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Currency Matters: Analyzing International Bond Portfolios

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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 in a single data point bonds of various currencies. 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 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 strong evidence that 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.

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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. And it is well understood that the currency denomination of a country's bond market has important implications—not the least, financial stability implications—for the local economy. Today it is difficult to imagine new research on the *structure* of bond markets not featuring information on and assessment of the currency denomination of the underlying bonds.[1] Knowledge of currency denomination is vital for analysis of the structure of bond markets.

However, currency denomination has been largely absent from analyses of international investment in bonds. Any analysis that uses the IMF's CPIS data on positions (see, among others, Lane (2006) and Fidora, Fratzscher and Thimann (2007)) or the IMF's BOP data on flows necessarily combines bonds of various currencies, as these widely used datasets do not differentiate bonds by currency denomination.[2] Many papers analyze bond flows—from the classic Chuhan, Claessens, and Mamingi (1998) to the more recent Fratzscher (2012), Fratzscher et al (2016), IMF (2011), Lim, Mohapatra, and Stoker (2014), Cerutti, Claessens and Puy (2016), and Chari, Dilts and Lundblad (2016)—without differentiating by currency denomination. In fact, we know of no analysis of international bond *flows* that differentiates by currency denomination, and for good reason: Most datasets on cross-border bond investment do not distinguish the currency of the underlying bond.

[1] Recent papers on the structure of bond markets that incorporate information on the currency denomination of bonds include Du and Schreger (2016) and Hale and Spiegel (2012), 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).

In this paper we use *positions* data to show that bonds denominated in the investor's currency are special. Our main points can be made from simple regional graphs. Figure 1 shows, for different regions' bonds, U.S. investors' relative weight: the weight of a region's bonds in US portfolios relative to their weight in global markets. Relative weight is a home bias measure; a relative weight of less than 1 means the investors (in Fig. 1, U.S investors) are underweight the region's bonds. Our main points are as follows:

1. *Investors greatly underweight foreign currency bonds, but their weights on foreign bonds denominated in the investor's currency are much closer to market weights.* In Figure 1, U.S. investors' relative weights are very low (in some cases near zero) on the local currency bonds of both advanced economies (AEs) and emerging market economies (EMEs). But they are quite high on foreign countries' USD-denominated bonds. Indeed, for some regions' USD-denominated bonds U.S. investors have 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.* The top right chart in Figure 1 shows differences in the share of each regions' bonds that are denominated in U.S. dollars. Latin America and "EME Other" issue a higher share of their bonds in dollars than EME Asia and the Eurozone and other AEs.[3]

3. *Combined, the above two points suggest that when analyzing countries' bonds using data that does not differentiate by the currency composition of the underlying bonds—that is, most off-the-shelf flows and positions data—foreign investment will be greatest in countries that issue a greater proportion of their bonds in foreign investors' currencies.* The bottom right chart in Figure 1 shows U.S. investors' relative weight on all bonds from each region (i.e., without differentiating by the bonds'

[3] 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.

currency denomination). Relative weight is higher in the two regions that tend to issue more USD-denominated bonds: Latin America and EME Other.

Not taking into account the currency composition of a country's bonds can taint analysis, with very different asset classes combined into one series. We show this more formally, but indirectly, in a global bilateral dataset of holdings—indirectly because the global dataset does not differentiate by currency denomination—and then more directly in two datasets of US holdings of foreign bonds that do differentiate by currency.[4] 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. This suggests that currency denomination is an important factor behind the home bias in international bond portfolios and, coupled with the Edison and Warnock (2004) results on the effects of cross-listing on equity portfolios, that home bias is at least in part a *home currency bias*.

We start with a global bilateral bond holdings dataset: the IMF's CPIS dataset. 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 is 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 that are denominated in the investor's currency is included as a control, another established result is 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

[4] 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).

hedging costs are related to volatility in this set of countries and higher hedging costs make cross-border investment less attractive. But the main takeaway from the CPIS analysis is that when observing cross-border bond holdings for which the currency denomination of the underlying bond is not identified, we cannot distinguish between a preference of one country's investors for another country's bonds versus a propensity of a destination country to issue bonds in the investor's currency.

We then turn to analysis of US investment data that differentiate by the bond's currency denomination. Two observations are immediately evident. First, 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 foreign currency bonds exhibit the familiar home bias. Second, in regressions that include the bonds of all currencies, the share of existing bonds that is denominated in the investor's currency is highly significant (*t*-stats above 10). To the extent that investor-currency bonds and bonds denominated in other currencies are fundamentally different to investors 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. Studies using such data that do not include a measure of the currency composition of existing bonds (specifically, the share of existing bonds that is denominated in the investor's currency) seem to be omitting an important variable.

Separating bonds by currency denomination provides more insight. In a sample including 40 countries and spanning 2006 to 2011, US investment is indeed higher in the bonds of countries with stronger regulator quality and creditor rights, and countries with greater trade linkages with the US have more US investment in both local currency and USD bonds. The effects of other factors differ by the currency denomination of the underlying bonds. For example, 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 countries with larger current account deficits. Further analysis shows that this result pertains specifically to AE bonds and that the opposite effect holds for EME bonds: US investors are more concerned about the potential financial instability associated with a current account deficit in emerging economies relative to advanced economies. The effect of US long rates is rather consistent in EMEs—for example, the lower are US Treasury yields, the greater is US investment in EME local currency and USD bonds—but for AE bonds is much less pronounced (and limited to local currency). In summary, empirical results differ substantially by the underlying bond's currency denomination.

For more updated analysis (2006 to 2015) we are limited to a sample of 15 EMEs. Again, the share of the country's bonds denominated in USD and regulatory quality and creditor rights are important factors associated with US investment in EME bonds. And, again, the effect of other factors differs by currency denomination; for example, trade linkages and openness are more important for US investment in USD-denominated bonds. Interestingly, in this 2006 to 2015 EME sample, if bonds of all currencies are included, one would conclude that US interest rates do not matter. Splitting by currency denomination shows, however, that low US rates are associated with significantly more investment in EME local currency bonds, but not in USD 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.

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 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.[5]

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 dataset on bonds changed materially in 2012, so we first describe the old dataset that went through 2011 and then the new dataset.

2.1 The Old BIS Bond Data

The old BIS bond data came in two complementary datasets. One dataset was on "domestic debt", which the BIS defined as local currency bonds issued by locals in the local market (i.e., not placed directly abroad). Data were available in BIS Quarterly Review Table 16A (Domestic Debt Securities). To focus on bonds (that is, debt securities with original maturity longer than one year), one must obtain from BIS the data underlying Table 16A, which enables the separation of short-term notes and commercial paper from bonds.[6]

[5] 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.

[6] 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).

The complementary piece of the old BIS bond dataset was data on "international bonds", bonds issued either in a different currency or in a different market. Certain aggregates of this were presented in BIS Quarterly Review Table 14B (International Bonds and Notes by Country of Residence), but the underlying data must be obtained from BIS in order to identify issuance by currency and country, a split not presented in the Quarterly Review.

Combined, the old "international bonds" and "domestic debt" (separating the short-term from the long-term) datasets formed a complete picture of the outstanding stock of long-term debt securities issued by a country's government and private sector.

Using the old BIS dataset, Table 1 shows our calculations of the size and currency composition of bond markets in 25 AEs and 23 EMEs for two years (2001 and 2011), data analyzed in Burger and Warnock (2006) and Burger, Sengupta, Warnock, and Warnock (2015). A number of salient facts emerge from the table. In dollar terms, at the end of 2011 the global bond market (defined by this set of 48 countries) was $82.5 trillion ($75.9 trillion in AEs, $6.7 trillion in EMEs), almost triple the $30 trillion in 2001. The local currency portion of these bond markets grew faster than nominal GDP in 24 of the AEs (all but Switzerland) and just over half the EMEs, and 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 are, as a percent of GDP, much larger in AEs (161% of GDP) than in EMEs (29% of GDP) but have 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 are less reliant 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 to the point where only one quarter of bonds in the region were issued in foreign currency.

2.2 The New BIS Bond Data

BIS methodology changed in 2012 (see Gruić and Wooldridge 2012) and the newer data might not be consistent with the historical data, so analysis of the old dataset ends in 2011. The new dataset comes with some history (as much as reporting central banks provide) and data quality might be improved along some dimensions, but it is also much more limited in terms of practical country coverage. The limitation comes not from the "international bonds" portion, which is largely as in the old dataset described above. Rather, the practical limitation of the new dataset stems from the fact that many countries' central banks have opted to combine domestic and international debt into one number when they report data to the BIS, so information on currency composition is lost, and some other countries do not split domestic debt by maturity.[7]

For analysis that explicitly requires splits on currency and maturity—a split that used to be readily available because the international portion was built up from security-level data and the domestic portion was separated by maturity and by definition denominated in the local currency—the new dataset is limiting. In the current dataset, only 9 AEs and 18 EMEs provide the BIS with information on domestic debt securities by residence, sector of issuer, and original maturity. Large countries that have to be omitted from analysis of the currency composition of bonds include Brazil, China and all euro currency countries; for these and some other countries the new dataset either presents domestic and international debt as one number or does not contain information on the split between short-term and long-term domestic debt instruments.

Given the change in BIS data, one strategy is to use the old dataset when one requires broad country coverage, as the old dataset splits data by currency and maturity for 25 AEs and 23 EMEs. Unfortunately, that dataset ends in 2011, precluding analysis of more current years. More recent analysis requires the new dataset, but country coverage is greatly reduced. Country coverage is reduced less in

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

EMEs so for now the current dataset might be more useful for analysis of bond markets in EMEs rather than AEs.

Table 2 uses the new dataset to present information on the evolution of EME bond markets from 2009 to 2015. So that the table is consistent, we include only the 13 countries that have complete data for these two dates: 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 the countries included in the table, from 2009 to 2015 local currency bond markets grew from $2289 billion to $3281 billion. 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%.[8] Foreign-currency-denominated bonds for this set of EMEs also increased, from $436 billion in 2009 to $851 billion in 2015, 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, most are USD denominated ($714 billion out of $851 billion in 2015).

Figures 2a and 2b provide information on the size and currency composition of EME bond markets by region. Local currency bond market development—that is, local currency bonds as a percent of GDP as depicted in Figure 2a—increased smartly since 2006 in Asia and Latin America (especially in Chile, Mexico, South Korea, Malaysia, and Thailand). And the local currency share (local currency bonds as a share of all bonds as depicted in Figure 2b) increased in Asian EMEs but peaked around 2010 in Latin America and "Others". Even for those, however, the local currency share, at about 67% on average, is much higher than in 2001 (when it was around 50% for Latin America).[9]

Our summary of the size and currency composition of global bond markets includes a few key takeaways for those studying cross-border investment in bonds and capital flows. First, global bond

[8] According to data from McKinsey Global Institute, at the end of 2015, the size of global bond markets was $95 trillion.
[9] 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.

markets have grown impressively over the past 15 years and EME bond markets have increased their global market share. Second, within EMEs the vast majority of bonds are now local currency denominated, although there has been a recent increase in foreign currency denominated bonds. Finally, with rapid growth in both local and foreign currency bond markets (and varying shares across countries), it is likely important that researchers properly account for the currency denomination of bonds when studying cross-border investment.

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

Most capital flow 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—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 "double fixed effects" regressions a la Lane and Milesi-Ferretti (2008) and Fidora, Fratzscher and Thimann (2007). The question we ask: Is the currency composition of outstanding bonds an important factor to consider when analyzing bilateral international bond investment?

First, we will lower expectations for this section. Our aim in presenting results from the global CPIS dataset of bilateral holdings is not to be comprehensive or even current, primarily because of limiting features of the bilateral CPIS dataset. One prominent problem is with countries whose residents tend to use non-resident intermediaries. Table 3 depicts, using 2006 CPIS data, what is by now a well-known manifestation of this problem. Eurozone countries whose residents tend to use foreign (in this case, Luxembourg) intermediaries will show enormous positions in that foreign country. The 2006 CPIS reported that French investors held 122% of the Luxembourg equity market, Germans held an additional

329%, Italians held another 381%, and in sum Eurozone residents held 1201% of the Luxembourg market. Obviously this cannot be true, and it is not. Reported foreign holdings are greater than the stock of existing Luxembourg equities because the CPIS counts as "equities" the cross-border holdings of mutual funds, which is both technically correct and, for the purpose of mapping bilateral international investment, misleading. Felettigh and Monti (2008) "pierce the veil" of this 3rd country mutual fund effect, focusing on Italy's international investment, and find 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 are actually in bond funds. Felettigh and Monti (2008) do not provide much insight into where those bond funds are invested, but their reasonable guess is that much is in US bonds, German bonds, Japanese bonds, and the bonds of many other countries (and perhaps even some in Luxembourg). The point is that just omitting financial centers, a common fix implemented by Lane and Milesi-Ferretti (2008) and virtually anyone else who uses bilateral CPIS data, is insufficient because for countries for whom residents tend to use non-resident intermediaries, much of what is labeled as equities in the CPIS may well be bond investment.

That is a long (but accurate) argument that backs up one choice we make: Because of its limiting features, we examine just one particular cross-section of CPIS data from 2003, rather than attempting to collect more recent data (or analyzing a panel). This choice is reasonable because the period is roughly the same vintage as 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." And so will we.

Following Lane and Milesi-Ferretti (2008) and Fidora et al (2007), we include a full set of host 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. For bilateral variables we include two highlighted in the literature: *Volatility*, emphasized in Fidora, Fratzscher and Thimann (2007), calculated here as the standard deviation over a 10-year period of bilateral exchange rate changes, and *Real 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 (Table 4, column 1), real linkages are very important. The greater trade is between two countries, the greater are bilateral bond holdings; this was the main finding, albeit in an equity setting, of Lane and Milesi-Ferretti (2008). The share of the destination country's bonds that are 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; we note that 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 (that is, "AE source", shown in columns 2-4) illustrates (again) that real linkages and the currency denomination of bonds are very important. And it is only for one slice of the dataset—AE source/AE destination country pairs (col. 3)—that volatility is negative and significant; perhaps hedging costs are related to volatility in this set of countries and higher hedging costs make cross-border investment less attractive. Finally, turning to regressions limited to EME sources (columns 5-7), real linkages and, to a lesser extent (in a statistical sense) the currency composition of bonds are important; exchange rate volatility is only marginally significant in one slice (EME source/EME destination), and there it is positive rather than negative.

One possible interpretation of the results from Table 4 is that when observing cross-border bond holdings for which the currency denomination of the underlying bond is not identified, we 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 AE source countries. 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 should be able to. 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.[10] See the actual surveys (for example, Treasury Department et al. 2002, 2009) 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, the number for international bonds in the Bureau of Economic Analysis's International Investment Position report is formed by aggregating the survey's security-level information).

[10] 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 ringit 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 the all bonds (i.e., issued by government and private entities) of many countries and is available through time.

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 2005 (see, for example, Table A.6 of Treasury Department et al. 2009). This provides our measure of US holdings of local currency bonds. For foreign currency bonds we limit our analysis to USD-denominated bonds, which is reasonable since 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.

Focusing on US investors' cross-border bond holdings is limiting 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. 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 since 2006.

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 outstanding dataset has better coverage for EMEs. As a preview, Figure 3 presents the stark contrast between the currency composition of EME bonds outstanding (top graph) and the holdings of US investors (bottom graph). EME local currency bonds are far more prevalent than foreign currency bonds, but US investors' EME bond portfolios are primarily USD-denominated. 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 during 2006-2015 is widespread across regions, and over the same period US investors dramatically increased their holdings of USD-denominated bonds from Latin America.

The contrast between the structure of EME bond markets and the composition of US investors' EME bond portfolios depicted in Figure 3 means that, relative to market-based weights, US investors will be more 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. Figure 4a is not drawn to highlight any particular country, but rather to show that relative weights for USD-denominated bonds are quite different from those for local currency bonds. Figures 4b and 4c split by region to better reveal country details.

A relative weight of 1 indicates 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. US investors' relative weights on EME local currency bonds (bottom graph of Fig. 4a) are all below one; this is the familiar home bias in international portfolios. However, relative weights on EME USD-denominated bonds (top graph) are quite high. For Latin American USD-denominated bonds, US investors have an overweight position, providing one of the rare instances in which there is no home bias.[11]

4.2 A framework for analyzing bonds denominated in the investors' currencies and other currencies

[11] 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: U.S. relative weights are substantially higher for USD-denominated bonds in every region, including AE countries.

The relative weight graphs in Figure 4 have implications for the analysis of cross-border bond investment. Bonds denominated in the currency of the investor are fundamentally different than bonds denominated in other currencies. To the extent that investor-currency bonds and bonds denominated in other currencies are fundamentally different to investors 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 will analyze 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 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*.[12] Relative weight (depicted in Figures 1 and 4) is 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:

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

[12] 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.

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 portfolio weight assigned to a particular bond market equals its weight in the global bond market, the relative weight for that 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—because over 90 percent of US investors' bond holdings are issued by US entities. That said, as Figure 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:

$$norm\,RelWgt = \frac{\omega_{i,US}}{\omega_{i.m}} / \frac{\omega_{US,US}}{\omega_{US.m}} \qquad (2)$$

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

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). Other explanatory variables include country-specific "pull" factors—such as yield[13] (to proxy for expected return), macroeconomic indicators (GDP growth rate and current account balance), institutional variables, and a proxy for the openness of a country's bond market to foreign investment—and the following global "push" factors: the volatility index VIX (which measures variation in expected volatility and risk appetite, the 10-year US Treasury rate (to capture a "reach for yield"), and a Rogers, Scotti and Wright (2016) measure of unconventional monetary policy (UMP) shocks.[14] 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 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. The share of a country's bonds denominated in USD, *USD_shr*, is included because it is the focus of our analysis; it is calculated just as it sounds.

The macroeconomic indicators included 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

[13] 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.

[14] Rogers, Scotti and Wright (2016), which updates Rogers, Scotti and Wright (2014), utilize 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 negative of the Rogers et al (2016) shocks to the 10-year Treasury yield (negative so that our UMP shocks are interpreted as expansionary monetary policy shocks).

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.[15] Originally ranging from 0 to 100, we recast to 0 to 1 for the readability of regression coefficients.

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) 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). We also recast *Fin_Open* to range from 0 to 1.

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

Tables 5a and 5b present coefficient estimates calculated using panel-feasible generalized least squares (FGLS) allowing for heteroskedastic error structures and country specific autocorrelation coefficients.[16] The dependent variable is normalized relative weight (as defined in equation 2) for the

[15] 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.
[16] Destination country autocorrelation coefficients allow for persistence in US portfolio weights.

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 labelled "All Currencies" 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.

The first two columns of Table 5a show that the factors associated with greater US investment in foreign countries' USD-denominated and local currency bonds differ substantially. Yes, some factors have similar impact; the coefficients on real linkages, regulatory/creditor rights, and VIX are significant and have the same signs in both columns (1) and (2). But the coefficients of all other variables differ in significance, sign, or both. For example, countries with higher yields and 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 countries with larger current account deficits.

In the third column of Table 5a, bonds of all currency denominations are included, as would be the case with any analysis of BOP-based bond flows or CPIS data. The results differ materially from those in columns (1) and (2). In the background of column (3) 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. We control for the latter in column (4) using the variable *USD_shr*, whose coefficient is positive and, with a *t*-stat of more than 10, more significant than any other coefficient in the entire table. Studies in which the capital flow or international investment variable includes bonds of different currency denominations but does not include a measure of the currency

composition of existing bonds (specifically, the share of existing bonds that is denominated in the investor's currency) seem to be omitting an important variable.

We note that when using data that combines bonds of all currency denominations and not controlling for the currency composition of recipient countries' bonds (column 3), the story that emerges is that real linkages, less capital controls, more positive current account balances and high yields all matter to US investors. That seems to provide a comfortable story—greater linkages, stronger fundamentals and higher yield are associated with more US investment—but in this sample just controlling for the share of a country's bonds denominated in the investor's currency (col. 4) undoes these results. So, which specification is appropriate, col. (3) or (4)? Col. (4) seems to be the more appropriate of the two—col. (3) omits a variable that has a *t*-stat of 17—but both mix very different asset classes, and each recipient country supplies a different mix of those assets.

Table 5a shows that factors determining cross-border investment in local currency bonds and USD bonds appear to be quite different. Table 5b provides further evidence but this time also splitting by type of destination country, AE and EME, and sheds more light on some results. For example, the result in Table 5a that US investment in USD bonds is higher in countries with larger current account deficits is an AE result (col. 5). For EMEs, the result is opposite: US investment is higher in the USD bonds of EMEs with stronger current account balances (col. 9). The contrast in the estimated current account coefficients suggests, intuitively, that US investors are more concerned about the potential financial instability associated with a current account deficit in emerging economies relative to advanced economies.

Turning to results on global factors (in particular the bottom portion of Table 5b), we find that lower US long rates affect investment in EME bonds—the lower are US Treasury yields, the greater is US investment in EME local currency and USD bonds—but the effect is much less pronounced for AE bonds (and limited to local currency). Although we do find evidence of a traditional "reach for yield"

where lower US rates increase cross-border allocations, there is only limited evidence that US unconventional monetary policy shocks result in more investment in foreign bonds: UMPs that lowered US long rates increased US investment in EME USD bonds, decreased it for EME local currency bonds and were insignificant for AE bonds.[17]

Overall, results in Table 5 indicate that data on the currency composition of the underlying bonds allows a finer analysis, and aggregates can be misleading. In particular, we find that the role of country specific factors varies depending on the currency denomination of the bonds. We turn next to similar analysis using a more current EME sample.

4.4 The More Current EME Sample

As noted above, 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 6). As in Table 5, the coefficient on the share of the country's bonds denominated in USD is positive and highly significant (*t*-stat is 11). Among local factors, trade linkages and regulatory quality and creditor rights are positive and significant in all specifications in Table 6, but the effect of other local factors differs by currency denomination. 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, especially in column 3, one would conclude that US rates do not matter: the coefficient on

[17] We also estimated, but do not tabulate, Table 5 regressions with time fixed effects instead of the global factors. *USD_shr* remains positive and highly significant for all samples (i.e., All Countries and the AE and EME splits). The main changes are that *ER_Vol* is positive and significant in all but column (11) and *Trade* loses some significance in the AE sample. The time FEs 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 FEs for USD bonds tend to be negative.

US 10-year yields is insignificant and UMP has a counterintuitive sign. But results in columns 1 and 2 indicate that low US rates are associated with significantly more investment in EME local currency bonds (but not in USD bonds). Interestingly, US unconventional monetary policy shocks are associated with less US investment in EME bonds (whether local currency or USD), something we return to below.[18]

5. On 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 in the investment data, as it was for the USD and Local Currency columns of Tables 5a, 5b and 6. But often investment data does not include information on currency denomination. For analysis of data that include 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, Klingebiel and Schmukler (2007), which found that the foreign currency share was higher in smaller countries with smaller banking

[18] It is important to note, however, 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 would 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.

systems, less exchange rate volatility and weaker institutions.[19] With the exception of institutional quality, these variables are good candidates to use as instruments for *usd_share* in our Relative Weight analysis, as they do not impact relative weight but have been shown in the literature to impact foreign currency share. We also include as an instrument a global variable that had a counterintuitive effect in Table 6: US unconventional monetary policy shocks.

Table 7 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 of instruments suggest 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's pushed down US long rates EMEs' USD issuance increased.[20] 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 7, 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.

[19] 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 is cheaper to issue.
[20] In column (2) we exclude as an instrument the one variable that plausibly affects Relative Weight, *RegCR*; results are similar.

Table 7 also sheds light on some results from Tables 5 and 6. In Table 6, US UMPs were associated with lower US relative weights. Table 7 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, US investors must have taken less than usual (the Table 6 relative weight result). Table 7 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 6 it sometimes is negative and significant in All Currencies regressions. A plausible explanation, supported by Table 7 results, is that *ER_Vol* explains the mix of a countries bonds, which in turn influences US investment, but not the attractiveness of any particular bond: 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 which 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 they will have a difficult time determining 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 dataset where currency denomination is available suggests that the determinants of cross-border bond investment vary significantly by currency. Although some variables such as trade linkages, 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*. This is easily 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. And one could 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). Future work might reveal if the propensity to hold investor-currency bonds is actually associated with reduced risk.

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Data Appendix

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

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. Recently 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 local currency bonds is 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. (2002, 2009) or the Griever, Lee, and Warnock (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 5-7, 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_shr is calculated as the share of a country's bonds denominated in US dollars.
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 is 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 for the entire period. 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) and Israel (which is not in the Markit sample). In constructing our financial openness measure we assume there are no impediments to investment in 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).

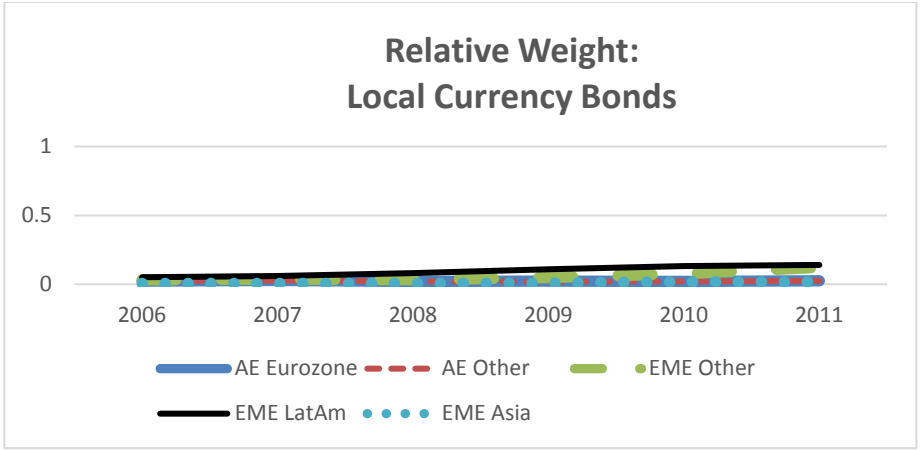
Global variables *VIX* and *USi10* are averages of monthly observations of the CBOE volatility index and 10-year US Constant Maturity Treasury rate, respectively. *US_UMP* is the sum of the Rogers, Scotti and Wright (2016) monetary policy shocks to the 10-year rate, which are constructed such that a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

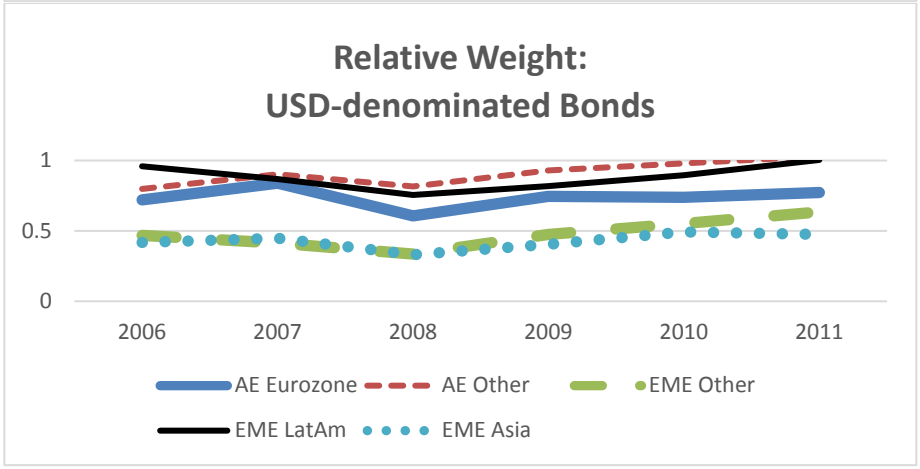
Additional instruments in Table 7 include *Country Size* (log of nominal GDP) and *Deposits* (bank liabilities as a share of GDP).

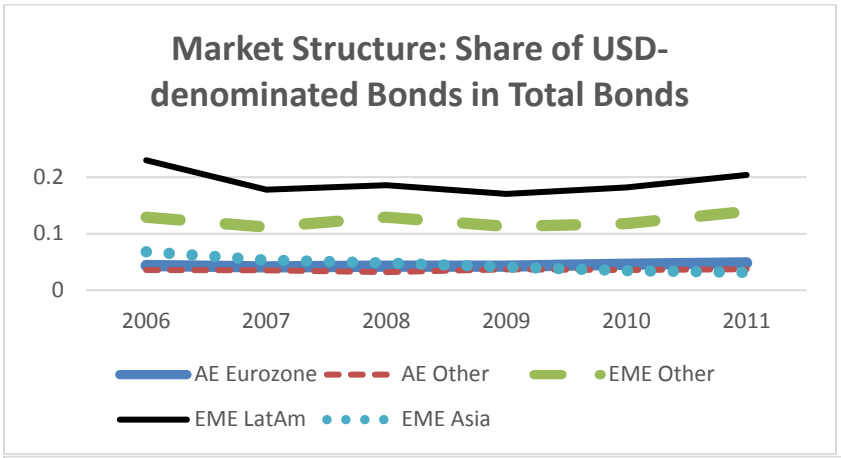
Country Groupings

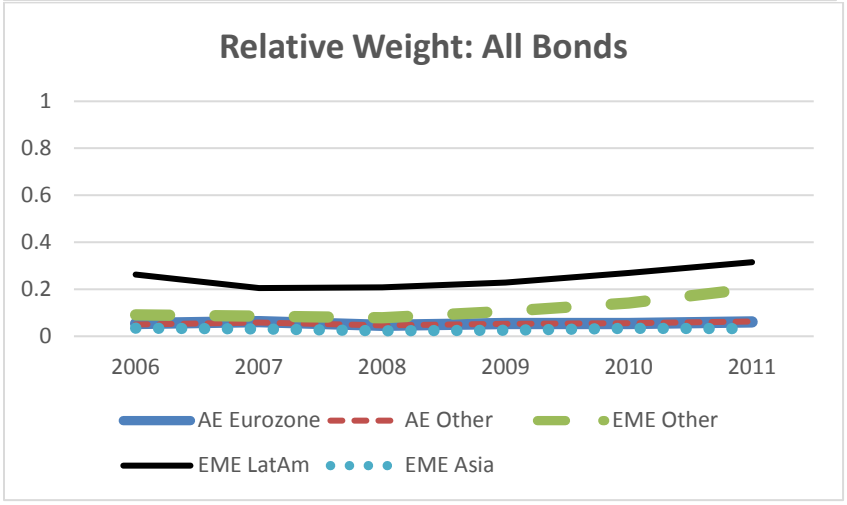
The groupings of "advanced economies" (AEs) and "other emerging market and developing countries" (shortened here to emerging market economies or EMEs) generally follow IMF classifications as of April 2013 (http://www.imf.org/external/pubs/ft/weo/2013/01/pdf/statapp.pdf). In our narrow more recent sample 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



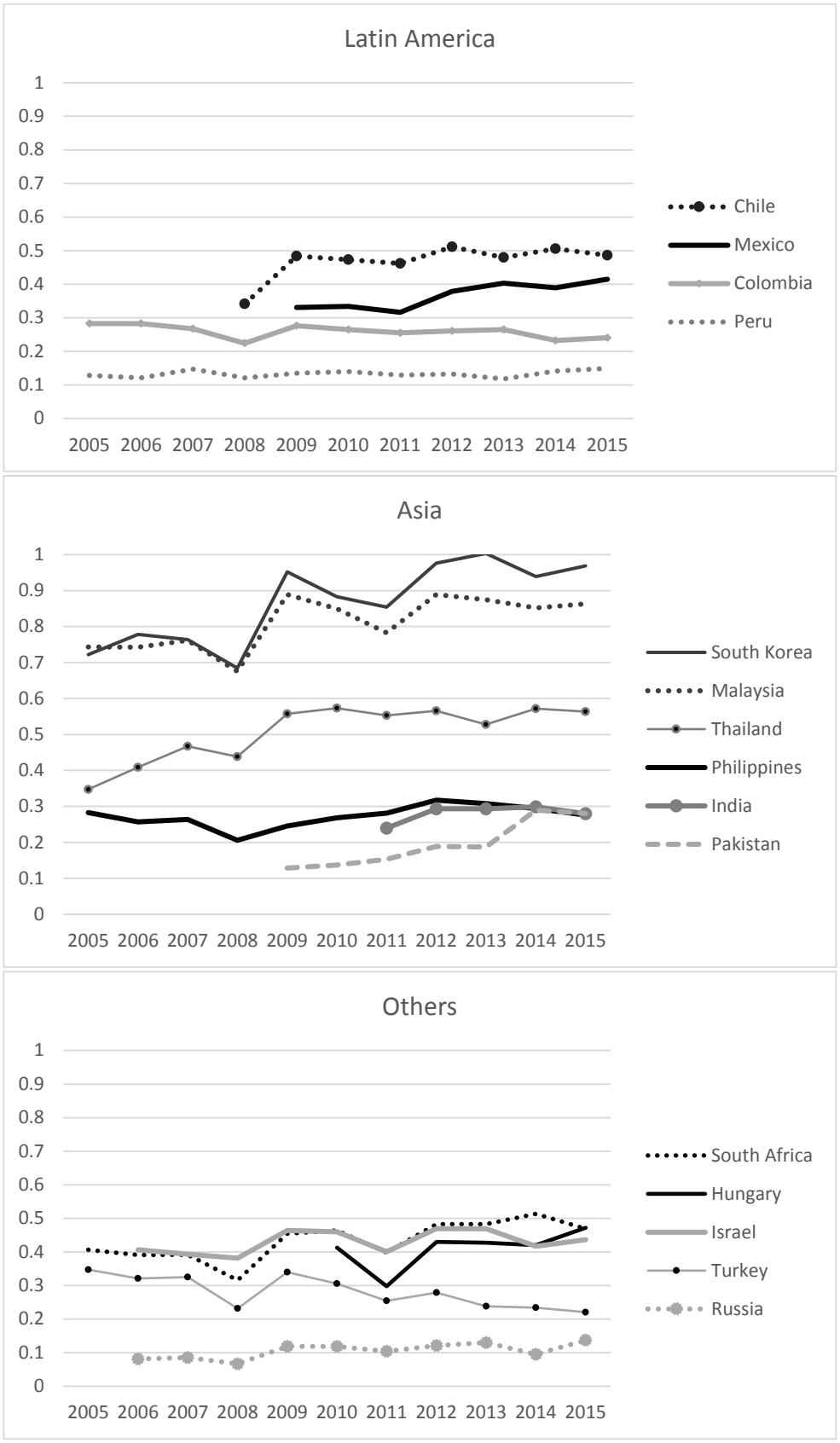






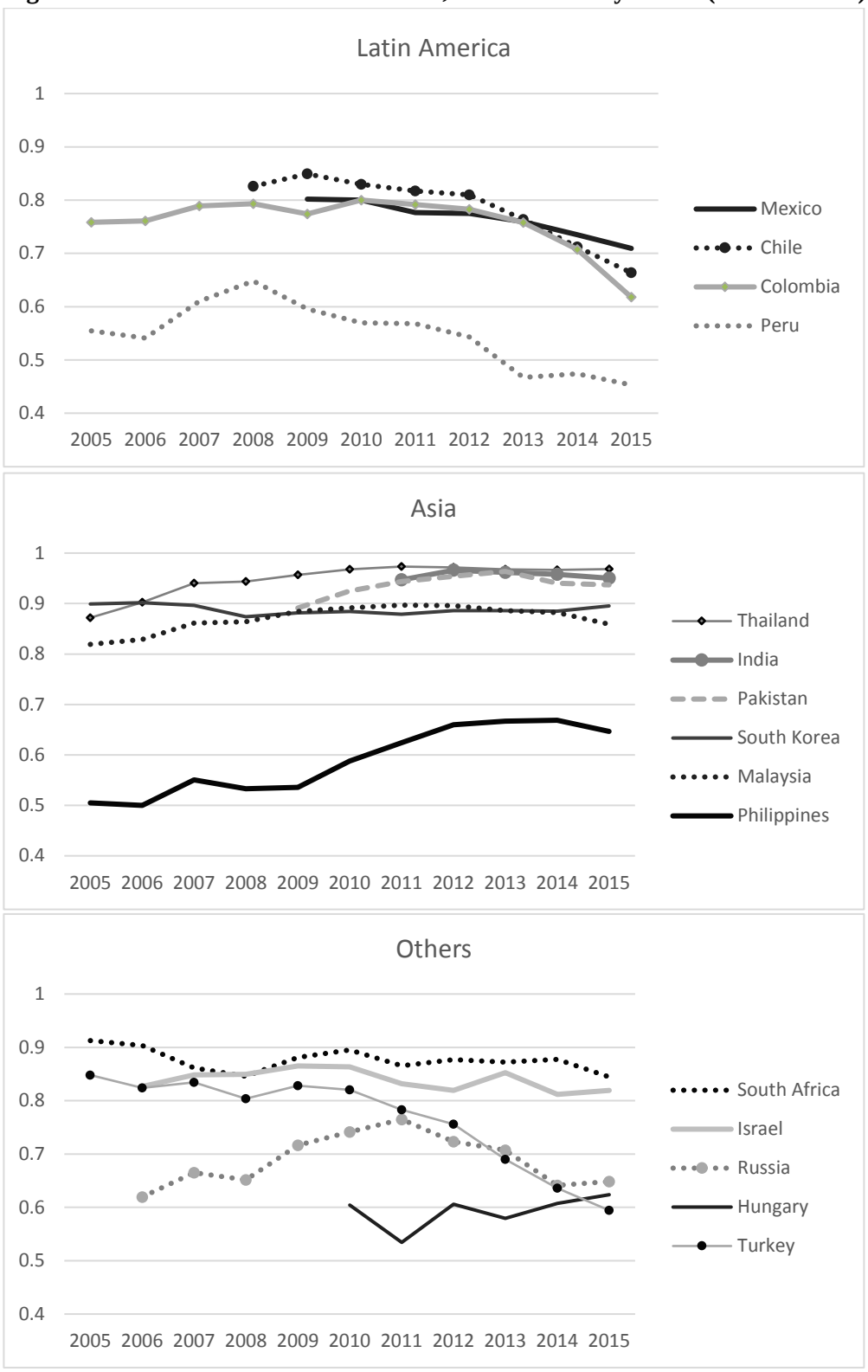
Note: Relative Weight is a country's bonds share in US portfolios relative to their share in global markets. A relative weight of less than 1 means US investors are underweight the country's (or region's) bonds.

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



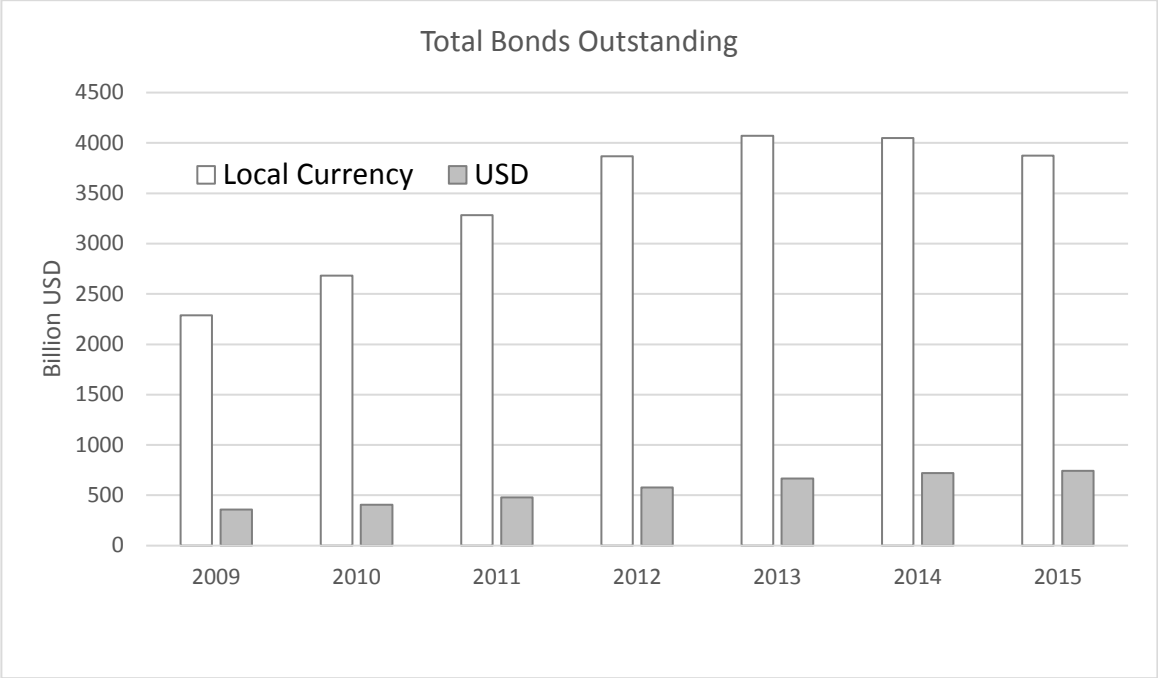
The figures depict the size of local currency bond markets (expressed as a share of GDP).

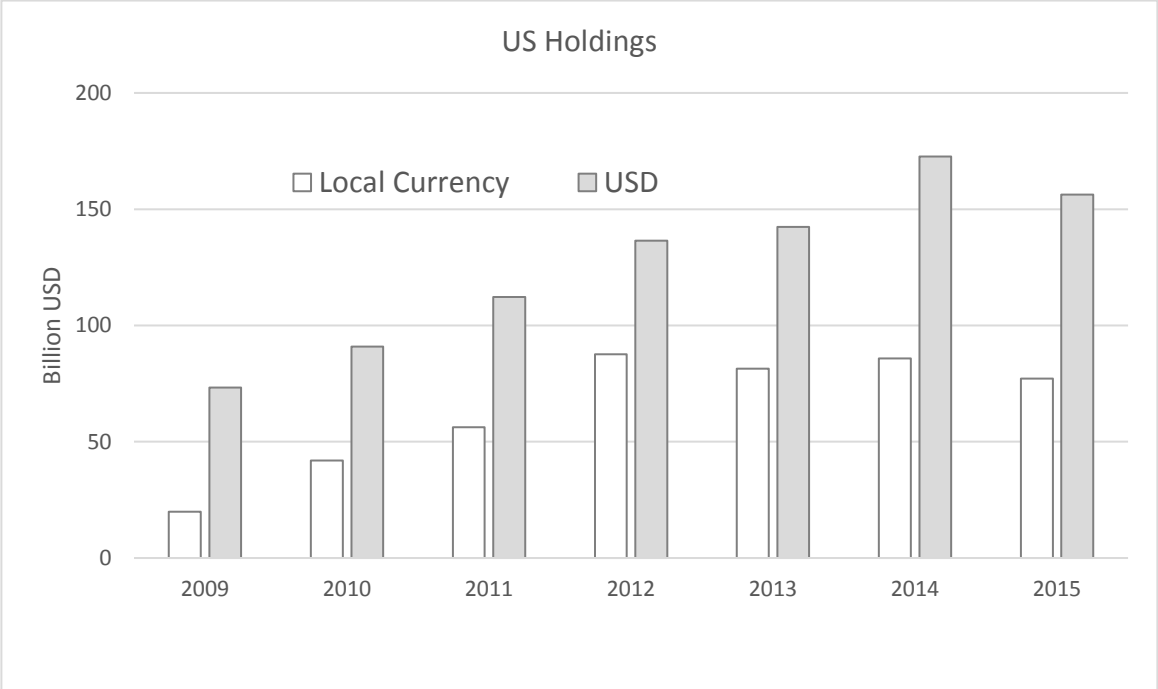
Figure 2b. EME Bond Market Structure, Local Currency Bonds (share of total)



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

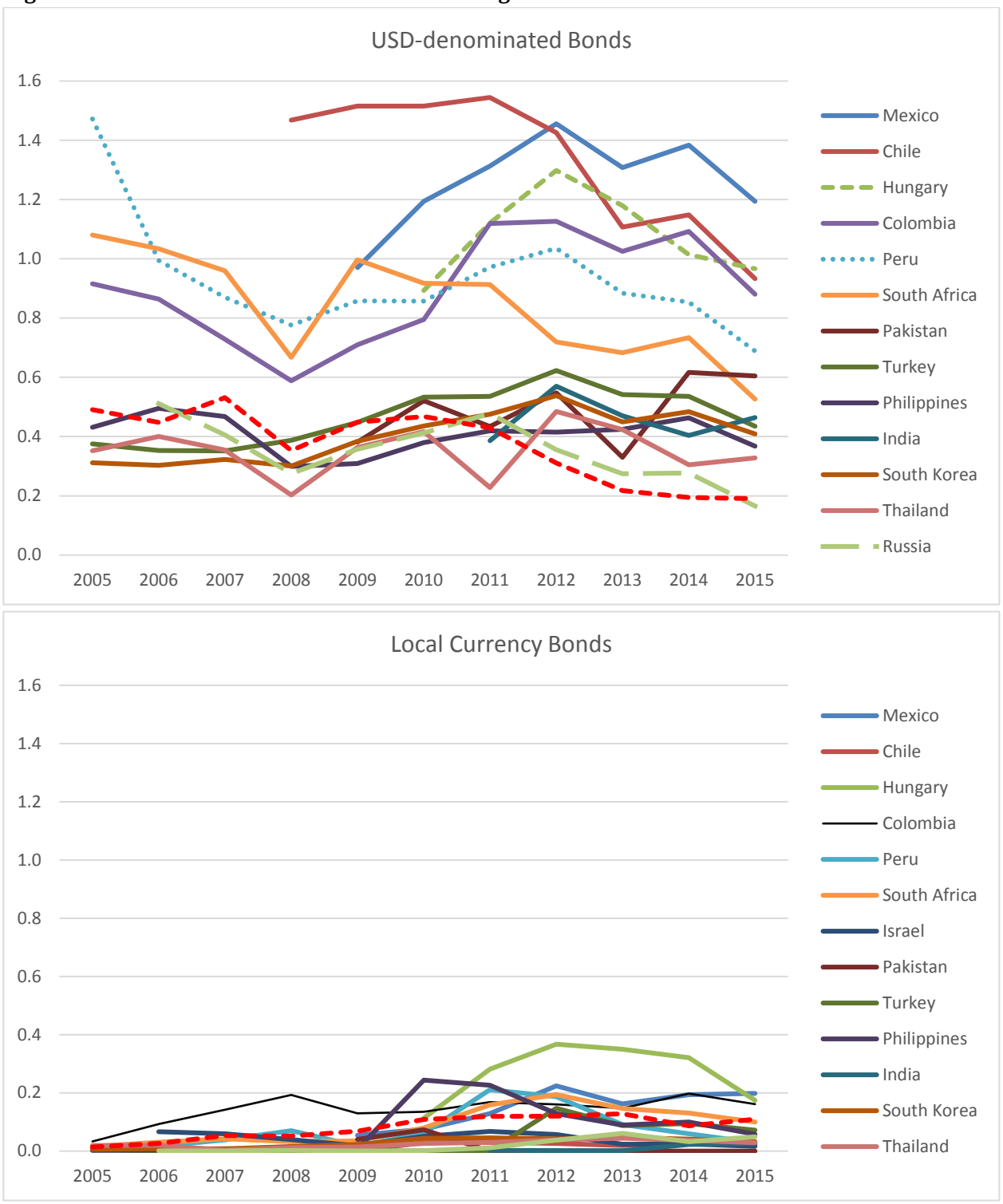
Figure 3. EME Bonds by Currency Denomination





Note: 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



Note that 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; its relative weight is off the chart at roughly 4.

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

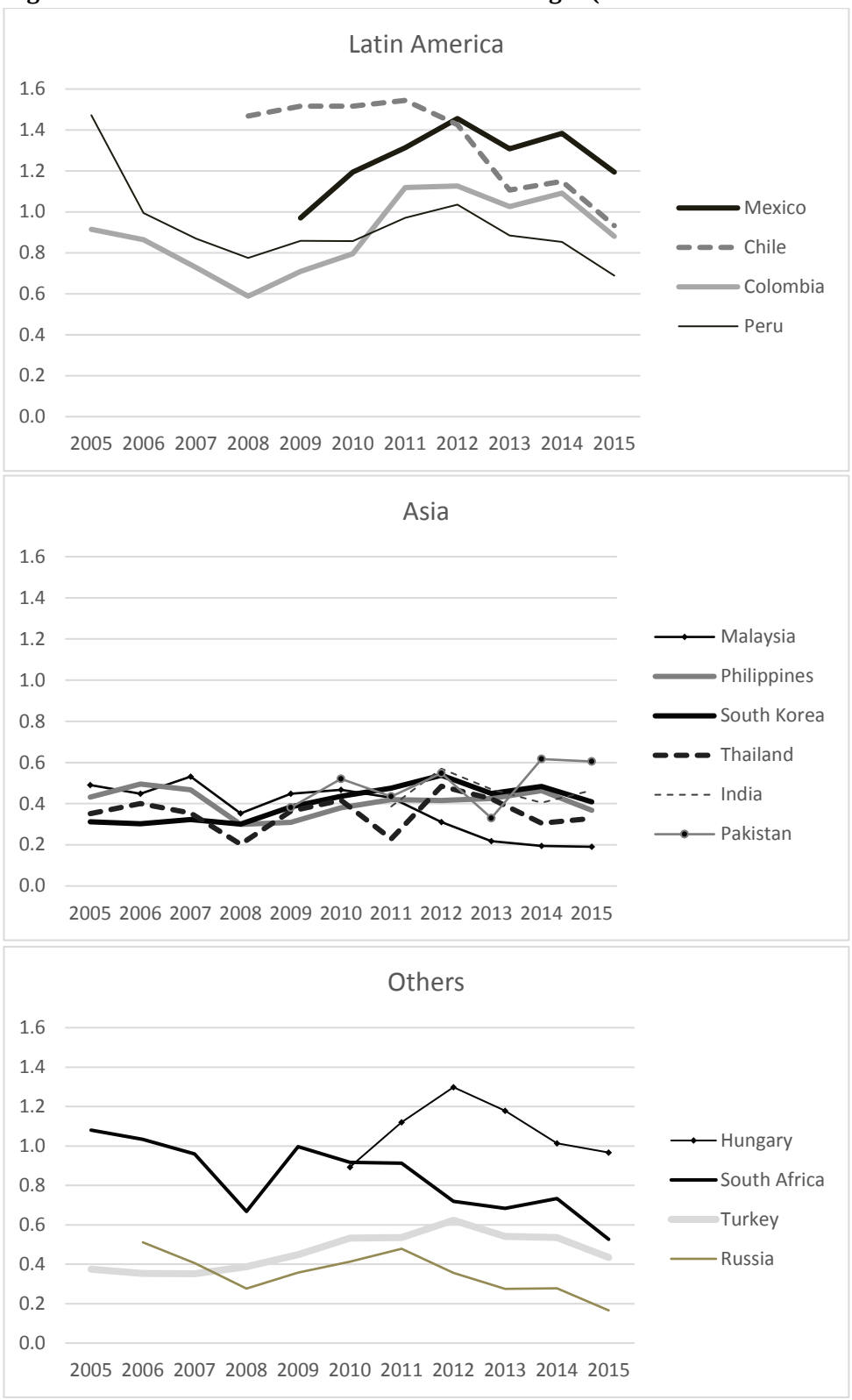


Figure 4c. US Investors' Relative Investment Weight (local currency bonds, country details)

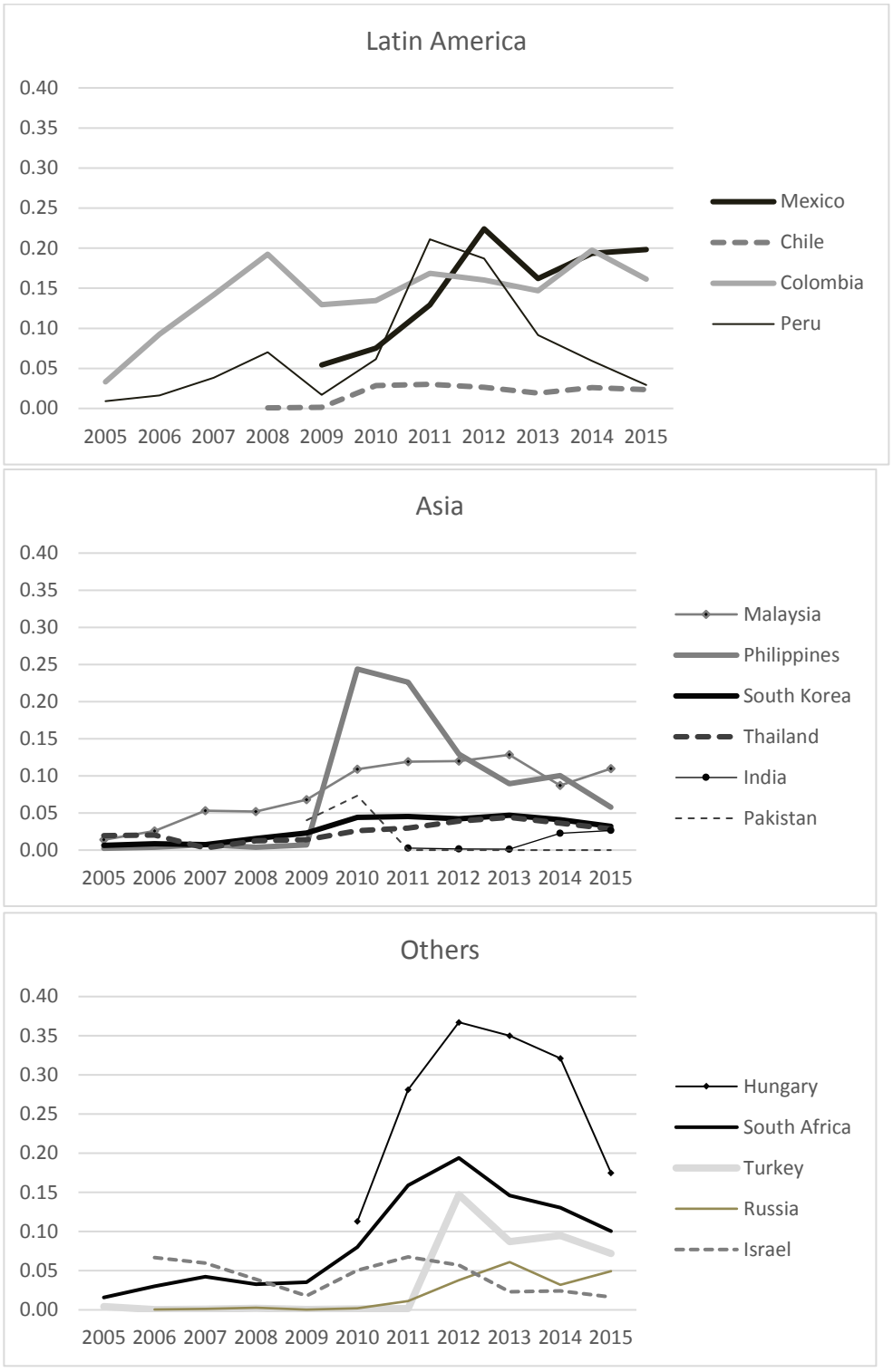


Table 1. Bonds Outstanding

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 23 EMEs, as well as the amount of local currency denominated bonds expressed as a percent of GDP and as a percent of total bonds. Source: Authors' calculations from BIS data.

	Total	Local Currency Denominated			
		2011		2001	
	US $ Billions	% of GDP	% of Total	% of GDP	% of Total
AE	**75,883**	**161**	**91**	**105**	**93**
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
U.S.	**29,409**	**191**	**97**	**131**	**98**

	Total	Local Currency Denominated			
		2011		2001	
	US $ Billions	% of GDP	% of Total	% of GDP	% of Total
EME	**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

Table 2. EME Bond Markets

	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%

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

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.

	% Foreign Portfolio	% Lux 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
Netherlan(	9	66
Portugal	23	8
Spain	33	74
sum		1201
memo: US	0	20

Source: Burger, Warnock and Warnock (2008)

Table 4. Determinants of Bilateral Bond Investment: Global Dataset

Bilateral Variable	All (1)	AE_source (2)	AE_source AE_dest (3)	AE_source EME_dest (4)	EME_source (5)	EME_source EME_dest (6)	EME_source AE_dest (7)
Issuance	0.057***	0.044**	0.064**	0.010**	4.376***	2.046	3.605***
	(0.017)	(0.017)	(0.027)	(0.004)	(1.368)	(1.522)	(1.190)
Linkages	0.672***	0.603***	0.541***	0.095*	0.685***	0.119**	0.990***
	(0.101)	(0.091)	(0.081)	(0.049)	(0.158)	(0.054)	(0.172)
Volatility	-0.155	-0.352	-3.550***	-0.009	0.621	0.517*	-0.165
	(0.231)	(0.382)	(1.062)	(0.093)	(0.559)	(0.292)	(1.704)
R^2	0.74	0.74	0.77	0.47	0.83	0.44	0.86
N	1,271	848	458	390	423	161	262

Depicted are cross-sectional OLS regressions 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 "double 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 real 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.

Table 5. Determinants of US Investment in Foreign Bonds (AEs and EMEs)

The table shows results from panel-feasible generalized least squared (FGLS) regressions allowing for heteroskedastic error structures and different autocorrelation coefficients within countries. Data are annual from 2006 through 2011. The dependent variable is US investors' normalized relative portfolio weight (scaled by 100) for each country's bonds. The sample includes countries listed in Table 1 with the exception of Iceland, Norway, Switzerland, Croatia, Argentina, Pakistan and Philippines, 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 Data Appendix for more details on all variables. Constants are included but not reported. Standard errors are reported in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

A. All Countries

	All Countries USD (1)	All Countries Local Currency (2)	All Countries All Currencies (3)	All Countries All Currencies (4)
USD_shr				0.368***
				(0.021)
Trade	7.395***	0.362**	2.128***	0.298
	(1.314)	(0.181)	(0.308)	(0.371)
RegCR	0.209***	0.059***	0.023	0.036***
	(0.064)	(0.008)	(0.017)	(0.011)
Fin_Open	17.749***	-1.144	3.547**	-0.042
	(5.306)	(0.905)	(1.626)	(1.094)
CAB	-0.675***	-0.011	0.045**	-0.047**
	(0.174)	(0.017)	(0.022)	(0.021)
ER_Vol	0.475	0.113*	-0.021	0.377***
	(0.753)	(0.065)	(0.102)	(0.115)
Yield	-0.125	0.116***	0.248***	0.004
	(0.327)	(0.033)	(0.057)	(0.035)
Growth	-0.751**	0.098***	0.008	0.137***
	(0.321)	(0.038)	(0.060)	(0.052)
USi10	2.829*	-0.921***	-0.739***	-0.541***
	(1.588)	(0.138)	(0.223)	(0.205)
US_UMP	-9.189	0.715	-1.164	0.040
	(10.094)	(0.712)	(1.146)	(1.180)
VIX	-49.954*	-3.647*	-8.446**	-6.613*
	(29.293)	(2.100)	(3.391)	(3.394)
N	231	235	235	235
# countries	39	40	40	40
Wald χ^2	184	200	107	694

b. AE and EME Splits

	AEs USD	AEs Local Currency	AEs All Currencies	AEs All Currencies	EMEs USD	EMEs Local Currency	EMEs All Currencies	EMEs All Currencies
	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
USD_shr				0.400***				0.330***
				(0.034)				(0.030)
Trade	7.735**	-0.210	3.780***	3.450***	8.100***	0.008	1.550***	1.349***
	(3.368)	(0.262)	(0.606)	(0.329)	(1.190)	(0.202)	(0.310)	(0.246)
RegCR	0.475**	0.053***	0.100***	0.089***	-0.052	0.020	-0.046*	0.036**
	(0.215)	(0.011)	(0.026)	(0.023)	(0.059)	(0.017)	(0.025)	(0.018)
Fin_Open					23.512***	-0.554	6.805***	2.659*
					(4.561)	(1.348)	(2.227)	(1.529)
CAB	-2.210***	0.001	-0.010	-0.152***	0.558***	0.008	0.035	-0.031
	(0.451)	(0.016)	(0.033)	(0.027)	(0.152)	(0.040)	(0.046)	(0.031)
ER_Vol	1.467	0.036	0.238	1.006***	1.482***	0.175	-0.493**	0.478***
	(1.888)	(0.074)	(0.161)	(0.289)	(0.561)	(0.136)	(0.211)	(0.129)
Yield	0.286	0.041**	0.074	0.159**	-0.247	0.173***	0.148	-0.126**
	(1.000)	(0.018)	(0.051)	(0.068)	(0.208)	(0.062)	(0.097)	(0.055)
Growth	-0.965	0.140***	0.102	0.184	-0.078	-0.008	-0.277***	0.011
	(0.966)	(0.036)	(0.078)	(0.113)	(0.247)	(0.074)	(0.105)	(0.084)
USi10	7.406**	-0.446***	-0.278	-0.104	-3.818***	-1.105***	-2.111***	-1.455***
	(3.284)	(0.141)	(0.306)	(0.426)	(1.171)	(0.296)	(0.439)	(0.347)
US_UMP	6.068	-0.731	-2.623	-2.775	-14.950**	4.756***	-5.048*	-2.491
	(19.539)	(0.726)	(1.651)	(2.648)	(7.624)	(1.622)	(2.646)	(2.025)
VIX	-17.865	-4.441**	-10.176**	-13.462*	-85.236***	3.126	-26.866***	-19.248***
	(56.495)	(2.167)	(4.942)	(7.476)	(21.716)	(4.630)	(7.811)	(5.896)
N	126	126	126	126	105	109	109	105
# countries	21	21	21	21	18	19	19	18
Wald χ^2	53	67	114	615	166	63	138	467

Table 6. Determinants of US Investment in EME Bonds

The table shows results from panel-feasible generalized least squared (FGLS) regressions allowing for heteroskedastic error structures and different autocorrelation coefficients within countries. Data are annual from 2006 through 2015 and includes 15 EMEs; because of data limitations, some EMEs enter the panel later than 2006. Dependent variables are normalized relative weights for bonds differentiated by currency denomination of the bond (USD or local currency, in columns 1 and 2) or all bonds (columns 3 and 4). Independent variables are as in Table 5; see Data Appendix for more details on all variables. Constants are included but not reported. Standard errors are reported in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

	EMEs USD	EMEs Local Currency	EMEs All Currencies	EMEs All Currencies
USD_shr				0.262***
				(0.023)
Trade	7.359***	1.109*	2.118***	2.603***
	(1.028)	(0.578)	(0.719)	(0.393)
RegCR	0.440***	0.050***	0.095***	0.123***
	(0.070)	(0.012)	(0.022)	(0.020)
Fin_Open	0.209***	0.010	0.030	0.025
	(0.065)	(0.011)	(0.020)	(0.015)
CAB	0.115	-0.029	-0.059	-0.073
	(0.165)	(0.030)	(0.055)	(0.051)
ER_Vol	-0.772	-0.236	-0.709***	-0.523**
	(0.775)	(0.161)	(0.256)	(0.217)
Yield	-0.386	0.073	-0.212**	-0.076
	(0.286)	(0.086)	(0.092)	(0.098)
Growth	-0.253	-0.069	-0.131	-0.144
	(0.312)	(0.076)	(0.114)	(0.103)
USi10	0.000	-0.008***	-0.003	-0.004*
	(0.007)	(0.002)	(0.003)	(0.002)
US_UMP	0.092***	0.010**	0.017**	0.027***
	(0.018)	(0.004)	(0.007)	(0.006)
VIX	0.102	-0.013	-0.003	0.025
	(0.084)	(0.019)	(0.031)	(0.027)
N	132	132	132	132
# countries	15	15	15	15
Wald χ^2	217	71	105	366

Table 7. IV Regressions

The sample is as in Table 6 (annual panel spanning the period 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_shr* 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%, 5% and 10% levels, respectively. Reported in brackets are the p-values for F-tests.

First Stage: USD_shr	EMEs All Currencies	EMEs All Currencies
Deposits	-0.0006**	-0.0006**
	(0.0002)	(0.0002)
ER_Vol	-2.05**	-2.05**
	(0.793)	(0.793)
RegCR	0.128	
	(0.101)	
Country Size	-0.077	-0.077
	(0.047)	(0.047)
US_UMP	-0.069***	-0.069***
	(0.019)	(0.019)
F-test of excluded instruments	6.50	7.40
	[0.0025]	[0.0020]
Second Stage: Norm_RelWgt		
USD_shr	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	-0.003	-0.003
	(0.005)	(0.005)
VIX	-0.057**	-0.063**
	(0.023)	(0.022)
R^2 *(within)*	0.45	0.45
# countries	15	15
N	132	132