency relative to the currency of bond issuance (see Devereux and Lane, 2003). Thus, bilateral exchange rate stability may serve as a proxy for bilateral issuance, and the previous results in the literature are consistent with our finding of an investor's strong preference for bonds denominated in the investor's currency. When observing cross-border bond holdings for which the currency denomination of the underlying bond is not identified, one cannot distinguish between a preference of one country's investors for another country's bonds and a propensity of a destination country to issue bonds in the investor's currency. This seems especially important when considering investment from AEs. In the next section we further explore the link between cross-border bond investment and the currency composition of bonds in a dataset that does differentiate by the currency denomination of the bond.

4. Currency Denomination and International Bond Portfolios: Portfolio Data that Identify Currency Denomination

4.1 A Usable Bond Portfolios Dataset

While the CPIS bilateral dataset, in its current form, does not identify the currency denomination of the underlying bonds, datasets built from security-level data can. One such dataset is of annual data on US investors' holdings of foreign bonds from periodic, comprehensive benchmark surveys conducted by the Treasury Department, Board of Governors

of the Federal Reserve System and the Federal Reserve Bank of New York. See the actual surveys (for example, US Treasury Department et al. 2009, 2016b) or the Griever, Lee and Warnock (2001) primer for details. Briefly, from Griever, Lee and Warnock (2001), the so-called "asset surveys" of US holdings of foreign securities collect data from two types of reporters: US-resident custodians and US institutional investors. Custodians are the primary source of information, typically reporting about 97 percent of total US holdings of foreign long-term securities. Institutional investors, such as mutual funds, pension funds, insurance companies, endowments and foundations, report in detail on their ownership of foreign securities only if they do not entrust the safekeeping of these securities to US-resident custodians. If they do use US-resident custodians, institutional investors report only the name(s) of the custodian(s) and the amount(s) entrusted (and the data are collected from the custodian, but not double counted). Custodians are asked but not mandated to enter information on the type of investor, so in practice the type of investor (e.g., institutional or retail) is not typically identified; where it has been identified the bulk of holdings (90+ percent) are by institutions (mutual funds, pension funds, etc.). Reporting on the asset surveys is mandatory, with both fines and imprisonment possible for willful failure to report. The data are collected at the security-level, greatly reducing reporting error; armed with a security identifier, a mapping to the currency of the bond and the residence of its issuer is straightforward. The holdings data form the official US data on international positions (for example, aggregating the survey's security-level information produces the amount of international bond holdings in the Bureau of Economic Analysis's International Investment Position report).

For our purposes, we require a split (US holdings of foreign bonds by country of issuer and by currency, including the local currency) published in the Treasury Department reports only in 2001 and then annually from 2006 (see, for example, Table A.6 of Treasury Department et al.

2009). This provides our measure of US holdings of local currency bonds. Investor-currency bonds in this US dataset are USD-denominated bonds.[12] Focusing on US investors' cross-border bond holdings is restrictive in the sense that we can only analyze the portfolios of one group of investors (US investors), but this is quite a large group for which we have high quality, publicly available data.[13] Importantly, US investors' bond holdings are captured by the US Treasury Department at the security level, so the exact nature of the bond is known to the data collector. No assumptions are necessary: The bond's security ID, when combined with an issuer's dataset, readily provides the country of the issuer as well as the currency denomination of the bond. The *security-level* holdings data are not currently available to researchers outside the Federal Reserve Board, but the *country-level* aggregates (and some splits) that are built from the security-level data are available for over 100 countries and provide a clean dataset for year-end 2001 and each year-end beginning in 2006.[14]

[12] We are not omitting much holdings, as US investors' holdings of third-currency bonds (i.e., not USD and not in the currency of the issuer) are extremely small, amounting to only 2.3% of their foreign bond portfolio in 2011.

[13] Of course, preferable would be a wide and long panel dataset on *all* foreigners' holdings of each country's local currency bonds. Included in such a dataset would be time series of foreigners' holdings of Malaysian ringgit bonds, Indonesian rupiah bonds, euro-denominated bonds issued by German entities and so on. Unfortunately, such time series data for a large set of countries does not, to our knowledge, exist. Asian Bonds Online covers foreigners' holdings of the *government* bonds of a handful of Asian countries, but we do not know of a source that includes all foreigners' holdings of all bonds (i.e., issued by government and private entities) of many countries and is available through time.

[14] The US asset surveys are high quality, but of course one must wonder if the holdings of any non-US investors are erroneously included in the data. This is most possible in the case of mutual funds: A foreigner could invest in a US mutual fund that holds foreign securities, and all of the US mutual fund's holdings of foreign securities are counted on US asset surveys (because the mutual fund is a US entity). Carol Bertaut of the Federal Reserve provided one way to think about the possible magnitudes. In the December 2015 claims survey, of the $9.5 trillion in foreign securities held by US residents, mutual funds accounted for $4.4 trillion (Exhibit 18 of US Department of the Treasury et al 2016b). US liabilities surveys indicate that foreign investors hold $1.05 trillion in US fund shares (Table 13 and Exhibit 13 of US Department of the Treasury et al 2016a, 2017), which is only 6 percent of the roughly $18 trillion in assets of US mutual funds, closed-end funds, money market mutual funds and ETFs (Tables L.121-123 of Board of Governors of the Federal Reserve System, 2016). Only a fraction of the $1.05 trillion in US funds held by foreigners is likely in funds invested in foreign assets. We do not have a direct way to measure this fraction, but overall about 22% of US mutual fund assets ($4.4t / $18t) are in foreign securities. If we guess that as much as 22 percent of the $1.05 trillion in US funds held by foreigners could be in funds invested in foreign assets, that would amount to $230 billion, or 2.4%, of the overall $9.5 trillion in foreign assets reported in US assets surveys. Thus, foreigners could be holding US mutual funds that invest in foreign securities, but a reasonable estimate is that such holdings are less than 3 percent of reported US foreign assets.

Much, but not all, of our analysis of US investors' holdings will focus on EMEs, for the simple reason (discussed in Section 2) that the new BIS bonds dataset has better coverage for EMEs. As a preview, Figure 3 presents the stark contrast between the currency composition of EME bonds outstanding (3a) and the holdings of US investors (3b). EME local currency bonds are far more prevalent than foreign currency bonds, but US investors' EME bond portfolios are primarily USD-denominated.[15] The contrast between the structure of EME bond markets and the composition of US investors' EME bond portfolios plotted in Figure 3 means that, relative to market-based weights, US investors more likely overweight USD-denominated bonds (they hold a lot and there are relatively few available) and more likely underweight local currency bonds (they hold relatively little and there are many available). This is shown in Figure 4a, which depicts "relative weight", defined as the weight of a country's bonds in US investors' global portfolio relative to their weight in a global size-weighted benchmark portfolio. When relative weight equals one, the country's weight in US investors' portfolio and the global benchmark is identical, whereas relative weight less than one is an underweight position (a home bias) and relative weight greater than one indicates an overweight position. Note that Figure 4a is not generated to highlight any particular country, but rather to show that relative weights for USD-denominated bonds are much higher than those for local currency bonds; Figures 4b (on USD-denominated bonds) and 4c (local currency bonds) split by region to better display country details. US investors' relative weights on EME local currency bonds (bottom panel of Figure 4a) are all well below one; this is the familiar home bias in international portfolios. However, relative weights on EME USD-denominated bonds (top panel) are quite high. For some Latin

[15] It is notable, however, that US holdings of local currency bonds increased sharply over this period from $20B in 2009 to $72B in 2015 and in 2015 represented approximately 32% of total EME bond holdings (up from 21% in 2009). The significant increase in US investor holdings of EME local currency bonds over the 2006-2015 period is widespread across regions, and over the same period US investors dramatically increased their holdings of USD-denominated bonds from Latin America.

American USD-denominated bonds (Figure 4b, top panel), US investors have an overweight position, providing one of the rare instances in which there is no home bias.[16]

4.2 A framework for analyzing international investment in bonds

The relative weight graphs in Figure 4 reveal investors' strong preference for investor currency bonds, something that has important implications for the analysis of cross-border bond investment. To the extent that investors view investor-currency bonds and bonds denominated in other currencies as fundamentally different and their shares vary across countries, off-the-shelf flows and positions data are mixing very different asset classes in ways (i.e. weights) that vary across countries.

In the following subsections we dig deeper into this by analyzing two different panel datasets of US investment in foreign bonds. The time periods and country coverage in the two datasets are largely dictated by BIS data on the size and structure of bond markets, discussed above in Section 2. One is broad and shorter (40 countries, of which 21 are AEs and 19 EMEs, for the period 2006 to 2011), whereas the other is more current with a longer time span but fewer countries (15 EMEs for the period 2006 to 2015).

The dependent variable in this analysis will be the Ahmed et al. (2016) measure of portfolio weights, *normalized relative weight*.[17] Relative weight (depicted in Figures 1 and 4) is

[16] Figure 1, discussed in the introduction, uses 2006-2011 data from the old BIS dataset and thus includes both AE and EME countries. The takeaway is the same: US relative weights are substantially higher for USD-denominated bonds in every region, including AE countries.

[17] Relative weight is consistent with an international CAPM-based model of international portfolio allocation as presented in Cooper and Kaplanis (1986). That model, described in some detail in Holland et al (2016), includes country-specific proportional investment costs, representing both explicit and implicit costs of investing abroad, and is designed to optimize an investor's allocation of wealth among risky securities in n countries in order to maximize expected returns net of costs. If there are no costs to investing, the allocation collapses to the global market capitalization allocation; that is, the investor allocates his wealth across countries according to market capitalizations. If costs are non-zero and non-uniform, allocations deviate from market weights. The higher the costs in a particular foreign market, the more severely underweighted that country will be in the investor's portfolios. The international CAPM therefore provides a theoretical underpinning for our focus on relative weight.

simply a country's weight in US investors' portfolio relative to its weight in a benchmark portfolio. Specifically, country *i*'s relative portfolio weight in US portfolios is the ratio of its weight in US investors' portfolio to its weight in the global market. Relative weight can be defined as:

$$RelWgt_i^{US} = \frac{\omega_{i,US}}{\omega_{i.m}} = \frac{H_i^{US} \Big/ \sum_i H_i^{US}}{MCap_i \Big/ \sum_i MCap_i} \tag{1}$$

where H_i^{US} is defined as US investors' holdings of country *i*'s bonds and $\sum_i H_i^{US}$ represents the global portfolio of bonds held by US investors, while $MCap_i$ is the market capitalization of country *i*'s bond market and $\sum_i MCap_i$ is the market capitalization of the global bond market. If the weight of a particular bond market in US investors' portfolios equals its weight in the global bond market, the relative weight for that bond market is one. In reality, US investors' relative portfolio weights are often far less than one—this is one dimension of the well-known home bias in asset holdings—as over 90 percent of US investors' bond holdings are issued by US entities. That said, as Figures 1 and 4 showed, for some asset classes—such as bonds denominated in the investor's currency—relative weights can and sometimes do exceed one.

Relative price changes will cause movements in relative weight even if investors do not alter their positions. This relative price effect can be removed through the simple normalization of dividing the relative weight from equation (1) by the relative weight for the home market (which for US bonds averages roughly 2.5 over our sample):

$$norm\,RelWgt = \frac{\omega_{i,US}}{\omega_{i,m}} \Big/ \frac{\omega_{US,US}}{\omega_{US,m}} \tag{2}$$

In our panel regressions we use this *normalized relative weight* measure, which has been shown in Ahmed et al (2016) to isolate portfolio reallocations that are independent of relative price changes (that is, it omits passive portfolio changes due to relative price changes). *Normalized relative weight* is also consistent with the Bekaert and Wang (2009) adjustment of scaling by the source country's home bias.

We use a common framework to analyze the evolution in US investors' country-specific relative portfolio weights—that is, their portfolio weights relative to a global benchmark— in various types of foreign bonds. We include the variables featured in our global CPIS analysis—bilateral trade linkages, bilateral exchange rate volatility and (in some specifications) the share of a country's bonds denominated in the investor's currency (i.e., USD). We also include "push" and "pull" factors. Country-specific "pull" factors include yield[18] (to proxy for expected return), macroeconomic indicators (GDP growth rate and current account balance), institutional variables and our *de jure* measure of the openness of a country's bond market to foreign investment. Global "push" factors include VIX (the volatility index, which measures variation in expected volatility and risk appetite), the 10-year US Treasury rate (to capture a "reach for yield") and a measure of unconventional monetary policy (UMP) shocks as in Rogers, Scotti and Wright (2016).[19] We also report but do not tabulate specifications in which we omit the global push factors and instead include time fixed effects.

We calculate bilateral trade linkages as the sum of a country's imports from the US and exports to the US as a share of the total imports and exports of that country and of the US; Lane

[18] Yield, expressed in basis points, is the annual average of monthly bond yields (yield-to-maturity from the J.P Morgan GBI indexes). JPMorgan provided yield data through 2013; for 2014 and 2015 we gathered data from Bloomberg and for the Philippines created yield as the average of 5-year and 10-year government bond yields.
[19] Rogers, Scotti and Wright (2016), which updates Rogers, Scotti and Wright (2014), utilizes high frequency financial market data around Fed announcements (FOMC statements as well as major speeches) to help identify monetary policy shocks in a VAR setting. Our UMP shocks are the sum of the Rogers et al (2016) shocks to the 10-year Treasury yield within a particular year (so that negative values of our UMP shocks are interpreted as expansionary monetary policy shocks).

and Milesi-Ferretti (2008) discusses various reasons bilateral trade might be related to portfolio allocations, although van Wincoop and Warnock (2010) offers a different view on some of these. Bilateral exchange rate volatility is the standard deviation of exchange rate changes calculated using 36 months of data. *USD_share* is the share of a country's bonds denominated in USD.

The local macroeconomic indicators in our regressions represent factors that likely impact the attractiveness of an economy as a destination for cross-border bond investment. We include the current account to GDP ratio to proxy for financial imbalances. A country that runs a current account deficit must attract inflows; if those inflows do not materialize, adverse financial market outcomes (such as currency depreciation and/or a spike in bond rates) are likely. We also include the 3-year average growth rate in real GDP per capita as an indicator of the vigor of the destination economy.

Our primary institutional variable is a measure of regulatory quality and creditor rights, *RegCr*, calculated as a weighted average of the Regulatory Quality Index from the World Bank's World Governance Indicators and the Legal Rights Index from the 'Getting Credit' section of the World Bank's Doing Business report. We follow the GEMLOC Investability Indicator Methodology (Markit 2013) by constructing a composite measure with twice the weight on regulatory quality.[20] The measure ranges from 0 to 100.

We also include a custom *de jure* measure of the openness of a country's local currency bond market to foreign investment, *Fin_Open*, provided by Markit (2013), with higher scores indicating that a bond market is more open to cross-border investment. From an update of Markit (2013) provided by the World Bank, we use the November observation of "Capital Control, Convertability and Access" for each country and year and merge with the Burger et al. (2015)

[20] The regulatory quality index measures a government's ability to formulate and implement sound policies and regulations that promote private sector development, while the creditor rights index measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders.

estimates of this measure for 2006 and 2007. We assume top scores (i.e., completely open) for South Korea (which enters the Markit dataset in 2011 with score of 100) and Israel (which is not in the Markit sample).

Summary statistics for all of our regression samples are provided in Tables 5a-5d. For readability of regression coefficients, we have scaled variables in the following way: all relative weight measures are multiplied by 100 (so that a relative weight of 100 indicates no home bias, i.e. holdings are in line with market capitalization) and *USD_share*, *Trade*, *CAB*, *ER_Vol*, *Yield*, *Growth*, *USi10* and *US_UMP* are in percentage points.

4.3. The Broad Shorter Sample: 40 Countries, 2006-2011

We analyze a broad (21 AEs, 19 EMEs) but relatively short (6 year) panel for which we have a maximum of 235 observations. The most appropriate econometric specification is not immediately self-evident. Our baseline specification, following Claessens et al. (2007), is panel-feasible generalized least squares (FGLS) that allow errors to be heteroscedastic across countries and serially correlated within country.[21] FGLS, which is more efficient than OLS, pools the cross-sectional and time variation of the panel. For completeness, we also use two other estimators that focus more squarely on the within-country time series variation (a "within" fixed effects estimator) and, separately, on the between-country cross-sectional variation (a "between" estimator). The within estimator has the attractive feature that it captures time invariant country-specific unobserved factors, but by maximizing the within-country fit (over time) it is ill suited to estimate the effect of variables that have little time variation. The between estimator is at the other extreme in that it focuses exclusively on the cross-sectional variation and provides OLS

[21] We model serial correlation in the error term using a common AR1 process for the entire panel. It is possible to estimate country-specific AR1 processes but with only 6 annual observations the estimation is likely to be highly imprecise (see Beck and Katz 1995).

estimation on the average values for each country (and is therefore unable to control for country-level effects).

Table 6a presents coefficient estimates calculated using FGLS (columns 1-4), country fixed effects in column 5, country and time fixed effects in column 6 and between effects in column 7. The dependent variable is *normalized relative weight* (as defined in equation 2) for the portfolio allocations of US investors using annual data from 2006 to 2011. Most publicly available datasets on bond flows and bond positions do not differentiate by currency denomination for either the flows or the structure of the recipient country's market, so regressions for which the Currency of Bonds is "All" (columns 3-7) can be considered typical. Local factors, which we will discuss first, are in the top portion of the tables; global push factors are in the bottom portion.

4.3.1 Local Factors

Local factors associated with greater US investment in foreign countries' USD-denominated and local currency bonds differ substantially (Table 6a, columns 1 and 2, labeled USD and LC). Yes, some factors have similar impact; for example, the coefficients on trade linkages and regulatory/creditor rights are at least marginally significant and have the same signs (in both columns 1 and 2). But the coefficients of most other variables differ in significance, sign, or both. For example, countries with stronger growth receive more US investment in their local currency bonds, but not in their USD-denominated bonds. Financial account openness is highly significant for USD bonds, but not for local currency bonds; perhaps US investors fear that capital controls are more likely to be imposed on foreign currency rather than local currency bonds. And, controlling for trade linkages, US investment in USD bonds is not restricted by large

current account deficits; US investment is actually higher in the USD bonds of countries with larger current account deficits.[22]

In column 3 of Table 6a, bonds of all currency denominations are included, as would be the case with any analysis of BOP-based bond flows or CPIS data. In the background of the column 3 results are the facts we depicted in Figure 1: US relative weights are much higher on USD-denominated bonds and the share of bonds that are USD-denominated varies across countries. Perhaps not surprisingly, the results in column 3 differ materially from those in columns 1 and 2 (except for the coefficient on trade linkages, which is again positive and significant).

In columns 4-7 we include bonds of all currencies but control for the share of each country's bonds that is USD-denominated. In each regression, the coefficient on *USD_share* is positive and highly significant. The specification in column 4 is as in column 3 but with the addition of *USD_share* (which is highly significant). The coefficient estimates on trade linkages are similar in columns 3 and 4, but others (such as on *RegCR* and *CAB*) differ. In column 5 we repeat the *all currencies* regression using country fixed effects. Even after controlling for country-level effects, the coefficient on *USD_share* is highly significant and only slightly smaller than the estimate in column 4, suggesting a strong preference for bonds denominated in the investor's currency that is independent of any attraction based on some other country-specific unobservable factor.[23,24] We then include two-way fixed effects—country and time—and the

[22] Some of these results seem to be picking up differences between AEs and EMEs, something we examine in Tables 6b and 6c.

[23] We also estimated (but do not tabulate) columns (1) and (2) using country fixed effects and not surprisingly found some of the variables with limited time variation (e.g. trade linkages and regulatory/credit rights) are statistically insignificant, while growth rates become more important (US investors increased relative weights on local currency bonds in countries that improved their economic growth rates).

[24] For completeness we also considered a random effects (RE) specification and again found the *USD_share* coefficient to be highly significant. RE estimates will be biased, however, if the unobserved country level effects are correlated with regressors; in our samples a robust Hausman test strongly rejects the RE specification in favor of fixed effects.

coefficient on *USD_share* is again highly significant (column 6). Finally, we focus on the cross-sectional variation and report results from the between effects estimator; once again we find *USD_share* to be highly significant (column 7).

The stability of the *USD_share* coefficient across different models indicates that a preference for investor currency bonds is a powerful explanatory factor in the patterns of investment both across countries and through time within a particular destination country. In the cross section this relationship is depicted in Figure 5 (top panel), where all but five observations are tightly clustered around an upward sloping fitted line (not shown). The within-country relationship is also quite strong (Figure 5, bottom panel). Studies, whether using cross-sectional or panel data, in which the capital flow or international investment variable includes bonds of different currency denominations should include a measure of the currency composition of existing bonds (specifically, the share of existing bonds that is denominated in the investor's currency) or risk omitting an important variable.[25]

Table 6a combined AEs and EMEs. We split these in Tables 6b (AEs) and 6c (EMEs); the structure of these tables is identical to that in Table 6a except we do not report "between" estimates (which would effectively have only 21 and 19 observations in these splits). For both AEs and EMEs, the coefficient on *USD_share* is again highly significant, even in the two-way fixed effects specifications (column 6 in Tables 6b and 6c). Additionally, the AE/EME splits provide insight into to some of the full sample results. For example, the result in Table 6a that US investment in USD bonds is higher in countries with larger current account deficits is an AE result (Table 6b, column 1); for EMEs, the coefficient on current account is generally

[25] While we do not want to overemphasize any particular point estimate in a small sample like that in Table 6a, consider a one standard deviation increase in *USD_share* from its mean (summary statistics for this sample are in Table 5a), which in the Table 6a sample would double the percentage of USD-denominated bonds from 12.4% to 24.9%. The column 4 coefficient estimate on *USD_share* suggests, ceteris paribus, an impact of +4.54 on the dependent variable (normalized relative weight). That is, a one standard deviation increase in the share of bonds denominated in USD yields nearly a one standard deviation increase in normalized relative weight.

insignificant except under fixed effects estimation and in that case we find the opposite result that US investment is higher in the bonds of EMEs with improving current account balances (Table 6c, columns 5 and 6). The contrast in the estimated current account coefficients suggests, intuitively, that US investors are more concerned about the potential financial instability associated with current account deficits in emerging economies relative to advanced economies.

4.3.2 Global Factors

Turning to results on global factors (the bottom rows of Tables 6a, 6b and 6c), we find that lower US Treasury yields are a significant push factor for US cross-border investment in local currency but not USD denominated bonds. It is difficult to find evidence in the Table 6 samples that US unconventional monetary policy shocks resulted in more investment in foreign bonds, but if one is willing to tolerate a 10 percent level of significance, one could conclude that UMPs that lowered US long rates increased US investment in EME USD bonds and decreased it for EME local currency bonds (Table 6c, col. 1 and 2).[26] We also estimated (but do not tabulate) columns (1) and (2) of Table 6a using country fixed effects and, as noted above, some local variables with limited time variation (e.g. trade linkages and regulatory/credit rights) lose statistical significance, while country growth rates become more important. Global factors also become important. For example, during this time span, investors responded to lower US interest rates by increasing their allocations toward local currency bonds but not USD-denominated bonds.

[26] We also estimated, but do not tabulate, the local currency and USD Table 6 regressions with time fixed effects instead of the global factors. The time fixed effects on local currency bonds are positive, especially for EMEs, suggesting that controlling for local factors there was greater US investment in EME local currency bonds over the period 2007-2011 (relative to 2006). The time fixed effects for USD bonds tend to be negative.

4.4 The More Current EME Sample

Results in Tables 6a, 6b and 6c suggest that the share of a country's bonds denominated in the investor's currency is an important determinant of the amount of cross-border bond investment the country receives. This relationship is quite robust and holds in both the cross-section and through time. In addition, the results in Table 6 specific to local currency and USD bonds indicate that the roles of country specific factors and global factors vary depending on the currency denomination of the bonds.

The sample in Table 6 ends in 2011. As noted in Section 2, a sample that is more current than 2011 and requires information on currency composition pretty much limits the analysis to EMEs. We do so, next, in a sample of 15 EMEs that spans the period 2006 to 2015 (Table 7). Again, the coefficient on the share of the country's bonds denominated in USD is positive and highly significant throughout Table 7, even after controlling for country level fixed effects or two-way fixed effects. Among local factors, trade linkages and regulatory quality and creditor rights are positive and significant in all FGLS specifications in Table 7, but the effects of other local factors differ by currency denomination. For example, there is more US investment in the USD-denominated bonds of EMEs that are more open, but this is not significant in the local currency regressions. For global factors, differences across specifications are striking. For the *All Currencies* regressions, one would conclude that US rates do not matter—the coefficient on US 10-year yields is insignificant—but results in column 2 indicate that low US rates are associated with significantly more investment in EME local currency bonds. Interestingly, US unconventional monetary policy shocks are associated with less US investment in EME bonds (especially those denominated in USD), something we return to below.[27]

[27] It is important to note that some of the impact of unconventional monetary policy is captured by the level of US long-term interest rates. Our UMP shock is calculated using the change in 10-year Treasury rates within a 2-hour window of FOMC statements and important speeches (following Rogers, Scotti and Wright 2016), but this shock

5. Modeling the Structure of EME Bonds Markets

We have argued that for the analysis of international bond investment, information on the currency composition of the underlying bonds is vital. That information might be included in the investment data, as it was for columns 1 and 2 (USD and LC) columns of Tables 6a, 6b, 6c and 7. But often investment data does not include information on currency denomination. For analysis of datasets that mix bonds of all currencies, we have argued that it is important to include a variable that captures the currency composition of the recipient country's bond market—in particular, the share of its bonds that is denominated in the investor's currency. This raises a reasonable question: What determines the foreign currency share of a country's bonds?

In this section we extend our relative weight analysis of the 2006-2015 EME dataset to endogenize the share of recipient countries' bonds denominated in the investor's currency, which in this sample of US investment is *USD_share* (the share of each countries bonds that is denominated in USD). We include variables from the literature, in particular Claessens et al (2007), which found that the foreign currency share was higher in smaller countries with smaller banking systems, less exchange rate volatility and weaker institutions.[28] We also include as an instrument a global variable that had a counterintuitive effect in Table 7: US unconventional monetary policy shocks.

Table 8 shows results using a two-stage instrumental variables estimator with destination country fixed effects. We are asking a lot of a relatively small sample—a maximum of 10 annual data points for 15 countries—but the IV estimation seems reasonably well specified. The *F*-test

most likely does not capture the full effect of UMP on US interest rates. Other methods of measuring UMP exist; it is not clear, however, that any dominates our strategy of including the level of long rates and an UMP shock.

[28] The rationale behind these variables put forward in Claessens et al. (2007) is as follows. Smaller countries might have more difficulty developing local bond markets and thus would tend to issue a greater share of foreign currency bonds. A larger banking system means the local investor base for local bonds is likely larger, thus the foreign share of bonds would be lower. Countries with less exchange rate volatility—a peg being the extreme—might issue more foreign currency bonds, either as a signal of the credibility of the exchange rate regime or because foreign currency bonds are cheaper to issue.

of instruments suggests that the instruments are appropriate, although using Stock and Yogo (2005) weak instrument critical values we would only be able to marginally reject the null of weak instruments. And first stage results are in line with the literature (Claessens et al. 2007), in that countries with a greater *USD_share* have smaller banking systems and less exchange rate volatility and are smaller (marginally, with a *p*-value of 0.107). And US UMP is negative and highly significant, indicating that when UMP pushed down US long rates EMEs' USD issuance increased.[29] Not shown, for readability, are the coefficients on all exogenous second-stage explanatory variables; of those, only *USi10* and *VIX* are significant (lower US long rates and lower VIX are associated with a higher *USD_share*). In the second stage regressions of Relative Weight, the explained portion of *USD_share*, trade linkages and VIX are all strongly significant. The IV results in Table 8, while from an admittedly small and specific sample (of US investment in EMEs), provide additional evidence that *USD_share* helps explain US international investment in bonds.

Table 8 also sheds light on some results from Tables 6 and 7. In Table 7, US UMPs were associated with lower US relative weights. Table 8 qualifies this: UMPs are associated with more *issuance* of USD bonds relative to local currency bonds (i.e., a higher *USD_share*) and, of the increased issuance, all else equal US investors took less than usual (the Table 7 relative weight result). Table 8 also aids in the understanding of *ER_Vol* results. In regressions that focused on a particular currency denomination (local currency or USD), *ER_Vol* was never negative and significant and sometimes even positive and significant, but in Table 7 it is sometimes negative and significant in regressions pertaining to "All" currencies. A plausible explanation, supported by Table 8 results, is that *ER_Vol* helps explain the mix of a countries bonds, which in turn influences US investment, but not the attractiveness of bonds of any particular currency

[29] In column (2) we exclude *RegCR* as an instrument but keep it in the second stage regression; results are similar.

denomination: Countries with less volatile exchange rates issue a higher share of USD-denominated bonds and these tend to have higher relative weights in US investors' portfolios.

6. Conclusion

In this paper we demonstrate that studies of cross-border bond investment that lack information about the currency denomination of the underlying bonds are omitting a critically important variable. Our empirical analysis reveals that cross-border investors exhibit a strong preference for bonds denominated in their home currency. Our results also suggest that when researchers are unable to distinguish between bonds of different currencies, it will be difficult to determine whether the data reveal a preference by cross-border investors for a particular destination country's bonds or a propensity of a destination country to issue bonds in the investor's currency.

Our examination of a holdings dataset in which currency denomination is available suggests that the determinants of cross-border bond investment vary significantly by the bond's currency denomination. Although some variables, such as trade linkages and regulator quality and creditor rights, are relatively robust predictors of cross-border investment across various splits of the data, other results vary by currency. The importance of currency denomination is particularly evident when attempting to determine the impact of advanced economies' monetary policy on cross-border financial flows. More specifically, our analysis of investment in 15 EMEs during the period from 2006 to 2015 demonstrates that if bonds of all currencies are lumped together the impact of US interest rates on US investors' EME bond allocations is insignificant. Splitting the analysis by currency, however, reveals that US investors responded to lower US interest rates by significantly increasing their allocations toward EME local currency bonds.

Further, our two-stage instrumental variables analysis suggests that unconventional monetary policy had its impact primarily by increasing the share of total EME bonds denominated in USD.

One result that emerges from the data is that the well-known home bias in international portfolios seems to be at least in part a home currency bias. While our analysis focuses primarily (but not exclusively) on US investors, other studies such as Maggiori et al (2017) and Boermans and Vermeulen (2016a, 2016b) provide evidence that the home currency bias is more general than just a USD bias. We note that in one sense the strong preference for home currency bonds can be understood in standard portfolio models if investor-currency bonds alleviate currency risk. This presumes, however, that the bonds were issued by entities that are hedged (operationally, by having substantial USD income streams, or financially), something we cannot discern in our datasets; one could just as easily imagine that the investor's perceived reduction in currency risk is offset by an increase in the issuer's currency risk (which the investor should recognize as an increase in default risk), something we cannot examine in our datasets. Along other dimensions, the home currency bias is puzzling. For example, from a US investor's perspective, in many periods the returns characteristics—mean, variance, skewness and correlation with the rest of the portfolio—of EME local currency bonds dominate those provided by EME USD-denominated bonds (Burger et al 2012). We leave it to future work to shed more light on this.

References

Ahmed, S., S. Curcuru, F. Warnock and A. Zlate, 2016. Decomposing International Portfolio Flows. mimeo.

Beck, N. and J. Katz, 1995. What to do (and not to do) with Time Series Cross Section Data. *American Political Science Review* 89(3): 634-647.

Bekaert, G., and X. Wang, 2009. Home bias revisited. unpublished working paper.

Bertaut, C., A. Tabova and V. Wong, 2014. The Replacement of Safe Assets: Evidence from the US Bond Portfolio. International Finance Discussion Papers 1123.

Board of Governors of the Federal Reserve System, 2016. Financial Accounts of the United States (Fourth Quarter 2015).

Boermans, M., and R. Vermeulen, 2016a. Newton meets Van Leeuwenhoek: Identifying international investors' common currency preferences. *Finance Research Letters* 17: 62-65.

Boermans, M., and R. Vermeulen, 2016b. International investment positions revisited: Investor heterogeneity and individual security characteristics. DNB Working Paper 531.

Burger, J., and F. Warnock, 2006. Local Currency Bond Markets. *IMF Staff Papers* 53: 133-146.

Burger, J., and F. Warnock, 2007. Foreign Participation in Local-Currency Bond Markets. *Review of Financial Economics* 16: 291-304.

Burger, J., F. Warnock and V. Warnock, 2008. Financial Globalization and Local Currency Bond Markets. Presentation at Deutsche Bundesbank and Bundesministerium der Finanzien conference on Bond Markets in Emerging Market Economies and Developing Countries (31 January 2008).

Burger, J., F. Warnock and V. Warnock, 2012. *Financial Analysts Journal* 68(4):73-93.

Burger, J., R. Sengupta, F. Warnock and V. Warnock, 2015. US Investment in Global Bonds: As the Fed Pushes, Some EMEs Pull. *Economic Policy* 30 (84): 729-766.

Cerutti, E, S. Claessens and D. Puy, 2016. Push Factors and Capital Flows to Emerging Markets: Why Knowing Your Lender Matters More Than Fundamentals. Working Paper.

Chari, A., K. Dilts Stedman and C. Lundblad, 2016. Taper Tantrums: QE, its Aftermath and Emerging Market Capital Flows. mimeo.

Chuhan, P., S. Claessens and N. Mamingi, 1998. Equity and bond flows to Latin America and Asia: The Role of Global and Country Factors. *Journal of Development Economics* 55(2): 439-463.

Claessens, S., D. Klingebiel and S. Schmukler, 2007. "Government Bonds in Domestic and Foreign Currency: The Role of Institutional and Macroeconomic Factors." *Review of International Economics* 15(2): 370-413.

Cooper, I., and E. Kaplanis, 1986. Costs to cross-border investment and international equity market equilibrium. in J. Edwards, J. Franks, C. Mayer and S. Schaefer (eds.), Recent Developments in Corporate Finance. Cambridge University Press, Cambridge.

Cooper, I., P. Sercu and R. Vanpee, 2012. The Equity Home Bias Puzzle: A Survey. *Foundations and Trends in Finance* 7(4): 289-416.

Devereux, M. and P. Lane, 2003. Understanding bilateral exchange rate volatility. *Journal of International Economics* 60: 109-132.

Du, W. and J. Schreger, 2016. Sovereign risk, currency risk and corporate balance sheets. Harvard Business School BGIE Unity Working Paper No. 17-024.

Edison, H,, and F. Warnock, 2004. US Investors' Emerging Market Equity Portfolios: A Security-Level Analysis. *Review of Economics and Statistics* 86: 691 - 704.

Eichengreen, B., and R. Hausmann, 1999. Exchange rates and financial fragility. Proceedings, Federal Reserve Bank of Kansas City, pages 329-368.

Eichengreen, B., and R. Hausmann, 2004. *Other People's Money: Debt Denomination and Financial Instability in Emerging Market Economies*. University of Chicago Press.

Felettigh, A., and P. Monti, 2008. How to interpret the CPIS data on the distribution of foreign portfolio assets in the presence of sizeable cross-border positions in mutual funds. Evidence for Italy and the main euro-area countries. Banca d'Italia Occasional Paper No. 16.

Fidora, M., M. Fratzscher and C. Thimann, 2007. Home Bias in Global Bond and Equity Markets: The Role of Real Exchange Rate Volatility. *Journal of International Money and Finance* 26: 631-655.

Fratzscher, M., 2012. "Capital Flows, Push Versus Pull Factors and the Global Financial Crisis," *Journal of International Economics* 88(2): 341-356.

Fratzscher, M., M. Lo Duca and R. Straub, 2016. On the international spillovers of US quantitative easing. *Economic Journal* (forthcoming).

Galstyan, V., C. Mehigan and R. Mercado, 2017. The Currency Composition of International Portfolio Assets. TEP Working Paper No. 1017.

Goldstein, M., and P. Turner, 2004. *Controlling Currency Mismatches in Emerging Economies*. Washington, DC: Institute for International Economics.

Griever, W., G. Lee and F. Warnock, 2001. The US system for measuring cross-border investment in securities: a primer with a discussion of recent developments. Federal Reserve Bulletin 87(10): 633-650.

Gruić, B., and P. Wooldridge, 2012. Enhancements to the BIS debt securities statistics. BIS Quarterly Review (December, pages 63-76).

Hale, G. and M. Spiegel, 2012. Currency Composition of International Bonds: The EMU Effect. *Journal of International Economics* 88(1): 134-149.

Hale, G., P. Jones and M. Spiegel, 2017. Home Currency Issuance in International Bond Markets. Mimeo.

Holland, S., S. Sarkissian, M. Schill and F. Warnock, 2016. Global Equity Investment. Mimeo.

International Monetary Fund, 2011. International Capital Flows: Reliable or Fickle? *World Economic Outlook* (April, Chapter 4).

J.P. Morgan, 2006. Introducing the JPMorgan Government Bond Index-Emerging Markets (GBI-EM): Index Methodology. J.P. Morgan Emerging Markets Research and Bond Index Research, January.

Lane, P., 2006. Global Bond Portfolios and EMU. *International Journal of Central Banking* 2(2): 1-23.

Lane, P., and G.M. Milesi-Ferretti, 2008. International Investment Patterns. *Review of Economics and Statistics* 90(3): 538–549.

Leal, R. P. C., A.L. Carvalhal da Silva, 2008. Development of the Brazilian Bond Market. In Eduardo Borensztein, Kevin Cowan, Barry Eichengreen and Ugo Panizza (eds.) Bond Markets in Latin America: On the Verge of a Big Bang? MIT Press.

Lewis, K., 1999. Trying to Explain Home Bias in Equities and Consumption. *Journal of Economic Literature* 37: 571–608.

Lim, J.J., S. Mohapatra and M. Stoker, 2014. Tinker, Taper, QE, Bye? The Effect of Quantitative Easing on Financial Flows to Developing Countries. Background paper for *Global Economic Prospects 2014*, Washington, DC: World Bank.

Maggiori, M, B. Neiman and J. Schreger, 2017. Unpacking Global Capital Flows. mimeo

Markit Indices Limited, 2013. “GEMLOC Investability Indicator Methodlogy,” February 2013, https://www.markit.com/assets/en/docs/products/data/indices/bond-indices/GEMLOC%20Investability%20Indicator%20Methodology.pdf

Rogers, J.H., C. Scotti and J. Wright, 2014. Evaluating Asset-Market Effects of Unconventional Monetary Policy: A Multi-Country Review. *Economic Policy* 749-799.

Rogers, J.H., C. Scotti and J. Wright, 2016. Unconventional Monetary Policy and International Risk Premia. International Finance Discussion Papers 1172.

Stock J, Yogo M., 2005. Testing for Weak Instruments in Linear IV Regression. In: Andrews DWK *Identification and Inference for Econometric Models*. New York: Cambridge University Press.

US Department of the Treasury, Federal Reserve Bank of New York and Board of Governors of the Federal Reserve System, 2009. Report on US Portfolio Holdings of Foreign Securities as of December 31, 2008.

_____ 2016a. Foreign Portfolio Holdings of US Securities as of June 30, 2015.

_____ 2016b. US Portfolio Holdings of Foreign Securities as of December 31, 2015.

_____ 2017. Foreign Portfolio Holdings of US Securities as of June 30, 2016.

Van Wincoop, E. and F. Warnock, 2010. Can trade costs in goods explain home bias in assets? *Journal of International Money and Finance*, *29*(6):1108-1123.

Data Appendix

Bonds refer to debt instruments with original maturity greater than one year.

CPIS Bilateral Bond Holdings
The IMF's Coordinated Portfolio Investment Survey data are available year-end 1997 and then starting 2001, and semiannually starting June 2013. The data are residency-based. In recent years some currency information is available, although not on a bilateral basis. In Table 4 we use data from the 2003 CPIS.

US Bond Holdings
Data on US investors' holdings of foreign bonds are from periodic, comprehensive benchmark surveys conducted by the Treasury Department, Board of Governors of the Federal Reserve System and the Federal Reserve Bank of New York. See the actual surveys, for example, Treasury Department et al. (2009) or the Griever et al. (2001) primer for details. Reporting on the asset surveys is mandatory, with both fines and imprisonment possible for wilful failure to report. The data are collected at the security-level, greatly reducing reporting error; armed with a security identifier, a mapping to the currency of the bond and the residence of its issuer is straightforward.

Explanatory Variables

In Table 4 we include the following bilaterally defined variables:

$Issuance_{i,j}$ is the share of country *i*'s bonds that are denominated in country *j*'s currency as of end-2003

$Linkages_{i,j}$ is the portion of country *i*'s imports in 2003 that were from country j

$Volatility_{i,j}$ (exchange rate volatility between country *i* and *j*, calculated from monthly percentage changes in the nominal bilateral exchange rate from 1994 through 2003).

In Tables 5-8, we use data series from a variety of sources as documented below:

Yield, expressed in basis points, is the yield-to-maturity in the GBI indexes from J.P Morgan and enters our regressions as an annual average of monthly data. See J.P Morgan (2006) Appendix B. JPMorgan provided yield data through 2013; for 2014 and 2015 we gathered data from Bloomberg and for the Philippines created yield as the average of 5-year and 10-year government bond yields.

USD_share is calculated as the share of a country's bonds denominated in US dollars. For details, see the discussion on BIS bonds data in Section 2.

RegCr (regulatory quality/creditor rights) is calculated as a weighted average of the Regulatory Quality Index from the World Bank's World Governance Indicators and the Legal Rights Index from the "Getting Credit" section of the World Bank's Doing Business report. The regulatory quality index measures a government's ability to formulate and implement sound policies and regulations that promote private sector development, while the creditor rights index measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders. We follow the GEMLOC Investability Indicator Methodology (Markit 2013) by constructing a composite measure with twice the weight on regulatory quality.

Trade is bilateral imports and exports between the US and the foreign country, scaled by both countries' nominal GDP (source: IMF).

Fin_Open, our measure of the openness of a country's local currency bond market to foreign investment, is de jure and based on two sources. For most EMEs in our sample, Markit has constructed detailed measures for 2008-2015 based on the IMF's AREAER documents. We backfill the series to 2006 by combining information from Markit's data with AREAER information. The resulting measure is *0* if a country's local currency bond market is by law completely closed to foreign investors and *100* if there are no impediments to foreign investment. We assume top scores (i.e., completely open) for South Korea (which enters the Markit dataset in 2011 with score of 100), Israel (which is not in the Markit sample) and all AE bond markets.

Most other explanatory variables are taken from Haver Analytics, including: *ER_Vol* (computed as the standard deviation of three years of monthly exchange rate changes), *CAB* (current account balance as a percent of GDP) and *Growth* (calculated as the 3-year average growth rate in real GDP per capita).

Global variables *VIX* and *USi10* are averages of monthly observations of the CBOE volatility index and 10-year US Constant Maturity Treasury rate, respectively. *US_UMP* is the sum of the Rogers, Scotti and Wright (2016) monetary policy shocks to the 10-year rate, constructed such that a negative UMP shock lowers 10-year rates.

Additional instruments in Table 8 include *Country Size* (log of nominal GDP) and *Deposits* (bank liabilities as a share of GDP, from the World Bank).

Country Groupings

The groupings of "advanced economies" (AEs) and "other emerging market and developing countries" (shortened here to emerging market economies or EMEs) generally follow IMF classifications as of April 2013 (http://www.imf.org/external/pubs/ft/weo/2013/01/pdf/statapp.pdf). In our narrow more recent sample (Tables 7 and 8) we rely on the BIS's classification of EMEs (which includes Korea and Israel).

Figure 1. US investment and the Structure of Foreign Bond Markets

Relative Weight is a country's (or, in this figure, a region's) bonds' share in US portfolios relative to their share in global markets. A relative weight of less than one means US investors are underweight the country's (or region's) bonds.

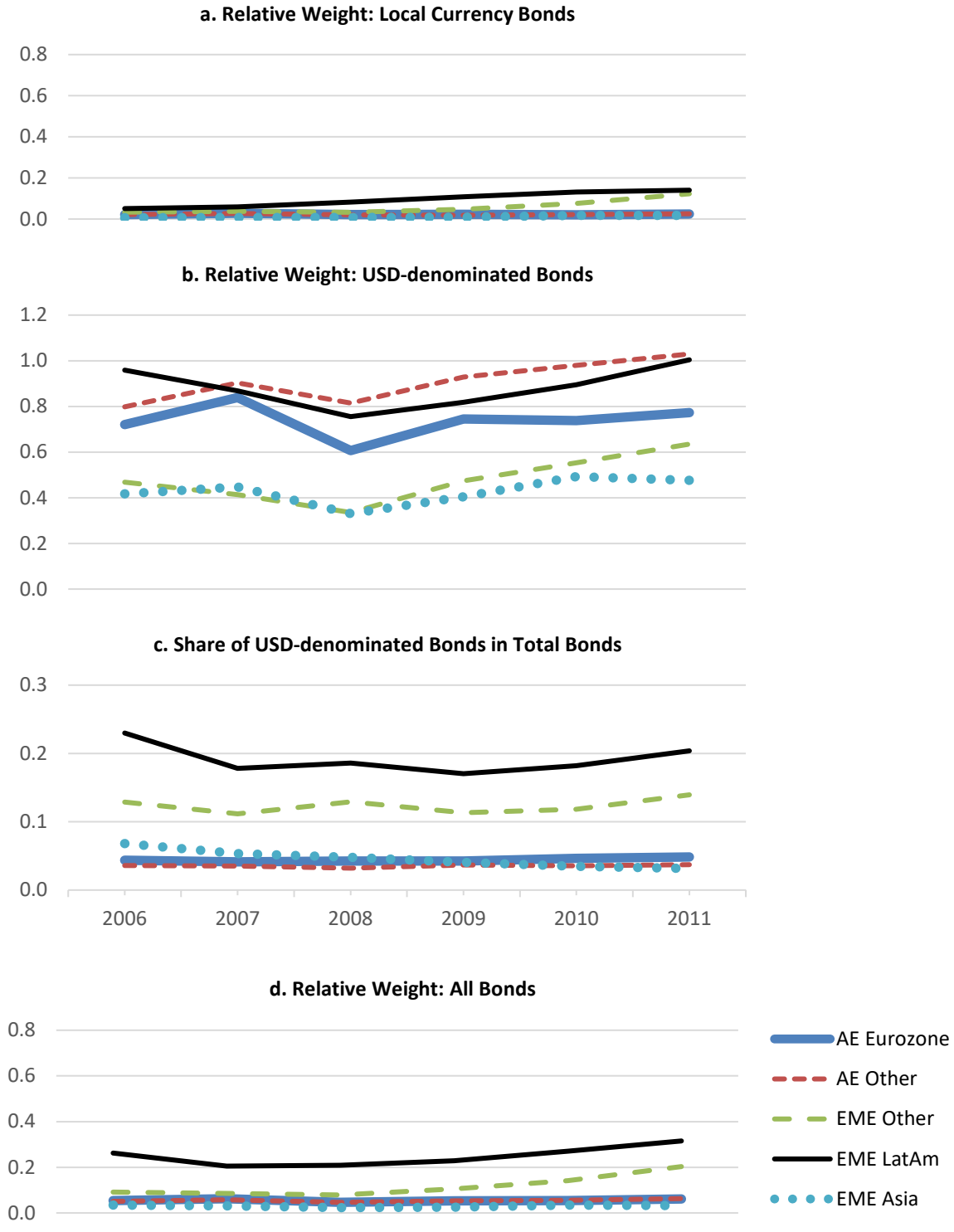
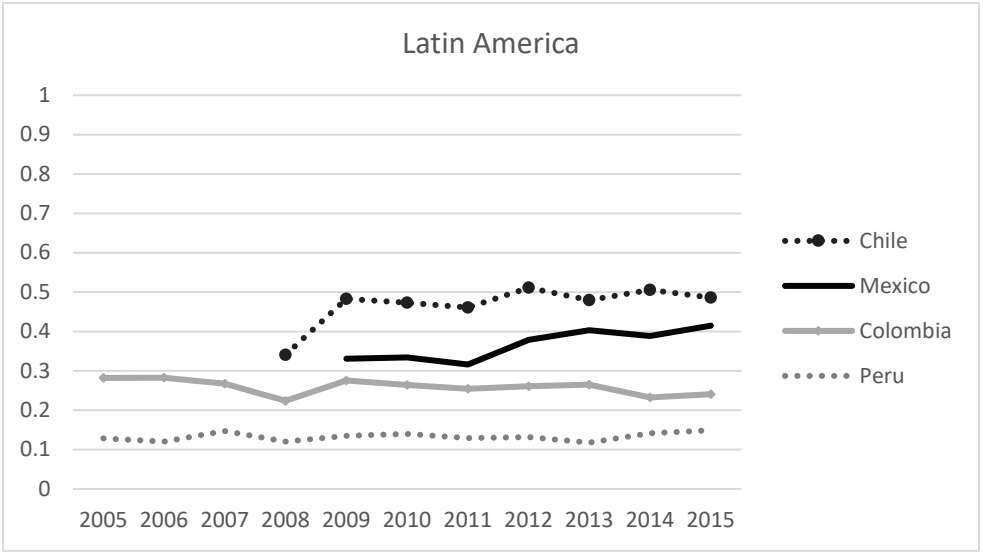
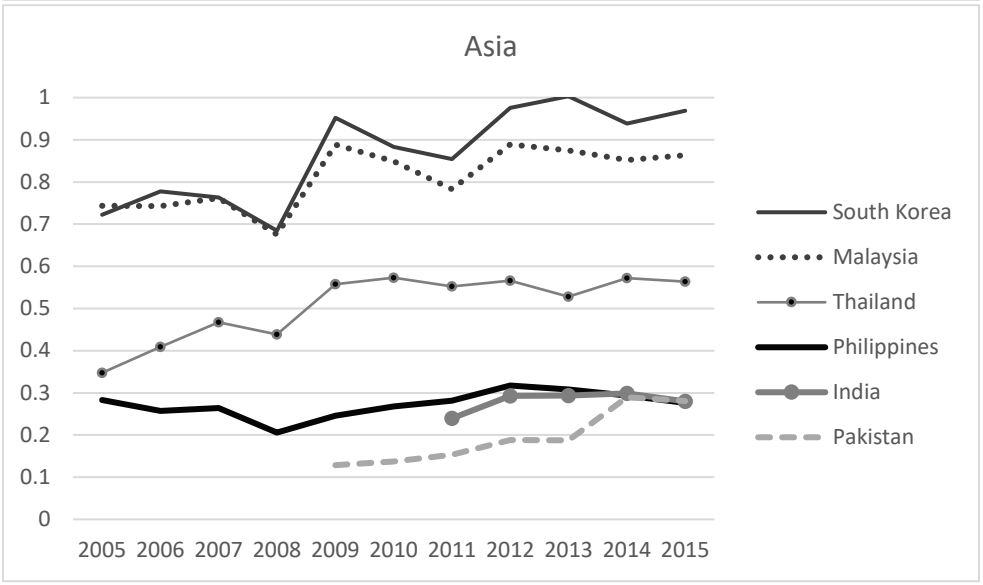


Figure 2a. EME Bond Market Structure, Local Currency Bonds (as share of GDP)

The figures depict the size of local currency bond markets (expressed as a share of GDP).





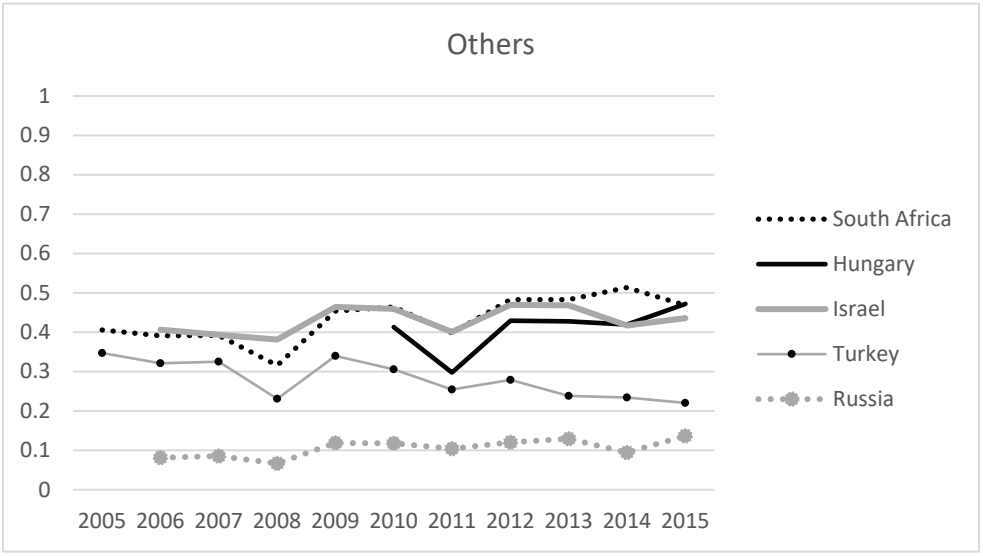


Figure 2b. EME Bond Market Structure, Local Currency Bonds (share of total)

The figures depict the share of local currency bonds in total bonds.

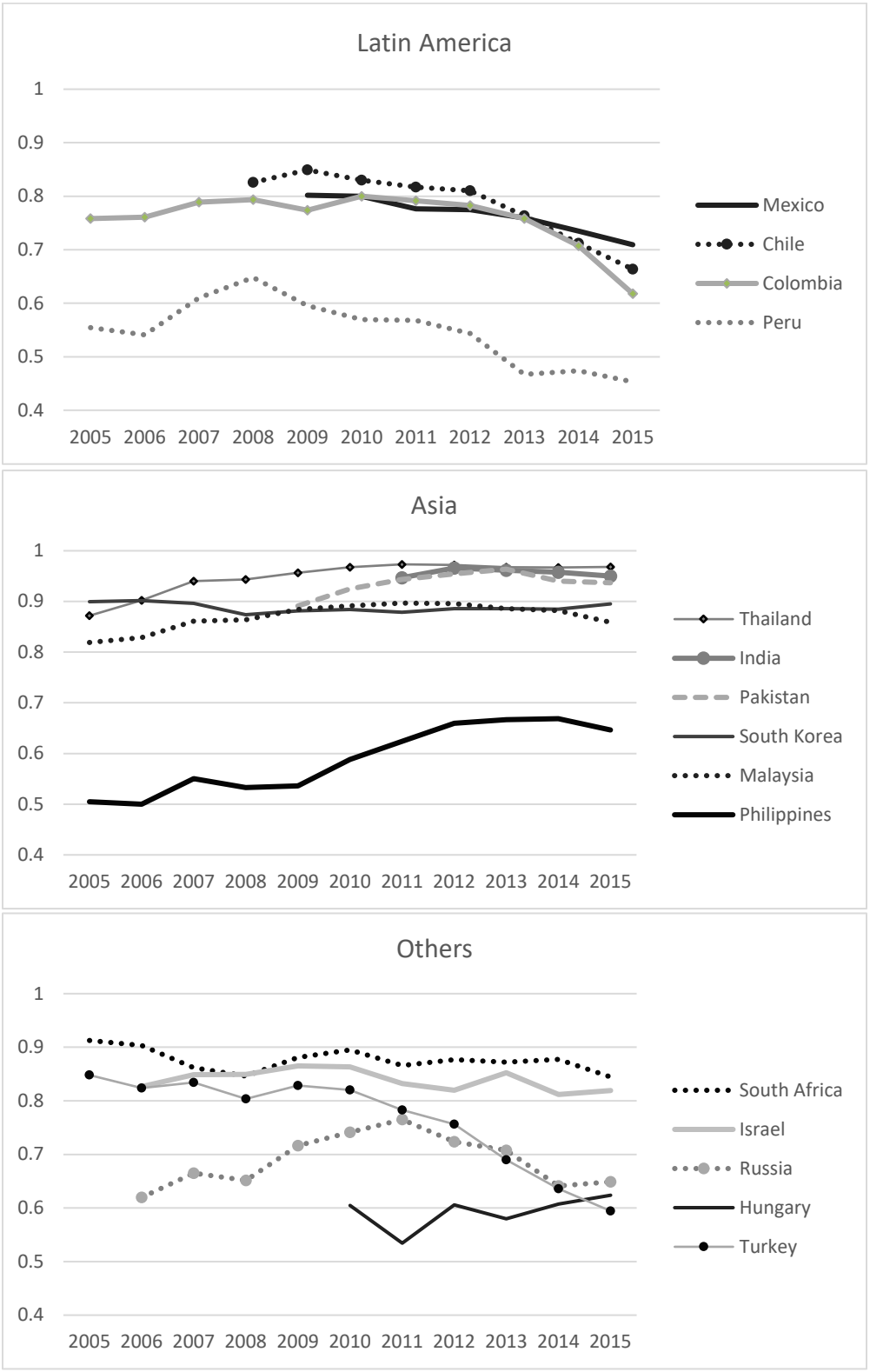


Figure 3. EME Bonds by Currency Denomination

This figure includes data for Chile, Colombia, Mexico, Peru; South Korea, Malaysia, Pakistan, Philippines, Thailand; and Israel, Russia, South Africa and Turkey.

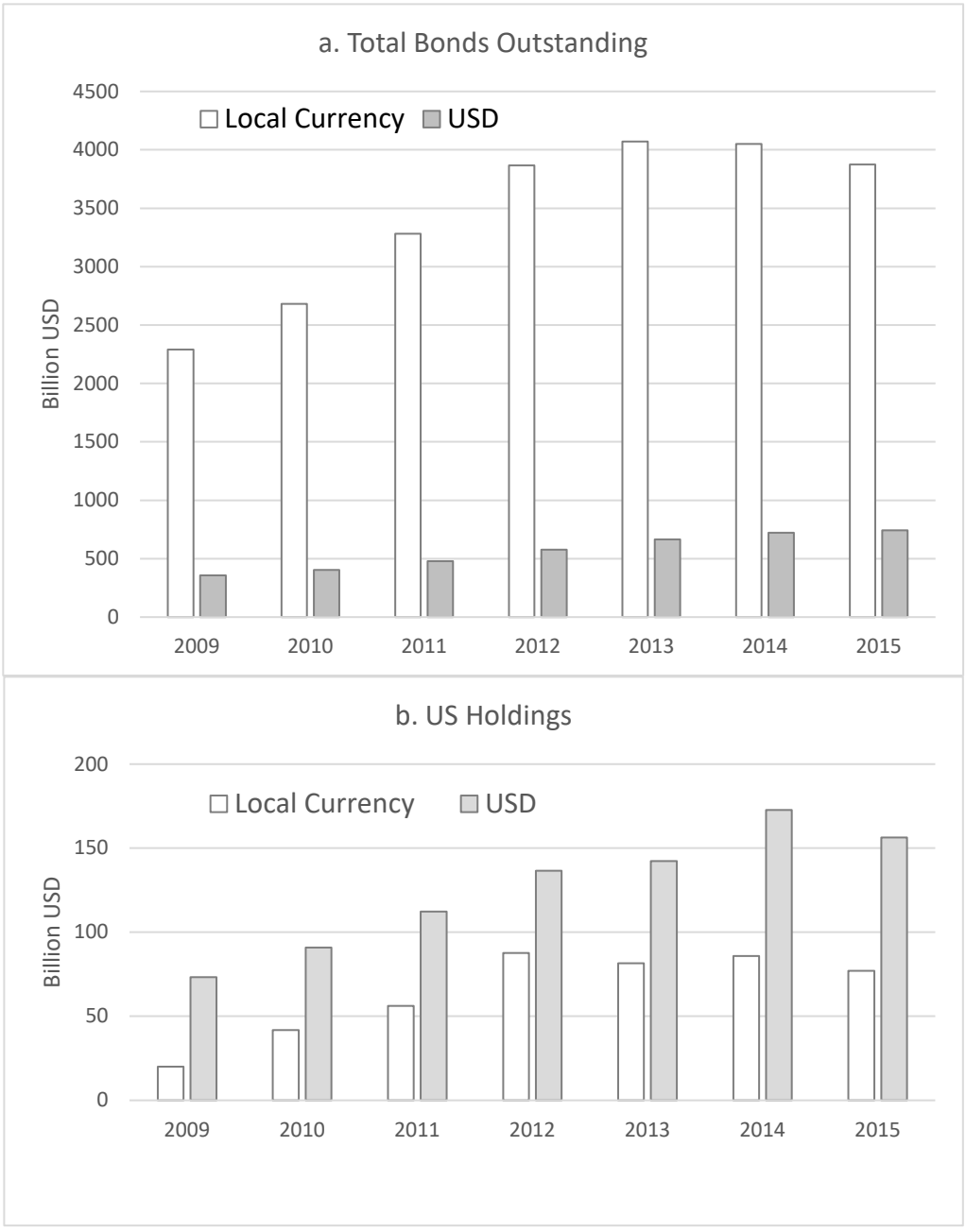
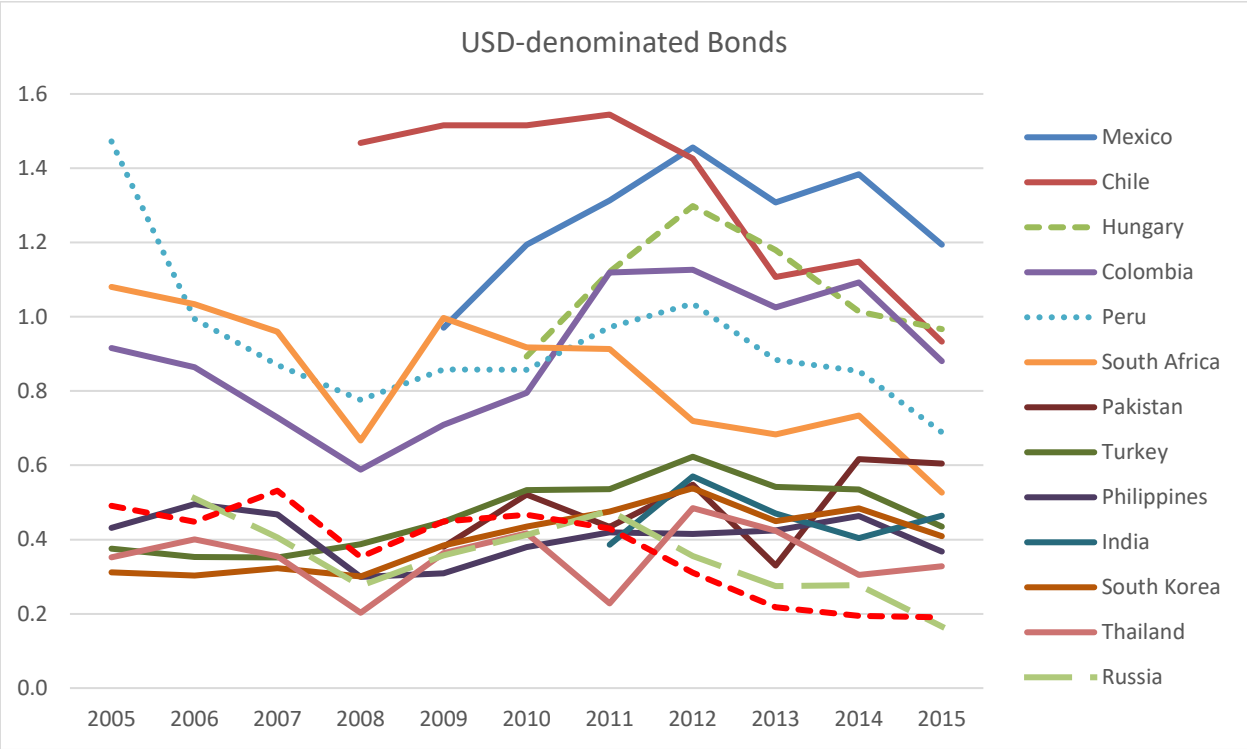


Figure 4a. US Investors' Relative Investment Weight

At a relative weight of one there is no home bias (i.e., portfolio weights equal market weights). Israel is not shown on the upper graph (or in Fig. 4b), as its relative weight is off the chart at roughly 4.



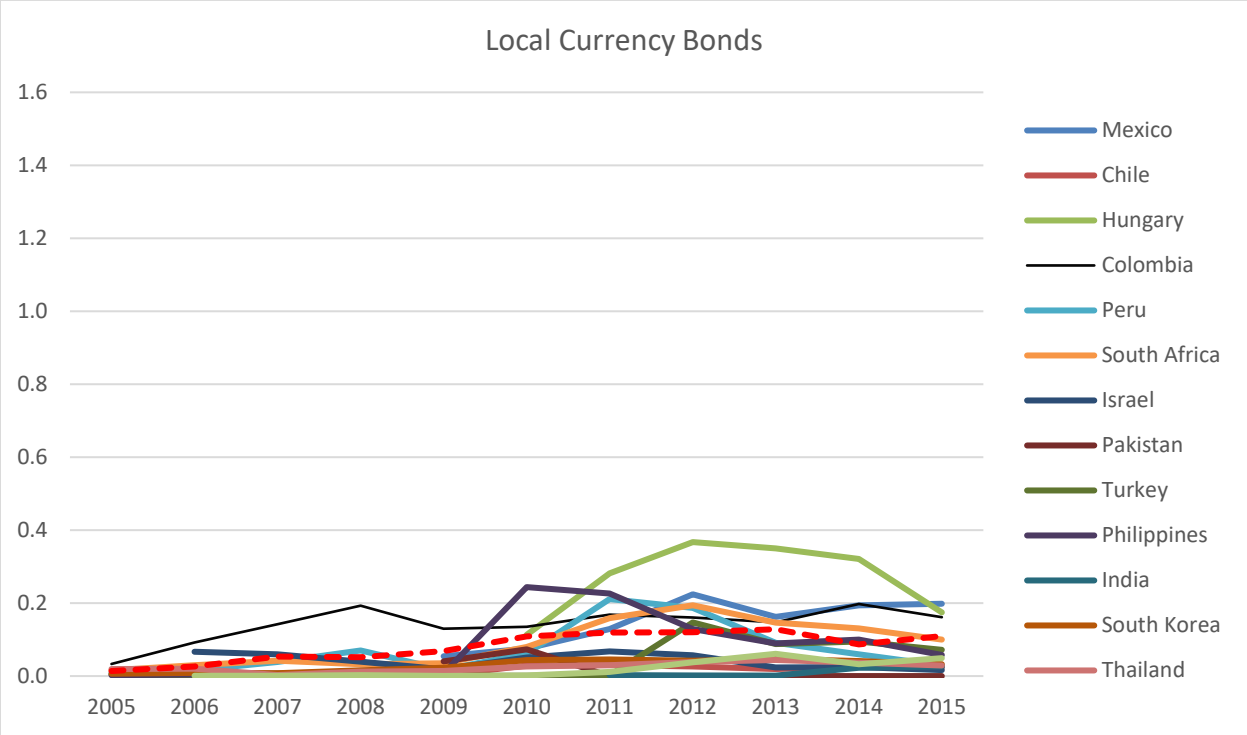


Figure 4b. US Investors' Relative Investment Weight (USD-denominated bonds, country details)

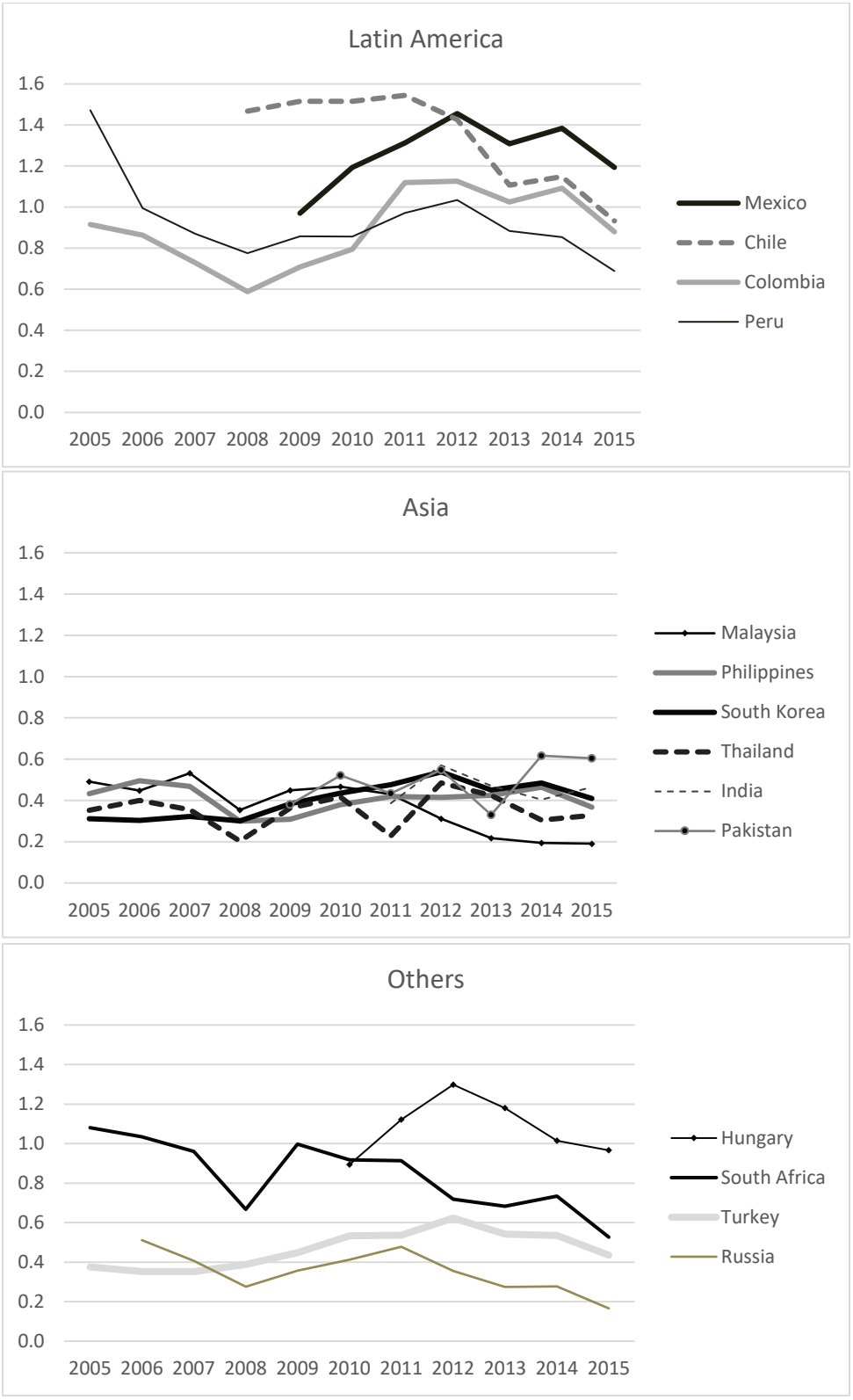
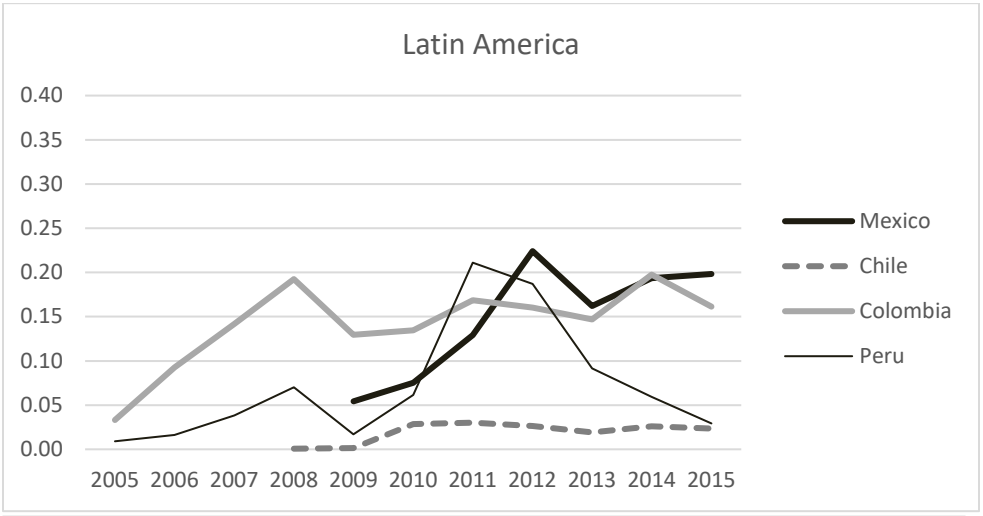
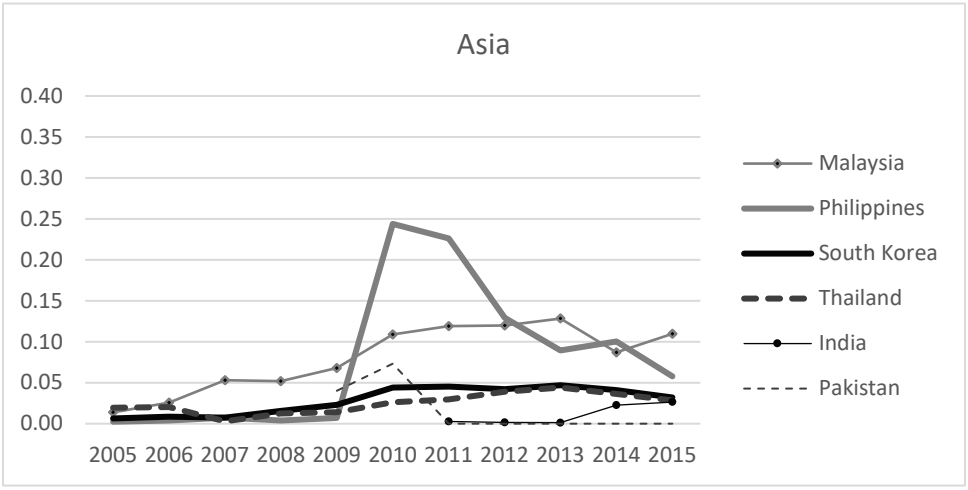


Figure 4c. US Investors' Relative Investment Weight (local currency bonds, country details)





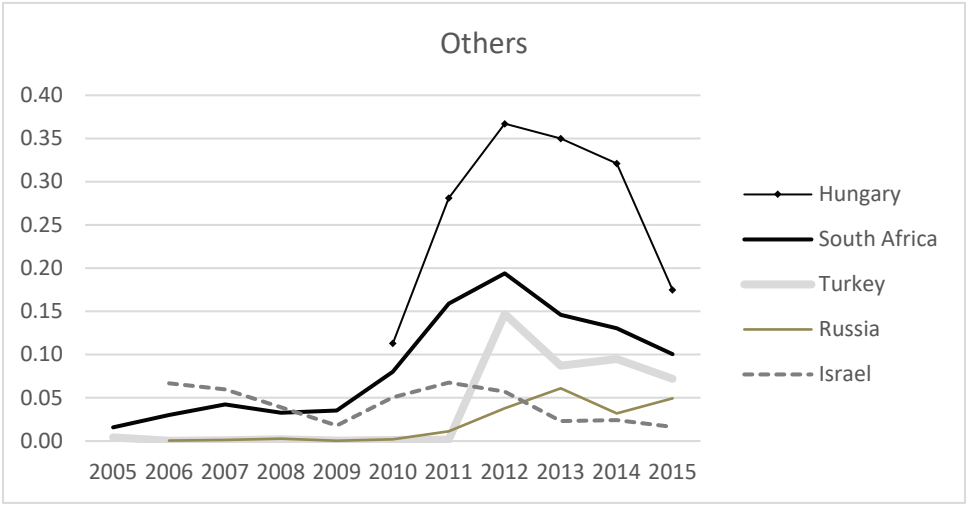
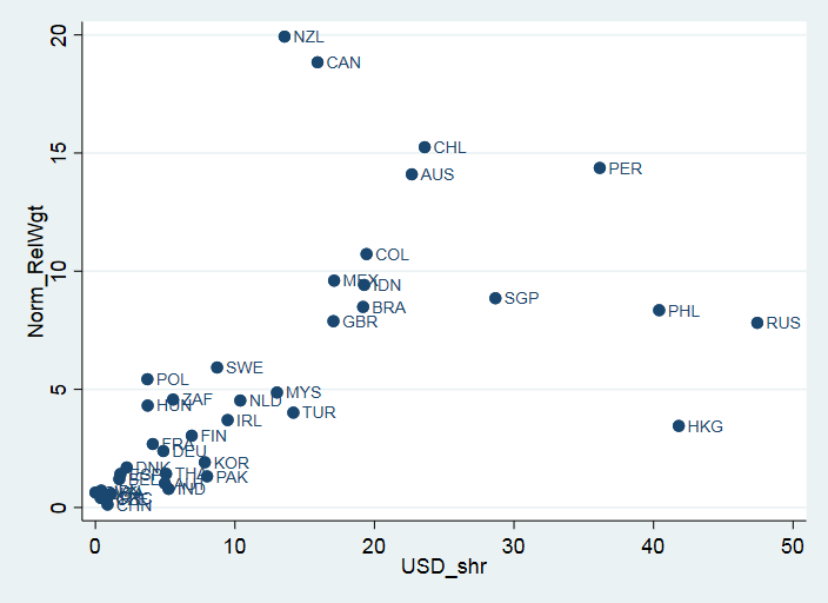


Figure 5. Cross-sectional and Temporal Relationships between Relative Weight and USD_share

The scatter plots show the "between" and "within" relationships between normalized US relative weight and *USD_share* from the 2006-2011 annual dataset. Labels are ISO country codes. The top graph of country means depicts the cross-sectional relationship; the few data points that are further from a fitted line (not shown) are New Zealand, Canada, Philippines, Russia and Hong Kong. In the bottom graph, each data point subtracts the country average and then adds the sample average, so the cluster is around the sample average for each variable; points to the northeast of the cluster are observations for which both variables are above the within-country average.



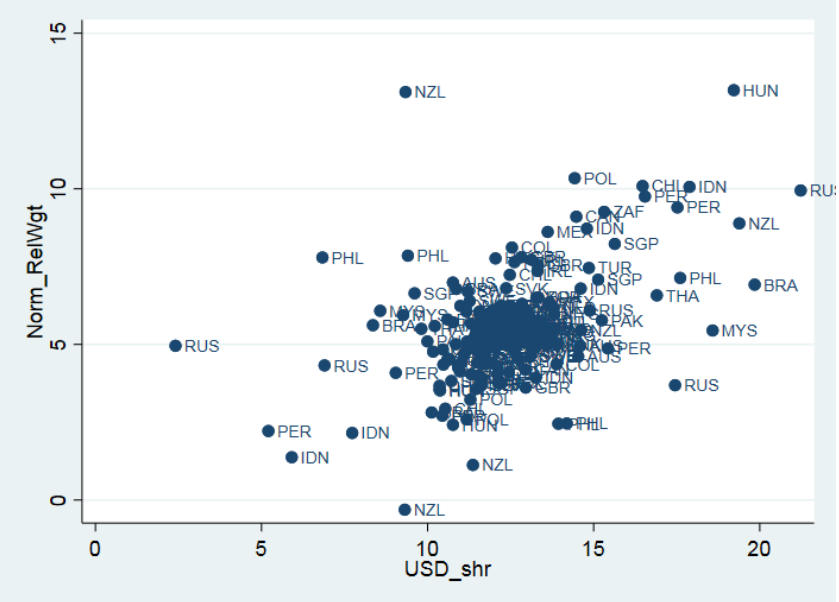


Table 1. Bonds Outstanding

The table shows, for year end 2001 and 2011, the total amount (in billions of US dollars) of bonds issued by entities resident in each of 25 AEs and 21 EMEs, as well as the amount of local currency denominated bonds expressed as a percent of GDP and as a percent of total bonds.

	Total 2011	Local Currency Denominated Bonds			
		2011		2001	
	Bil USD	% of GDP	% of Total	% of GDP	% of Total
Advanced Economies	**75,883**	**161**	**91**	**105**	**93**
US	**29,409**	**191**	**97**	**131**	**98**
Euro area AEs	**22,106**	**157**	**91**	**94**	**89**
Austria	672	141	88	90	74
Belgium	765	145	98	118	96
Finland	193	57	77	41	72
France	4,397	145	91	82	91
Germany	4,269	105	89	96	92
Greece	556	190	99	74	89
Ireland	1,259	470	81	46	65
Italy	4,021	180	98	114	96
Netherlands	2,817	271	80	165	74
Portugal	400	167	99	57	89
Spain	2,756	181	97	53	92
Other AEs	**24,369**	**134**	**84**	**82**	**87**
Australia	1,216	56	64	30	55
Canada	1,957	88	78	69	72
Denmark	840	211	84	160	90
Hong Kong SAR	116	18	39	15	54
Iceland	41	132	45	78	63
Japan	12,331	209	99	108	99
New Zealand	64	29	72	22	64
Norway	430	45	51	27	54
Singapore	130	37	69	35	69
South Korea	1,265	100	88	85	91
Sweden	745	83	60	57	63
Switzerland	327	47	95	58	97
United Kingdom	4,907	115	58	46	62

Table 1. Bonds Outstanding, continued.

	Total 2011 Bil USD	Local Currency Denominated			
		2011		2001	
		% of GDP	% of Total	% of GDP	% of Total
	6,607	**29**	**88**	**20**	**71**
Europe	**699**	**24**	**72**	**25**	**76**
Croatia	18	15	52	9	33
Czech Republic	97	34	76	14	85
Hungary	75	28	52	28	60
Poland	223	31	72	20	86
Slovakia	36	23	61	18	68
Turkey	249	25	78	36	78
Latin America	**1,406**	**22**	**75**	**19**	**54**
Argentina	93	8	40	14	29
Brazil	582	18	78	20	59
Chile	105	32	75	42	77
Colombia	107	26	80	19	61
Mexico	477	32	78	17	59
Peru	41	14	59	12	60
Asia	**4,155**	**36**	**96**	**22**	**90**
China	2,956	40	99	18	95
India	515	26	95	25	97
Indonesia	113	10	74	27	96
Malaysia	260	81	90	57	77
Pakistan	34	15	94	22	96
Philippines	101	28	62	21	48
Thailand	175	49	97	28	80
Other EMEs	**347**	**11**	**74**	**10**	**50**
Russia	156	5	59	2	13
South Africa	191	40	86	32	87

Source: Authors' calculations from BIS data.

Table 2. EME Bond Markets

This table includes data for Chile, Colombia, Mexico and Peru; South Korea, Malaysia, Pakistan, Philippines and Thailand; and Israel, Russia, South Africa and Turkey.

	2009	2015
Size of EME Local Currency Bond Markets		
$ billions	2289	3281
% of GDP	41.9%	45.7%
% of Global Bond Market	2.7%	3.5%
Size of EME Foreign Currency Bond Markets		
$ billions	436	851
% of GDP	8.0%	11.8%
% of Global Bond Market	0.5%	0.9%
Size of EME USD Bond Markets		
$ billions	357	714
% of GDP	6.5%	9.9%
% of Global Bond Market	0.4%	0.8%
Ratio of Local Currency to Total Bonds	84.0%	79.4%

Table 3. Holdings of Luxembourg Equities, Selected Countries

The table shows the percent of each country's foreign equity portfolio that is reported in the 2006 CPIS dataset to be held in Luxembourg, as well as the percent of the Luxembourg equity market those holdings constitute.

	% of Foreign Portfolio	% of Luxembourg Market
Austria	22	24
Belgium	41	138
Finland	14	17
France	14	122
Germany	43	329
Greece	30	5
Ireland	5	35
Italy	57	381
Netherlands	9	66
Portugal	23	8
Spain	33	74
Total		1199
Memo: US	0	20

Table 4. Determinants of Bilateral Bond Investment: Global Dataset

Depicted are cross-sectional Tobit regressions, with lower limit of zero and upper limit of one, using 2003 CPIS data of bilateral cross-border bond investment. In the full sample, there is at most 39 source countries and 44 destination countries (with fewer than 39x44 total observations because of missing data). Following Lane and Milesi-Ferretti (2008) we adopt a two-way fixed effects specification, $x_{ij} = \phi_i + \phi_j + \beta Z_{ij} + \varepsilon_{ij}$, where x_{ij} is the share of source-country *j*'s foreign bond holdings that are in bonds issued by host-country *i*; $\phi_i + \phi_j$ are dummy variables for each host and source country; Z_{ij} is a vector of bilateral explanatory variables; and ε_{ij} is a residual term. Z_{ij} includes factors that vary across country pairs and hence can help explain why the same destination attracts different levels of investment from different sources; we focus on three: $Issuance_{i,j}$ (the share of country *i*'s bonds that are denominated in country *j*'s currency as of end-2003), $Linkages_{i,j}$ are trade linkages (the portion of country *i*'s imports in 2003 that were from country *j*) and $Volatility_{i,j}$ (exchange rate volatility between country *i* and *j*, calculated from monthly percentage changes in the nominal bilateral exchange rate from 1994 through 2003). Robust standard errors are reported in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Source:		From AE			From EME		
Destination:	All	to both	to AE	to EME	to both	to EME	to AE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Issuance	0.059***	0.051***	0.070***	0.010***	5.845***	3.850*	4.521***
	(0.019)	(0.017)	(0.026)	(0.004)	(1.782)	(2.039)	(1.374)
Linkages	0.698***	0.607***	0.542***	0.102**	0.793***	0.209***	1.008***
	(0.098)	(0.084)	(0.076)	(0.047)	(0.150)	(0.070)	(0.164)
Volatility	-0.210	-0.436	-3.511***	-0.015	0.658	0.888**	-0.471
	(0.260)	(0.371)	(1.001)	(0.097)	(0.701)	(0.447)	(1.702)
N	1,271	848	458	390	423	161	262
Left-censored	180	68	6	62	112	68	44
Right-censored	0	0	0	0	0	0	0

Table 5. Summary Statistics for Regression Samples

a. All Countries, 2006-2011

	Obs	Mean	Std. Dev.	Min	Max
normRelWgt	235	5.5	5.5	0.04	27.5
normRelWgt_USD	231	30.8	30.3	0.00	322.3
normRelWgt_LC	235	2.2	2.7	0.00	12.7
USD_shr	235	12.4	12.5	0.00	56.3
Trade	235	0.40	0.67	0.01	3.6
RegCr	235	74	18	36	100
Fin_Open	235	90	17	25	100
CAB	235	0.5	6.7	-14.9	26.8
ER_Vol	235	2.6	1.2	0.1	5.4
Yield	235	5.5	3.2	1.2	22.7
Growth	235	2.1	2.9	-6.3	12.1
USi10	235	3.7	0.7	2.8	4.8
US_UMP	235	0.13	0.15	-0.35	0.00
VIX	235	24	7	13	33

b. Advanced Economies, 2006-2011

	Obs	Mean	Std. Dev.	Min	Max
normRelWgt	126	5.0	5.9	0.20	27.5
normRelWgt_USD	126	36.6	37.9	0.90	322.3
normRelWgt_LC	126	2.0	2.7	0.11	12.7
USD_shr	126	9.8	10.5	0.16	43.2
Trade	126	0.44	0.69	0.01	3.6
RegCr	126	85	12	58	100
Fin_Open	126	100	0	100	100
CAB	126	0.9	7.7	-14.9	26.8
ER_Vol	126	2.5	0.9	0.1	4.8
Yield	126	4.1	2.2	1.2	22.7
Growth	126	0.9	2.1	-6.3	7.0
USi10	126	3.7	0.7	2.8	4.8
US_UMP	126	0.13	0.15	-0.35	0.00
VIX	126	24	7	13	33

Table 5. Summary Statistics for Regression Samples, continued

c. Emerging Market Economies, 2006-2011

	Obs	Mean	Std. Dev.	Min	Max
normRelWgt	109	6.1	4.9	0.04	19.8
normRelWgt_USD	105	23.9	14.9	0.00	71.6
normRelWgt_LC	109	2.3	2.8	0.00	11.3
USD_shr	109	15.3	14.0	0.00	56.3
Trade	109	0.34	0.64	0.01	2.80
RegCr	109	61	15	36	87
Fin_Open	109	79	20	25	100
CAB	109	0.1	5.3	-9.7	17.1
ER_Vol	109	2.7	1.4	0.3	5.4
Yield	109	7.2	3.4	2.6	18.8
Growth	109	3.6	3.0	-1.8	12.1
USi10	109	3.7	0.7	2.8	4.8
US_UMP	109	0.13	0.15	-0.35	0.00
VIX	109	24	7	13	33

d. Emerging Market Economies, 2006-2015

	Obs	Mean	Std. Dev.	Min	Max
normRelWgt	132	8.1	6.1	0.5	25.9
normRelWgt_USD	132	33.3	30.2	7.0	168.0
normRelWgt_LC	132	2.8	3.0	0.0	13.8
USD_shr	132	17.8	12.4	2.2	54.2
Trade	132	0.30	0.57	0.02	2.85
RegCr	132	62	16	25	89
Fin_Open	132	81	16	42	100
CAB	132	0.7	4.9	-9.6	16.9
ER_Vol	132	2.4	1.2	0.6	5.9
Yield	132	6.5	3.2	1.3	18.8
Growth	132	2.8	1.9	-1.7	7.9
USi10	132	3.0	0.9	1.8	4.8
US_UMP	132	-0.08	0.20	-0.41	0.21
VIX	132	20	7	13	33

Table 6. Determinants of US Investment in Foreign Bonds (AEs and EMEs)

The table shows results using three different estimators: panel-feasible generalized least squared (FGLS) regressions allowing for heteroscedasticity and autocorrelated error structures (in columns 1-4), fixed effects "within" estimator allowing for correlated errors within countries (in columns 5 and 6), and a random-effects "between" estimator with bootstrapped standard errors (column 7). Included are all countries (Panel a), advanced economies (Panel b) and EMEs (Panel c). Data are annual from 2006 through 2011. Currency denomination of bonds for the dependent variable (normalized relative weight) is indicated in the top row: USD (column 1), local currency (column 2) or all currencies (columns 3-7). The dependent variable is US investors' normalized relative portfolio weight (multiplied by 100) for each country's bonds. The sample includes countries listed in Table 1 with the exception of Iceland, Norway, Switzerland, Croatia and Argentina, which are excluded based on the availability of explanatory variables. Independent variables are, in order, the share of a country's bonds denominated in US dollars, bilateral trade, Regulatory/Creditor Rights, openness, current account balance (scaled by GDP), exchange rate volatility, yield, real GDP growth and global variables (US 10-year Treasury yield, US monetary policy shock and VIX). See Table 5 and Data Appendix for summary statistics and more details on all variables. Constants and, in column 6, time fixed effects are included but not reported. Standard errors are reported in parentheses; *p*-values for all Wald tests are 0.000. ** and * denote significance at the 1% and 5% levels, respectively.

a. All Countries

Currency	USD	LC	All	All	All	All	All
Estimator:	FGLS	FGLS	FGLS	FGLS	Within	Within	Between
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
USD_share				0.363**	0.310**	0.317**	0.341**
				(0.022)	(0.087)	(0.084)	(0.074)
Trade	8.716**	0.759*	2.575**	1.674**	1.039	0.451	2.664
	(1.299)	(0.302)	(0.487)	(0.317)	(0.869)	(0.837)	(1.360)
RegCR	0.131	0.028**	0.020	0.049**	0.003	0.000	0.088
	(0.072)	(0.010)	(0.021)	(0.014)	(0.044)	(0.041)	(0.079)
Fin_Open	0.178**	0.002	-0.006	0.006	-0.014	-0.017	-0.069
	(0.060)	(0.012)	(0.021)	(0.013)	(0.030)	(0.032)	(0.079)
CAB	-0.362**	-0.025	0.020	-0.080**	0.106	0.101	-0.125
	(0.121)	(0.019)	(0.033)	(0.027)	(0.055)	(0.058)	(0.140)
ER_Vol	0.867	-0.042	-0.217	0.088	-0.035	0.418	2.368*
	(0.563)	(0.070)	(0.149)	(0.126)	(0.230)	(0.375)	(1.203)
Yield	0.141	0.020	0.063	0.028	-0.090	-0.147*	-0.056
	(0.251)	(0.030)	(0.055)	(0.046)	(0.049)	(0.066)	(0.454)
Growth	-0.968**	0.096*	0.048	0.010	0.185	0.116	-0.123
	(0.285)	(0.042)	(0.071)	(0.058)	(0.099)	(0.130)	(0.326)
USi10	2.778*	-0.678**	-0.971**	-0.526*	-1.146**		
	(1.321)	(0.165)	(0.300)	(0.258)	(0.292)		
US_UMP	2.346	0.868	-1.900	-0.633	-0.197		
	(8.970)	(0.845)	(1.577)	(1.565)	(1.267)		
VIX	-0.248	-0.020	-0.120*	-0.083	-0.084		
	(0.270)	(0.025)	(0.047)	(0.046)	(0.047)		
N	231	235	235	235	235	235	235
# countries	39	40	40	40	40	40	40
Fixed Effects	none	none	none	none	country	country+time	none
Wald χ^2	237	50	58	394			
within R^2					0.34	0.37	
between R^2							0.63

Table 6. Determinants of US Investment in Foreign Bonds, continued

b. Advanced Economies

Currency:	USD	LC	All	All	All	All
Estimator:	FGLS	FGLS	FGLS	FGLS	Within	Within
	(1)	(2)	(3)	(4)	(5)	(6)
USD_share				0.324**	0.239*	0.241*
				(0.040)	(0.088)	(0.090)
Trade	12.436**	1.193**	3.817**	3.344**	-0.337	-0.221
	(2.822)	(0.308)	(0.586)	(0.410)	(0.551)	(0.693)
RegCR	0.695**	0.069**	0.160**	0.090**	0.061	0.059
	(0.187)	(0.013)	(0.030)	(0.027)	(0.062)	(0.062)
CAB	-0.936**	-0.041*	-0.047	-0.138**	0.071	0.066
	(0.313)	(0.021)	(0.045)	(0.039)	(0.042)	(0.059)
ER_Vol	0.842	-0.013	0.047	0.987**	-0.168	-0.026
	(2.107)	(0.092)	(0.268)	(0.340)	(0.239)	(0.394)
Yield	0.007	0.031	0.070	0.130	0.043	0.038
	(0.940)	(0.027)	(0.069)	(0.079)	(0.063)	(0.102)
Growth	-0.787	0.083	-0.003	0.053	0.333**	0.327
	(0.988)	(0.054)	(0.128)	(0.150)	(0.100)	(0.188)
USi10	3.775	-0.466*	-0.428	0.100	-0.844*	
	(3.841)	(0.194)	(0.483)	(0.549)	(0.364)	
US_UMP	-3.468	-0.597	-3.134	-3.157	-1.266	
	(23.786)	(0.992)	(2.636)	(3.404)	(1.274)	
VIX	-0.472	-0.047	-0.126	-0.134	-0.053	
	(0.684)	(0.030)	(0.078)	(0.096)	(0.053)	
N	126	126	126	126	126	126
# countries	21	21	21	21	21	21
Fixed effects	none	none	none	none	country	country+time
Wald χ^2	49	58	95	259		
within R^2					0.16	0.16

Table 6. Determinants of US Investment in Foreign Bonds, continued

c. Emerging Market Economies

Currency:	USD	LC	All	All	All	All
Estimator:	FGLS	FGLS	FGLS	FGLS	Within	Within
	(1)	(2)	(3)	(4)	(5)	(6)
USD_share				0.359**	0.350**	0.355**
				(0.032)	(0.079)	(0.071)
Trade	7.556**	0.195	1.438*	1.350**	-0.187	-1.416
	(1.672)	(0.334)	(0.577)	(0.298)	(2.030)	(2.266)
RegCR	0.028	0.024	-0.038	0.045*	-0.037	-0.034
	(0.078)	(0.017)	(0.028)	(0.022)	(0.042)	(0.037)
Fin_Open	0.229**	0.009	0.079**	0.023	-0.013	-0.013
	(0.052)	(0.014)	(0.026)	(0.018)	(0.024)	(0.025)
CAB	0.211	0.013	0.054	-0.042	0.199**	0.206**
	(0.186)	(0.035)	(0.065)	(0.044)	(0.066)	(0.070)
ER_Vol	1.287*	-0.066	-0.264	0.228	0.033	0.552
	(0.570)	(0.179)	(0.269)	(0.188)	(0.342)	(0.446)
Yield	0.006	0.201*	0.233*	-0.062	0.038	-0.055
	(0.231)	(0.083)	(0.115)	(0.078)	(0.094)	(0.077)
Growth	-0.348	0.030	-0.078	-0.038	0.164	0.154
	(0.288)	(0.088)	(0.141)	(0.092)	(0.169)	(0.175)
USi10	-2.444	-1.18**	-2.51**	-1.20**	-2.05**	
	(1.291)	(0.367)	(0.601)	(0.425)	(0.450)	
US_UMP	-14.629	3.922	-4.139	0.639	2.835	
	(8.317)	(2.080)	(3.459)	(2.628)	(2.561)	
VIX	-0.812**	0.020	-0.283**	-0.097	-0.103	
	(0.239)	(0.060)	(0.100)	(0.077)	(0.077)	
N	105	109	109	109	109	109
# countries	18	19	19	19	19	19
Fixed Effects	none	none	none	none	country	country+time
Wald χ^2	80	38	49	277		
within R^2					0.63	0.66

Table 7. Determinants of US Investment in EME Bonds

The table shows results using two different estimators: panel-feasible generalized least squared (FGLS) regressions allowing for heteroscedasticity and autocorrelated error structures (in columns 1-4) and fixed effects within estimator allowing for correlated errors within countries (in columns 5 and 6). Data are annual from 2006 through 2015; because of data limitations, some countries enter the panel later than 2006. Currency denomination of bonds for the dependent variable (normalized relative weight) is indicated in the top row: USD (column1), local currency (column 2) or all currencies (columns 3-6). Independent variables are as in Table 6; see Table 5 and Data Appendix for summary statistics and more details on all variables. Constants and, in column 6, time fixed effects are included but not reported. Standard errors are reported in parentheses; *p*-values for Wald tests are in brackets. ** and * denote significance at the 1% and 5% levels, respectively.

Currency:	USD	LC	All	All	All	All
Estimator:	FGLS	FGLS	FGLS	FGLS	Within	Within
	(1)	(2)	(3)	(4)	(5)	(6)
USD_share				0.280**	0.249**	0.254**
				(0.027)	(0.056)	(0.058)
Trade	7.404**	1.334*	2.222**	2.171**	6.577**	6.035*
	(2.071)	(0.530)	(0.851)	(0.673)	(2.150)	(2.799)
RegCR	0.269**	0.026*	0.067*	0.079**	0.029	0.031
	(0.082)	(0.013)	(0.027)	(0.020)	(0.038)	(0.051)
Fin_Open	0.191**	0.004	0.035	0.018	0.044	0.046
	(0.059)	(0.010)	(0.022)	(0.016)	(0.027)	(0.029)
CAB	0.084	-0.036	-0.063	-0.085	0.001	0.012
	(0.192)	(0.034)	(0.070)	(0.049)	(0.095)	(0.114)
ER_Vol	-0.438	-0.170	-0.554	-0.314	-0.690*	-0.604
	(0.845)	(0.175)	(0.317)	(0.241)	(0.317)	(0.329)
Yield	-0.281	0.141	-0.027	-0.091	0.099	0.100
	(0.350)	(0.081)	(0.126)	(0.094)	(0.178)	(0.186)
Growth	-0.059	-0.049	-0.100	-0.157	-0.032	0.044
	(0.362)	(0.077)	(0.135)	(0.105)	(0.140)	(0.202)
USi10	0.012	-0.569**	-0.473	-0.430	-0.392	
	(0.784)	(0.165)	(0.324)	(0.235)	(0.506)	
US_UMP	8.244**	0.516	1.879*	2.671**	2.781*	
	(2.044)	(0.475)	(0.872)	(0.661)	(0.987)	
VIX	0.053	-0.029	-0.014	0.015	0.021	
	(0.097)	(0.020)	(0.040)	(0.030)	(0.031)	
N	132	132	132	132	132	132
# countries	15	15	15	15	15	15
FEs	none	none	none	None	country	country+time
Wald χ^2	82.4 [0.000]	33.2 [0.000]	38.5 [0.000]	192.3 [0.000]		
within R^2					0.51	0.52

Table 8. IV Regressions – EMEs, All Currencies

The sample is as in Table 7: annual panel data from 2006 to 2015 and including 15 EMEs. Estimation is by GMM using Stata's XTIVREG2 command with fixed effects and clustering by country. First stage regressions of *USD_share* include the instruments listed as well as all second stage explanatory variables (the coefficients of which are not shown for space considerations; of those, only *USi10* and *VIX* are significant in the first stage). Standard errors, clustered by country, are reported in parentheses. ** and * denote significance at the 1% and 5% levels, respectively. Reported in brackets are the *p*-values for *F*-tests.

First Stage: *USD_share*		
Deposits	-0.058*	-0.058*
	(0.024)	(0.024)
ER_Vol	-2.05*	-2.05*
	(0.793)	(0.793)
RegCR	0.128	
	(0.101)	
Country Size	-7.66	-7.66
	(4.71)	(4.71)
US_UMP	-6.94**	-6.94**
	(1.87)	(1.87)
F-test of excluded instruments	6.50	7.40
	[0.0025]	[0.0020]
Second Stage: *Norm_RelWgt*		
USD_share	0.244**	0.220*
	(0.074)	(0.076)
Trade	8.031**	7.698**
	(1.864)	(2.118)
RegCR		0.030
		(0.045)
Fin_Open	0.034	0.035
	(0.030)	(0.030)
CAB	0.005	0.016
	(0.074)	(0.077)
Yield	-0.031	-0.038
	(0.155)	(0.165)
Growth	0.110	0.106
	(0.102)	(0.105)
USi10	-0.320	-0.340
	(0.496)	(0.520)
VIX	-0.057*	-0.063*
	(0.023)	(0.022)
Fixed Effects	country	country
R^2 *(within)*	0.45	0.45
# countries	15	15
N	132	132