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Which Exchange Rate Matters to Global Investors?*

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Abstract

How do exchange rates affect the asset allocation of bond portfolio investors? Using detailed security-level holdings, we find that euro area-based investors systematically shed sovereign bonds as the dollar strengthens, confirming the role of the dollar as a global risk factor even for euro-based investors. More distinctively, they also shed local currency bonds when the euro strengthens, due to currency mismatches on their own balance sheets. There is no such effect for foreign currency bonds of the same sovereign issuers. These findings are consistent with a Value-at-Risk portfolio choice model that brings out separate roles for local, foreign and reference currencies.

Keywords: Currency mismatch, balance sheet effects, emerging markets, exchange rates, institutional investors, sovereign bonds.
JEL classifications: F31, G11, G15, G23.

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I. Introduction

How do exchange rates affect the portfolio decisions and risk-taking behavior of global investors? A common response, especially for assets issued by emerging market economies (EMEs), invokes the currency mismatch EMEs take on when borrowing abroad in a major currency, such as the US dollar. Borrowers are exposed to higher debt burdens when their currencies depreciate against the dollar. Foreign investors would then reduce their positions on account of credit risk.

This paper shows that several forces shape how portfolio allocation responds to exchange rates. Foreign portfolio investors typically do not hedge currency risk when investing in local currency bonds denominated in all but the major currencies, as we illustrate below. As such, it is the *investors* who face a currency mismatch, and they accordingly react to exchange rate movements. Hence, the issue turns out to be multi-faceted, with currency indices playing a distinct role beyond that of bilateral exchange rates.

Previous studies provide a partial view when focusing on US dollar-based investors and fluctuations in exchange rates referencing the dollar. Doing so confounds the role of the *reference exchange rate* – the currency against which investors measure their gains and losses – with the role of the dollar as a *global risk factor* where a stronger dollar works through diminished risk-taking in the financial channel of exchange rates (e.g., Bruno and Shin 2015; Avdjiev et al. 2019; Georgiadis et al. 2024). This flows from the dominant role of the US dollar in global finance and trade invoicing.

Our innovation is to introduce a distinction between the investor's reference currency and the dollar's role as a global risk factor. We do so through a detailed analysis of the portfolio choices of *euro-based investors*: rotating the reference currency away from the dollar toward the euro allows for a novel identification. In this way, we decouple the investor's reference currency (euro) from fluctuations in global financial conditions (dollar). The borrower's local currency, on the other hand, is neither the euro nor the dollar, giving us the degree of freedom for identifying several exchange-rate related effects.

Using security-level holdings of sovereign bonds, our analysis reveals that specific exchange rates come into play at different levels of the portfolio allocation problem. At the level of individual country exposures, euro-based investors shed local currency bonds of a sovereign whose currency depreciates against the euro, reflecting the fact that the depreciation implies losses in terms of their reference currency. A broader appreciation of the euro, on the other hand, curbs the euro value of non-euro positions more broadly, and leads investors to shed local currency bonds across their entire portfolio; yet they retain foreign currency bonds of the same sovereign issuers, suggesting that the retrenchment is not due to credit risk.

Separately, consistent with recent studies, we find that episodes of dollar strength have the broadest effect, since tighter global financial conditions lead investors to retrench from all types of bonds, regardless of bond's currency of denomination. Overall, we find that a currency mismatch on the lender's side is an important driver of international portfolio allocation. These findings are consistent with a model of portfolio choice that incorporates separate roles for local, foreign and reference currencies, which we develop in detail below.

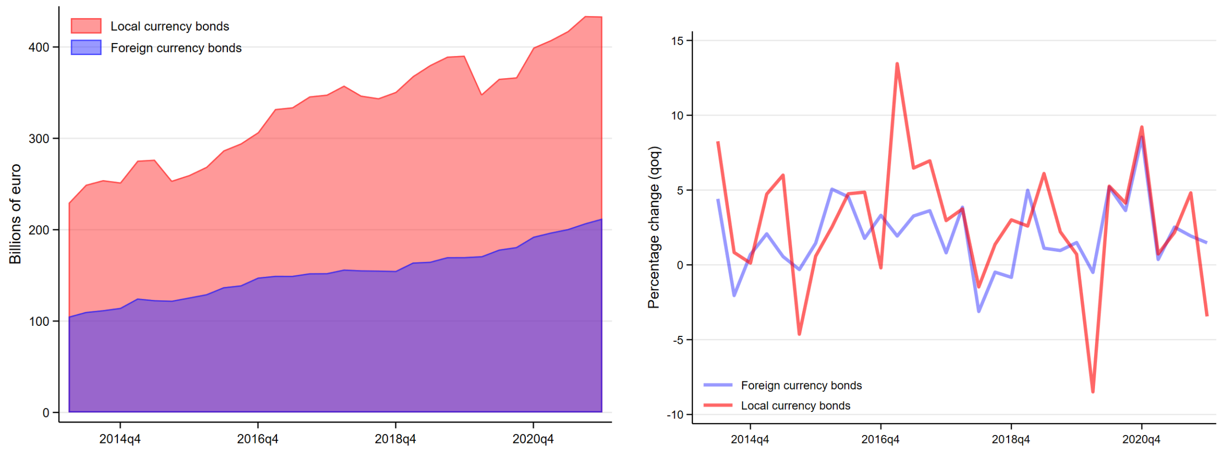
We exploit security-level detail on the issuer, the holder and the currency of each bond to define the relevant exchange rates for currency mismatches facing borrowers and lenders. Euro-area investors make up a substantial portion of the investor pool for EME sovereign debt. Figure 1 shows the corresponding slice of the ECB's Securities Holdings Statistics (SHS-S). At end-2021, euro area investors held €433 billion in EME sovereign bonds, €221 in local currency and €212 billion in foreign currency bonds (left panel).[1] These holdings amount to 5% and 20% of local and foreign currency bonds outstanding, respectively.

The onset of the pandemic in March 2020 took a toll on their EME sovereign bond portfolios, especially on their local currency bonds (red area). EME currencies depreciated sharply against major currencies, including the euro. Meanwhile, the US dollar strengthened against all currencies, reaching record highs as the world's safe haven. Against this backdrop, investors sold 8.5% of their EME local currency bonds in Q1 2020, but only 0.5% of their foreign currency bonds (right panel).

The retreat at the onset of the pandemic illustrates a mechanism that we also detect in normal times: holdings of local currency bonds are more volatile than those in foreign currencies. What accounts for this difference? Our dataset affords an ideal laboratory for studying the financial channel of exchange rates. For identification, our focus on euro-based investors decouples the lender's reference currency (euro) from the borrower's currency for invoicing and external debt (mostly dollar), and from global financial conditions more generally (dollar).

[1] Throughout the paper, we define "foreign currency" from the perspective of the borrower country. For Mexico, for instance, this includes sovereign bonds denominated in dollars, euros, pounds and yen.

Figure 1. **Local versus foreign EME bond holdings by EA investors**



(a) Total nominal amount (b) Changes nominal amount (constant FX)

Panel (a) shows the total nominal amount of EME bonds held by euro area investors (in billion EUR). Panel (b) shows the percentage change in nominal amounts while keeping the exchange rate (FX) constant over time. Both panels show the results separately for local and foreign currency bonds. The quarterly sample period is 2013q4-2021q4.

Our empirical findings highlight systematic and distinct responses of euro-based investors to three types of exchange rates. An increase in the broad dollar index (BDI) leads to net selling across the board, consistent with a stronger dollar reflecting tighter global financial conditions. A rise in the broad euro index (BEI), on the other hand, triggers selling of local currency bonds, in line with the valuation losses a stronger euro implies for assets in other currencies in terms of the reference currency. In addition, investors sell more local currency bonds of individual sovereigns that depreciate against the euro, precisely those bonds on which their currency mismatch bites hardest. For better identification, we exploit variation across investors' sovereign exposures and show that investor-specific currency exposures better explain movements in portfolio holdings than an overall depreciation against the euro. These results are remarkably robust to variations in our specification and samples, and are not limited to EMEs; importantly, we find similar results for bonds issued by advanced economies outside the euro area.[2]

Our results are consistent with the hedging practices of institutional investors. Sialm and Zhu (2024) finds that US international fixed income mutual funds hedge only 18% of their currency risk, while Dutch pension funds hedge a small fraction of currency exposures outside the major currencies (see Figure 3). The locus of currency risk we observe is very specific,

[2]Since our specifications are linear, we observe the opposite responses – investors buying sovereign bonds – when the dollar or the euro weaken, or when EME currencies appreciate.

tied to lenders' balance sheets. When a country's currency depreciates, the rise in its debt burden may increase credit risk on foreign currency bonds; the same depreciation makes no difference for servicing local currency debt. Yet we find that investors primarily sell local currency bonds when the currency depreciates against the euro. Investors first react to the currency mismatch on their *own* balance sheet: the relevant exchange rate to global investors is the currency of the bond they hold, not the currency of the issuer country.

Based on our findings, we formulate a portfolio choice model that captures the key features uncovered in the data. The key to the portfolio choice model is to incorporate the currency dimensions relevant for global investors holding sovereign bonds in local and foreign currency. In the model, bond investors are subject to a Value-at-Risk (VaR) constraint and choose between local and foreign currency bonds across different issuer countries. They evaluate the returns in their own reference currency (euro), which differs from the dominant global currency (dollar). In this context, the stringency of their VaR constraints depends on global financial conditions, reflected in the broad dollar index. The model captures the features in the data that a country-specific depreciation leads to selling of the local currency bond of that country, while a broad appreciation of the euro leads to selling of *all* local currency bonds. Separately, a tightening of global financial conditions reduces bond holdings across the board.

Our findings shed new light on the mechanisms underlying the financial channel of exchange rates. We show that both the financial channel associated with borrowers (e.g., Bruno and Shin 2015, 2023) and the currency-mismatch faced by investors play a key role in explaining investor flows. While the previous literature has documented a link between risk-taking capacity or global risk appetite and capital flows (e.g., Bertaut et al. 2023; Lilley et al. 2022; Georgiadis et al. 2024), we disentangle the generalized risk-taking effect from the currency-mismatch on the lender side by moving the reference currency away from the dollar.

We also contribute to the literature on the importance of currency denomination in explaining cross-sectional variation in investor portfolios. We find that euro area investors disproportionately invest in bonds denominated in their own currency or in the US dollar, in line with the findings of Boermans and Vermeulen (2016); Burger et al. (2018); Maggiori et al. (2020); Boermans and Burger (2023); Faia et al. (2022); Florez-Orrego et al. (2023); Zhou (2023). In particular, Maggiori et al. (2020) show that investor holdings are biased toward their own currencies to such an extent that few corporations borrow abroad in their own currency, but issue bonds denominated in US dollars or in the currency of foreign investors. Boermans and Burger (2023) also use holdings data of euro area investors and show a strong preference for bonds denominated in euro. Faia et al. (2022) further specify that this preference is mainly driven by pension funds and insurance companies, rather than investment funds. Kubitza et al. (2024) argue that frictions in foreign exchange derivatives markets may explain currency preferences. We contribute to this literature by showing that investors prefer holdings in their own currency because of the currency mismatch on their own balance sheets.

Finally, we contribute to the literature on capital flows and exchange rates in equilibrium (e.g., Hau and Rey 2004, 2006; Gabaix and Maggiori 2015; Lilley et al. 2022; Camanho et al. 2022; Koijen and Yogo 2020; Pandolfi and Williams 2019; Aldunate et al. 2023). Our paper complements empirical work on the effect of investors flows on exchange rates, by studying how investors respond to exchange rates that they individually take as given.

The behavior we observe has important implications for EMEs and small open economies. Investors exposed to currency risk may sell at the first sign of depreciation regardless of the underlying credit risk. For lenders to continue holding local currency bonds, borrowers pay a sizeable yield spread over US Treasuries, mainly to compensate for currency risk (Du and Schreger 2016; Lee 2022).[3] As a result, most countries borrowing abroad in their own currency face risks that mirror those of foreign currency debt (e.g., Lane and Shambaugh 2010). Since the 1990s, major EME sovereigns have made substantial progress in borrowing abroad in their local currency; they are overcoming "original sin" in the original sense of the term (Eichengreen et al. 2005; Onen et al. 2023). But the flipside is that currency mismatches migrate to the balance sheets of global investors, leading to volatile capital flows. The problem changes shape, but countries remain vulnerable to global financial conditions.

The paper is structured as follows. Section II reviews the main channels through which exchange rates affect lenders and borrowers, and explains how we disentangle the effects by focusing on euro-based investors. Section III describes how we combine two granular databases to enable our empirical approach. Section IV presents the baseline regressions at three levels of aggregation, along with robustness tests and a further exploration of the currency mismatch on the lender side. Section V lays out a model to rationalize our empirical findings. Section VI concludes.

II. Channels and Identification

This section reviews the main channels through which exchange rates affect global investors in view of testable hypotheses. We examine the role of currency mismatches on local and foreign currency debt, respectively, as featured in the literature on the financial channel of

[3]For EMEs, the currency risk accounts for about three quarters of the local currency yield spread over US Treasuries, while the borrower's intrinsic credit risk accounts for one quarter (Du and Schreger 2016).

exchange rates. We then explain how we identify the effects of different exchange rates by focusing our empirical analysis on euro-based investors.

A. Exchange Rate Channels in the Literature

We classify various exchange rate effects to infer the expected response of foreign investors' portfolio allocation across countries. For concreteness, consider a generic open economy (country c) that trades goods invoiced in US dollars with many countries, and borrows abroad in dollars, unhedged. Global investors lend or invest on the basis of prospective returns across a number of borrower countries, including c.

Several types of exchange rates or indices can be relevant in this context. The bilateral exchange rate (BER) is the nominal exchange rate against the reference currency, quoted in terms of local currency units per US dollar ($BER_c^{\$}$) or per euro ($BER_c^{€}$). An increase represents a depreciation of country c's currency. The broad dollar index (BDI) is a weighted average of the foreign exchange value of the US dollar against the currencies of a broad group of major US trading partners; an increase represents a stronger US dollar. The broad euro index (BEI) is the corresponding index measuring the value of the euro against the euro area's main trading partners.

We briefly describe the traditional **trade channel** of exchange rates. Exchange rate fluctuations impact a country's trade competitiveness due to nominal rigidities. In traditional models, depreciations are expansionary (Dornbusch 1980; Obstfeld and Rogoff 1995). When country c's currency depreciates, it boosts net exports by making imports costlier and exports cheaper, which in turn attracts more foreign investment. In reality, most trade is invoiced in major currencies, notably the US dollar (Boz et al. 2020): hence, mainly a depreciation against the US dollar ($BER_c^{\$} \uparrow$) is expansionary, since it reduces country c's imports from all other countries. When many countries depreciate simultaneously, however, the broad-based strengthening of the US dollar ($BDI \uparrow$) tends to depress world trade (Gopinath et al. 2020). As the trade channel is not the objective of our study, we examine *sovereign bonds* to reduce any confounding effects between the trade and financial channels of exchange rates. Corporates are subject to *both* channels: a depreciation of currency c has expansionary effects (trade channel) as well as adverse balance sheet effects – especially with respect to the dollar, the currency of choice for most corporates issuing international bonds (e.g., Salomao and Varela 2022; Gutierrez et al. 2023).

The **financial channel** of exchange rates describes how exchange rate movements influence risk capacity. The traditional focus is on the ***borrower side***, since most countries' external debt is denominated in foreign currency (Bénétrix et al. 2019; Eichengreen et al. 2022).

A depreciation raises the burden of foreign currency debt in terms of the borrower's own currency, with adverse effects on the economy and the financial system. Most countries outside Europe borrow internationally in US dollars; the relevant exchange rate for country c is that against the dollar. A depreciation ($BER_c^{\$} \uparrow$) is contractionary and raises the borrower's credit risk (e.g., Chang and Velasco 2001; Bruno and Shin 2015). Hence, foreign investors are likely to react by cutting exposures.

A generalized strengthening of the dollar in this context leads to a broad-based reduction in credit because borrowers' balance sheets become weaker, thereby reducing financial intermediary lending activities (Bruno and Shin 2015, 2023). In that sense, the BDI gauges global risk-taking capacity or risk-appetite (e.g., Avdjiev et al. 2019; Miranda-Agrippino and Rey 2022; Lilley et al. 2022; Obstfeld and Zhou 2023; Georgiadis et al. 2024) and a generalized strengthening of the dollar ($BDI \uparrow$) can reduce investors' investments abroad. Indeed, the BDI has been found to exhibit attributes of a global risk factor (e.g., Lustig et al. 2014; Jiang et al. 2020).

Currency mismatches also occur on the ***lender side***, where we can distinguish effects at three levels of the portfolio allocation problem (exposure level, the portfolio level, and broader global financial conditions). Most advanced economies and major EMEs increasingly borrow abroad in their own currency (Bénétrix et al. 2019; Du and Schreger 2022; Onen et al. 2023). In this case, a depreciation can be inconsequential for borrowers servicing their local currency debt. But the currency mismatch now sits on the balance sheets of foreign lenders: since they measure returns in their own currency, the depreciation of currency c causes valuation losses at the exposure level.[4]

At the portfolio level, lenders will face tighter financial constraints when their reference currency strengthens. Such an appreciation represents the simultaneous depreciations of many currencies in their portfolios, implying valuation losses in terms of the reference currency, tightening lenders' VaR constraints (e.g., Hofmann et al. 2020). When many market participants are affected in the same direction, the appreciation of US dollar in particular reduces intermediary capacity in the financial system and tightens global financial conditions in the way described in the literature on the BDI as a global factor.

From the lender side, we thus expect foreign holders to reduce their investments across the board in the event of a broad-based depreciation across many borrower countries ($BDI \uparrow$), and to cut their local currency positions on individual countries facing larger depreciations ($BER_c^{\$} \uparrow$).

[4]When foreign investors hold local currency debt, their portfolios become more exposed to *currency risk*, instead of the *credit risk* associated with foreign currency debt.

B. Identification through Euro-based Sovereign Bond Investors

We now define the data dimensions best suited for capturing the financial channel of exchange rates, with the aim of identifying the effects of currency mismatch on foreign investors' bond portfolios.

First, our brief review makes clear that the US dollar plays an central role in all aspects of the financial channel of exchange rates because of its dominance in trade invoicing and global finance. Taking the perspective of US or global investors evaluating returns in US dollars, exchange rates referencing the dollar have effects across all levels of portfolio choice, confounding identification (Figure 2, upper panel). We therefore focus on **euro-based investors** to disentangle the various channels. Rotating the reference currency away from the US dollar allows for better identification of lender-specific effects, because doing so decouples the investor's reference currency (euro) from the borrower's currency for invoicing and external debt (mostly dollar) and from global financial conditions (dollar) (Figure 2, lower panel).

Second, in our main tests we focus on **major EMEs'** sovereign bonds. Focusing on *sovereign* borrowing avoids conflating the measurement of exchange rate effects with those from the trade channel, as discussed. Major EMEs stand out for attracting external finance in both foreign and in local currencies.[5] They do so by issuing sovereign bonds, the main instrument for government borrowing (in contrast to the 1980s when bank loans were dominant). Investors can often choose between local currency and foreign currency bonds of the same issuer. At the same time, investors typically incur EME exposures on an unhedged (or partially hedged) basis, since EME currencies are costly to hedge.[6] To illustrate, Figure 3 uses regulatory data to show that Dutch pension funds hedge at most a small fraction of their local currency sovereign bonds. The left panel plots their overall portfolio exposure by currency, showing that they mostly hedge major currencies, including dollar exposures (this is consistent with the findings in (Du and Huber 2023)); by contrast, "Other" currencies, including all EME currencies, remain almost entirely unhedged. The right panel zeros in on holdings of EME sovereign bonds by region, again showing that the respective exposures must be largely unhedged since the derivatives positions are much smaller than their sovereign bond holdings.

Figure 2 (lower panel) summarizes the expected effects of EME depreciations on foreign bond

[5] By contrast, advanced economies tend to borrow in their own currency, while small EMEs and developing countries rely almost exclusively on foreign currency when borrowing abroad (Eichengreen et al. 2022).

[6] The extent of hedging among foreign investors in EME local currency bonds is known to be low in general (Siddiqui et al. 2020). Full hedging seem to be the exception, given that the cost of hedging eliminates much of the yield spread on EM sovereign bonds. The arguments in the paper remain intact under partial hedging.

holdings according to the financial channel of exchange rates as identified in our setting. Episodes of dollar strength ($BDI \uparrow$) are expected to have the broadest effect, since tighter global financial conditions lead investors to retrench from all types of bonds, regardless of the currency of denomination. Bilateral rates referencing the dollar ($BER_c^{\$}$) have a narrow effect on foreign currency bonds only, as EMEs face rising debt burdens when their currency falls against the dollar. Few EMEs have much external debt in euro, hence depreciations against the euro do not materially raise credit risk; as such, investors will not shed foreign currency bonds when individual EMEs depreciate against the euro. We expect no reaction in foreign currency bond holdings to changes in $BER_c^{€}$ and BEI.

However, exchange rates referencing the euro are much more relevant to the *lender* side, notably for local currency bond holdings. Euro-based investors will react to $BER_c^{€}$ and the BEI, just as dollar-based investors respond to $BER_c^{\$}$ and the BDI. Euro-based investors face losses on local currency bonds for any EME that depreciates against the euro ($BER_c^{€} \uparrow$). Moreover, a broad-based euro appreciation ($BEI \uparrow$) should lead to more extensive selling across EMEs than the equivalent depreciation of a single EME ($BER_c^{€} \uparrow$), because of the reduction in their risk-taking capacity at the portfolio level. Separately, euro investors may also react to a tightening of global financial conditions associated with the BDI. Our approach promises to identify this generalized risk-taking separately from the euro-specific currency mismatch effects at the portfolio and country-exposure levels. These foreign investor responses to exchange rates at the different levels are also modelled in Section V of the paper.

Figure 2. Financial channel of exchange rates

Dollar-based investors	**Foreign currency bonds**	**Local currency bonds**
Exposure to country c	$BER_c^{\$}$ (borrower)	$BER_c^{\$}$ (lender)
Bond portfolio	0	BDI
Global financial conditions	BDI	BDI

confounding effects of the US dollar

Euro-based investors	**Foreign currency bonds**	**Local currency bonds**
Exposure to country c	$BER_c^{\$}$ (borrower)	$BER_c^{€}$ (lender)
Bond portfolio	0 (EUR-USD hedged)	BEI
Global financial conditions	BDI	BDI

Figure 2 summarizes the expected negative effects of various exchange rates on foreign holdings of sovereign bonds, contrasting the cases of dollar-based (upper) with euro-based (lower panel) investors. The columns split bonds by currency denomination, where local currency bonds are in the domestic currency of borrower country c. The rows show at which level of the portfolio choice problem each type of exchange rate is expected to play a role. Bilateral exchange rates are quoted in local currency units per dollar ($BER_c^{\$}$) or per euro ($BER_c^{€}$); indices express the trade-weighted value of the US dollar (BDI) or of the euro (BEI). In all cases, an increase represents a strengthening of the dollar (or euro), and a corresponding depreciation of other currencies.

III. Data and Methodology

A. *Granular Statistics on Bond Holdings*

We use the euro area Securities Holdings Statistics by Sector (SHS-S) that record securities holdings for each country and sector in the euro area over the period 2013q4-2021q4.[7] For each country and sector, the statistics contain information on the quarter-end holdings at the ISIN level; for instance, the SHS-S data reports the aggregate holdings of German insurance companies in a specific security.

The SHS-S are connected to the Centralised Securities Database (CSDB). The CSDB holds accurate information on all individual securities relevant for the statistical purposes of the European System of Central Banks (ECB 2010). For a large number of debt securities, the CSDB contains data on debt type, maturity dates, coupon rates, coupon frequencies, coupon type (e.g., fixed, floating or zero-coupon), last coupon payment date, yield-to-maturity,

[7] For more details on the SHS-S data, see for instance https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32012R1011, Koijen et al. (2017), and Koijen et al. (2021).

prices, and amount outstandings.

We also merge the SHS-S with data on exchange rates and macroeconomic series. The bilateral nominal exchange rates against the US dollar and the euro (BER) are from the BIS (end of period). The BDI is the broad nominal US dollar index against 26 major trading partners from the Federal Reserve, and the volatility index (VIX) is from the Chicago Board Options Exchange (both retrieved from FRED). The BEI is the nominal effective euro exchange rate against 41 main trading partners from the ECB. Credit ratings are from Fitch Ratings. We also merge the data with sovereign bond yields from JP Morgan indices.[8] The yield differentials are computed with respect to the US Treasury yield (dollar) and the German Bund yield (euro). Macroeconomic series such as GDP growth, fiscal capacity, and inflation for each country are from the IMF WEO.

For debt securities, the focus of this paper, the SHS-S report bond holdings in both nominal and market values expressed in euros. To isolate active changes in allocations from fluctuations in prices and exchange rates, we focus on nominal bond holdings and express nominal values at constant exchange rates.[9] This ensures that the quarterly changes in nominal values reflect active changes in holdings, rather than currency valuation effects.

For the reasons elaborated above, we focus on EME sovereign bonds held by euro-based investors for our main analysis. Our empirical approach takes advantage of the bilateral nature of the bond holdings statistics. On the lender side, the data comprises bond holdings in the 19 euro area countries.[10] On the borrower side, we focus on 27 major emerging markets that make up most of the investible EM bond universe.[11]

B. Empirical Design

Our analysis proceeds from general to specific. We first combine all euro area investors, and present regressions at three levels of aggregation on the borrower side: all EMEs combined at the aggregate level (time series), at the EME country level (panel), and at the individual security level (large panel). Further analysis then makes use of heterogeneity on the lender

[8]We use individual country series from the GBI-EM Broad Diversified Index for local currency bonds; the EMBI Global Diversified Index for dollar-denominated external government bonds, and the Euro EMBIG Diversified Index for euro-denominated external government bonds.

[9]We convert nominal holdings to their original currencies using current exchange rates against the euro, and convert them back to euros at constant exchange rates as of 2021q4.

[10]Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia, Spain. This list excludes Croatia, which entered the euro area in January 2023.

[11]Argentina, Brazil, Bulgaria, Chile, China, Colombia, Croatia, Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, Peru, Philippines, Poland, Romania, Russia, Saudi Arabia, Singapore South Africa, Taiwan (Chinese Taipei), Thailand, and Turkey.

side, exploiting the different portfolio exposures that individual euro area countries hold across the EMEs in the sample.

The dependent variable is the change in log nominal values (as in, e.g., Timmer 2018), corrected for exchange rate fluctuations. As described, by applying a fixed exchange rate (2021q4) over the sample period, the changes in log nominal values contain active changes by euro area investors and exclude price and currency valuation effects. The main regressors of interest are the different exchange rates outlined in Section A. Formally, we run the following regressions, separately for bonds denominated in all, in local, and in foreign currencies:

1. **Aggregate level** (time series):

$$\Delta \ln N_{FD,t} = \alpha + \beta_1 \Delta BDI_t + \beta_2 \Delta BEI_t + \beta_3 \Delta C_{FD,t} + \epsilon_{FD,t}, \quad (1)$$

   where ΔBDI_t equals the change in the log BDI from time $t-1$ to t; ΔBEI_t the change in the log BEI from time $t-1$ to t; and $C_{FD,t}$ the controls for foreign/local bonds at time t.

2. **Country level** (panel):

$$\begin{aligned} \Delta \ln N_{c,d,t} &= \alpha + \beta_1 \Delta BDI_t + \beta_2 \Delta BEI_t + \beta_3 \Delta BER^{€}_{c,d,t} \\ &+ \beta_4 C_{c,d,t} + \gamma_{c,d} + \epsilon_{c,d,t}, \end{aligned} \quad (2)$$

   where $\Delta BER^{€}_{c,d,t}$ equals the change in the log bilateral exchange rate for country c and currency of denomination d with respect to the euro from time $t-1$ to t, $C_{c,d,t}$ the controls for country c and currency of denomination d at time t, and $\gamma_{c,d}$ are fixed effects at the country-currency level. We orthogonalize $\Delta BER^{€}_{c,d,t}$ with respect to the BEI when combined in the regression with the BEI.

3. **Security level** (large panel):

$$\begin{aligned} \Delta \ln N_{s,t} &= \alpha + \beta_1 \Delta BDI_t + \beta_2 \Delta BEI_t + \beta_3 \Delta BER^{€}_{s,t} \\ &+ \beta_4 C_{s,t} + \gamma_s + \epsilon_{s,t}, \end{aligned} \quad (3)$$

   where $\Delta BER^{€}_{s,t}$ equals the change in the log bilateral exchange rate for the currency of denomination of security s with respect to the euro from time $t-1$ to t, $C_{s,t}$ are controls for security s at time t, and γ_s are security fixed effects.

In our regressions, we control for several factors distinct from currency effects (C). First, we control for the change in log total amount outstandings (TAO) of EME bonds in all three specifications. The reason is to take into account that the growth in the TAO in sovereign bonds of a specific EME will lead to more investors moving towards that EME, notably due to benchmarking. We also control for changes in the VIX to capture uncertainty in the economic outlook. Likewise, at the country and security level, to control for changes in country-specific macro fundamentals we include changes in yield differentials, credit ratings, GDP, fiscal capacity, and inflation. We further include changes in the yield differentials and credit ratings for bonds denominated in local versus foreign currencies. Finally, at the security level regressions, we also control for the remaining time to maturity of the bond to capture that investors typically target a specific duration of their portfolios; investors will buy bonds with longer time to maturities over time.

C. Summary Statistics

In the introduction, we showed that the holdings of EME bonds are more volatile over time than the foreign holdings. Figure 4 shows that euro area investors hold a larger share of the foreign (20%) than local currency bonds (5%) outstanding, consistent with the finding in Maggiori et al. (2020) that foreign investors mainly hold bonds in their own currency or in USD.

Table 1 and 2 summarize our main variables of interest. An important point to note is that the low correlations across the different types of exchange rates helps support our identification of the different financial channels. First, dollar strength and euro strength are quite distinct: the correlation between ΔBDI and ΔBEI at the quarterly frequency equals -0.36. Since the euro area and the US are major trade partners to each other, the EUR-USD exchange rate tends to push the BDI and BEI in opposite directions; moreover, each currency area has a different set of other major trade partners. Note also that depreciations of specific EME currencies are different from the general movement in the BDI: the correlation between changes in $BER^{€}$ and BDI is 0.00. Therefore, an EME depreciation against the euro (which affects euro-based lenders holding local currency bonds) can occur independently of the broad effects associated with a strong dollar.

[Place Table 1-2 about here]

IV. Empirical Results at three Levels of Aggregation

This section presents our baseline results, regressing the euro area investors' holdings of EME sovereign bonds on exchange rates and controls. As described, we run analogous regressions at each level of granularity: for all EMEs combined (Table 3), at the country level (Table 4) and at the security level (Table 5). Each table distinguishes local from foreign currency bonds in order to test the various expressions of the financial channel of exchange rates set out in Figure 2, focusing on the significance of the different exchange rates referencing the dollar and the euro, respectively. The section ends with extensions and robustness tests.

A. Aggregate Analysis

Treating all EMEs as an aggregate reduces the analysis to a simple time-series regression (Table 3). The only controls are the log changes in the VIX and in total sovereign bonds outstanding for all EMEs combined. Even at this coarse level the importance of exchange rates for foreign holdings of sovereign bonds is evident.

The coefficient on the BDI is negative and significant throughout. Taking the point estimate at face value, when the dollar strengthens by 1%, investors sell about 0.8% of their EME bond holdings (Column "All").[12] For local currency bonds, the response is more than one for one, whereas foreign currency bonds appear less sensitive to the dollar index.

A strengthening of the euro ($\Delta BEI > 0$) is also associated with net selling of EME sovereign bonds. The effect is similar, if weaker, to that of the dollar index. However, the key difference is that the effect only appears for bonds denominated in EMEs' local currencies (Column "Local"). This is a first sign that euro-based investors face a currency mismatch on local, not on foreign, currency bonds (Figure 2). To explore this channel, we need more variation in exchange rates available in the country-level regressions.

[Place Table 3 about here]

B. Country-level Analysis

The country-level regressions treat each EME separately in a panel setting, and thus provide more heterogeneity across currency pairs (Table 4). We examine how investors adjust their bond holdings vis-à-vis every EME, depending how that EME's currency moves against the euro over each quarter ($BER_c^{€}$). The bilateral rates now capture currency risk for euro-based investors holding local currency bonds.

Dollar strength tends to reduce bond holdings, as is apparent from all specifications of Table 4. A broad appreciation of the euro has a similar effect, but confined to local currency bonds ("Local" columns). For both indices, the effect is strong: when the dollar or the euro strengthens by 1% , investors reduce their holdings of EME bonds by 1% on average. Again,

[12] As described in the data section, the log change in holdings represents active allocation decisions, since the series excludes currency and other valuation effects by construction.

these estimated responses exclude currency valuation effects. The size of the euro-index effect drops to about a third when replacing the BEI by the bilateral rate between the euro and each EME currency ($BER_c^{€}$), in the middle columns of Table 4.

The right columns include both indices along with the bilateral exchange rates with respect to the euro. The coefficients on both indices are consistent with earlier results, after orthogonalising $BER_c^{€}$ with respect to the BEI to avoid multicollinearity. That means $\Delta BER^{€,ort}$ measures by how much *more* an EME depreciates against the euro than what the broader euro appreciation implies. The columns reveal that changes in holdings of local currency bonds at the country level are better explained by the broad euro index than by individual EME depreciations. The same findings hold in a bilateral setting with the holdings of individual euro area countries on individual EMEs (Appendix Table A1).

[**Place Table 4 about here**]

C. Security-level Analysis

In the security-level regressions we can make use of the rich dimensionality of the matched SHS-S-CSDB dataset (Section III). The sample size jumps from 1,751 (country-level) to almost 44,000 observations in Table 5. The granular data allow us to control for security fixed effects, so that we are sure our findings are not driven by security characteristics such as maturity, coupons or issue size. Using security-level data also alleviates concerns over endogeneity, since individual bonds sold in response to depreciation will not materially deepen that EME's depreciation (see Camanho et al. (2022)).

Taking out fixed effects at the security level leaves only *within* variation for each individual bond to be explained by the time-varying regressors. A rise in total amounts outstandings (TAO) leads some investors to include newly issued bonds into their EME portfolio, not least due to benchmarking. Also at the security level we find evidence of the turnover effect, in the variable "time-to-maturity": institutional investors target their portfolio at a particular duration or maturity, often around 7 years. If they held all bonds to maturity, the duration of their portfolios would decline over time; to compensate, investors tend to buy bonds with long time-to-maturities and sell those with shorter remaining maturities.

The results in Table 5 confirm our earlier findings with greater precision. Dollar strength leads to net selling of all types of EME sovereign bonds, with a greater effect on local than on foreign currency bonds. The elasticities are smaller in magnitude than for the country-level regression, but highly significant in most specifications. Global financial conditions, as gauged by the BDI, play a considerable role – even for euro area investors.

[Place Table 5 about here]

When EMEs depreciate against the euro, euro-based investors tend to shed bonds of the respective sovereign. The reaction to $BER_c^{€}$ is systematic for local currency bonds where investors face the currency mismatch; it is insignificant for foreign currency bonds, where borrowers face the mismatch. Euro-based investors also sell local currency bonds when the euro appreciates more broadly (against euro area trade partners). Their holdings of foreign-currency bonds do not react in measurable ways. Note that the effects of broad euro appreciation (BEI) are consistently larger than those of a bilateral euro appreciation against individual countries ($BER_c^{€}$). This matches the findings of (Hofmann et al. 2022) and is indicative of the role played by financial constraints.

The fact that foreign currency bonds are retained while local currency bonds are sold in response to depreciations is indicative of a lender-specific effect. Euro-based investors face valuation losses only on local currency bonds, not on the foreign currency bonds they hold. If investors viewed local currency bonds as risky on account of the sovereign's dollar borrowing, they would sell both types. But they might be unconcerned about a depreciation against the euro since most EMEs borrow predominantly in dollars, not euros.

Our results also highlight the strength and consistency of the BDI across all specifications. This finding is consistent with changes in global financial conditions (as measured by the BDI) affecting euro-based investors via funding availability and risk appetite.

D. Extensions and Robustness

The results at all levels of aggregation so far suggest that global investors systematically react to different types of exchange rates. A stronger dollar (BDI) has the broadest effect on bond holdings, akin to a global risk factor; a stronger euro (BEI) affects local currency bonds specifically, consistent with its role in euro-based investors' financial constraints; and bilateral depreciations against the euro trigger net selling of specific local currency bonds on which euro-based investors face a currency mismatch – identified without confounding dollar-related effects. These findings are consistent with the channels illustrated in Figure 2. The remainder of this section examines whether our findings remain robust in specifications designed to address various caveats.

Advanced economies. The analysis so far focused on a particular slice of the securities holdings statistics for reasons of identification, namely euro-based investors' holdings of sovereign bonds issued by major EMEs. The same mechanism could be at play for bonds issued by advanced economies (AEs), in particular for non-major currencies that are unlikely to be hedged (Figure 3). Table 6 runs the security-level regressions for sovereign bonds issued by major AEs outside of the euro area; we also exclude the United States to avoid confounding effects from the US dollar. As major AE sovereigns issue mostly in their own currency, the table presents estimates for local currency bonds and omits the foreign currency column.

The results again show that euro area investors sell local currency bonds when the BEI rises, consistent with the notion of tightening financial constraints when assets in other currencies lose value in terms of euros. In addition, the $BER_c^{€}$ has a negative impact on holdings, indicating that investors sell more of those AEs that depreciate against the euro. The estimated magnitude is larger than for EMEs, perhaps because AE bonds account for a larger share of investor portfolios, implying a greater effect on financial constraints.

EMEs borrowing euro. One concern is that the separation between borrower FX risk (mostly dollar) and investor currency mismatch (with respect to the euro) is not as clear-cut as we think. Several major EMEs in Europe rely to a large extent on euro-denominated borrowing, notably Bulgaria, Croatia, Czech Republic, Hungary, Poland, and Romania.[13] In those cases, depreciations against the euro play a dual role: causing losses on investors' local currency bond holdings *and* raising borrowers' debt burdens. Table 7 shows that excluding this set of borrowers from the baseline regression leaves results qualitatively unchanged. Hence, there is little evidence that euro borrowing among some EMEs undermines our identification of the channels in Figure 2.

Currency of bond vs issuer. Another possible concern is that country risk may blur the line between the reactions to local and foreign currency bonds of the same sovereign. It is possible that the burden that, say, Chile faces on its external dollar debt also makes its Chilean peso bonds more risky – defaults need not be selective. The specifications so far treated local and foreign currency bonds as distinct investments; holdings were assumed to react to the currency denomination of the bond, i.e. to dollar-euro rate for dollar bonds, and to the Chilean peso-euro rate for Chile's local currency bonds. However, if depreciations hurt a sovereign's creditworthiness overall, perhaps *all* bond holdings (also those of foreign currency bonds) respond to a depreciation of that issuer's currency.

To test this idea, we align the bilateral euro rate with the issuer country: in the example above, holders of Chilean bonds now face the peso-euro exchange rate, even on Chilean bonds issued in dollars or euros. Table 8 leaves several earlier results unchanged: we still observe net selling in response to dollar strength, and the shedding of local currency bonds when

[13] Each of these sovereigns has half or more of the government bonds issued as international debt securities (IDS) government bonds denominated in euros. More generally, the euro also accounts for a large share of their overall external debt liabilities at the country level (Bénétrix et al. 2019).

the euro appreciates and when specific EME currencies depreciate. However, a novel result is that euro-based investors seem to *buy* foreign-currency bonds in those circumstances, as evidenced by the *positive* signs on ΔBEI and $BER_c^{€}$. Seeing opposite signs suggests that investors shift from local to foreign currency bonds of the same sovereign when its currency depreciates. The same occurs when the euro appreciates (BEI) causing losses on other non-euro assets; though that effect is driven by euro-denominated bonds and disappears when they are excluded.

The net buying of foreign currency bonds is not as robust as the net selling of local currency bonds in response to EME depreciations. Even so, it is interesting to see holdings of local and foreign currency bonds move in opposite directions only because they have different currency denominations. These findings underscore that the relevant currency for investors is that of the bond they hold and the currency mismatch they face on their own balance sheet.

Investment funds and custodians. Belgium, Luxembourg, and Ireland are well-known for their funds industry and custodians that invest or hold financial assets on behalf of investors in other jurisdictions (Tabova and Warnock 2022). If the ultimate investors reside outside the euro area, the relevant currency mismatch may not relate to the euro. Indeed, Beck et al. (2023) show that UK investors often invest through investment funds in Luxembourg and Ireland. Table 9 shows that excluding these financial centers does not alter our findings. In fact, the reaction to euro-based exchange rates strengthen – an intuitive result, given that the modified investor base contains fewer investors with other reference currencies.

Analysis by sector. Finally, the channels we have in mind may not be relevant for all types of lenders. Some institutions mark to market continuously, others realise valuation losses only when bonds are sold or redeemed. Lenders may face leverage ratios, VaR constraints, or investment mandates leading to very different portfolios. To account for such differences, we run the baseline regressions separately for the major investor types in EME sovereign debt: banks, insurance companies and pension funds (ICPFs), and investment funds.

Table 10 summarizes the results. We find the strongest effects for investment funds. This is intuitive, given the practice of marking to market on a daily basis. These results are similar to those in Bertaut et al. (2023): mutual funds are more sensitive to exchange rates than other investors in local currency bonds. The findings are also consistent with Zhou (2023), who shows that German investment funds hold around 25% of their EME holdings in local currency bonds, while German banks and ICPFs hold less than 5% in local currency bonds, and over 90% in euro-denominated bonds. Finally, the findings are consistent with Sialm and Zhu (2024), who show that US international fixed income funds hedge only 18% of their currency exposure.

These results highlight the potential of exploiting the heterogeneity across lenders for better identification, an approach we pursue in the next subsection.

[Place Table 6-10 about here]

E. Exploring the Lender Currency Mismatch Effect

Our findings so far suggest that the currency mismatch on the lender side plays an important role in shaping investors' holdings of local currency debt. To further corroborate this idea, we make use of heterogeneity on the lender side by exploiting the variation in portfolio allocations (hence currency exposures) that investors in different euro area countries maintain vis-à-vis individual EMEs. Formally, we analyze the lender-specific changes in holdings $N^l_{c,d,t}$ on EME country c separately for each euro area country l, by currency of denomination d. As a preliminary step, we confirm that earlier country-level results (Table 4) still hold when we expand the panel by breaking out each euro area country on the lender side (see Appendix Table A1). There may be a common component driving the trades of all euro-area investors similarly. To explain variation across investors in different countries, we propose a specification that relates lender-specific changes to lender-specific currency exposures. We do so in three steps: (1) construct the currency exposure of investors in each country, (2) identify the changes in holdings that happen for reasons specific to each lender, and (3) examine how much of these lender-specific changes in (2) are due to the lender's specific exchange rate exposure in (1), as opposed to any other lender-specific factors (such as different capitalisations, investment style etc). In the first step, we compute lender-specific currency exposures by weighing exchange rate changes by each lender's specific portfolio allocation,

$$CE^l_t = \sum_c w^l_{c,t-1} \Delta BER^{€}_{c,t}, \tag{4}$$

where $w^l_{c,t-1} = \frac{N^l_{c,t-1}}{\sum_c N^l_{c,t-1}}$, the exposure of euro area investor l to EME country c at time $t-1$. Clearly, there is variation in the way bilateral exchange rates affect investors located in different euro area countries (Figure 6). The currency exposures co-move across investors in different euro area countries, but there are also structural differences in exposures over time, and in some periods the currency exposures even diverge. This is not surprising in view of the heterogeneity in holdings: some euro area countries hold larger exposures to Eastern European EMEs (e.g. Poland and Romania), whereas others primarily invest in Latin America (e.g. Brazil and Mexico).

[Place Figure 6 about here]

In a second step, we identify the lender-specific component in the change in holdings. To do so, we decompose the changes in holdings into three components: the common, the borrower-specific and the lender-specific components, based on the methodology developed by Amiti and Weinstein (2018) (henceforth: AW).[14] The AW methodology decomposes the growth variation in holdings in such a way that the three components exactly add up to the aggregate growth in holdings. The common component captures global growth in EME holdings, reflected in the median across all lender-borrower pairs, leaving only changes in holdings that are specific to individual borrowers (the different EMEs) or lenders (investors in different euro area countries). Extracting the lender-specific component alone ensures that the other two components do not bias the results in a second stage regression. We provide a technical description of the AW decomposition in our setting in Appendix A.

To apply AW, we focus on *local* currency debt, since this is where the lender-side currency mismatch arises. We combine a few small euro area countries with thin data: we aggregate the holdings of the Baltic countries (Estonia, Latvia, and Lithuania), group Malta with Italy, and Cyprus with Greece. The resulting AW decomposition is summarized in Figure 5. It aggregates the three components across all euro area investors and EME countries. Importantly, the lender-specific component (red bars) plays an important role in explaining overall growth in EME holdings.

[Place Figure 5 about here]

The final step examines the extent to which the lender-specific component in holdings responds to lender-specific currency exposures. Table 11 reports the results of panel regressions using OLS and WLS, where the weight for each investor country reflects the relative fraction of their EME portfolio in local (as opposed to foreign) currency bonds. The latter gives more weight to those investor countries that hold larger exposures to local bonds within their EME portfolio. In all cases currency exposures help explain the lender-specific component, with a negative sign (although the R^2 is low). Intuitively, when euro area investors in country l experience a larger depreciation given the EMEs in their portfolio, they shed a larger share of their sovereign EME portfolio than investors in other countries with a lower exposure to EME depreciations. Conversely, the broad euro index has no explanatory power for the lender-specific component, since a stronger euro affects all euro-based investors. This finding

[14] Other papers that apply their methodology include Amiti et al. (2019); Avdjiev et al. (2021).

helps corroborate the idea that lender-specific currency mismatches play a role in shaping investors' bond allocations.

[Place Table 11 about here]

V. A Mean-Variance Model of Sovereign Bond Portfolios

This section sets out a model to rationalize our empirical findings. We allow exchange rates to play a role at each level of the portfolio allocation problem: at the exposure level, the portfolio level, and broader global financial conditions, as sketched in Figure 2 (lower panel). To do so, we expand a standard model of portfolio choice to incorporate the currency dimensions relevant for global investors holding emerging market or small open economy bonds. Bond investors chose between local currency and foreign currency bonds across different issuers, and value the returns in their own reference currency (e.g. euro) that differs from the dominant global currency (dollar). We first set out a generic portfolio choice problem, and then specify return processes amendable to a closed-form solution in the presence of covariance across bonds.[15] We then show that the comparative statics broadly match our empirical findings on the effect of different exchange rates on bond holdings.

A. Generic Portfolio Choice Problem

Consider a risk-neutral institution or investor who maximises expected returns subject to a Value-at-Risk (VaR) constraint of the form

$$\alpha\sigma_r \leq \kappa,$$

where σ_r denotes the standard deviation of the investor's portfolio. The term α measures the stringency of the VaR constraint, and κ represents available capital. Squaring the VaR gives rise to the traditional mean-variance approach of maximising expected portfolio returns subject to a constraint on the variance of the portfolio,

$$\sigma_r^2 = w'\Sigma w \leq \left(\frac{\kappa}{\alpha}\right)^2. \tag{5}$$

[15]The set-up generalizes Aramonte et al. (2022) in several ways. We introduce endogenous capital, as in (Hofmann et al. 2022), but also expand the investment choice to local and foreign currency bonds while allowing for a separate reference currency.

The investor chooses portfolio weights w at the beginning of t. The terms α and κ will be endogenous, but do not depend on the current choice of w. From the Lagrangian

$$\mathcal{L} = w'\mu - \lambda \left[w'\Sigma w - \left(\frac{\kappa}{\alpha} \right)^2 \right],$$

the first-order conditions satisfy

$$\mu = \lambda \left(\Sigma + \Sigma' \right) w \quad \Rightarrow \quad w = \frac{1}{2\lambda} \Sigma^{-1} \mu. \tag{6}$$

The optimal choice equates the expected return from increased bond holdings with the marginal cost of additional risk. Using the binding VaR constraint (5) allows to solve for the Lagrange multiplier, $\lambda = \frac{\alpha}{2\kappa} \sqrt{\mu'\Sigma^{-1}\mu}$. Substituting λ into (6) yields the optimal portfolio,

$$w^* = \frac{\kappa/\alpha}{\sqrt{\mu'\Sigma^{-1}\mu}} \Sigma^{-1} \mu. \tag{7}$$

Optimal bond holdings are proportional to the effective capital available for managing portfolio risk, given the structure of expected returns and covariances.

Proposition 1. Optimal Bond Holdings

- The optimal allocation across individual bonds reflects their risk-adjusted expected returns $\Sigma^{-1}\mu$.
- The size of the overall bond portfolio is:
  - proportional to available capital κ.
  - inversely proportional to the stringency of the VaR constraint α.
  - inversely proportional to the generalized Sharpe ratio $\sqrt{\mu'\Sigma^{-1}\mu}$.

Before specifying returns and covariances, we discuss the role of capital and the VaR constraint. They are not exogenous, but predetermined. The investor solves a sequence of static portfolio choice problems every period: the portfolio w_t is chosen in period t, based on the expected returns from t to $t+1$, $E_t(r_{t+1}) = \mu_{t+1}$. The quantity of capital available is κ_t, reflecting the realised return of the previous portfolio,

$$\kappa_t = w'_{t-1} \, r_t.$$

Available capital rises when realized portfolio returns increase, giving investors a larger cushion against future losses. The stringency of the capital constraint α varies with global financial conditions over time. Since the BDI has attributes of a barometer of global risk-taking capacity (see above), we allow the VaR constraint to tighten as the US dollar rises in value: $\alpha_t = v_t^{\pi}$, where v_t is a weighted average of the value of the US dollar against other currencies (BDI). This assumption is equivalent to assuming that the level of risk aversion of a risk-averse investor depends on the BDI.

Note that the multiplicative forms we use correspond to our empirical specification: given expected returns and covariances, the log-linearized percentage change in holdings, $\Delta \ln(w_t)$, is linear in the corresponding percentage changes in capital and exchange rates.

B. *Return Process, Expected Returns, and Covariances*

We now specify the structure of returns and covariances to which investors respond in their portfolio choice of equation (7). With n sovereign issuers, the model is of dimension $2n$ to encompass bonds denominated in local currency (LC) and in foreign currency (FC). For emerging market sovereign bonds, it would be unrealistic to posit independent and identically distributed returns. Our approach allows for linkages across bond returns, yet admits an explicit solution for $\Sigma^{-1}\mu$ in (7). We incorporate two forms of covariance on top of idiosyncratic risk: (1) A common price drift induces covariance across all bonds; and (2) LC bonds have a common component reflecting the currency risk associated with emerging market currencies. Formally, the log-returns for bonds issued by country i follow:

$$\begin{aligned} \text{For LC bonds} &: \quad r_{i,t+1}^L = \chi_i^L + \delta_{t+1} + \gamma_{i,t+1} \\ \text{For FC bonds} &: \quad r_{i,t+1}^F = \chi_i^F + \varepsilon_{i,t+1}. \end{aligned}$$

The variables in the model relate to the exchange rates in our empirics as follows. Euro-based investors evaluate all returns in terms of their reference currency. FC bonds, if not denominated in euro, are hedged into euro to yield a return of $r_{i,t+1}^F$; the drift χ_i^F captures the risk premium of FC bonds (in country i). LC bonds are denominated in emerging market currencies and held unhedged; on top of the local-currency risk premium, χ_i^L, investors face currency risk. The common component δ_{t+1} captures a broad-based appreciation across currencies, and thus corresponds to (a decline in) the BEI; the idiosyncratic component $\gamma_{i,t+1}$ reflects a specific BER_i, i.e. the appreciation of a particular country's exchange rate against the euro.

Following Proposition 1, the vector $\Sigma^{-1}\mu$ is the key ingredient for the comparative statics of how investors allocate their holdings across different bonds. To derive the expected returns and covariances needed for equation (7), we make the following assumptions. First, we assume that the covariance of the country-specific components of returns across *all* bonds equals ρ. Second, for the exchange rate dynamics we assume the common component δ_{t+1} follows a random walk: $\delta_{t+1} = \delta_t + \eta_{t+1}$, with $\eta_{t+1} \sim \mathcal{N}(0, c)$ i.d.d.[16] We also allow for persistence in the country-specific component $\gamma_{i,t+1} = \gamma_{i,t} + \nu_{i,t+1}$, with $\nu_{i,t+1} \sim \mathcal{N}(0, z + \rho)$ i.d. (identically, not independently, distributed). Note that the country-specific component includes both country-specific appreciations and idiosyncratic variation in the LC risk premium χ_i^L. We assume that $\gamma_{i,t}$ averages zero in the cross-section of LC bonds. For LC bonds, combining the various components, LC returns follow $r^L_{i,t+1} \sim \mathcal{N}(\chi_i^L + \delta_t + \gamma_{i,t}, z + c + \rho)$.[17] For FC bonds, $\varepsilon_{i,t+1}$ captures idiosyncratic variation in the general FC risk premium χ_i^F, with $\varepsilon^F_{i,t+1} \sim \mathcal{N}(0, f + \rho)$ i.d. (identically, not independently, distributed).[18] With this, the returns on foreign currency bonds are distributed as $r^F_{i,t+1} \sim \mathcal{N}(\chi_i^F, f + \rho)$.

In every period, investors solve a problem of the same form. Dropping time subscripts to highlight the differential returns across countries and currency denominations, we can write expected returns and the covariance matrix as:

$$\mu = \left(\begin{array}{l} \chi_1^L + \delta + \gamma_1 \\ \chi_2^L + \delta + \gamma_2 \\ \dots \\ \chi_n^L + \delta + \gamma_n \\ \hline \chi_1^F \\ \dots \\ \chi_n^F \end{array} \right), \text{ and } \Sigma = \left[\begin{array}{llll|lll} \rho + c + z & \rho + c & \dots & \rho + c & \rho & \dots & \rho \\ \rho + c & \rho + c + z & \dots & \rho + c & \rho & \dots & \rho \\ \dots & \dots & \dots & \rho + c & \rho & \dots & \rho \\ \rho + c & \rho + c & \dots & \rho + c + z & \rho & \dots & \rho \\ \hline \rho & \rho & \rho & \rho & \rho + f & \dots & \rho \\ \dots & \dots & \dots & \dots & \dots & \dots & \rho \\ \rho & \rho & \rho & \rho & \rho & \rho & \rho + f \end{array} \right] \quad (8)$$

Recall that the solution to the portfolio problem in equation (7) involves the vector $\Sigma^{-1}\mu$, while the remaining terms scale the entire portfolio (Proposition 1). To derive an explicit solution for $\Sigma^{-1}\mu$ under the current assumptions, we make use of a result in linear algebra known as the Sherman-Morrison formula to obtain the inverse Σ^{-1} (see Appendix B.1).

Lemma 1. The allocation to LC and FC bonds is proportional to the vector $\Sigma^{-1}\mu$, and is

[16] This assumption is for expositional simplicity. Strictly speaking, exchange rate changes do not follow a random walk but rather an AR(1) process, as evidenced by the data where regressing current exchange rates on their lagged counterparts gives an AR(1) coefficient of 0.2 on average. Our main results are qualitatively the same for positive AR coefficients smaller than one.

[17] We write it in this way for tractability to obtain an analytical solution. In particular, we have $\text{Cov}(r^L_{i,t}, r^L_{j,t}) = c + \rho$, hence $\text{Var}(r^L_{i,t}) = \text{Cov}(r^L_{i,t}, r^L_{j,t}) = c + \rho + z$.

[18] This is again for tractability: $\text{Cov}(r^F_{i,t}, r^F_{j,t}) = \rho$, hence $\text{Var}(r^F_{i,t}) = \text{Cov}(r^F_{i,t}, r^F_{i,t}) = \rho + f$.

of the following form:

$$\begin{array}{llll} \text{LC bonds:} & w_i^{LC} & \propto & \mu_i^L/z - \sigma^L\overline{\mu}^L - \beta\,\overline{\mu}^F \\ \text{FC bonds:} & w_i^{FC} & \propto & \mu_i^F/f - \sigma^F\overline{\mu}^F - \beta\,\overline{\mu}^L, \end{array} \tag{9}$$

Proof: see Appendix B.2.

The proportionality ($\propto$) recognises that optimal holdings w_i are proportional to $\Sigma^{-1}\mu$ (see Proposition 1). In (9), μ_i^{LC} (μ_i^{FC}) denotes the expected return of the local (foreign) currency bond issued by country i, and $\overline{\mu}^{LC}$ ($\overline{\mu}^{FC}$) represents the corresponding average expected returns across local (foreign) currency bonds. The remaining parameters are positive constants collecting parameters from the covariance matrix.

Proposition 2. Solution and Comparative Statics

The optimal bond holdings (7) under our return and covariance assumptions give rise to solution (9), with the following characteristics:

1. Bond holdings w_i rise in their own **return**, and fall in the return components of competing bonds.
2. Holdings fall in a bond's own **variance**, and rise in the variance of other bonds. The **covariance** terms reduce holdings of the respective bonds: ρ lowers all bond holdings, c reduces LC bonds.
3. **Exchange rates** affect optimal bond holdings as follows:
   - A drop in δ (increase in BEI) reduces w_i^{LC} and raises w_i^{FC}, for all i; the absolute change in w_i^{LC} exceeds that in w_i^{FC} in magnitude.
   - A drop in γ_i (increase in BER_i) reduces w_i^{LC} and leaves w_i^{FC} unaffected. In contrast to δ, γ_i acts on w_i^{LC} whereas δ acts on all local currency bonds.
4. The **capital constraint** scales the entire bond portfolio:
   - A tighter VaR constraint (an increase in α, e.g. due to an increase in v (BDI)), reduces all bond holdings, w_i^{LC} and w_i^{FC} for all i.

Proof: See Appendix B.3.

The comparative statics indicate which exchange rates matter to global investors. An increase in the BDI ($v\uparrow$) reduces all bond holdings, even for euro-based investors holding local currency bonds denominated in EME currencies. A rise in BEI ($\delta < 0$) reduces local currency bond holdings across the board ($w_i^{LC}\downarrow \forall i$). Looking across individual issuers i, the demand for LC bonds is relatively higher for countries with greater expected appreciations against the reference currency ($\gamma_i > 0$, reflecting BER_i).

In line with the empirical findings in the previous section, the model predicts that euro area investors systematically shed local currency bonds after a depreciation of these currencies against the euro, while retaining foreign currency bonds of the same sovereign issuers. Thus, a currency mismatch on the *lender* side is an important channel driving the asset allocation of global investors.

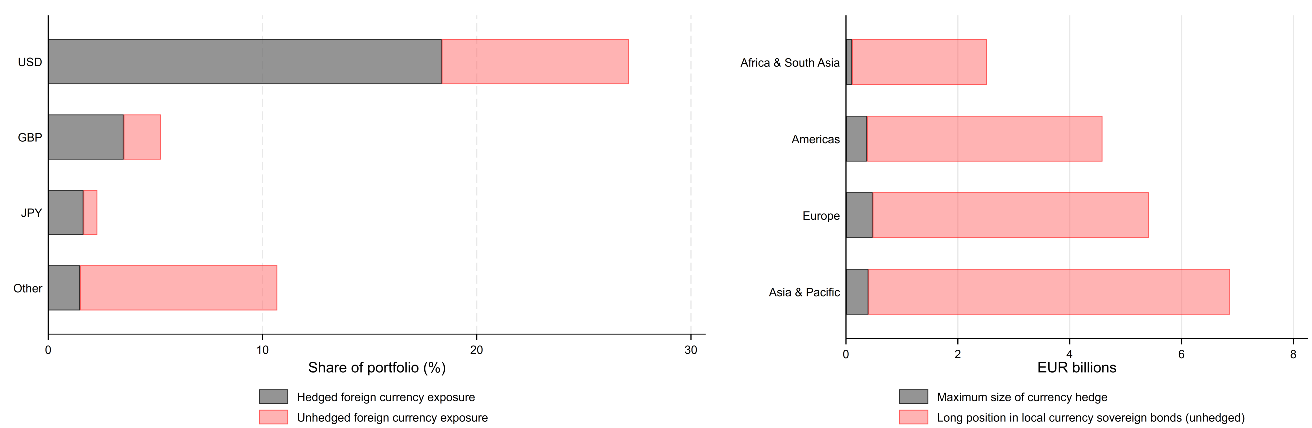
VI. Conclusions

This paper has shed new light on how international investors adjust their bond holdings in response to exchange rate movements across reference currencies, local currencies and the dollar as a global risk factor. By focusing on euro area-based investors for whom the euro is the reference currency, we rotate the reference currency away from the dollar, to identify the impact on the reference currency (euro) without the confounding effects from the dominant role of the dollar in global finance and trade invoicing. This allows us to exploit granular security-level detail on the issuer, the holder and the currency of each bond to define the relevant exchange rates for the currency mismatch on either side.

We find that euro-based investors sell local currency bonds as an asset class when there is a broad-based depreciation of EME currencies against the euro, and sell more local currency bonds of those sovereign issuers whose currency depreciates against the euro, precisely those bonds on which investors' currency mismatch bites hardest. In this sense, the locus of currency risk we observe is very specific, tied to the lender's balance sheet. When an EME depreciates, the rise in its debt burden may increase credit risk on foreign currency bonds; the same depreciation is inconsequential in terms of servicing local currency debt. Yet we find that investors primarily sell local currency bonds in response to a depreciation of an EME against the euro. Investors react to the currency mismatch on their *own* balance sheet: the relevant exchange rate is the currency of the bond they hold, not the currency of the issuer country. The results underscore the importance of currency mismatches with respect to lenders' reference currencies.

Figure 3. **Hedging practices of Dutch pension funds**

Panel (a) shows a breakdown of the total assets held by Dutch pension funds to different currencies: USD, GBP, JPY, and the rest. The graph also shows the fraction of the total currency exposure that is hedged. Both data points are from mandatory regulatory filings that pension funds report to the Dutch Central Bank, and we take the time-series and cross-sectional averages over all pension funds from 2012q1-2021q4. The average share of the portfolio that is invested in the euro area equals 55%, hence the breakdown to currencies covers the remaining 45% of the portfolio. Panel (b) sets the nominal value of local EME sovereign bonds held by Dutch pension funds (from SHS-S), aggregated by region, against the maximum size of their currency hedges. The latter are computed by aggregating the overall derivatives notional positions in each of the respective EME currencies that pension funds are mandated to report to trade repositories (EMIR). The calculations are based on average quarterly positions in 2021.

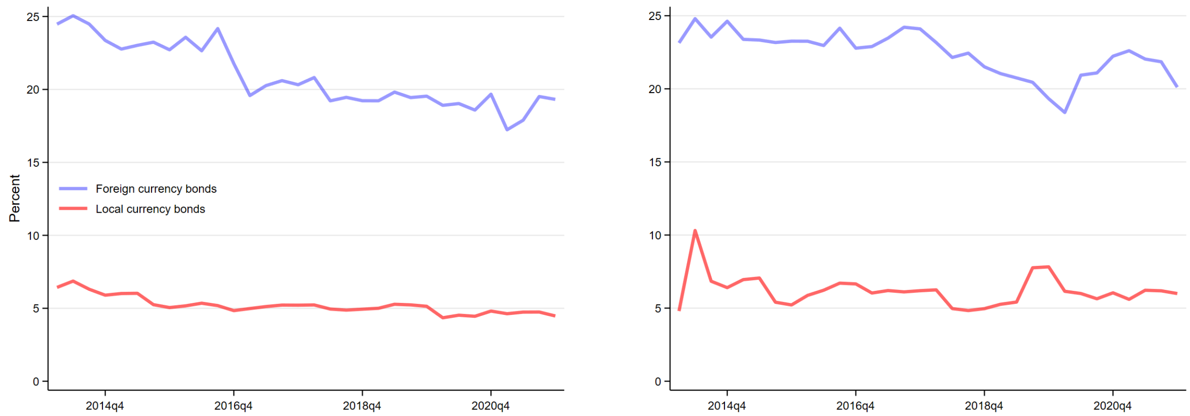


(a) Hedging by currency

(b) Hedging of EME sovereign bonds

Figure 4. **Fraction of TAO held by EA investors**

This figure shows the fraction of the total amount outstanding (TAO) of EME bonds held by euro area investors (in percentage points), separately for local and foreign currency bonds. Panel a) shows the results for all securities held by euro area investors (full sample). Panel b) focuses on securities that are in our sample over the entire period 2013q4-2021q4 (balanced sample). The quarterly sample period is 2013q4-2021q4.



(a) Full sample (b) Balanced sample

Figure 5. **Changes in EME local currency bond holdings - decomposed**

This figure decomposes the changes in EME local currency bonds held by euro area investors in components unique to euro area investors (lenders), EME countries (borrowers), and a common component. The decomposition is based on the algorithm in Amiti and Weinstein (2018). The changes in EME local currency bonds are free of price and currency valuation effects. The borrower and lender components are weighted by total nominal holdings to compute the aggregate change in holdings. The quarterly sample period is 2013q4-2021q4.

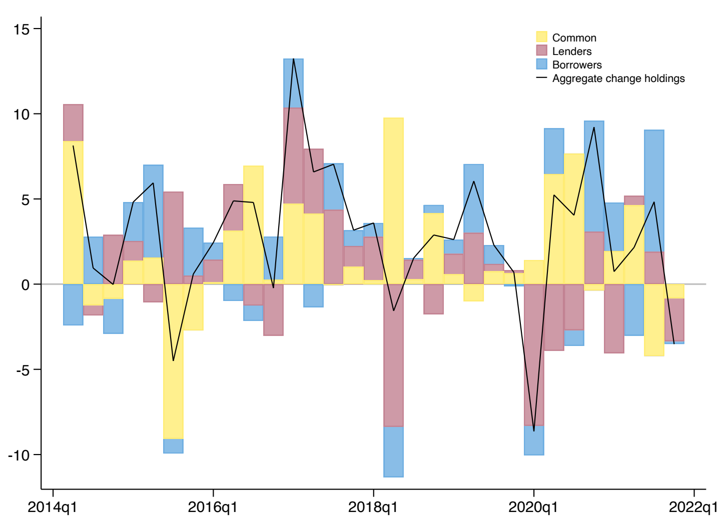


Figure 6. **Heterogeneity in currency exposures across EA countries**

This figure shows the currency exposures for each euro area country. The currency exposure equals: $CE_t^l = \sum_c w_{c,t-1}^l \Delta BER_{c,t}^{€}$, with $w_{c,t-1}^l$ the weight of EME c in investor's l portfolio. The weighted average includes our entire set of 27 EME countries and the quarterly sample period is 2013q4-2021q4.

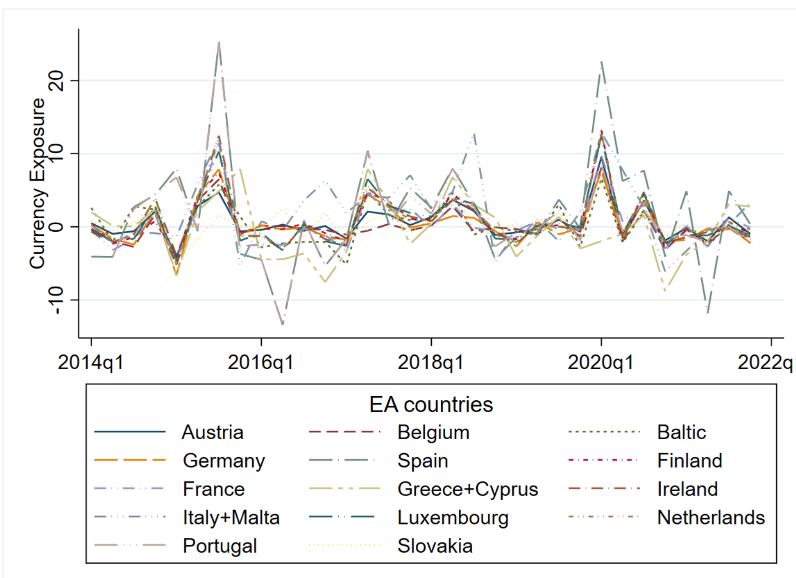


Table 1. **Summary statistics**: This table shows summary statistics for the variables used in the main analysis. Panel A shows variables at the time-level: changes in Broad Dollar Index (BDI), changes in Broad Euro Index (BEI), changes in the VIX, and total amount outstanding (TAO). Panel B shows variables at the country-level: bilateral exchange rates with respect to the euro ($BER^{€}$), GDP, fiscal (net lending/borrowing as % of GDP), inflation, yield differentials (yield on EME country c minus German yield), credit ratings, and TAO. Panel C shows variables at the security-level: remaining time to maturity and TAO. TAO, yield differentials, credit ratings, and time to maturity are reported separately for local and foreign currency bonds. For foreign currency bonds, our analysis is at the country-currency level. BDI, BEI, BERs, VIX, inflation, and yield differentials are in percentage points. TAO is in millions EUR and GDP in billions USD. Fiscal is in percent of GDP. Credit ratings are numerical, and range from 1 (lowest rating) to 21 (highest rating). The quarterly sample period is 2013q4-2021q4.

Panel A: Time level					
	mean	std.dev.	p5	p50	p95
Δ BDI	0.59	2.94	-3.07	0.29	5.26
Δ BEI	0.18	2.27	-2.51	0.38	3.25
Δ VIX	0.06	37.38	-56.50	-13.49	74.07
TAO *domestic*	3397	921	1757	3701	4708
TAO *foreign*	710	199	427	716	1074
Panel B: Country level					
	mean	std.dev.	p5	p50	p95
Δ BER €	0.87	5.48	-6.09	0.06	9.02
GDP	1131	2500	64	382	2729
Fiscal	-2.73	3.06	-7.74	-2.50	2.38
Inflation	4.12	6.96	-0.64	2.62	13.53
Yield differential *domestic*	5.12	6.49	0.61	3.52	11.96
Yield differential *foreign*	3.29	3.32	0.36	3.05	6.75
Credit rating *domestic*	12.92	3.43	8	12	19
Credit rating *foreign*	12.10	3.47	6	12	17
TAO *domestic*	131	222	5	59	571
TAO *foreign*	38	39	2	25	119
Panel C: Security level					
	mean	std.dev.	p5	p50	p95
Time to maturity *domestic*	7.27	7.51	0.44	4.81	23.89
Time to maturity *foreign*	11.73	16.42	0.71	7.34	29.58
TAO *domestic*	3	5	0	2	12
TAO *foreign*	1	2	0	1	3

Table 2. **Correlation table**: This table shows the correlation table of the main variables introduced in Table 1. For all variables, we take log changes to construct the correlation table. The quarterly sample period is 2013q4-2021q4.

	Correlation table									
Δ BDI	1.00									
Δ BEI	-0.36	1.00								
Δ BER €	0.00	0.42	1.00							
Δ VIX	0.42	0.16	0.18	1.00						
Δ TAO	0.00	0.02	-0.01	-0.04	1.00					
Δ Yield diff	0.12	-0.04	0.29	0.05	0.03	1.00				
Δ credit rating	0.00	0.01	0.01	0.02	-0.04	-0.25	1.00			
Δ GDP	-0.54	0.12	-0.54	-0.19	0.01	-0.18	0.07	1.00		
Δ Fiscal	0.10	-0.19	-0.11	-0.10	0.00	0.05	0.04	0.08	1.00	
Δ Inflation	-0.06	-0.02	0.12	-0.01	-0.03	0.06	0.08	0.04	0.04	1.00

Table 3. **Time-series regressions**: This table reports regressions of quarterly changes in foreign holdings (log nominal amounts) on log changes in the Broad Dollar Index (BDI) and the Broad Euro Index (BEI). Column headings indicate whether the sample includes bonds denominated in all, in local or in foreign currencies (from the perspective of the EME sovereign). For foreign currency bonds, our analysis is at the country-currency level. Controls include the change in log total amount outstanding (TAO), and the change in the VIX. The quarterly sample period is 2013q4-2021q4. Standard errors are clustered at the foreign-local level and reported in brackets. Significance: ***99%, **95%, *90%.

	All	Domestic	Foreign
ΔBDI	-0.842***	-1.170***	-0.499***
	[0.147]	[0.258]	[0.165]
ΔBEI	-0.475***	-0.783***	-0.098
	[0.171]	[0.265]	[0.145]
ΔTAO	0.004	-0.252	0.15
	[0.232]	[0.634]	[0.090]
ΔVIX	0.001	0.006	-0.003
	[0.010]	[0.015]	[0.010]
Constant	2.637***	3.884**	1.981***
	[0.489]	[1.813]	[0.350]
N	64	32	32
R-sq	0.31	0.36	0.51

Table 4. **Panel regressions at the country level**: This table reports regressions of quarterly changes in foreign holdings (log nominal amounts) on log changes in the Broad Dollar Index (BDI), Broad Euro Index (BEI), and EME bilateral exchange rates against the euro ($BER^{€}$) and the same bilateral exchange rates orthogonalized with respect to the BEI ($BER^{€,ort}$). Column headings indicate whether the sample includes bonds denominated in all, in local or in foreign currencies (from the perspective of the EME sovereign). For foreign currency bonds, our analysis is at the country-currency level. Controls include the change in log total amounts outstanding, credit ratings, yield differentials, VIX, GDP, fiscal, and inflation. Country and country-currency fixed effects are included as reported. The quarterly sample period is 2013q4-2021q4. Standard errors are clustered at the country-currency level and reported in brackets. Significance: ***99%, **95%, *90%.

	BDI vs BEI			BDI vs $BER^{€}$			BDI vs BEI vs $BER^{€}$		
	All	**Local**	**Foreign**	**All**	**Local**	**Foreign**	**All**	**Local**	**Foreign**
ΔBDI	-0.944***	-1.245***	-0.549**	-0.883***	-1.119***	-0.471	-1.000***	-1.258***	-0.591**
	[0.200]	[0.297]	[0.266]	[0.215]	[0.297]	[0.354]	[0.211]	[0.307]	[0.282]
ΔBEI	-0.533**	-0.860***	-0.123			-0.553**	-0.861***	-0.147	
	[0.227]	[0.292]	[0.327]		[0.230]	[0.294]	[0.331]		
$\Delta BER^{€}$				-0.210**	-0.268*	0.033			
				[0.095]	[0.157]	[0.199]			
$\Delta BER^{€,ort}$						-0.129	-0.029	-0.105	
					[0.098]	[0.174]	[0.107]		
ΔTAO	0.444***	0.217***	0.621***	0.446***	0.210***	0.623***	0.443***	0.217***	0.620***
	[0.064]	[0.069]	[0.092]	[0.064]	[0.069]	[0.092]	[0.064]	[0.069]	[0.092]
Δ Yield diff	0.17	-0.388	0.767	0.225	-0.231	0.763	0.22	-0.37	0.783
	[0.239]	[0.254]	[0.491]	[0.239]	[0.274]	[0.491]	[0.248]	[0.280]	[0.495]
ΔVIX	0.012	0.022	-0.008	0.005	0.012	-0.011	0.013	0.022	-0.007
	[0.012]	[0.016]	[0.017]	[0.012]	[0.017]	[0.017]	[0.012]	[0.016]	[0.017]
ΔCredit rating	0.592	-3.525	2.034	0.685	-3.09	1.979	0.74	-3.475	2.109
	[1.428]	[2.275]	[1.422]	[1.421]	[2.339]	[1.428]	[1.418]	[2.354]	[1.400]
Δ GDP	-0.012	-0.004	0.013	-0.045	-0.13	0.018	-0.067	-0.019	-0.026
	[0.062]	[0.097]	[0.080]	[0.068]	[0.137]	[0.082]	[0.083]	[0.132]	[0.105]
Δ Fiscal	-0.462	0.299	-0.898	-0.313	0.541	-0.846	-0.436	0.302	-0.867
	[0.643]	[0.965]	[0.839]	[0.635]	[0.962]	[0.823]	[0.644]	[0.965]	[0.843]
Δ Inflation	-0.232	0.177	-0.368	-0.14	0.376	-0.351	-0.175	0.191	-0.328
	[0.318]	[0.542]	[0.378]	[0.319]	[0.563]	[0.376]	[0.325]	[0.568]	[0.381]
Country FE	No	Yes	No	No	Yes	No	No	Yes	No
Country-Curr FE	Yes	–	Yes	Yes	–	Yes	Yes	–	Yes
N	1751	779	972	1751	779	972	1751	779	972
R-sq	0.17	0.09	0.28	0.16	0.08	0.28	0.17	0.09	0.28

Table 5. **Panel regressions at the security level**: This table reports regressions of quarterly changes in foreign holdings (log nominal amounts) on log changes in the Broad Dollar Index (BDI), Broad Euro Index (BEI), and EME bilateral exchange rates against the euro ($BER^{€}$) and the same bilateral exchange rates orthogonalized with respect to the BEI ($BER^{€,ort}$). Column headings indicate whether the sample includes bonds denominated in all, in local or in foreign currencies (from the perspective of the EME sovereign). For foreign currency bonds, our analysis is at the country-currency level. Controls include the change in log total amounts outstanding, credit ratings, yield differentials, VIX, GDP, fiscal, and inflation, and the remaining time-to-maturity (of security s, TTM). Security fixed effects are included as reported. The quarterly sample period is 2013q4-2021q4. Standard errors are clustered at the security level and reported in brackets. Significance: ***99%, **95%, *90%.

	BDI vs BEI			BDI vs $BER^{€}$			BDI vs BEI vs $BER^{€}$		
	All	**Local**	**Foreign**	**All**	**Local**	**Foreign**	**All**	**Local**	**Foreign**
ΔBDI	-0.600***	-0.671***	-0.469***	-0.693***	-0.660***	-0.476***	-0.629***	-0.691***	-0.493***
	[0.076]	[0.096]	[0.115]	[0.078]	[0.098]	[0.136]	[0.079]	[0.100]	[0.118]
ΔBEI	-0.161**	-0.278***	0.083				-0.171**	-0.284***	0.074
	[0.081]	[0.104]	[0.119]				[0.082]	[0.105]	[0.120]
$\Delta BER^{€}$				-0.179***	-0.114**	0.03			
				[0.043]	[0.056]	[0.097]			
$\Delta BER^{€,ort}$							-0.053	-0.143**	-0.032
							[0.042]	[0.067]	[0.052]
ΔTAO	0.285***	0.278***	0.287***	0.285***	0.277***	0.287***	0.285***	0.278***	0.287***
	[0.017]	[0.018]	[0.039]	[0.017]	[0.018]	[0.039]	[0.017]	[0.018]	[0.039]
Time-to-maturity	1.907***	2.481***	0.847***	1.901***	2.479***	0.848***	1.905***	2.481***	0.843***
	[0.094]	[0.129]	[0.126]	[0.094]	[0.129]	[0.126]	[0.094]	[0.129]	[0.126]
Δ Yield diff	0.087	-0.434***	0.434***	0.13	-0.353**	0.437***	0.105	-0.403**	0.439***
	[0.095]	[0.168]	[0.114]	[0.095]	[0.176]	[0.114]	[0.097]	[0.179]	[0.115]
ΔVIX	-0.003	0.001	-0.016**	-0.002	-0.002	-0.015**	-0.003	0.001	-0.016**
	[0.005]	[0.006]	[0.007]	[0.004]	[0.006]	[0.007]	[0.005]	[0.006]	[0.007]
ΔCredit rating	-2.153***	-3.119***	-1.362**	-1.926***	-2.897***	-1.338**	-2.091***	-3.036***	-1.324**
	[0.475]	[0.839]	[0.581]	[0.479]	[0.849]	[0.582]	[0.479]	[0.851]	[0.587]
Δ GDP	0.034	0.074**	-0.04	-0.012	0.03	-0.043	0.007	0.056	-0.06
	[0.024]	[0.036]	[0.032]	[0.025]	[0.041]	[0.032]	[0.031]	[0.042]	[0.042]
Δ Fiscal	-0.115	-0.227	0.116	-0.104	-0.168	0.09	-0.107	-0.231	0.133
	[0.263]	[0.348]	[0.362]	[0.261]	[0.347]	[0.356]	[0.264]	[0.348]	[0.363]
Δ Inflation	0.314***	0.062	0.416***	0.334***	0.106	0.416***	0.330***	0.083	0.424***
	[0.093]	[0.179]	[0.105]	[0.093]	[0.181]	[0.105]	[0.097]	[0.179]	[0.115]
Security FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	43824	29916	13908	43824	29916	13908	43824	29916	13908
R-sq	0.13	0.13	0.1	0.13	0.13	0.1	0.13	0.13	0.1

Table 6. **Robustness - Advanced economies**: This table reports regressions of quarterly changes in foreign holdings (log nominal amounts) on log changes in the Broad Dollar Index (BDI), Broad Euro Index (BEI), and bilateral exchange rates against the euro ($BER^{€}$) and the same bilateral exchange rates orthogonalized with respect to the BEI ($BER^{€,ort}$). The sample includes major advanced economies outside of the euro area and excluding the United States, namely Australia, Canada, Denmark, Japan, Norway, New Zealand, Sweden, Switzerland and the United Kingdom. As these countries primarily issue bonds in their own currencies, we show the results for local currency bonds only. Controls include the change in log total amounts outstanding, credit ratings, yield differentials, VIX, GDP, fiscal, and inflation, and the remaining time-to-maturity (of security s). Security fixed effects are included as reported. The quarterly sample period is 2013q4-2021q4. Standard errors are clustered at the security level and reported in brackets. Significance: ***99%, **95%, *90%.

	BDI vs BEI	BDI vs $BER^{€}$	BDI vs BEI vs $BER^{€}$
ΔBDI	-0.111	-0.274***	-0.263***
	[0.087]	[0.098]	[0.098]
ΔBEI	-0.370***		-0.390***
	[0.101]		[0.101]
$\Delta BER^{€}$		-0.338***	
		[0.074]	
$\Delta BER^{€,ort}$			-0.273***
			[0.086]
Controls	Yes	Yes	Yes
Security FE	Yes	Yes	Yes
N	39568	39568	39568
R-sq	0.07	0.07	0.07

Table 7. **Robustness - EMEs borrowing euro**: This table reports regressions of quarterly changes in foreign holdings (log nominal amounts) on log changes in the Broad Dollar Index (BDI), Broad Euro Index (BEI), and EME bilateral exchange rates against the euro ($BER^{€}$) and the same bilateral exchange rates orthogonalized with respect to the BEI ($BER^{€,ort}$), *excluding* the following EMEs: Bulgaria, Croatia, Czech Republic, Hungary, Poland, and Romania. Column headings indicate whether the sample includes bonds denominated in all, in local or in foreign currencies (from the perspective of the EME sovereign). For foreign currency bonds, our analysis is at the country-currency level. Controls include the change in log total amounts outstanding, credit ratings, yield differentials, VIX, GDP, fiscal, and inflation, and the remaining time-to-maturity (of security s). Security fixed effects are included as reported. The quarterly sample period is 2013q4-2021q4. Standard errors are clustered at the security level and reported in brackets. Significance: ***99%, **95%, *90%.

	BDI vs BEI			BDI vs $BER^{€}$			BDI vs BEI vs $BER^{€}$		
	All	**Local**	**Foreign**	**All**	**Local**	**Foreign**	**All**	**Local**	**Foreign**
ΔBDI	-0.611***	-0.670***	-0.493***	-0.709***	-0.658***	-0.401**	-0.634***	-0.691***	-0.504***
	[0.082]	[0.101]	[0.129]	[0.084]	[0.103]	[0.168]	[0.085]	[0.105]	[0.132]
ΔBEI	-0.197**	-0.272**	-0.036				-0.207**	-0.281**	-0.041
	[0.088]	[0.110]	[0.137]				[0.089]	[0.111]	[0.137]
$\Delta BER^{€}$				-0.186***	-0.105*	0.067			
				[0.044]	[0.057]	[0.117]			
$\Delta BER^{€,ort}$							-0.039	-0.041	-0.015
							[0.044]	[0.068]	[0.054]
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Security FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	36674	25903	10771	36674	25903	10771	36674	25903	10771
R-sq	0.13	0.13	0.1	0.13	0.13	0.1	0.13	0.13	0.1

Table 8. **Robustness - Currency of bond vs issuer**: This table reports regressions of quarterly changes in foreign holdings (log nominal amounts) on log changes in the Broad Dollar Index (BDI), Broad Euro Index (BEI), and EME bilateral exchange rates against the euro ($BER^{€}$) and the same bilateral exchange rates orthogonalized with respect to the BEI ($BER^{€,ort}$), using bilateral euro rates with respect to the *issuer country*. Column headings indicate whether the sample includes bonds denominated in all, in local or in foreign currencies (from the perspective of the EME sovereign). For foreign currency bonds, our analysis is at the country-currency level. Controls include the change in log total amounts outstanding, credit ratings, yield differentials, VIX, GDP, fiscal, and inflation, and the remaining time-to-maturity (of security s). Security fixed effects are included as reported. The quarterly sample period is 2013q4-2021q4. Standard errors are clustered at the security level and reported in brackets. Significance: ***99%, **95%, *90%.

	BDI vs BEI			BDI vs $BER^{€}$			BDI vs BEI vs $BER^{€}$		
	All	**Local**	**Foreign**	**All**	**Local**	**Foreign**	**All**	**Local**	**Foreign**
ΔBDI	-0.656***	-0.671***	-0.538***	-0.402***	-0.660***	-0.048	-0.482***	-0.691***	-0.139
	[0.076]	[0.096]	[0.116]	[0.078]	[0.098]	[0.122]	[0.080]	[0.100]	[0.124]
ΔBEI	-0.109	-0.278***	0.227*				-0.061	-0.284***	0.333***
	[0.082]	[0.104]	[0.122]				[0.082]	[0.105]	[0.122]
$\Delta BER^{€}$				0.207***	-0.114**	0.499***			
				[0.039]	[0.056]	[0.062]			
$\Delta BER^{€,ort}$							0.303***	-0.143**	0.542***
							[0.044]	[0.067]	[0.068]
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Security FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	43824	29916	13908	43824	29916	13908	43824	29916	13908
R-sq	0.13	0.13	0.16	0.13	0.13	0.16	0.13	0.13	0.16

Table 9. **Robustness - Investment funds and custodians**: This table reports regressions of quarterly changes in foreign holdings (log nominal amounts) on log changes in the Broad Dollar Index (BDI), Broad Euro Index (BEI), and EME bilateral exchange rates against the euro ($BER^{€}$) and the same bilateral exchange rates orthogonalized with respect to the BEI ($BER^{€,ort}$), *excluding* the following holder countries: Belgium, Luxembourg, and Ireland. Column headings indicate whether the sample includes bonds denominated in all, in local or in foreign currencies (from the perspective of the EME sovereign). For foreign currency bonds, our analysis is at the country-currency level. Controls include the change in log total amounts outstanding, credit ratings, yield differentials, VIX, GDP, fiscal, and inflation, and the remaining time-to-maturity (of security s). Security fixed effects are included as reported. The quarterly sample period is 2013q4-2021q4. Standard errors are clustered at the security level and reported in brackets. Significance: ***99%, **95%, *90%.

	BDI vs BEI			BDI vs $BER^{€}$			BDI vs BEI vs $BER^{€}$		
	All	**Local**	**Foreign**	**All**	**Local**	**Foreign**	**All**	**Local**	**Foreign**
ΔBDI	-0.713***	-0.912***	-0.338***	-0.750***	-0.853***	-0.467***	-0.753***	-0.921***	-0.387***
	[0.083]	[0.108]	[0.119]	[0.084]	[0.109]	[0.139]	[0.086]	[0.112]	[0.122]
ΔBEI	-0.322***	-0.536***	0.095				-0.336***	-0.539***	0.076
	[0.090]	[0.119]	[0.123]				[0.090]	[0.119]	[0.124]
$\Delta BER^{€}$				-0.190***	-0.175***	-0.091			
				[0.046]	[0.061]	[0.101]			
$\Delta BER^{€,ort}$							-0.072	-0.019	-0.068
							[0.045]	[0.073]	[0.054]
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Security FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	40240	26516	13724	40240	26516	13724	40240	26516	13724
R-sq	0.13	0.13	0.09	0.13	0.13	0.09	0.13	0.13	0.09

Table 10. **Robustness - Analysis by sector**: This table reports regressions of quarterly changes in foreign holdings (log nominal amounts) on log changes in the Broad Dollar Index (BDI), Broad Euro Index (BEI), and EME bilateral exchange rates against the euro orthogonalized with respect to the BEI ($BER^{€,ort}$), *separately* for the following investor types: banks, investment funds, and insurance companies and pension funds (ICPFs). All results are for local currency bonds. Controls include the change in log total amounts outstanding, credit ratings, yield differentials, VIX, GDP, fiscal, and inflation, and the remaining time-to-maturity (of security s). Security fixed effects are included as reported. The quarterly sample period is 2013q4-2021q4. Standard errors are clustered at the security level and reported in brackets. Significance: ***99%, **95%, *90%.

	Banks		Mutual Funds		ICPFs	
ΔBDI	-0.3225	-0.2799	-0.6063***	-0.5709***	-0.6989***	-0.7130***
	[0.3642]	[0.3707]	[0.0870]	[0.0871]	[0.1028]	[0.1028]
ΔBEI	-0.2437	-0.2245	-0.2711***	-0.2566**	-0.0386	-0.0425
	[0.4291]	[0.4306]	[0.1048]	[0.1048]	[0.1416]	[0.1415]
$\Delta BER^{€,ort}$		-0.0878		-0.1851***		0.0597
		[0.1647]		[0.0535]		
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Security FE	Yes	Yes	Yes	Yes	Yes	Yes
N	7104	7104	28484	28484	17035	17035
R-sq	0.0483	0.0483	0.1231	0.1236	0.1426	0.1427

Table 11. **Lender-specific component and currency exposures**: This table shows the results of regressions of the lender-specific component of changes in holdings on euro area country specific currency exposures: $CE^l_t = \sum_c w^l_{c,t-1} \Delta BER^{€}_{c,t}$, with $w^l_{c,t-1}$ the weight of EME c in investor's l portfolio. Standard errors are clustered at the euro area country level and reported in brackets. Significance: ***99%, **95%, *90%.

	Equally weighted		Value weighted	
Panel A: Euro area country specific BER				
ΔCE	-0.4680**	-0.5592**	-0.2840**	-0.2731*
	[0.2005]	[0.2604]	[0.1276]	[0.1295]
Constant	2.4845*	2.5561***	2.0050*	1.9958***
	[1.3437]	[0.2045]	[0.9545]	[0.1085]
Lender FE	No	Yes	No	Yes
N	460	460	460	460
R-sq	0.0055	0.0442	0.0042	0.0761
Panel B: Broad Euro Index				
	Equally weighted		Value weighted	
Δ BEI	-0.5403	-0.6221	-0.2267	-0.2042
	[0.3745]	[0.4109]	[0.1976]	[0.1707]
Constant	2.1671*	2.1747***	1.7783*	1.7772***
	[1.2136]	[0.0382]	[0.9400]	[0.0085]
Lender FE	No	Yes	No	Yes
N	460	460	460	460
R-sq	0.002	0.0392	0.0007	0.0729

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Appendix

A. The AW decomposition

The AW decomposition links the growth in nominal amounts held by lenders from country l to EME country c to a "lender component" (α_t^l) unique to lender l and a "EME-country component" ($\beta_{c,t}$) affecting all euro area investors in EME c. These components are time-varying fixed effects that break down the total growth variation across euro area investors and EMEs over time as follows (we leave out the subscript d for ease of exposition):

$$\frac{N_{c,t}^l - N_{c,t-1}^l}{N_{c,t-1}^l} = \alpha_t^l + \beta_{c,t} + \epsilon_{l,c,t}. \tag{A1}$$

The AW decomposition breaks down Equation (A1) into the "common component" γ_t, median growth in lending (of all $l - c$ pairs), a lender component $\tilde{\alpha}_t^l$, and a borrower component $\tilde{\beta}_{c,t}$, where tildes indicate deviations from γ_t. AW show that the decomposition is exact, as the three components sum to overall growth.

B. Model

This appendix derives the closed-form solution for $\Sigma^{-1}\mu$ in equation (7), and proves the comparative statics summarized in Proposition 2.

1. The Covariance Matrix Inverse Σ^{-1}

Under the assumptions of the model, the covariance matrix Σ is given by equation (8). The matrix consists of four blocks defining the variances and covariances within and between bonds denominated in local currency (LC) and in foreign currency (FC), respectively. If there was zero covariance between LC and FC bonds ($\rho = 0$), then Σ would have a block-diagonal form,

$$S = \left[\begin{array}{cccc|ccc} c+z & c & \dots & c & 0 & \dots & 0 \\ c & c+z & \dots & c & 0 & \dots & 0 \\ \dots & \dots & \dots & c & 0 & \dots & 0 \\ c & c & \dots & c+z & 0 & \dots & 0 \\ \hline 0 & 0 & 0 & 0 & f & \dots & 0 \\ \dots & \dots & \dots & \dots & \dots & \dots & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & f \end{array}\right] \qquad \text{(A2)}$$

The top left block defining the covariances between LC bonds, S_{LC}, is a diagonal matrix $z\,I_n$ with a constant c added to each element. In the general case with $\rho > 0$, Σ can also be written in this form, where S is augmented by a so-called rank-1 update, in this case the matrix of constants ρ,

$$\Sigma = S + \rho\, uu^T,$$

where u is a conformable vector of ones, so the outer product uu^T is a matrix of ones.

This form allows us to find the inverse by means of the Sherman-Morrison formula (Bartlett 1951), which states that the inverse of a matrix of the form $B = A + uv^T$ has a similar structure,

$$B^{-1} = A^{-1} - \frac{A^{-1}uv^TA^{-1}}{1 + v^TA^{-1}u}.$$

Applied to Σ, u is a $2n$ long vector of ones, $v = \rho\, u$, and A equals S from equation (A2). With this, the inverse of the full covariance matrix Σ^{-1} can be obtained from

$$\Sigma^{-1} \quad = \quad S^{-1} - \frac{\rho\, S^{-1}uu^TS^{-1}}{1 + \rho\, u^TS^{-1}u}. \qquad \text{(A3)}$$

If LC bonds and FC bonds did not covary ($\rho = 0$), Σ^{-1} simplifies to S^{-1}.

Deriving the general inverse Σ^{-1} with $\rho > 0$ and any number of countries n therefore involves four steps: (1) Inverting S, (2) computing the denominator $1 + \rho\, u^T S^{-1} u$, (3) deriving the shift matrix $\rho\, S^{-1} u u^T S^{-1}$, and (4) combining those elements in the Sherman-Morrison formula (A3).

Step 1. Inverse of S. Note that S is block-diagonal, so the inverse S^{-1} equals

$$S^{-1} = \begin{bmatrix} S_{LC}^{-1} & 0 \\ 0 & S_{FC}^{-1} \end{bmatrix},$$

where S_{FC} is an (n, n) diagonal matrix with variance f on the diagonal, so $S_{FC}^{-1} = I_n / f$. S_{LC} is a full matrix that can be written in the form of a rank-1 update,

$$S_{LC} = z\, I_n + c\, \iota\, \iota^T,$$

where c is a constant variance, and ι is the unit vector of length n. Hence, S_{LC}^{-1} can itself be found via the Sherman-Morrison formula,

$$S_{LC}^{-1} = A^{-1} - \frac{c\, A^{-1} \iota\, \iota^T A^{-1}}{1 + c\, \iota^T A^{-1} \iota} \quad \text{with} \quad A^{-1} = I_n / z.$$

The negative shift term is matrix divided by a scalar. For the scalar, $\iota^T A^{-1} \iota$ sums up all elements of A^{-1}, so the scalar equals $1 + n\, c/z$. For the matrix, since $\iota\, \iota^T$ is a matrix of ones, $\iota\, \iota^T A^{-1}$ is simply a matrix of constants all equal to $1/z$. Pre-multiplying this matrix by $c\, I_n / z$ again yields a matrix of constants equal to c/z^2. Hence the shift term is an (n, n) matrix of constants $\frac{c}{(nc+z)z}$. Subtracting this matrix from $A^{-1} = I_n / z$ yields

$$S_{LC}^{-1} = \frac{1}{(nc + z)z} \begin{bmatrix} z + (n-1)c & -c & ... & -c \\ -c & z + (n-1)c & ... & -c \\ ... & ... & ... & -c \\ -c & -c & ... & z + (n-1)c \end{bmatrix}.$$

With this, S^{-1} is a block-diagonal matrix consisting of $S_{FC}^{-1} = I_n / f$ and S_{LC}^{-1}, each of size (n, n).

For notational convenience, we will characterise matrices by their on- and off-diagonal terms.

For S_{LC}^{-1}, on defining $\phi \equiv (nc + z)$, this reads as

$$S_{LC}^{-1} = \frac{1}{\phi z} \begin{cases} z + (n-1)c & \text{on the diagonal} \\ -c & \text{off the diagonal.} \end{cases} \tag{A4}$$

Step 2. The scalar $1 + \rho\, u^T S^{-1} u$. Since u is the unit vector, $u^T S^{-1} u$ sums up the elements of S^{-1}; from Step 1, this is the sum of the elements of I_n/f, i.e. n/f, and those of S_{LC}^{-1}. From equation (A4), the sum of elements of S_{LC}^{-1} includes n diagonal terms and $n(n-1)$ off-diagonal terms, yielding n/ϕ. Hence,

$$1 + \rho\, u^T S^{-1} u = 1 + \rho\, n \left(\frac{1}{\phi} + \frac{1}{f} \right) = \frac{\phi f + (\phi + f) n \rho}{\phi f}, \tag{A5}$$

or simply $\frac{\omega}{\phi f}$ when defining $\omega \equiv \phi f + (\phi + f) n \rho$.

Step 3. The shift matrix $\rho\, S^{-1} u\, u^T S^{-1}$. The shift matrix equals ρ times the outer product of the column vector $S^{-1}u$ with itself, since $(S^{-1}u)^T = u^T S^{-1}$. Post-multiplying a matrix by the unit vector yields a vector containing the row sums of the matrix. From Step 1, we know that S^{-1} is block-diagonal, so $S^{-1}u$ consists of n row sums of S_{LC}^{-1} followed by n row sums of S_{FC}^{-1}. The unit vector u (length $2n$) comprises two unit vectors ι (length n), so

$$S^{-1} u = \begin{bmatrix} S_{LC}^{-1}\, \iota \\ S_{FC}^{-1}\, \iota \end{bmatrix} = \begin{bmatrix} \frac{1}{\phi}\, \iota \\ \frac{1}{f}\, \iota \end{bmatrix},$$

where the latter equality uses the fact that each row sum of S_{LC}^{-1} involves $z + (n-1)c$ plus $(n-1)$ times the off-diagonal term $-c$, from equation (A4). With this, the shift matrix is found by forming the outer product,

$$\rho\, S^{-1} u\, (S^{-1}u)^T = \rho \begin{bmatrix} \frac{1}{\phi}\, \iota \\ \frac{1}{f}\, \iota \end{bmatrix} \begin{bmatrix} \frac{1}{\phi}\, \iota & \frac{1}{f}\, \iota \end{bmatrix} = \rho \begin{bmatrix} \frac{1}{\phi^2} & \frac{1}{\phi f} \\ \frac{1}{\phi f} & \frac{1}{f^2} \end{bmatrix} \otimes \iota\, \iota^T,$$

which is simply four submatrices of constants, each of size (n, n).

Step 4. Applying the Sherman-Morrison formula to obtain Σ^{-1}. Sherman-Morrison formula (A3) allows to derive Σ^{-1} from S^{-1} (from Step 1) minus the shift matrix (Step 3) divided by the scalar found in Step 2,

$$\Sigma^{-1} = \begin{bmatrix} S_{LC}^{-1} & 0 \\ 0 & S_{FC}^{-1} \end{bmatrix} - \rho\, \frac{\phi f}{\omega} \begin{bmatrix} \frac{1}{\phi^2} & \frac{1}{\phi f} \\ \frac{1}{\phi f} & \frac{1}{f^2} \end{bmatrix} \otimes \iota\, \iota^T.$$

Σ^{-1} is the difference between two partitioned matrices, each with four (n, n) submatrices that represent the covariances within and between LC and FC bonds. Each submatrix has a simple structure: S_{FC}^{-1} is diagonal, S_{LC}^{-1} is diagonal with the same constant off-diagonal elements, and the shifter matrix consists of four arrays of constants. Computing Σ^{-1} thus boils down to forming these differences:

- The off-diagonal submatrices of Σ^{-1} have all elements equal to $-\frac{\rho}{\omega}$.
- The lower-right submatrix Σ_{FC}^{-1} has

$$\Sigma_{FC}^{-1} = \begin{cases} \frac{1}{f} - \frac{\rho\phi}{\omega f} & \text{on the diagonal} \\ -\frac{\rho\phi}{\omega f} & \text{off the diagonal.} \end{cases}$$

- The upper-left submatrix Σ_{LC}^{-1} has, from equation (A4),

$$\Sigma_{LC}^{-1} = \begin{cases} \frac{\phi - c}{\phi z} - \frac{\rho f}{\phi\omega} & \text{on the diagonal} \\ \frac{-c}{\phi z} - \frac{\rho f}{\phi\omega} & \text{off the diagonal.} \end{cases}$$

The full inverse of the covariance matrix Σ^{-1} thus consists of four submatrices with these terms as their typical elements.

2. The Vector of Optimal Holdings $\Sigma^{-1}\mu$

The full solution, equation (7) in the text, is proportional to the vector $\Sigma^{-1}\mu$, where Σ^{-1} has just been derived, and μ was specified in (8). We make use of the fact that the partition of μ into LC and FC bonds corresponds to the four submatrices of Σ^{-1}; they have the useful property that their diagonal minus the off-diagonal terms equal $1/f$ in the case of Σ_{FC}^{-1}, and $1/z$ in the case of Σ_{LC}^{-1}.

For LC bonds of country i, for instance, row i of Σ^{-1} multiplies the full vector μ, which consists of the expected returns of LC bonds μ_k^L and FC bonds μ_k^F, respectively, of all countries $k = 1$ to n. This yields

$$\begin{aligned} \left[\Sigma^{-1}\right]_{row(i)} \mu &= \left(\frac{\phi - c}{\phi z} - \frac{\rho f}{\phi\omega}\right)\mu_i^L + \left(\frac{-c}{\phi z} - \frac{\rho f}{\phi\omega}\right)\sum_{k\neq i}^{n}\mu_k^L + \left(\frac{-\rho}{\omega}\right)\sum_{k=1}^{n}\mu_k^F \\ &= \mu_i^L/z - \left(\frac{c}{\phi z} + \frac{\rho f}{\phi\omega}\right)n\overline{\mu}^L - \frac{\rho}{\omega}n\overline{\mu}^L, \end{aligned}$$

where line 2 expands the term in μ_i^L to bring out the average expected return $\overline{\mu}^L = \frac{1}{n}\sum_{k=1}^{n}\mu_k^L$.

Similarly, for FC bonds of country i, row $(n+i)$ of Σ^{-1} multiplies μ, which now involves the submatrix Σ^{-1}_{FC}, so

$$\begin{aligned}\left[\Sigma^{-1}\right]_{row(n+i)}\mu &= \left(\frac{1}{f}-\frac{\rho\phi}{\omega f}\right)\mu_i^F+\left(-\frac{\rho\phi}{\omega f}\right)\sum_{k\neq i}^{n}\mu_k^F+\left(\frac{-\rho}{\omega}\right)\sum_{k=1}^{n}\mu_k^L\\ &= \mu_i^F/f-\frac{\rho\phi}{\omega f}n\overline{\mu}^F-\frac{\rho}{\omega}n\overline{\mu}^L.\end{aligned}$$

After some algebra involving the definitions of ω and ϕ , we obtain

$$\begin{array}{ll}\text{For LC bonds of country } i\text{:} & \mu_i^L/z-\sigma^L\overline{\mu}^L-\beta\,\overline{\mu}^F\\ \text{For FC bonds of country } i\text{:} & \mu_i^F/f-\sigma^F\overline{\mu}^F-\beta\,\overline{\mu}^L,\end{array}\tag{A6}$$

where the terms σ^L, σ^F and β collect parameters from the covariance matrix,

$$\begin{aligned}\sigma^L &= n\frac{cf+(nc+f)\rho}{\omega z}\\ \sigma^F &= n\frac{(nc+z)\rho}{\omega f}\\ \beta &= n\frac{\rho}{\omega},\end{aligned}$$

where ω was defined earlier as $\omega=\phi f+(\phi+f)n\rho$ with $\phi=nc+z$. Hence (A6) characterises $\Sigma^{-1}\mu$; plugging it into the solution (7) yields the optimal bond holdings in (7).

3. **Proposition 2 and Comparative Statics**

We now derive the comparative statics stated in Proposition B:

Bond holdings w_i rise in their own ***return****, and fall in the return components of competing bonds.*

This comparative static is directly observable from the linearity of portfolio holdings in the expected return of bond i.

Holdings fall in a bond's own ***variance****, and rise in the variance of other bonds. The* ***covariance*** *terms reduce holdings of the respective bonds: ρ lowers all bond holdings, c reduces LC bonds.*

This comparative static is directly observable from the linearity of portfolio holdings in the variance of bond i (which is different only between local and foreign currency bonds): an increase in z (f) lowers the first term in (A6), while the other two components decrease as well but only mildly so because the influence of z (f) on ω is small relative to the other components of ω. For the effect of c, note that an increase in c (i.e., the volatility of the common component in exchange rates) leads to an increase in σ^L, and thus lowers the allocation to LC bonds. For the effect of ρ on bond holdings, note that ρ enters β. As ρ increases, the rate of increase is greater in the numerator than that in the denominator.

Exchange rates *affect optimal bond holdings as follows: A drop in δ (increase in BEI) reduces w_i^{LC} and raises w_i^{FC}, for all i; the absolute change in w_i^{LC} exceeds that in w_i^{FC} in magnitude.*

Let us assume a change in δ, or $\Delta\delta$. In that case we have:

$$\Delta w_i^L = \frac{\Delta\delta}{z} - \sigma_L \Delta\delta = \Delta\delta\big(\frac{f+n\rho}{\omega}\big),$$
$$\Delta w_i^F = \beta\overline{\mu}^L = \Delta\delta\big(\frac{-n\rho}{\omega}\big). \tag{A7}$$

Hence, $\frac{f+n\rho}{\omega} > \frac{n\rho}{\omega}$ and therefore Δw_i^L changes more in value than Δw_i^F does. In the extreme case of $\rho = 0$, only Δw_i^L changes, while Δw_i^F is unaffected. Note that the effect of a change in δ affects all bond holdings, not just i.

Exchange rates *affect optimal bond holdings as follows: A drop in γ_i (increase in*

BER_i) reduces w_i^{LC} and leaves w_i^{FC} unaffected. The difference with δ is that γ_i acts on w_i^{LC} whereas δ acts on all local currency bonds.

For a proof, let's assume a change in γ_i, or $\Delta\gamma_i$. In that case we have:

$$\Delta w_i^L = \frac{\Delta\gamma_i}{z},$$
$$\Delta w_i^F = 0. \tag{A8}$$

Hence, an increase in γ_i increases the allocation to LC denominated bond i, whereas w_i^F is unaffected.

*The **capital constraint** scales the entire bond portfolio: A tighter VaR constraint (an increase in α, e.g. due to an increase in v (BDI)), reduces all bond holdings, w_i^{LC} and w_i^{FC} for all i.*

This is directly observable from the optimal solution 7, where α affects all bond holdings inversely in the same way.

C. Additional Tables

Table A1. **Panel regressions at the borrower-lender level**: This table reports regressions of quarterly changes in foreign holdings (log nominal amounts) on log changes in the Broad Dollar Index (BDI), Broad Euro Index (BEI), and EME bilateral exchange rates against the euro ($BER^{€}$) and the same bilateral exchange rates orthogonalized with respect to the BEI ($BER^{€,ort}$) at the borrower-lender level. Column headings indicate whether the sample includes bonds denominated in all, in local or in foreign currencies (from the perspective of the EME sovereign). For foreign currency bonds, our analysis is at the country-currency level. Controls include the change in log total amounts outstanding, credit ratings, yield differentials, VIX, GDP, fiscal, and inflation, and the remaining time-to-maturity (of security s). Security fixed effects are included as reported. The quarterly sample period is 2013q4-2021q4. Standard errors are clustered at the security level and reported in brackets. Significance: ***99%, **95%, *90%.

	BDI vs BEI			BDI vs $BER^{€}$			BDI vs BEI vs $BER^{€}$		
	All	**Local**	**Foreign**	**All**	**Local**	**Foreign**	**All**	**Local**	**Foreign**
ΔBDI	-0.446***	-0.597***	-0.269**	-0.505***	-0.606***	-0.189	-0.487***	-0.661***	-0.267*
	[0.113]	[0.195]	[0.137]	[0.117]	[0.204]	[0.155]	[0.116]	[0.204]	[0.141]
ΔBEI	-0.200*	-0.424**	0.021				-0.214*	-0.427**	0.022
	[0.120]	[0.203]	[0.148]				[0.120]	[0.203]	[0.149]
$\Delta BER^{€}$				-0.178***	-0.204*	0.127			
				[0.068]	[0.110]	[0.120]			
$\Delta BER^{€,ort}$							-0.095	-0.136	0.006
							[0.067]	[0.128]	[0.079]
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Borrower-Lender FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	23129	7753	15376	23129	7753	15376	23129	7753	15376
R-sq	0.04	0.03	0.06	0.04	0.03	0.06	0.04	0.03	0.06

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