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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. 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.

In this paper we use *positions* data to show that bonds denominated in the investor's currency are special. Not taking this into account can taint analysis, with two very different asset classes combined into one series. We show this indirectly in a global bilateral dataset of holdings – indirectly because the

[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.

global dataset does not differentiate by currency denomination – and then more directly in a dataset of US holdings of foreign bonds that does differentiate by currency.[2] 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. Evidently, currency denomination is an important factor behind the home bias in international bond portfolios. This, coupled with the Edison and Warnock (2004) results on the effects of cross-listing on equity portfolios, suggests that home bias is at least in part a *home currency bias*.

We start with an analysis of bilateral bond holdings as reported in the IMF's CPIS dataset. Some results are consistent with the existing literature. For example, bilateral trade is 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 disappears: After controlling for the strong positive impact of investor currency issuance on bilateral holdings we no longer find an impact of exchange rate volatility on cross-border bond investment (counter to Fidora et al. 2007). Splitting the CPIS sample by types of destination and source countries—advanced economies (AEs) and emerging market economies (EMEs)—provides more insight. For example, the exchange rate volatility result reappears if the dataset is limited to AE source/AE destination; perhaps hedging costs are related to volatility in this set of countries and higher hedging costs make cross-border investment less attractive. And the currency denomination of bonds matters most (in a statistical sense) for the combination of AE source and EME destination; bonds issued by countries where hedging exchange rate risk is prohibitively costly (EMEs) are more likely to be held by AE investors if they are issued in the investor's currency. One 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

[2] 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).

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, and this seems especially important when considering AE source countries.

We then turn to analysis of US investment data that differentiate by the bond's currency denomination. Two observations are immediately evident. One, 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. Two, 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; indeed, we show that some results that are quite reassuring—greater linkages, stronger fundamentals and higher yield are associated with more US investment—disappear once we control for the share of a country's bonds denominated in the investor's currency.

Separating bonds by currency denomination provides more insight. In a sample including 41 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. And, finally, macro stability matters in EMEs (regardless of currency denomination), whereas in AEs, most of whom have very low inflation volatility, cross-country differences in macro stability do not matter. 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, trade linkages and regulatory quality and creditor rights are all important factors associated with US investment in EME bonds. And, again, the effect of other factors differs by currency denomination; for example, there is more US investment in the USD-denominated bonds of EMEs with lower inflation volatility, lower yield and more openness, but these are not significant in the local currency regressions. 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.

We demonstrate in this paper that distinguishing the currency denomination of bonds greatly impacts the analysis of cross-border bond investment and our understanding of the home bias. It also has important implications for the literature on financial stability. For example, Obstfeld (2015) evaluates

the capacity of EMEs to moderate the impact of global financial flows and argues that the combination of local currency bond markets and flexible exchange rates provide a potential stabilizing force; this seems likely, but one actually needs to know the extent to which cross-border flows go into local versus foreign currency bonds to assess the viability of this policy prescription.

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 provides a brief analysis of bond issuance, 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.[3]

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

[3] 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.

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 exclusion of short-term notes and commercial paper. Consider, for example, Brazil, where a large proportion of debt securities are short-term; see Leal and Carvalhal da Silva (2008) for a detailed analysis. Using the unpublished data underlying BIS Table 16A enables the researcher to determine that as of end-2011 about $1 trillion of its $1.5 trillion in domestic debt securities were actually short-term (e.g., money market) instruments.

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 $83 trillion ($76 trillion in AEs, $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.[4]

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

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

is limiting. In the current dataset, there are only 9 AEs and 18 EMEs that 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 has data split 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 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%.[5] 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).

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

Figures 1a and 1b 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 1a—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 1b) 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).[6]

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 markets have grown impressively over the past 15 years and EME bond markets have increased their 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

[6] 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.

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 the bilateral CPIS dataset is sufficiently flawed that any claim of comprehensiveness would be misplaced. One prominent problem with CPIS handicaps the analysis of bond portfolios: Any country whose residents tend to use non-resident intermediaries will have meaningless entries in the CPIS. Table 3 depicts, using 2006 CPIS data, what is by now a well-known manifestation of this problem. Euro currency 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%, and Italians held another 381%. Obviously this cannot be true, and it is not. 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 have particular 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: We examine just one particular cross-section of CPIS data from 2003, rather than attempting to collect more recent data (or analyzing a panel). The main reason for this decision is that we do not see the value of analyzing multiple years (or even more current ones) of a fundamentally flawed dataset. But this choice is also 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 are very important. Currency denomination of bonds matters most (in a statistical sense) for the combination of AE source and EME destination; bonds issued by countries where hedging exchange rate risk is prohibitively costly (EMEs) are more likely to be held by AE investors if they are issued in the investor's currency. For AE source/AE destination this relationship between issuance and investment is less strong in a statistical sense (but still marginally significant). And it is only for this combination (AE source/AE destination, 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), EME investment in bonds are almost wholly a function of real linkages.

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 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.[7] 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

[7] 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.

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).

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 seems fine 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.

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 of our analysis of US investors' holdings will focus on EMEs. As a preview, Figure 2 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 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 3a, 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 3a 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 3b and 3c 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. 3a) 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.

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

The relative weight graphs in Figure 3 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 next section 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 but with fewer countries (16 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*.[8] Relative weight (depicted in Figure 3) is simply a country's weight

[8] 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

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:

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

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 3 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:

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

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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.

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 two significant variables featured in our global CPIS analysis—bilateral trade linkages 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[9] (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.[10] 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. The share of a

[9] 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.

[10] 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).

country's bonds denominated in USD, *USD_shr*, is included because it is the focus of our analysis; 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 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.[11] 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.

[11] 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.

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.[12] 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. Thus, regressions labelled "All Currencies" can be considered typical. Local factors are in the top portion of the tables; global push factors are in the bottom portion.

4.3.1 Market Structure

The first observation from Tables 5a and 5b is that *USD_shr* is positive and highly significant for all bonds and also the AE and EME subsamples. Indeed, with a *t*-stat of roughly 10 in these regressions, the coefficient on *USD_shr* is 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.

4.3.2 Local Factors

Focusing next on All Countries (Table 5a) and specifically on local factors (the top portion of the table), the story that emerges from column 2 is that real linkages, regulatory/creditor rights, less capital controls, more positive current account balances and high yield all matter to US investors. That seems to provide a comfortable story—greater linkages, stronger fundamentals and higher yield are

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

associated with more US investment—but just controlling for the share of a country's bonds denominated in the investor's currency (col. 1) undoes most of these results. So, which specification is appropriate, col. (1) or (2)? Col. (1) seems to be the more appropriate of the two—col. (2) omits a variable that has a *t*-stat of 11—but both mix very different asset classes, and each recipient country supplies a different mix of those assets.

In our view cols. (3) and (4), which separate bonds by currency (local or USD), are preferred to the All Currencies regressions. In those specifications, as in the All Currencies regressions, US investment is 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 local currency and USD bonds. But the effects of all other significant 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.

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. 8). For EMEs, the result is opposite: US investment is higher in EMEs with current account surpluses (col. 12). 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. And, finally, macro

stability matters in EMEs (regardless of currency denomination), whereas in AEs, most of whom have very low inflation volatility, cross-country differences in macro stability do not matter.

4.3.3 Global Factors

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 no evidence that US unconventional monetary policy shocks result in more investment in foreign bonds: UMPs are negative for EME local currency bonds and insignificant for all other bonds (whether AE or EME).[13]

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 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, with a *t*-stat of 12. Trade linkages and regulatory quality and creditor rights are positive and significant in all specifications in Table 6, but the

[13] We also estimated, but do not tabulate, Table 5 regressions with time fixed effects instead of the global factors. Results for the local factors are almost identical, with the only changes being that a few coefficients marginally significant (at the 10% level) in one specification are not significant in the other. 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, especially for AE USD bonds.

effect of other factors differs by currency denomination. There is more US investment in the USD-denominated bonds of EMEs with lower inflation volatility, lower yield and more openness, but these are not significant in the Local Currency regressions.

Also striking are differences for the global factors across the specifications. For the All Currencies regressions, especially in column 2, one would conclude that US rates do not matter. Columns 3 and 4 provide more insight. 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).[14]

5. On the Structure of EME Bonds Markets

Table 6 analyzed factors associated with the amount of US investment in EME bonds, and we highlighted some of the effects of global "push" factors. But global factors also impact the issuance of EME bonds, so in Table 7 we analyze bond market development. Dependent variables are local currency bonds and USD-denominated bonds, each scaled by GDP.

Global factors have a significant impact on bond issuance in EMEs. Lower US long rates and lower VIX were associated with more issuance by EMEs of both local currency as well as USD-denominated bonds; and US UMPs were associated with more issuance of USD-denominated bonds (but not local currency bonds). Overall, Table 7 indicates that global factors led to more EME bond issuance, both local currency and USD-denominated.

Recall from Table 6 that low US rates are associated with more investment in EME local currency bonds, but not in USD bonds, and that US UMPs were associated with less investment in both

[14] 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.

local currency and USD bonds. Table 7 qualifies this: Low US rates are associated with more *issuance* of both local currency and USD bonds. Of the increased local currency issuance, US investors took even more than usual (the Table 6 relative weight result), whereas they did not take a disproportionate amount of the increased USD issuance (i.e, this effect is insignificant in Table 6). UMP shocks are associated with relatively lower portfolio weights in Table 6, but this could be driven in part by the increased issuance of USD-denominated bonds in response to UMP as documented in Table 7.

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. For example, focusing on cross-border investment in EMEs, we find that local macroeconomic conditions are most important for US investors' allocations to USD-denominated bonds while global factors appear to be the primary driver of allocations to EME bonds denominated in local currency. This distinction is of particular relevance given recent interest in determining the impact of advanced economies' unconventional monetary policy on cross-border financial flows. More specifically, in our analysis of investment in 15

EMEs between 2006-2015, we demonstrate 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, while unconventional monetary policy shocks led to a reduction in the relative weight on EME bonds, especially USD-denominated bonds.

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.

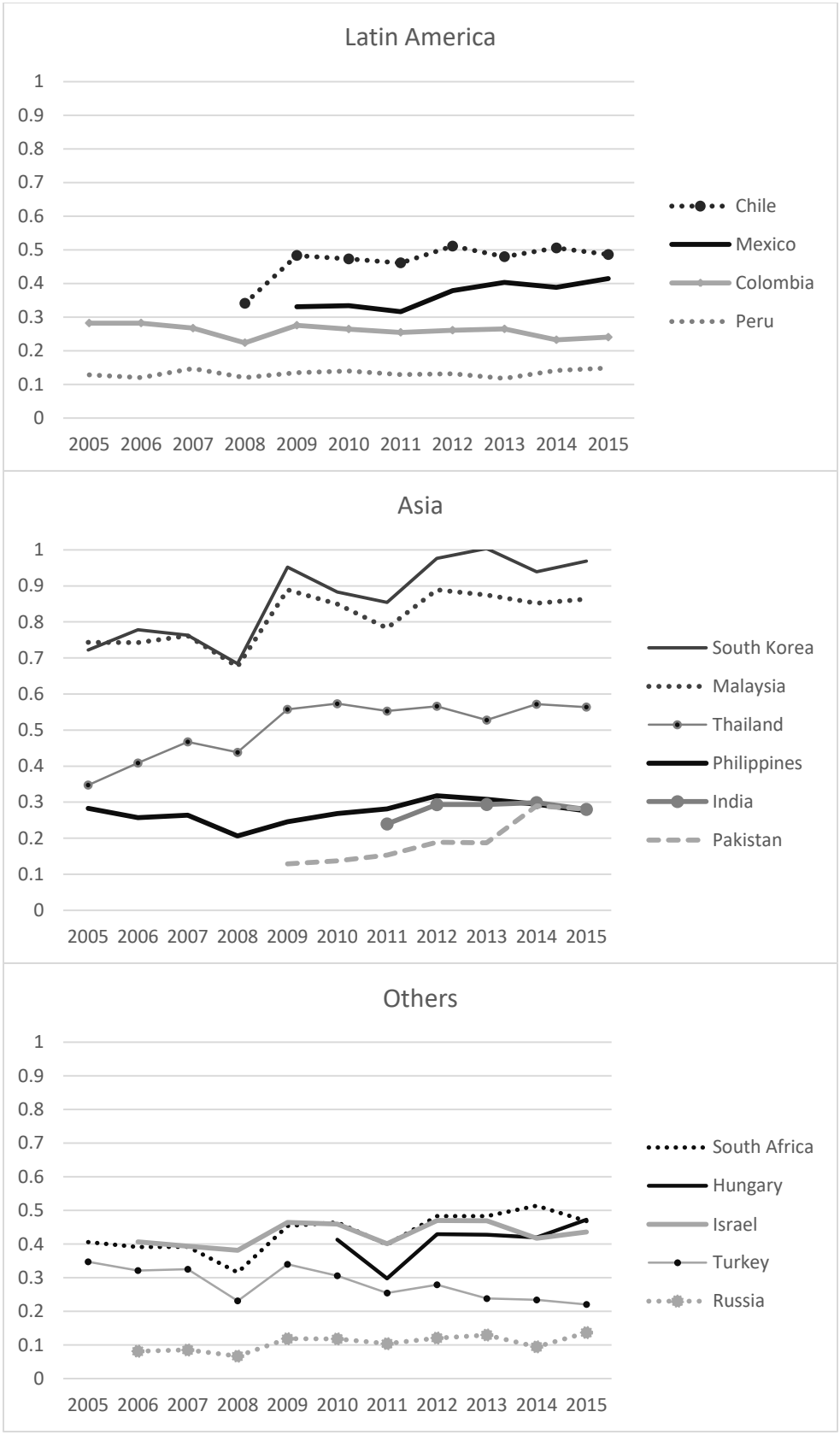
Most other explanatory variables are taken from Haver Analytics including *InflVol* (computed from three years of quarterly CPI inflation), *CAB* (current account balance as a percent of GDP), *Growth* (calculated as the 3-year average growth rate in real GDP per capita), *Size* (log of nominal GDP), and *Fiscal* (fiscal balance scaled by GDP).

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. For expository ease, we take the negative of the RSW shocks, so that a positive monetary policy shock (i.e., one that lowers 10-year rates) is positive.

Country Groupings

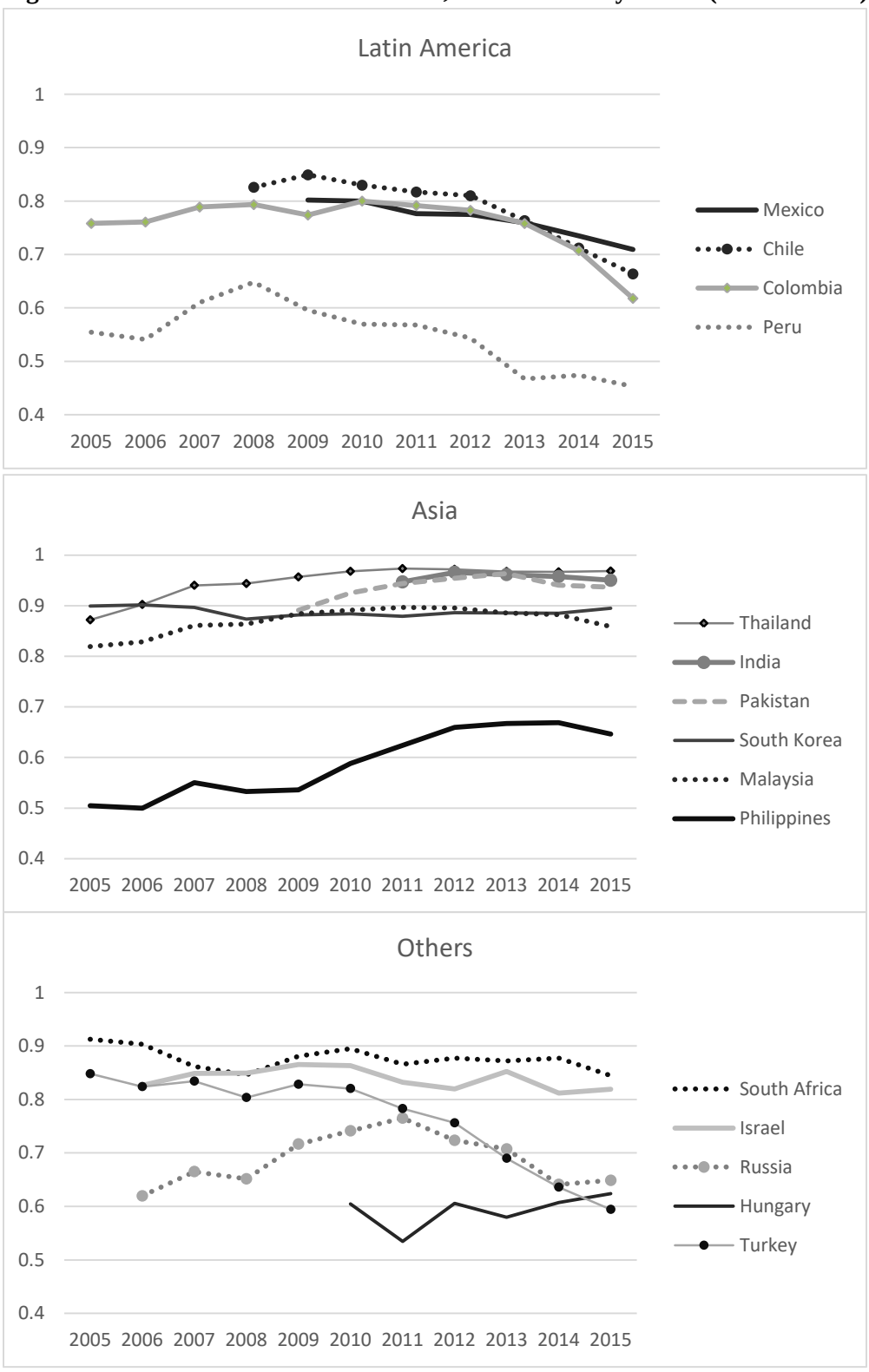
The groupings of "advanced economies" (AEs) and "other emerging market and developing countries" (shortened here to emerging market economies or EMEs) generally follow IMF classifications as of April 2013 (http://www.imf.org/external/pubs/ft/weo/2013/01/pdf/statapp.pdf). In our narrow more recent sample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

Figure 1a. EME Bond Market Structure, Local Currency Bonds (as share of GDP)



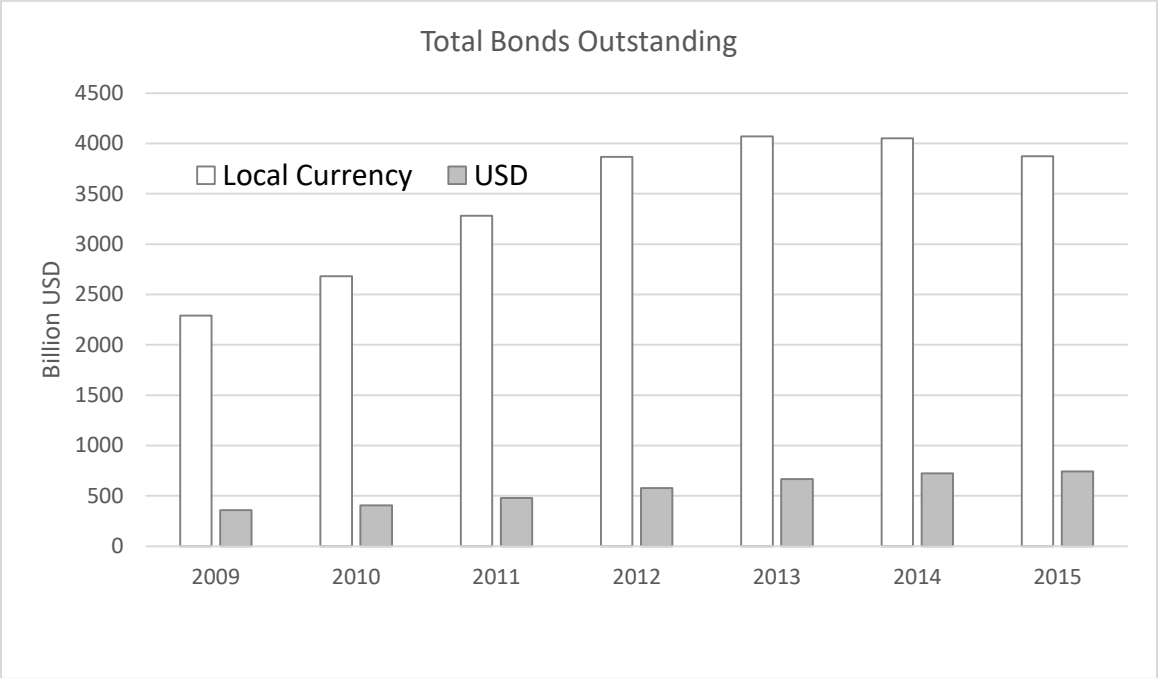
The figures depict the size of local currency bond markets (expressed as a share of GDP).

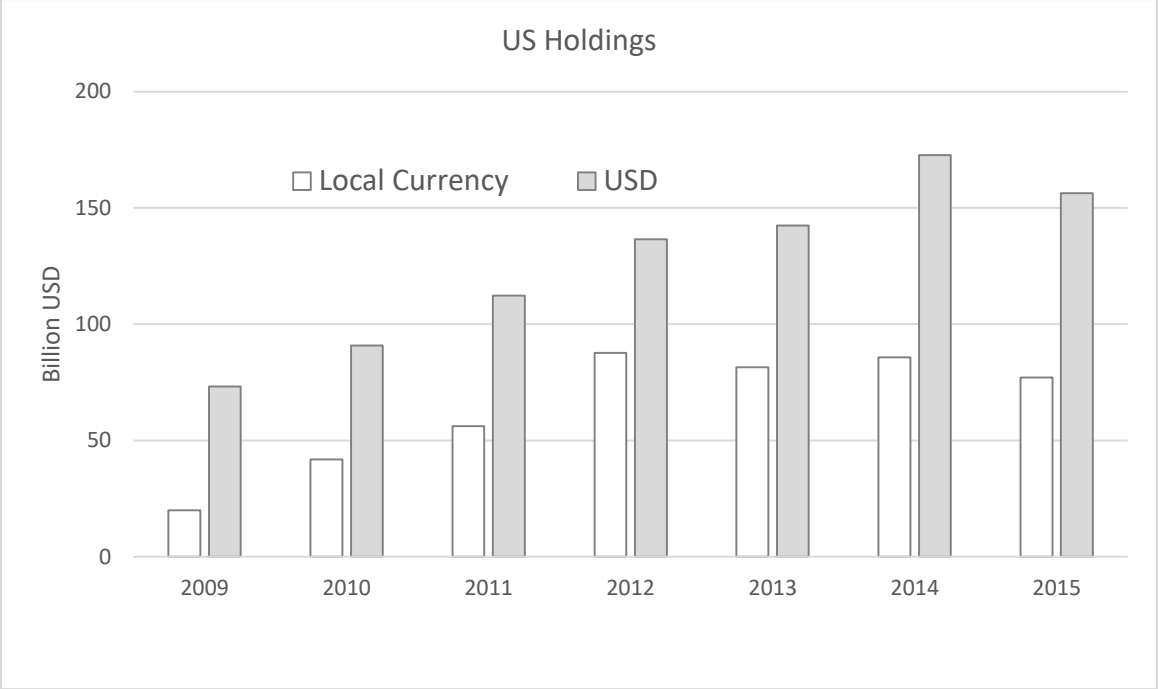
Figure 1b. EME Bond Market Structure, Local Currency Bonds (share of total)



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

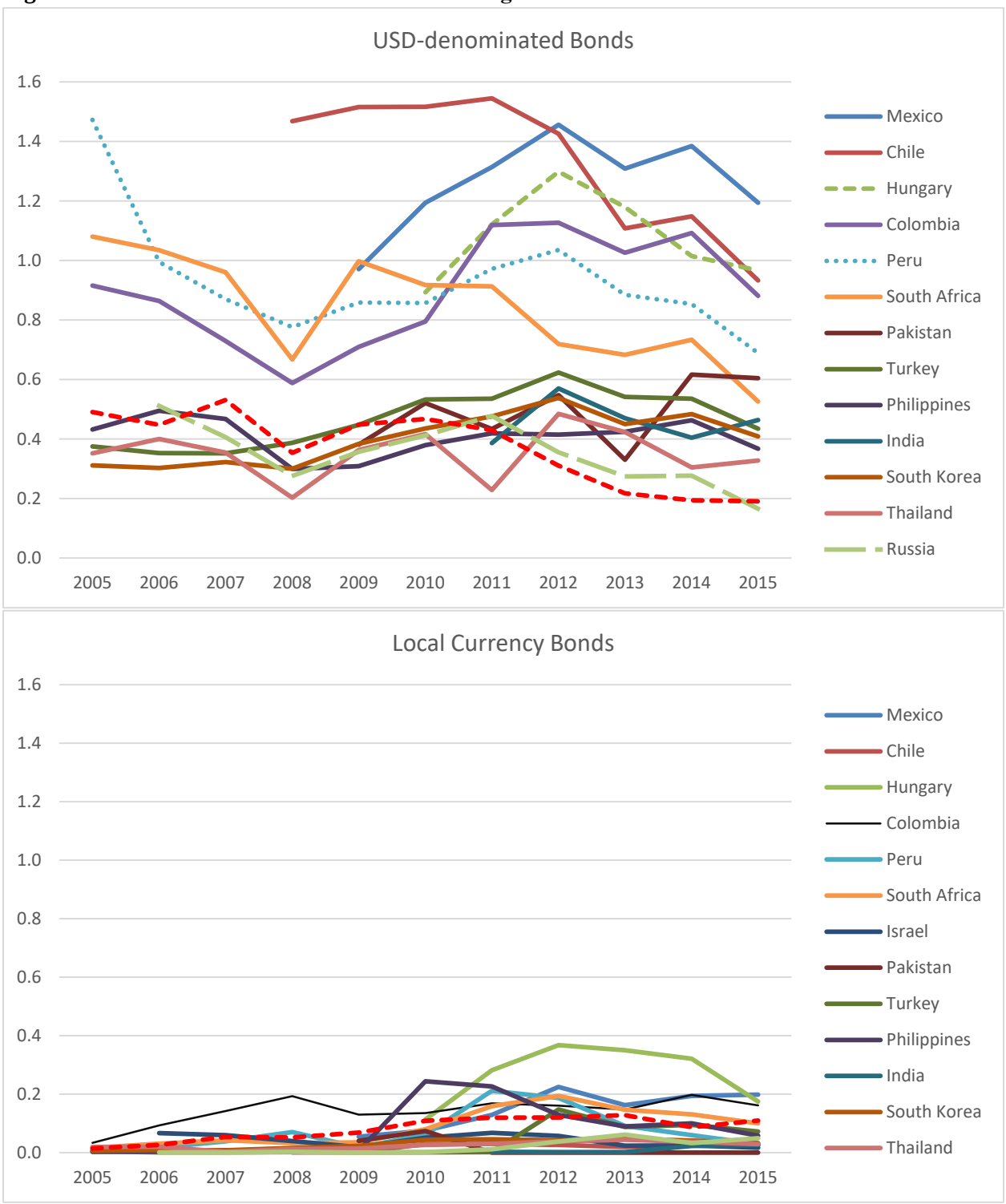
Figure 2. EME Bonds by Currency Denomination





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

Figure 3a. 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. 3b; its relative weight is off the chart at roughly 4.

Figure 3b. US Investors' Relative Investment Weight (USD-denominated bonds, country details)

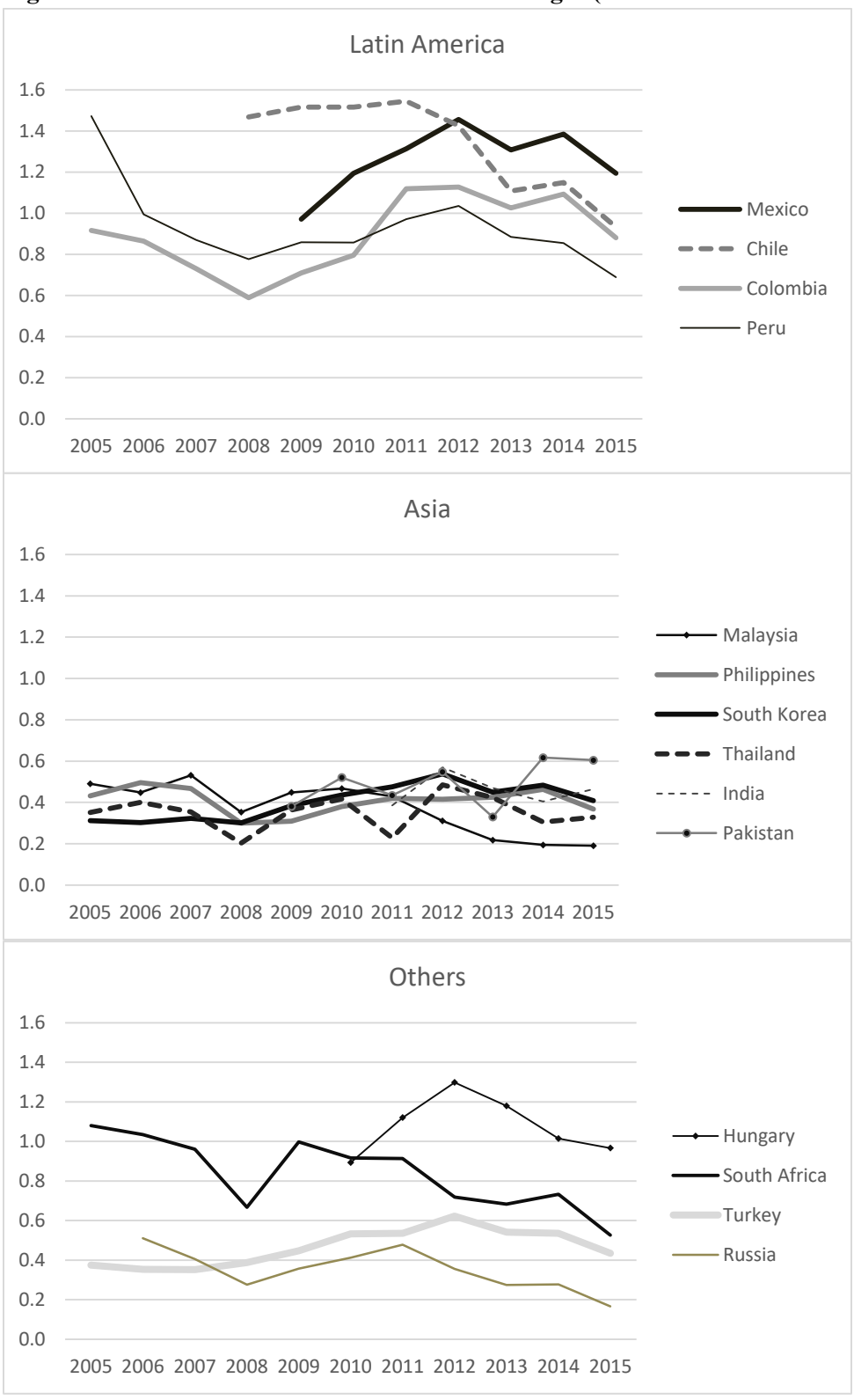


Figure 3c. US Investors' Relative Investment Weight (local currency bonds, country details)

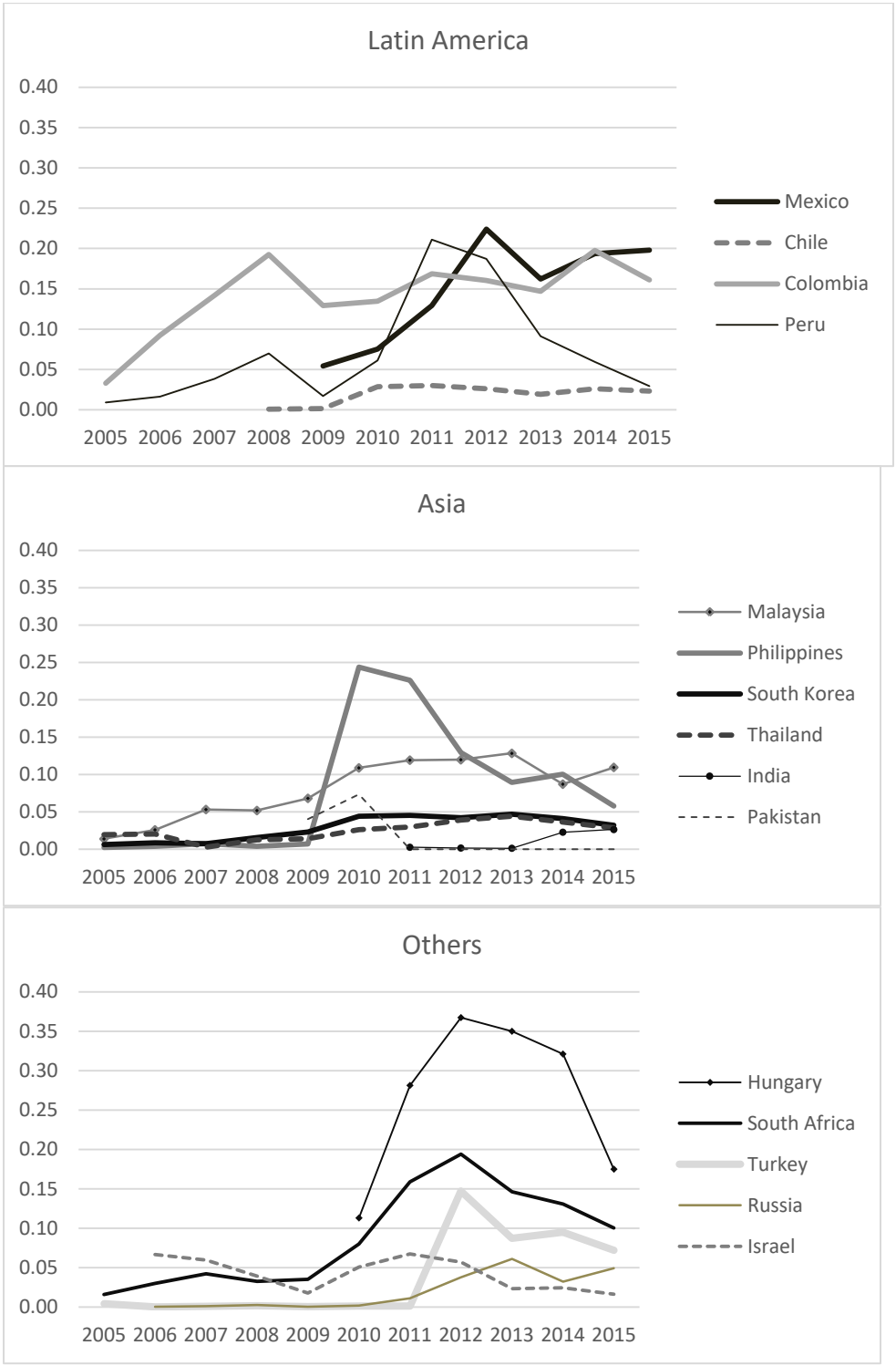


Table 1. Bonds Outstanding

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
Netherlanc	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
	(0.022)	(0.021)	(0.036)	(0.003)	(2.655)	(2.199)	(3.475)
Linkages	0.672***	0.603***	0.541***	0.095***	0.685***	0.119***	0.990***
	(0.038)	(0.044)	(0.061)	(0.015)	(0.063)	(0.040)	(0.094)
Volatility	-0.155	-0.352	-3.550***	-0.009	0.621	0.517*	-0.165
	(0.277)	(0.400)	(0.832)	(0.078)	(0.537)	(0.281)	(1.202)
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). 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), inflation volatility, yield, real GDP growth, and global variables (US 10-year Treasury yield, US monetary policy shock, and VIX). See Appendix A for more details on all variables. Constants are included but not reported. Standard errors are reported in parentheses. ** and * denote significance at the 1% and 5% levels, respectively.

A. All Countries

	All Countries All Currencies (1)	All Countries All Currencies (2)	All Countries Local Currency (3)	All Countries USD (4)
USD_shr	0.280**			
	(0.027)			
Trade	0.624	2.241**	0.453*	6.625**
	(0.497)	(0.500)	(0.208)	(1.887)
RegCr	0.053**	0.046**	0.046**	0.196**
	(0.017)	(0.018)	(0.007)	(0.064)
Fin_Open	0.522	4.811**	-0.960	14.628**
	(1.297)	(1.485)	(0.671)	(5.488)
CAB	-0.036	0.088**	-0.002	-0.658**
	(0.025)	(0.021)	(0.014)	(0.176)
InflVol	-0.001	-0.001	-0.001	-0.021*
	(0.001)	(0.001)	(0.001)	(0.008)
Yield	0.021	0.370**	0.174**	-0.181
	(0.049)	(0.070)	(0.038)	(0.314)
Growth	-0.009	-0.022	0.065*	-1.002**
	(0.059)	(0.068)	(0.030)	(0.343)
USi10	-0.729**	-1.161**	-1.052**	1.184
	(0.235)	(0.226)	(0.152)	(1.689)
US_UMP	-0.478	1.251	-0.577	11.303
	(1.090)	(1.153)	(0.614)	(10.125)
VIX	-5.036	-11.887**	-4.329*	-54.340
	(3.226)	(3.392)	(1.802)	(29.359)
N	229	229	229	225

b. AE and EME Splits

	AEs	AEs	AEs	AEs	EMEs	EMEs	EMEs	EMEs
	All Currencies	All Currencies	Local Currency	USD	All Currencies	All Currencies	Local Currency	USD
	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
USD_shr	0.250**				0.318**			
	(0.048)				(0.037)			
Trade	-0.437	-0.776	-0.169	4.289	1.277**	0.657	-0.416*	8.785**
	(0.514)	(0.664)	(0.287)	(5.163)	(0.282)	(0.397)	(0.195)	(1.241)
RegCr	0.058**	0.114**	0.072**	0.192	0.067**	-0.088**	-0.007	0.017
	(0.018)	(0.021)	(0.011)	(0.286)	(0.020)	(0.019)	(0.014)	(0.072)
Fin_Open					1.676	6.291**	-2.098	15.438**
					(1.629)	(1.942)	(1.275)	(4.901)
CAB	-0.001	0.021	-0.011	-1.821**	-0.059	0.042	0.034	0.520**
	(0.027)	(0.033)	(0.018)	(0.511)	(0.038)	(0.041)	(0.022)	(0.177)
InflVol	-0.003	-0.002	0.001	-0.005	-0.004**	-0.011**	-0.005**	-0.018**
	(0.002)	(0.003)	(0.001)	(0.032)	(0.002)	(0.002)	(0.001)	(0.005)
Yield	0.045	0.083	0.071	-0.014	0.056	0.013	0.152**	-0.049
	(0.076)	(0.076)	(0.037)	(1.735)	(0.075)	(0.097)	(0.050)	(0.203)
Growth	-0.025	0.069	0.142**	-1.205	-0.068	-0.356**	-0.033	-0.534*
	(0.079)	(0.081)	(0.046)	(1.124)	(0.093)	(0.104)	(0.058)	(0.255)
USi10	-0.064	-0.488	-0.337*	5.562	-2.325**	-2.192**	-1.857**	-4.669**
	(0.280)	(0.296)	(0.155)	(3.952)	(0.381)	(0.435)	(0.253)	(1.177)
US_UMP	0.392	1.981	0.950	0.404	-0.504	3.257	-5.801**	3.888
	(1.615)	(1.622)	(0.819)	(21.265)	(1.933)	(2.333)	(1.403)	(7.201)
VIX	-2.713	-8.673	-4.585	-33.905	-14.763**	-21.696**	4.562	-54.174**
	(4.632)	(4.718)	(2.409)	(62.428)	(5.624)	(6.829)	(4.106)	(20.549)
N	121	121	121	121	108	108	108	104

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 16 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 (local currency or USD) and sector of the issuer (government or private). Independent variables are, in order, current account balance (scaled by GDP), bilateral real exchange rate volatility, yield, real GDP growth, bilateral trade, Regulatory/Creditor Rights, openness and either time fixed effects (odd columns) or global variables (US 10-year Treasury yield, US monetary policy shock, and VIX). See Appendix A for more details on all variables. Constants are included but not reported. Constants are included but not reported. Standard errors are reported in parentheses. ** and * denote significance at the 1% and 5% levels, respectively.

	EMEs All Currencies	EMEs All Currencies	EMEs Local Currency	EMEs USD
USD_shr	0.283**			
	(0.022)			
Trade	-0.050	-0.044	-0.036	-0.009
	(0.048)	(0.056)	(0.030)	(0.175)
RegCr	0.000	-0.003	0.001	-0.017*
	(0.002)	(0.002)	(0.001)	(0.007)
Fin_Open	-0.109	-0.301**	-0.013	-0.905**
	(0.070)	(0.091)	(0.078)	(0.285)
CAB	-0.010	-0.002	-0.014	-0.075
	(0.092)	(0.105)	(0.076)	(0.287)
InflVol	2.469**	2.130*	1.229*	6.780**
	(0.467)	(1.057)	(0.578)	(1.266)
Yield	0.111**	0.096**	0.056**	0.522**
	(0.021)	(0.021)	(0.012)	(0.070)
Growth	0.020	0.018	0.008	0.128*
	(0.016)	(0.020)	(0.011)	(0.062)
USi10	-0.004	-0.001	-0.007**	0.010
	(0.002)	(0.003)	(0.002)	(0.007)
US_UMP	-0.031**	-0.015*	-0.010*	-0.090**
	(0.006)	(0.007)	(0.004)	(0.020)
VIX	0.039	0.006	-0.016	0.202*
	(0.027)	(0.031)	(0.019)	(0.092)
N	132	132	132	132

Table 7. Determinants of the Structure of EME Bond Markets

The annual panel spans the period 2006 to 2015 and includes 15 EMEs. Because of data limitations, some EMEs enter the panel later than 2006. Dependent variables are, in order, local currency bonds (all, government or private) scaled by GDP and USD-denominated bonds (all, government or private) scaled by GDP. Independent variables are, in order, a set of local variables—fiscal balance (scaled by GDP), current account balance (scaled by GDP), inflation volatility, real GDP growth, the size of the local economy (calculated as the log nominal GDP in USD), our Regulatory/Creditor Rights variable, and openness—and two global variables (US 10-year Treasury yields, US unconventional monetary policy shock). Constants are included but not reported. Estimates are calculated using panel-feasible generalized least squared (FGLS) allowing for heteroskedastic error structures and different autocorrelation coefficients within countries. Standard errors are reported in parentheses. ** and * denote significance at the 1% and 5% levels, respectively.

	EMEs Local Currency	EMEs USD
Fiscal	-0.006*	0.001
	(0.002)	(0.001)
CAB	0.525**	0.174**
	(0.190)	(0.035)
InflVol	0.006	-0.004*
	(0.006)	(0.002)
Growth	-0.184	-0.074
	(0.345)	(0.089)
Size	-0.000**	-0.000**
	(0.000)	(0.000)
Trade	-3.216	1.609**
	(4.058)	(0.433)
RegCr	0.224**	0.009
	(0.065)	(0.016)
Fin_Open	0.056	0.030*
	(0.057)	(0.013)
USi10	-0.032**	-0.006**
	(0.007)	(0.002)
US_UMP	-0.022	0.018**
	(0.017)	(0.006)
VIX	-0.307**	-0.091**
	(0.078)	(0.023)
N	133	133