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Sovereign yields and the risk-taking channel of currency appreciation*

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Abstract

Currency appreciation goes hand in hand with easier financial conditions and compressed sovereign bond spreads, even for local currency sovereign bonds. This yield compression comes from a reduction in the credit risk premium. Crucially, the relevant exchange rate involved in yield compression is the bilateral dollar exchange rate, not the trade-weighted exchange rate. Our findings point to a financial risk-taking channel of currency appreciation associated with the global role of the dollar.

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1 Introduction

What are the determinants of the yields on international sovereign bonds denominated in local currency? In addressing this question, the risks associated with exchange rate variability is a complicating factor. In a recent paper, Du and Schreger (2016a) show how the question can be simplified by decomposing the spread of a local currency sovereign bond yield over the US Treasury yield into a currency risk spread, or currency forward premium, and a residual credit risk premium.

In this paper, we argue that the credit risk premium is itself determined by the spot exchange rate, so that the spot exchange rate takes on the role of a risk measure. More generally, we find evidence of a broader *risk-taking channel of exchange rates* which influences investor risk-taking and the supply of credit.

Our paper assesses this channel empirically by exploring the connection between exchange rates and sovereign yield spreads in emerging market economies (EMEs). Our central finding is that an appreciation of an EME currency against the US dollar is associated with a compression in sovereign yield spreads, both for local currency bonds and for foreign currency bonds, as well as greater portfolio inflows into EME bond funds. Delving deeper, we find that these fluctuations in yield spreads are due to shifts in the risk premium, rather than in any deviations in interest rates already priced into forward rates. We examine the local currency credit risk spread measure due to Du and Schreger (2016a), defined as the spread of the yield on EME local currency government bonds achievable by a dollar-based investor over the equivalent US Treasury security. The definition takes account of hedging of currency risk through cross-currency swaps. We find strong evidence that currency appreciation against the US dollar is associated with a compression of the Du-Schreger spread. In contrast, the expectations of interest rates already priced into forward rates are not significantly affected. These results suggest that the local currency sovereign spread is driven primarily by shifts in the risk premium and point to the importance of risk taking and portfolio adjustments in generating our results.

Crucially, the relevant exchange rate for our finding is the bilateral exchange rate relative to the US dollar rather than the trade-weighted effective exchange rate. We find no evidence that an appreciation of the effective exchange rate that is orthogonal to the dollar has a similar impact in compressing sovereign yields. Indeed, we actually find the opposite result for the trade-weighted exchange rate: an appreciation in trade-weighted terms is associated with more stringent financial conditions. We attribute this finding to the standard trade-channel effects whereby an appreciation of the effective exchange rate has a negative effect on net exports and hence on growth, which in turn may drive up credit risk.

The importance of the bilateral exchange rate against the US dollar needs to be better understood, but one possible source of our results is the role of the dollar as the international funding currency for debt contracts globally. McCauley, McGuire and Sushko (2015) estimate that the outstanding US dollar-denominated debt of non-banks outside the United States stood at \$9.8 trillion as of June 2015. Of this total, \$3.3 trillion was owed by non-banks in EMEs, which is more than twice the pre-crisis total. These totals have grown further and are tracked in the BIS global liquidity indicators (BIS (2017)).

Our paper is intended primarily as an empirical investigation documenting the impact of the exchange rate on sovereign bond markets. Future work should be aimed at illuminating the possible economic mechanisms. A promising line of inquiry would be the *risk-taking channel of currency appreciation*, as discussed in Bruno and Shin (2015a, 2015b). A possible model is sketched in an appendix to our paper.

The core mechanism of the risk-taking channel works as follows: in the presence of currency mismatch for EME corporate borrowers, a weaker dollar flatters the balance sheet of dollar borrowers whose liabilities fall relative to assets, which enables creditors to extend more credit to EME corporate borrowers. This in turn increases investment by EME corporates, boosts economic activity and improves the government fiscal position. Then, the risk-taking channel operates across the set of EMEs, and a diversified investor in EME sovereign bonds sees reductions in tail risks, allowing greater portfolio positions for any given exposure limit stemming from an economic capital constraint. As a consequence, a weaker dollar goes hand in hand with reduced tail risks and increased portfolio flows into EME sovereign bonds.

However, when the dollar strengthens, these same relationships go into reverse and conspire to tighten financial conditions. Borrowers' balance sheets look weaker. Their creditworthiness declines. Creditors' capacity to extend credit declines for any exposure limit, and credit supply tightens, serving to dampen economic activity and weaken the government fiscal position. This increases tail risks for a diversified bond investor, which are then met by reductions in overall portfolio positions on EMEs. In this way, a stronger dollar coincides with portfolio outflows from EME sovereign bonds. As well as naked currency mismatches for EME corporates (for instance for property developers), the valuation mismatch may come from the empirical regularity that commodity prices tend to be weak when the dollar is strong (see Akram (2009) and Aastveit, Bjornland and Thorsrud (2015)).

The risk-taking channel sheds light on why it is the bilateral exchange rate against the US dollar that drives sovereign yields. This is because the risk-taking channel has to do with leverage and risk taking, in contrast to the net exports channel which revolves around trade and the effective exchange rate. The wedge between the bilateral US dollar exchange rate and the trade-weighted effective exchange rate provides a window for a reconciliation of the risk-taking channel with the net exports channel, and permits an empirical investigation that disentangles the two channels.

Our findings also have implications for the macroeconomic impact of currency appreciation. From traditional arguments in the spirit of the Mundell-Fleming model (Mundell (1963), Fleming (1962)), currency appreciation is contractionary. An appreciation is associated with a decline in net exports and a contraction in output, other things being equal. On the other hand, currency appreciation often goes hand in hand with rapid credit growth and easier financial conditions (Kaminsky and Reinhart (1999), Borio and Lowe (2002), Reinhart and Reinhart (2009)). Gourinchas and Obstfeld (2012) find that the combination of a rapid increase in leverage and a sharp appreciation of the currency is the most reliable indicator of booms associated with the build-up of vulnerability to subsequent crises. Our results reconcile both arguments. An appreciation of the effective exchange rate is contractionary as it primarily operates through the traditional trade channel. By contrast, an appreciation against international funding currencies, in particular the US dollar, is expansionary as it works through the financial risk-taking channel. Indeed, our analysis finds that an appreciation of EME currencies against the US dollar that is unrelated to the effective exchange rate significantly boosts EME output, while an isolated appreciation of the effective exchange rate has contractionary effects.

Related literature

Currency mismatch on EME corporate balance sheets has been a recurring theme. Krugman (1999) and Céspedes, Chang and Velasco (2004) examine models with corporate currency mismatch where currency appreciation increases the value of collateral and hence relaxes borrowing constraints on EME corporates.[1] Du and Schreger (2016b) show based on an otherwise standard sovereign debt model, that local currency EME sovereign debt carries default risk stemming from currency mismatch on corporate balance sheets. This is because governments may prefer to default rather than inflate their debt away if currency mismatch makes the corporate sector vulnerable to exchange rate depreciations. However, there is no paper yet exploring systematically the effect of exchange rate fluctuations on EME sovereign spreads or EME financial conditions more generally.

A number of papers have instead looked at the impact of changes in financial conditions on exchange rates. Gabaix and Maggiori (2015) analyse the determination of exchange rates based on capital flows in imperfect financial markets. In their theoretical model, capital flows drive exchange rates by altering the risk-bearing capacity of financiers, which in turn affects their required compensation for holding currency risk, thus affecting both the level and volatility of exchange rates. In an empirical paper, Della Corte et al. (2015) present evidence suggesting that a decrease in sovereign risk, captured by the CDS spread, is associated with an appreciation of the bilateral exchange rate against the US dollar across advanced economies (AEs) and EMEs. The authors interpret their finding as showing how an exogenous increase in sovereign default probability leads to a depreciation of the exchange rate. In contrast, our narrative goes in the opposite direction. For us, there is an economic impact of exchange rate changes on the real economy, which in turn leads to portfolio shifts. Nevertheless, the two narratives are complementary, and the interaction of the two effects could potentially lead to amplification effects that elicit sizeable moves in exchange rates and sovereign spreads. In the empirical exercise, our focus will be on disentangling these two narratives.

Our paper is also related to the literature on monetary spillovers. Rey (2013, 2014) argues that monetary policy shocks from AEs spill over into financial conditions elsewhere even in a regime of floating exchange rates. Plantin and Shin (2016) examine a global game with floating exchange rates where the unique equilibrium exhibits two regimes in monetary conditions. In one, currency appreciation goes hand in hand with lower domestic interest rates, capital inflows and higher credit growth. However, when the economy crosses the equilibrium threshold, currency depreciation goes hand in hand with higher domestic interest rates, capital outflows and a contraction in credit.

[1] Aghion, Bacchetta and Banerjee (2000, 2004) also examine currency crisis models featuring currency mismatch on corporate balance sheets and the implied negative impact of currency depreciations on their balance sheets.

The feedback effect of currency appreciation is strengthened if domestic monetary policy responds to the appreciation pressure by lowering domestic short-term rates to track global short-term interest rates. Hofmann and Takáts (2015) find evidence of such co-movement of short-term rates. The term "risk-taking channel" was coined by Borio and Zhu (2012) in the broader context of the transmission of monetary policy, and more recently, Dell'Ariccia, Laeven and Suarez (2017) find evidence of a risk-taking channel of monetary policy operating in the US banking system. The lessons from our paper bear on this larger issue.

Earlier papers on the risk-taking channel focused on banking sector flows, as in Bruno and Shin (2015a, 2015b) and Cerutti, Claessens and Ratnovski (2014). Recent studies have extended the findings to bond markets (see Sobrun and Turner (2015) and Feyen et al. (2015)). The aggregate cross-country evidence on credit supply is complemented by micro-empirical studies based on firm- and issuance-level data which suggest that credit supply fluctuations are key to understanding financial conditions (Morais, Peydró and Ruiz (2015)). Based on evidence from loan-level data in Turkey, Baskaya et al. (2015) show that domestic loan growth and the cost of borrowing are strongly influenced by global financing conditions proxied by the VIX and banking inflows. Mian, Sufi and Verner (2015) provide additional cross-country evidence, and Agénor, Alper and Pereira da Silva (2014) examine broader implications for financial stability.

On the macroeconomic impact of currency depreciation, Krugman (2014) appeals to the net exports channel in the Mundell-Fleming model to argue that a "sudden stop" is expansionary under floating exchange rates. In contrast, Blanchard et al. (2015) acknowledge that the empirical evidence points to the contrary, and modify the Mundell-Fleming model by introducing two classes of assets. In their extended model, currency appreciation may be expansionary. Bussière, Lopez and Tille (2015) analyse the impact of currency appreciations on growth for a large sample of AEs and EMEs, using the propensity score matching method to disentangle the direction of causality from appreciation to growth, and find that currency appreciation associated with a capital surge is significant in the case of EMEs.

The outline of our paper is as follows. In section 2, we begin by documenting some stylised facts on the link between changes in the US dollar exchange rate and EME bond yields and bond inflows. In section 3, we conduct a more systematic empirical investigation of the role of the exchange rate for future EME sovereign spreads and portfolio flows by running monthly and daily predictive regressions. In section 4, we conduct a panel VAR analysis to assess the dynamic impact of exchange rate shocks on bond spreads and bond fund flows, as well as on output and consumer prices. Section 5 concludes and poses additional questions that are thrown up by our analysis.

2 Stylised facts

In the existing literature, EME financial conditions are commonly modelled as a function of the business cycle and monetary conditions as well as global financial conditions (see, eg, Bellas, Papaioannou and Petrova (2010) and Du and Schreger (2016a)). In contrast, our focus is on the link between the bilateral exchange rate against the US dollar and financial conditions. Before we embark on a systematic empirical investigation in sections 3 and 4, we first document some stylised facts by way of motivation.

Consider first some evidence from the returns on 36 EME local currency bond funds.[2] Figure 1 shows how yield changes relate to returns in local currency terms (in blue) and in dollar terms (in red), with one scatter chart magnified for illustration.

In all the panels in Figure 1, the slope for dollar returns is steeper than that for local currency returns. On the left part of each chart, investors gain both in local currency terms and in dollar terms, but the dollar returns are higher, suggesting that local currency appreciation tends to magnify the gains from a decline in yields to dollar-based investors. Conversely, on the right-hand side of each chart, investors lose from the rise in yields, but the losses of the dollar-based investor are magnified by the depreciation of the local currency. In this way, dollar returns are more sensitive to yield changes (red line is steeper) as currency moves magnify the gains and losses from yield changes.[3] In short, when local currency bond yields fall, the currency tends to appreciate against the dollar. Currency appreciation and looser financial conditions therefore go hand in hand.

At a more aggregate level, a negative association between currency appreciation and local currency sovereign spreads is also evident in a cross section of 20 EMEs over the

[2] We use data on EME local currency bond funds available from the EPFR database and for which data on their respective benchmarks are available from JP Morgan Chase every month from January 2011 to July 2015. In total, we use data on 36 funds consisting of 33 global EME local currency government bond funds and three regional EME local currency government bond funds. Appendix A.2 provides the list of the 36 funds and their respective benchmarks.

[3] The same relationship is found in papers investigating the impact of monetary policy on EME exchange rates. See, for example, Kohlscheen (2014) and Hnatkovska, Lahiri and Vegh (2016).

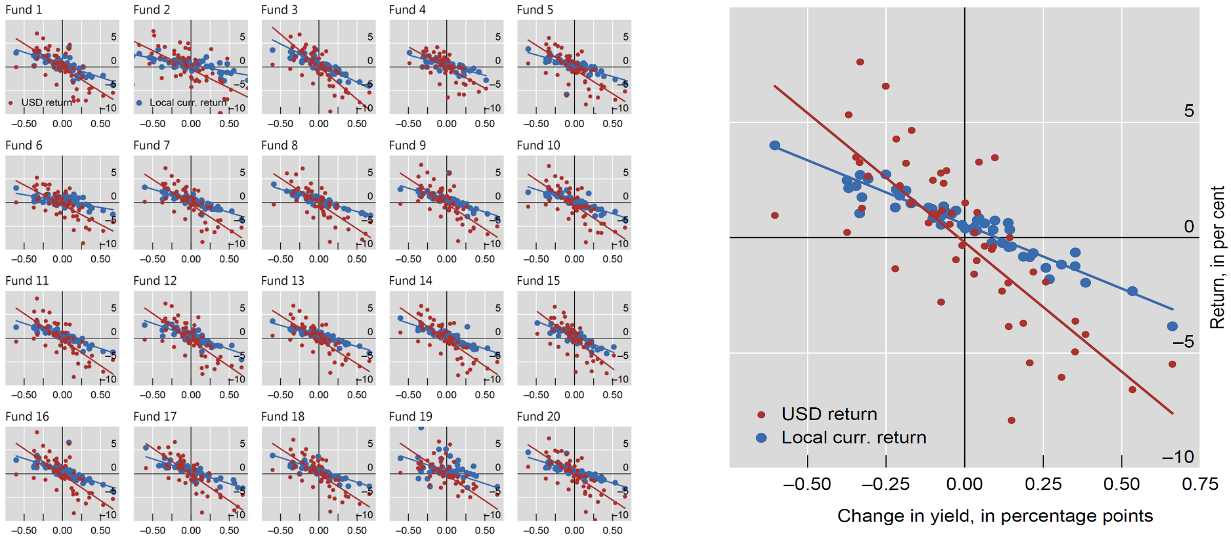

Figure 1. **Dollar and local currency returns on EME local currency sovereign bond funds.** The left-hand panel shows monthly returns on 20 EME local currency sovereign bond funds over the period of January 2011 to July 2015. Blue scatter is local currency return (in per cent) against the domestic bond yield change (in percentage points). Red scatter is US dollar return against the yield change. The right-hand panel magnifies the scatter plot for Fund 31. Source: EPFR.

past 10 years (Figure 2, left-hand panel). The chart shows the relationship between the cumulative currency appreciation (x-axis) and the average spread of the 5-year local currency bond yield over the 5-year US Treasury yield (y-axis) over the 10-year period (see Appendix A.2 for details on the data). The scatterplot shows that there is a clear negative relationship. Countries with stronger currencies had on average lower yield spreads.

The relationship also holds over time, and played out forcefully since 2013, a period characterised by a large depreciation of many EME currencies against the US dollar, including the US Federal Reserve announcement of a tapering of its asset purchases. (Figure 2, right-hand panel). EME currencies depreciated on average by about 30%, when measured by the FX return on the JP Morgan GBI-EM Diversified index. At the same time, the EME local currency sovereign bond spread, measured through the JP Morgan GBI-EM Diversified index spread over the 10-year US Treasury yield, rose by more than 100 basis points.

A useful anecdotal piece of evidence comes from the events surrounding the realignment of the renminbi exchange rate on 11th August 2016 with the announcement by the People's Bank of China which widened the trading band of the renminbi against the US dollar and where the central parity around which the band is set was changed to the

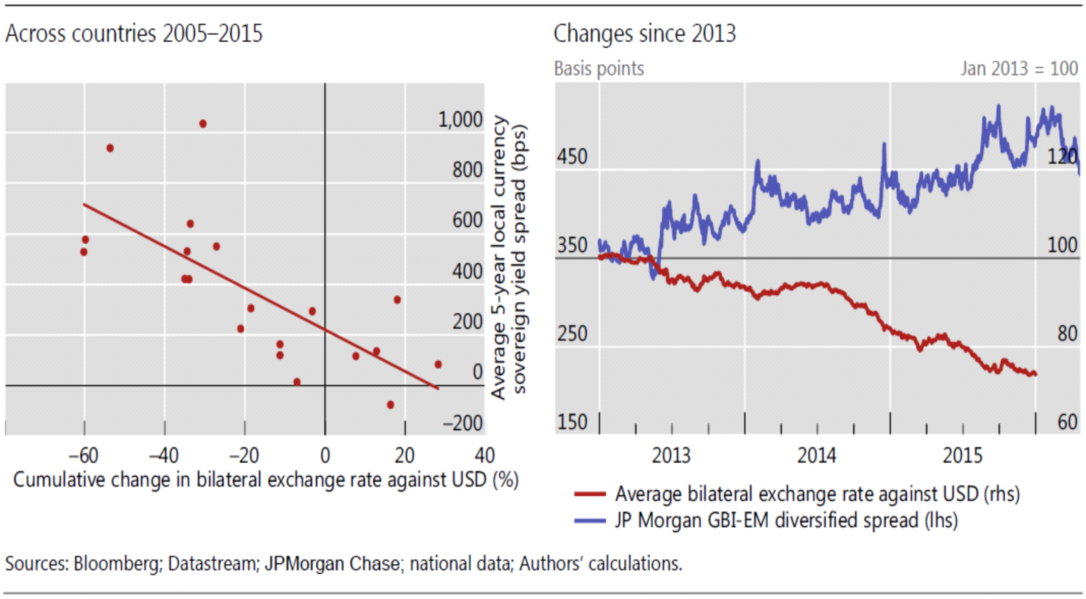

Figure 2. **Changes in the bilateral exchange rate against the US dollar and local currency sovereign spreads in EMEs.** A decrease in the exchange rate is a depreciation of the domestic currency against the US dollar.

previous day's closing rate rather than a preset target rate. This change was not anticipated by traders in the foreign exchange market, and the renminbi saw a decline of 2.8% against the US dollar in the two days following the announcement. To the extent that this depreciation was unanticipated, we may gain insights on the impact of exchange rate changes on sovereign yields.

The left-hand panel of Figure 3 shows the magnitude of the renminbi realignment against the US dollar. The centre panel shows that bond fund flows to China dropped significantly immediately after the deprecation. Finally, the right-hand panel shows that China's local currency government bond spread spiked on 11th August and remained at elevated levels thereafter.

3 Evidence from predictive regressions

Building on the preliminary evidence, we proceed to a more systematic empirical investigation. We begin by documenting the association between EME exchange rates and EME bond market conditions using monthly and daily data for up to 20 EMEs over the period from January 2005 to December 2015 (see Appendix A.2 for details on the data).

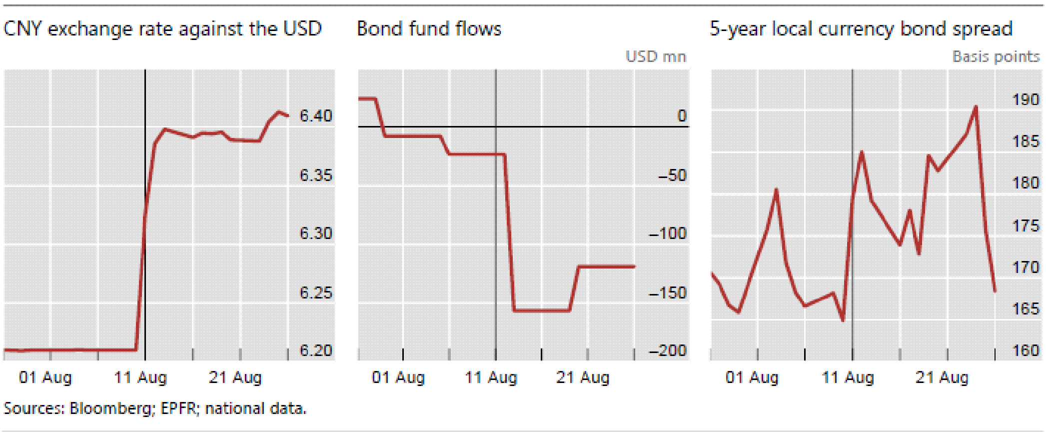

Figure 3. **Impact of a depreciation of the renminbi on bond spreads and bond fund flows.**

In order to address the risk-taking channel hypothesis, we consider different measures of the exchange rate and different measures of EME bond market conditions. We perform the analysis using both the bilateral exchange rate against the US dollar and the nominal effective exchange rate.

For EME bond market conditions, we consider both quantity- and price-based indicators. For the former, we use monthly data for investor flows to individual EMEs via bond mutual funds and exchange-traded funds (ETFs) collected by EPFR Global.[4] For the latter, we look at daily and monthly data on the spread of the dollar-denominated 5-year foreign currency government bond yield over the 5-year US Treasury yield as a standard measure of EME credit risk. Against the background of the rising share of EME sovereign borrowing in local currency (Du and Schreger (2016b)), we further consider the link between the exchange rate and EME local currency government bond spreads, measured as the spread of the 5-year local currency bond yield over the 5-year US Treasury yield. In order to shed light on the channel through which the exchange rate affects the local currency bond spread we decompose this indicator into a local currency credit risk

[4] Since new EME bond funds are added to the EPFR database over the sample period, we need to control for potential bias created by new funds' entering the database. We use flows normalised by NAV, and we consider investor flows to a country by any fund that is covered by the EPFR database at a point in time. An alternative approach is to fix a subset of bond funds for which complete monthly data are available throughout the sample period. The scatter plots in Figure 1 were generated in this way.

premium component and a forward premium component approximated by cross-currency swap rates following Du and Schreger (2016a).[5] If exchange rates affect local currency bond market conditions through a risk-taking channel, we would expect to see in particular a significant link between exchange rate changes and risk premium measures.

There are two main issues that we have to address in the empirical analysis. First, endogeneity is an issue. Exchange rate appreciation may loosen financial conditions and lower risk spreads, but higher bond inflows and lower risk spreads may in turn drive up the value of the domestic currency (Della Corte et al. (2015)). We address this issue by running panel predictive regressions, addressing endogeneity by lagging the explanatory variables (section 3),[6] and by doing impulse response analysis in panel VARs (section 4). Second, the association between bond market conditions and the exchange rate may reflect common factors, financial or macroeconomic, moving both variables at the same time. In order to address this issue, we include in all estimations a wide range of macroeconomic and financial control variables that might drive the unconditional association between bond market conditions and exchange rates.[7]

3.1 Monthly predictive regressions

We first run monthly panel predictive regressions. In particular, we regress EME sovereign bond market indicators Δy on their own lag as well as on the (log) change in the exchange rate (Δe) and a set of control variables (Z):

$$\Delta y_{i,t} = \alpha_i + \lambda \Delta y_{i,t-1} + \beta \Delta e_{i,t-1} + \Gamma Z_{i,t-1} + \varepsilon_{i,t}. \quad (1)$$

We run the regressions separately with the change in the bilateral US dollar exchange

[5] The local currency credit risk spread is given by the spread of the local currency bond yield over a synthetic risk-free local currency yield given by the sum of the US Treasury yield and the cross-currency swap rate. The underlying idea is that a dollar investor can lock in the local currency credit spread by swapping the cash flow from the local currency yield into the US dollar. As shown by Du and Schreger (2016a), the level and the dynamics of local currency credit risk spreads are quite different from those of foreign currency risk spreads, potentially reflecting (i) covariance between currency and credit risk (quanto adjustment), (ii) selective default and capital control risk, and (iii) financial market frictions, including specific frictions in local currency bond markets and the failure of covered interest rate parity.

[6] Another way to address endogeneity would be to use an instrumental variable estimator. This approach would, however, be plagued by the problem of finding good instruments for the exchange rate (and any other endogenous variable in the regression).

[7] We do not include control variables capturing a country's fiscal and external position or its indebtedness as such variables are mostly available only at a lower frequency (quarterly or even annual).

rate (BER) and with the nominal effective exchange rate ($NEER$). The exchange rates are defined such that an increase is an appreciation of the domestic currency. The set of control variables Z includes the log change in the VIX, the change in year-on-year domestic and US consumer price index (CPI) inflation, the change in year-on-year domestic and US industrial production growth and the change in the domestic and the US short-term interest rates (3-month money market rates). Moreover, the regressions include country fixed effects α_i. The inclusion of the lagged dependent variable in the regression captures persistence in the dynamics of the dependent variable. If the dependent variable is autocorrelated, then omission of the lagged dependent variable could give rise to endogeneity bias as the effect of the lagged regressors might just reflect the correlation between the lagged regressor and the omitted lagged dependent variable.[8]

The results in Table 1 show that an appreciation of the bilateral exchange rate against the US dollar is followed by a significant increase in bond flows into EMEs and by a significant reduction in foreign and local currency bond spreads (Table 1, upper part, columns two to four).[9] Specifically, an appreciation of the BER by 1% is followed by an increase in bond flows relative to NAV by 4.7 basis points and a reduction of foreign currency and local currency spreads by 1.9 and 1.7 basis points, respectively.[10] In each case the effects are significant at the 1% level. For the two components of the local currency spread, namely, the Du-Schreger local currency credit risk spread and the forward premium measured through the cross-currency swap rate (columns five and six), we find that an appreciation against the dollar significantly lowers the former by 1.3 basis points, but has no significant effect on the latter. These results provide first support for a risk-taking channel being at work in EMEs. An appreciation against the dollar is followed by loosening of EME bond market conditions, working through credit risk spreads, in both foreign and local currency bond markets.

The results in Table 1 further suggest that it is the bilateral exchange rate against the US dollar that affects EME bond market conditions rather than the effective exchange

[8] The inclusion of a lagged dependent variable in fixed-effects panel estimations can gives rise to biases in panels with small time dimensions (Nickell (1981)). However, with more than 100 monthly observations, the time dimension of our panel is quite large so that the Nickell bias should not be of concern to us. This notion is confirmed by the fact that the results are very similar when we re-run the regressions with the lagged dependent variable excluded.

[9] Full details of the regressions are reported in Appendix Tables 3.1 and 3.2.

[10] We obtain similar results when we consider the CDS spread measured by the difference between an EME's 5-year dollar-denominated CDS spread and the corresponding US CDS spread.

	Dependent variable				
	Bond flows	FC spread	LC spread	DS spread	Swap rate
(i) Bilateral USD exchange rate					
ΔBER_{t-1}	0.046***	−0.019***	−0.017***	−0.013**	−0.006
	[3.81]	[−4.74]	[−4.20]	[−2.39]	[−1.09]
F-stat Z^{US}	203.35***	47.50***	4.45***	5.00***	2.30*
F-stat $Z^{domestic}$	2.57*	2.34*	4.39***	0.28	2.37*
N	20	13	20	14	14
N×T	2,584	1,613	2,503	1,599	1,638
Within R^2	0.54	0.16	0.11	0.05	0.04
(ii) Effective exchange rate					
ΔNEER_{t-1}	0.031	−0.008	−0.014**	−0.011	−0.003
	[1.64]	[−1.21]	[−2.36]	[−1.47]	[−0.32]
F-stat Z^{US}	221.37***	48.46***	3.26**	4.81***	2.29
F-stat $Z^{domestic}$	1.96	2.70**	4.33***	0.35	2.42*
N	20	13	20	14	14
N×T	2,584	1,613	2,503	1,599	1,638
Within R^2	0.54	0.15	0.10	0.04	0.04

Table 1. **EME bond markets and exchange rates: panel predictive regressions.** This table reports results from monthly panel regressions with country fixed effects for various EME sovereign bond market indicators: (i) aggregate investor flows to EME bond funds as a percentage of net asset value (Bond flows); (ii) the change in the spread of the 5-year dollar-denominated bond yield over the corresponding US Treasury yield (FC spread); (iii) the change in the spread of the 5-year local currency bond yield over the corresponding US Treasury yield (LC spread); (iv) the change in the Du-Schreger local currency sovereign risk spread defined as the spread of the 5-year local currency bond yield over a synthetic risk-free rate calculated as the 5-year US Treasury yield adjusted for the forward currency premium constructed from cross-currency and interest rate swap rates (DS spread); and (v) the change in the 5-year cross-currency swap rates (Swap rate) as a measure of the forward currency premium. ΔBER and ΔNEER are, respectively, the log change in the bilateral US dollar exchange rate and in the nominal effective exchange rate; positive ΔBER/ΔNEER is an appreciation of the EME currency. t-statistics for exchange rate coefficients reported in brackets and F-statistics for US controls Z^{US} (including the change in the VIX, in the short-term interest rate and in year-on-year inflation and industrial production growth) and for domestic controls $Z^{domestic}$ (including the change in the short-term interest rate and in year-on-year inflation and industrial production growth) are calculated based on cluster-robust standard errors. *, ** and *** denote, respectively, significance at the 10 percent, 5 percent and 1 percent level.

rate. Specifically, the results for the regressions with the change in the *NEER* (Table 1, lower part) generally yield much weaker effects of a change in the exchange rate on bond market conditions, and the effects are often not significantly different from zero. Only for the local currency bond spread a significantly negative effect obtains, which is however weaker than that found for the change in the *BER*.

Table 1 also shows that US macroeconomic and financial control variables (Z^{US}) have a major impact on bond flows and bond spreads, as indicated by the highly significant F-statistics indicating overwhelming rejection of the hypothesis that the US control variables can be excluded from the regressions. This lends support for the notion that global factors in the form of US macro-financial conditions play a major role in shaping financial conditions around the globe. Domestic control variables ($Z^{domestic}$) also have an effect, but at much lower significance levels and not universally across all indicators. It is only for the local currency bond spread that the F-statistic of the exclusion test of the domestic variables is significant at the 1% level.

In order to shed further light on the role of the two exchange rates for bond market conditions in EMEs, we run "horse-race" regressions with both exchange rates. Specifically, we re-run the predictive regressions in equation (1) with both the *BER* and the *NEER* included. This is done in three different ways: (i) with both the change in the *BER* and the *NEER*; (ii) with the change in the *BER* and the component of the change in the *NEER* that is unrelated (or orthogonal) to the change in the *BER* ($\Delta NEER^{orth}$); and (iii) with the change in the *NEER* and the component of the change in the *BER* that is unrelated (or orthogonal) to the change in the *NEER* (ΔBER^{orth}). The component of the change in the *NEER* that is unrelated to changes in the *BER* is obtained by regressing for each country separately the change in the *NEER* on the change in the *BER*, and retaining the residuals. Likewise, the component of the change in the *BER* that is orthogonal to the change in the *NEER* is given by the residuals of country-level regressions of the change in the *BER* on the change in the *NEER.* These wedge measures serve the purpose of filtering out the correlation between the *BER* and the *NEER* in order to isolate specific changes in the respective exchange rate measures which help identifying their ultimate effect on bond market conditions.

The results of this exercise reported in Table 2 show that it is indeed the *BER* that affects EME bond market conditions through a risk-taking channel.[11] The effective ex-

[11] Full details of the regressions are reported in Appendix Tables 3.3, 3.4 and 3.5.

change rate, in contrast, seems to work in the opposite direction, probably reflecting standard trade-channel effects. In all three variants of the horse-race regressions, an appreciation of the *BER* is found to significantly increase bond flows to EMEs and to significantly lower credit risk spreads. The effects are in terms of size and statistical significance even stronger than when the *BER* enters the regressions alone. This reflects the fact that the ultimate effect of a change in the *NEER*, once we control for the effect of changes in the *BER*, works in the opposite direction. In specifications (i) and (ii) as reported in Table 2, we see that an appreciation of the *NEER* lowers bond flows and increases bond and credit risk spreads. This effect is even statistically significant in the case of the bond flows and the foreign currency spread. Even in specification (iii) where we combine the change in the *NEER* and the orthogonal component of the change in the *BER*, the latter has a much larger negative effect and is more significant.

Thus, the horse-race regressions show that while an appreciation of the *BER* is consistently followed by a loosening of EME financial conditions in particular through compressed credit risk spreads, an isolated appreciation of the *NEER,* controlling for fluctuations in the *BER*, seems to be followed by a tightening of EME financial conditions. This result probably reflects the standard textbook trade channel-type effects where an appreciation of the effective exchange rate has a negative effect on trade and, through this channel, also on the wider economy. This, in turn, seems to adversely affect perceptions of sovereign credit risk and hence credit supply.

3.2 Daily predictive regressions

For the price-based bond market conditions indicators where daily data are available, we complement the monthly regressions with daily panel predictive regressions of the form:

$$\Delta y_{i,t+h} = \alpha_i + \rho \Delta y_{i,t-1} + \beta \Delta e_{i,t-1} + \Gamma Z_{i,t-1} + \eta_{i,t+h} \tag{2}$$

where we link the change in the bond market indicator to the lagged change in the exchange rate over horizons *(h)* of up to 30 trading days. The vector of control variables here includes only the change in the domestic and the US short-term interest rates and the log change in the VIX, as the macroeconomic controls are not available in daily frequency.

We first run the daily predictive regressions separately for the change in the *BER* and for the change in the *NEER*, as we did before for the monthly regressions. Figure 4

	Dependent variable				
	Bond flows	FC spread	LC spread	DS spread	Swap rate
(i)					
ΔBER_{t-1}	0.107***	−0.061***	−0.029***	−0.026**	−0.021*
	[4.07]	[−7.02]	[−4.65]	[−2.19]	[−1.87]
ΔNEER_{t-1}	−0.081**	0.057***	0.017	0.018	0.020
	[−2.27]	[4.79]	[1.61]	[1.11]	[1.10]
(ii)					
ΔBER_{t-1}	0.049***	−0.020***	−0.017***	−0.013**	−0.006
	[4.09]	[−4.52]	[−4.22]	[−2.37]	[−1.09]
$\Delta\text{NEER}^{orth}_{t-1}$	−0.073*	0.054***	0.012	0.005	0.022
	[−1.94]	[5.22]	[1.25]	[0.30]	[1.32]
(iii)					
$\Delta\text{BER}^{orth}_{t-1}$	0.083***	−0.057***	−0.028***	−0.020**	−0.021*
	[2.64]	[−6.56]	[−4.56]	[−2.00]	[−1.82]
ΔNEER_{t-1}	0.032*	−0.009	−0.014**	−0.010	−0.003
	[1.74]	[−1.54]	[−2.30]	[−1.42]	[−0.28]
N	20	13	20	14	14
N×T	2,584	1,613	2,503	1,599	1,638

Table 2. **EME bond markets and exchange rates: BER vs NEER.** This table reports results from monthly panel regressions with country fixed effects for various EME sovereign bond market indicators: (i) aggregate investor flows to EME bond funds as a percentage of net asset value (Bond flows); (ii) the change in the spread of the 5-year dollar-denominated bond yield over the corresponding US Treasury yield (FC spread); (iii) the change in the spread of the 5-year local currency bond yield over the corresponding US Treasury yield (LC spread); (iv) the change in the Du-Schreger local currency sovereign risk spread defined as the spread of the 5-year local currency bond yield over a synthetic risk-free rate calculated as the 5-year US Treasury yield adjusted for the forward currency premium constructed from cross-currency and interest rate swap rates (DS spread); and (v) the change in the 5-year cross-currency swap rates (Swap rate) as a measure of the forward currency premium. ΔBER and ΔNEER are, respectively, the log change in the bilateral US dollar exchange rate and in the nominal effective exchange rate. ΔNEER^{orth} is the residual from the regression of ΔNEER on ΔBER. ΔBER^{orth} is the residual from the regression of ΔBER on ΔNEER. Exchange rates are defined such that an increase represents an appreciation of the EME currency. The control variables include the change in the VIX, in the US short-term interest rate and in year-on-year US inflation and US industrial production growth as well as the change in the domestic short-term interest rate and in year-on-year domestic inflation and domestic industrial production growth. t-statistics for exchange rate coefficients reported in brackets are calculated based on cluster-robust standard errors. *, ** and *** denote, respectively, significance at the 10 percent, 5 percent and 1 percent level.

shows the estimated coefficients from running equation (2) for forecast horizons h=1,...,30 trading days with a two standard error band. The effects are qualitatively similar, but quantitatively somewhat larger than those obtained from the monthly regressions. An appreciation of both the *BER* and the *NEER* is followed by significant decreases of EME bond and credit risk spreads. Specifically, an appreciation of the *BER* (left-hand panels of Figure 4) is followed by a decline of the foreign currency bond spread by up to 3 basis points, respectively, over the next 30 days. Also the local currency bond spread declines by up to 3 basis points. This effect is driven by the decline in the local currency credit risk spread, which falls by 3 basis points, while there is no significant reaction of the forward premium measured through the cross-currency swap rate. The impact of an appreciation of the *NEER* (right-hand panels of Figure 4) is again qualitatively similar to that of an appreciation of the *BER*, but somewhat smaller in magnitude and statistically less significant.

Also, here we run a horse race between *BER* appreciation and *NEER* appreciation by including both variables at the same time in the predictive regressions. Figure 5 shows the coefficient estimates for both variables in a two standard error band. The charts show that, as in the monthly regressions, it is *BER* appreciation that exerts a negative effect on EME bond and credit risk spreads, while the effect of *NEER* appreciation is significantly positive or insignificant. We also run horse-race regressions using the wedges between the two exchange rates as before. These regressions yield results very similar to those obtained in the monthly predictive regressions so that we refrain from reporting them here for the sake of brevity.

3.3 Economic significance of the effects

Overall, the results of the predictive regressions support the notion that an appreciation of the bilateral exchange rate against the US dollar loosens financial conditions in EMEs through a risk-taking channel, ie, by lowering credit risk spreads. But how important is the impact of the US dollar exchange rate on EME bond and credit risk spreads economically?

According to our estimates, a 1% appreciation of the domestic currency against the US dollar lowers local currency bond and risk spreads by around 1.5 to 3 basis points. Taken at face value, the economic impact therefore seems small. However, we need to put these estimated effects into perspective against the background of observed exchange

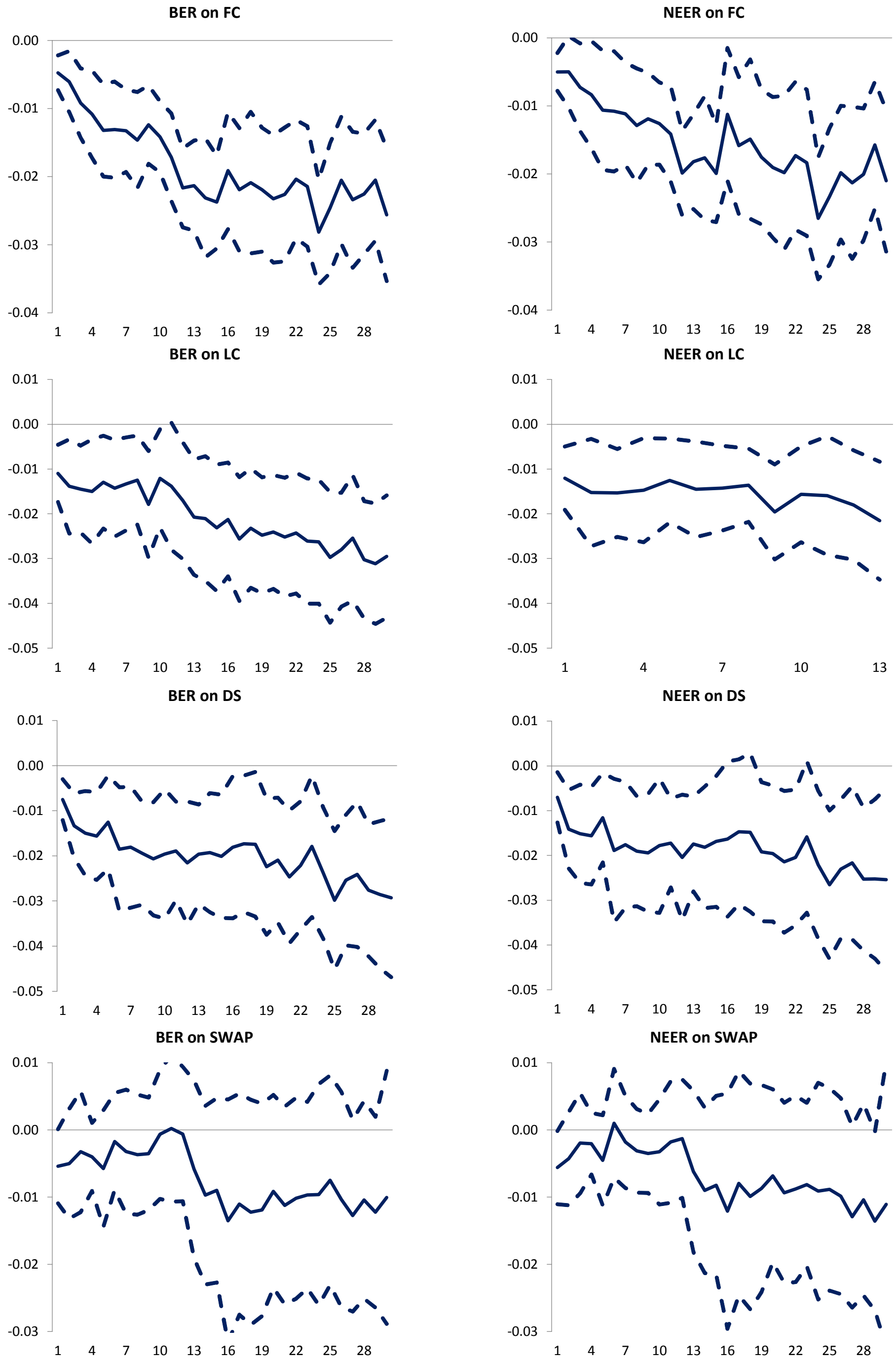

Figure 4. **Impact of exchange rates on EME sovereign spreads.** The figure shows the impact estimated from separate regressions of the change in the bilateral exchange rate against the US dollar (BER) and the nominal effective exchange rate (NEER). The dependent variable is respectively the change over the next h = 1,..,30 trading days in (i) the 5-year foreign currency spread (FC), (ii) the 5-year local currency spread (LC), (iii) the Du-Schreger local currency sovereign risk spread (DS), and (iv) the cross-currency swap rate (SWAP). Control variables are the log change in the VIX and the change in the US and the domestic 3-month money market rates. Broken lines are two standard error bands. Standard errors are cluster robust.

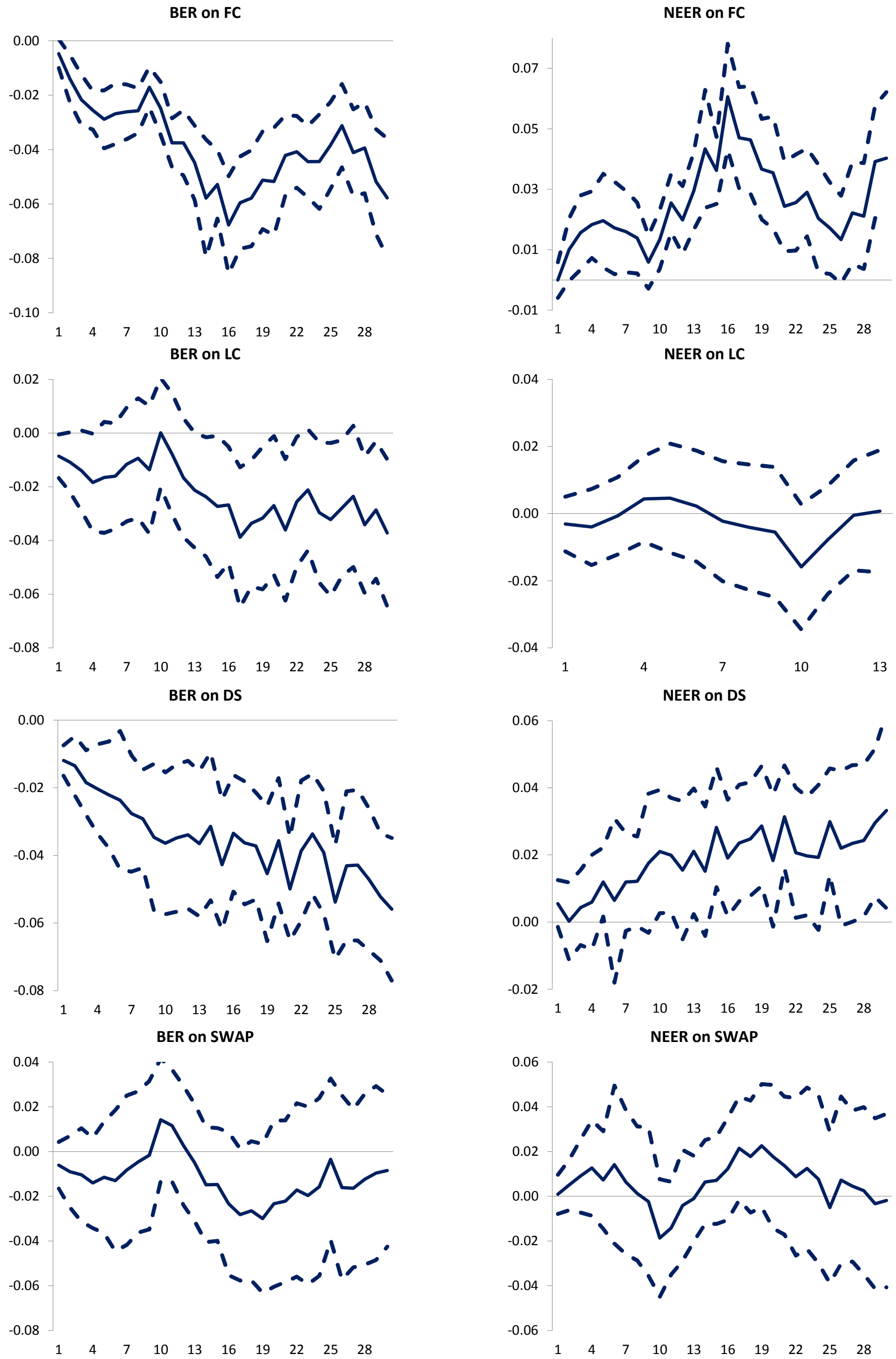

Figure 5. **Impact of exchange rates on EME sovereign spreads: BER vs NEER.** The figure shows the impact estimated from joint regressions of the change in the bilateral exchange rate against the US dollar (BER) and the nominal effective exchange rate (NEER). The dependent variable is respectively the change over the next h = 1,..,30 trading days in (i) the 5-year foreign currency spread (FC), (ii) the 5-year local currency spread (LC), (iii) the Du-Schreger local currency sovereign risk spread (DS), and (iv) the cross-currency swap rate (SWAP). Control variables are the log change in the VIX and the change in the US and the domestic 3-month money market rates. Broken lines are two standard error bands. Standard errors are cluster robust.

rate fluctuations. Across the 20 economies covered by our analysis, the average standard deviation of the change in the US dollar exchange rate over the sample period is about 2.5 percentage points. This means that a standard change in the exchange rate moves EME spreads by between 3.75 and 7.5 basis points. It is also instructive to do a back-of-the-envelope calculation to assess the cumulative effect of the considerable exchange rate movements that we have observed between end-2012 and end-2015. Over this period, the EME currencies covered in our analysis depreciated against the US dollar by on average about 30%. Our estimations suggest that this might have added between 45 and 90 basis points to EME sovereign spreads through the risk-taking channel of exchange rate appreciation, in addition to the sizeable direct interest rate spillovers that were established in the literature (Hofmann and Takáts (2015)).

4 Panel VAR analysis

As a robustness check for the results of the daily and monthly predictive regressions, we assess in this section the impact of exchange rate fluctuations on sovereign yields and bond flows based on a monthly panel vector autoregression (VAR) analysis. The panel VARs take the form:

$$Y_{i,t} = A_i + B(L)Y_{i,t-1} + C(L)X_{i,t-1} + \varepsilon_{i,t}. \tag{3}$$

where Y is a vector of endogenous variables comprising the log change in domestic industrial production, the log change in domestic CPI, the change in the domestic 3-month interest rate, an indicator of sovereign bond market conditions, and the log change in the exchange rate. X is a vector of exogenous variables comprising the log change in US industrial production and US CPI, the log change in the VIX and the change in the US 3-month money market rate. We estimate VARs separately for the five measures of sovereign bond market conditions (bond fund flows, 5-year foreign currency bond spread, 5-year local currency bond spread, 5-year Du-Schreger local currency credit risk spread, and 5-year cross-currency swap rate).[12] The VARs are estimated first with the change in the *BER* and the *NEER* entering separately, and then with the two exchange rates entering jointly. We thus estimate in total 15 VARs. The lag order of each VAR is determined based on the Schwarz-Bayes information criterion where up to three lags are considered.

[12] We obtain similar results when we consider the CDS spread, which are not reported here due to space constraint.

Based on these VARs, we assess the dynamic impact of an exchange rate shock. The shock is identified using a standard Cholesky scheme with the exchange rate ordered last in the system. In other words, we assume that the exchange rate can respond immediately to all the shocks in the system, but that an exchange rate shock can affect the other variables only with a lag. Through this identification scheme, we endogenise the exchange rate as much as possible, thus minimising any potential remaining endogeneity issues in the estimated effect of exchange rates on sovereign bond markets to the extent possible.

In the VARs where both exchange rates enter jointly, we apply two different identification schemes, respectively ordering the exchange rate whose shock impact is analysed last. In other words, when we investigate the impact of a shock to the change in the *BER*, then that exchange rate is ordered last and the change in the *NEER* is ordered second to last. When we investigate the impact of a shock to the change in the *NEER*, this order is reversed. We thus consistently endogenise the exchange rate we look at to the maximum extent by putting it last in the recursive system when we identify the shock. This approach is comparable to the horse-race regressions before where we have purged each exchange rate in turn from its correlation with the other exchange rate prior to the regressions (ie, specifications (ii) and (iii) in Table 2).

Figure 6 shows for the VARs including each exchange rate separately the accumulated impulse response functions (IRFs) of the five EME bond market variables to a one percent appreciation shock to the exchange rate. The broken lines denote two standard error bands around the IRFs, obtained from a Monte Carlo simulation with 1,000 replications. The results are in line with those of the regression analysis in the previous subsection. Specifically, a standard appreciation shock to the *BER* (left-hand panels in Figure 6) increases bond inflows and lowers bond spreads in a significant way. For the bond fund flows relative to NAV, the dynamic impact of a *BER* appreciation shock is larger (around 10 basis points) than the impact estimated in the monthly predictive regressions (almost 5 basis points). This reflects the high persistence in the bond fund flow variable which gives rise to a much larger long-run effect compared to the short-run effect. Foreign and local currency bond spreads decrease by about 3 and 2 basis points, respectively. The IRFs of the Du-Schreger spread and the swap rate also show that the effect of a *BER* appreciation on the local currency spread is driven by the impact on the credit risk spread. While the Du-Schreger spread decreases significantly by about 2 basis points, the response of the swap rate is not significantly different from zero. For *NEER* appreciation shocks (Figure 6, right-hand panels), we obtain again similar effects which are, however, weaker and less significant than those of *BER* appreciation shocks. Thus, the VAR analysis also indicates that the *BER* is more relevant for EME financial conditions than the *NEER*.

This notion is further confirmed by the results from the VARs where both exchange rates are included (Figure 7). The results are also similar to those obtained from the horse-race predictive regressions. An isolated appreciation shock to the *BER* (left-hand panels in Figure 7) consistently lowers EME bond risk spreads and increases bond fund flows. In contrast, an appreciation shock to the *NEER* (right-hand panels in Figure 7) does not loosen financial conditions in EMEs. Instead, such a shock consistently increases bond spreads and lowers bond inflows, pointing again to trade channel effects working in the opposite direction to the risk-taking channel effects, which seem to come out even stronger in the VAR set-up.

This finding becomes even clearer when we look at the dynamic effects of an appreciation shock to the *BER* and to the *NEER* on the macroeconomic variables based on the VARs including both exchange rates. Figure 8 shows the accumulated IRFs for domestic industrial production growth and domestic CPI inflation. The results are quite striking. An independent appreciation shock to the *BER* has a significant expansionary effect on output, and no effect on consumer prices. In contrast, an appreciation shock to the *NEER* has a significant contractionary effect on output and a significant negative effect on consumer prices. The interpretation of these results is straightforward against the background of the previous results on the exchange rate impacts on EME financial conditions. An isolated appreciation of the *BER* leads to an easing of domestic financial conditions which has expansionary effects on output, neutralising the direct negative effects of the appreciation on prices. In contrast, an isolated appreciation of the *NEER* primarily leads to a loss in trade competitiveness and thus has negative effects on output and the price level.

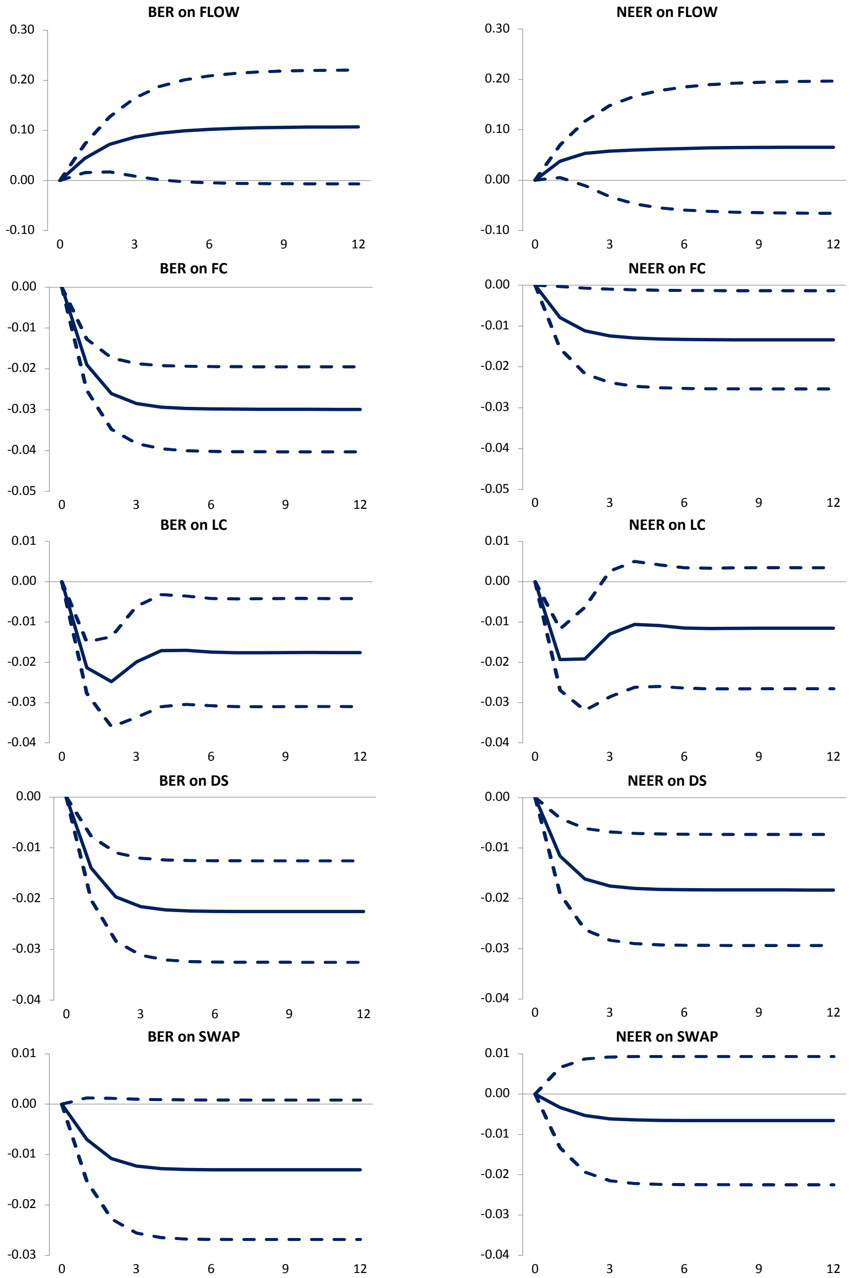

Figure 6. **The dynamic effects of exchange rate shocks.** The figure shows accumulated impulse response functions (IRFs) to a one percent appreciation shock respectively to the bilateral exchange rate against the US dollar (*BER)* and to the nominal effective exchange rate (*NEER)*. Each IRF comes from a separate VAR including either exchage rate. FLOW is the bond fund inflow, FC is the 5-year foreign currency bond spread, LC is the 5-year local currency bond spread, DS is the Du-Schreger 5-year local currency credit risk spread and SWAP is the 5-year cross-currency swap rate. The VARs further include domestic inflation and industrial production growth and the change in the domestic 3-month interbank rate as endogenous variables as well as lags of the change in the VIX, US inflation, US industrial output growth and the change in the US 3-month interbank rate as exogenous variables. The exchange rate shock is identified based on a Cholesky ordering with the respective exchange rate ordered last in the system. The broken lines denote two standard error bands around the IRF, obtained from a Monte Carlo simulation with 1,000 replications.

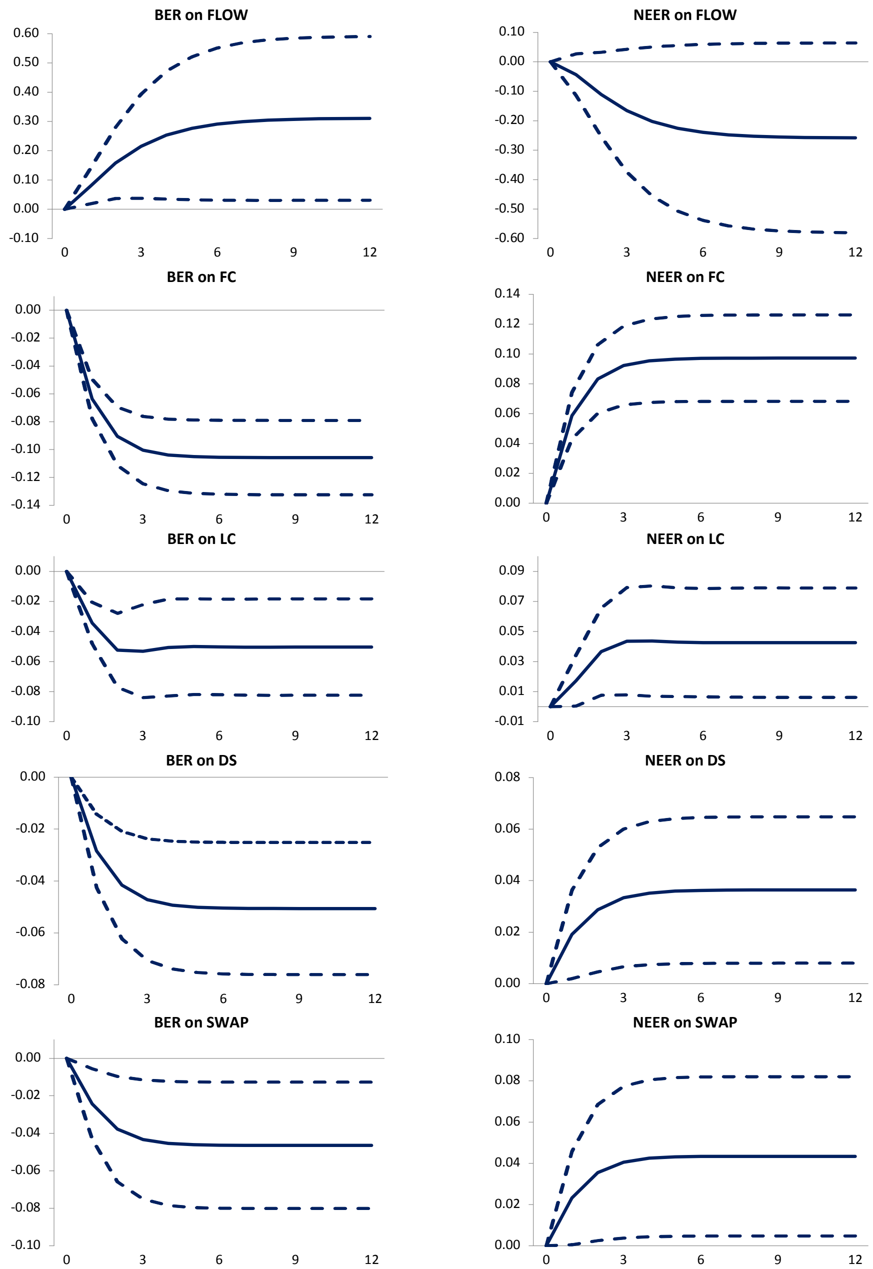

Figure 7. **The dynamic effects of exchange rate shocks: BER vs NEER.** The figure shows the accumulated impulse response functions (IRFs) to a one percent appreciation shock respectively to the bilateral exchange rate against the US dollar (*BER*) and to the nominal effective exchange rate (*NEER*). The IRF for each bond market variable comes from a separate VAR including both exchange rates. FLOW is the bond fund inflow, FC is the 5-year foreign currency bond spread, LC is the 5-year local currency bond spread, DS is the Du-Schreger 5-year local-currency credit risk spread and SWAP is the 5-year cross-currency swap rate. The VARs further include domestic inflation and industrial production growth and the change in the domestic 3-month interbank rate as endogenous variables as well as lags of the change in the VIX, US inflation, US industrial output growth and the change in the US 3-month interbank rate as exogenous variables. The exchange rate shock is identified based on a Cholesky ordering, respectively ordering the shocked exchange rate last in the system. The broken lines denote two standard error bands around the IRF, obtained from a Monte Carlo simulation with 1,000 replications.

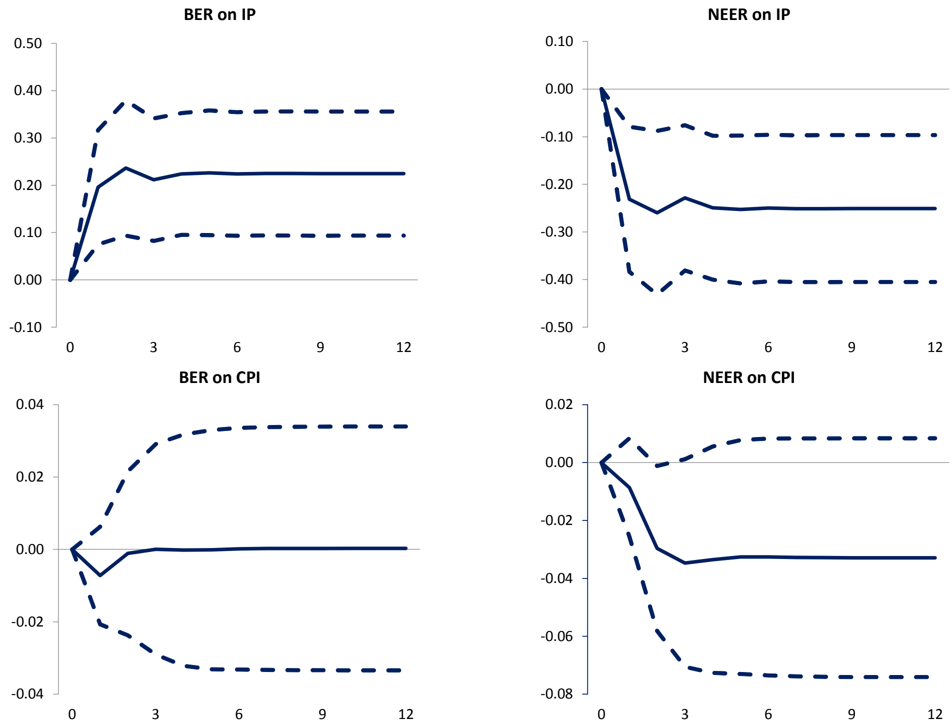

Figure 8. **The macroeconomic effects of exchange rate shocks: BER vs NEER.** The figure shows accumulated impulse response functions (IRFs) of EME industrial production growth (IP) and consumer price inflation (CPI) to a one percent appreciation shock respectively to the bilateral exchange rate against the US dollar (*BER*) and to the nominal effective exchange rate (*NEER*). The IRFs come from a VAR including domestic output growth, domestic inflation, the change in the domestic 3-month interest rate, the change in the 5-year local currency sovereign bond spread, the log change in the *BER* and the log change in the *NEER*. The VAR further includes lags of the change in the VIX, US inflation, US industrial output growth and the change in the US 3-month interbank rate as exogenous variables. The exchange rate shock is identified based on a Cholesky ordering, respectively ordering the shocked exchange rate last in the system. The broken lines denote two standard error bands around the IRF, obtained from a Monte Carlo simulation with 1,000 replications.

5 Conclusions

We have explored the risk-taking channel of currency appreciation which stands in contrast to the traditional Mundell-Fleming analysis of currency appreciation operating through net exports. Unlike the traditional model, the risk-taking channel can render a currency appreciation expansionary through loosening of monetary conditions. Specifically, the risk-taking channel operates through the balance sheets of both borrowers and lenders. For borrowers who have net liabilities in dollars, an appreciation of the domestic currency makes borrowers more creditworthy. In turn, when borrowers become more creditworthy, the lenders find themselves with greater lending capacity.

We have shown that the main predictions of the risk-taking channel are borne out in the empirical investigation for our spread-based measures of domestic monetary conditions as well as for bond portfolio flows. Specifically, the results of the empirical analysis confirm the notion that an appreciation of the bilateral exchange rate against the US dollar loosens financial conditions in EMEs through a risk-taking channel, ie, by lowering credit risk spreads. The results further suggest that it is the US dollar exchange rate that works through these financial channels, and not the nominal effective exchange rate. An appreciation of the latter is instead often followed by higher bond and risks spreads. This suggests that the *NEER* seems to work instead through the classical trade channels whereby an appreciation leads to higher bond and risk spreads due to the adverse economic effects of the associated loss in trade competitiveness. Indeed, our analysis also shows that an appreciation shock to the US dollar exchange rate has expansionary macroeconomic effects on EMEs, while the effect of an appreciation shock to the effective exchange rate is contractionary.

A key implication of the paper is that currency appreciation against the US dollar is associated with greater bond fund flows and lower bond spreads as a consequence of lower credit risk spreads. These effects reverse when the currency depreciates. Together with the evidence that lower sovereign risk pushes up the exchange rate as reported in earlier studies (see, eg, Della Corte et al. (2015)), this implies that self-reinforcing feedback loops between exchange rate appreciation (depreciation) and financial easing (tightening) can develop.

Our analysis addresses the procyclicality stemming from portfolio flows that depend sensitively on tail risk, hence transmit financial conditions through global markets. In this respect, our paper adds to the debate on the cross-border transmission of financial conditions, recently galvanised by the findings in Rey (2013, 2014) that monetary policy has cross-border spillover effects on financial conditions even in a world of freely floating currencies. Similarly, Obstfeld (2015) has shown that financial globalisation worsens the trade-offs monetary policy faces in navigating among multiple domestic objectives, which makes additional tools of macroeconomic and financial policy more valuable. The potential spillover effects may be amplified if EME central banks attempt to insulate domestic financial conditions from spillovers by shadowing global policy rates through direct interest rate spillover effects (Hofmann and Takáts (2015)).

We have not addressed the detailed policy implications of our findings here. Broadly, however, our analysis suggests that attention may be paid to three areas: (i) policy actions to restrict the degree of valuation mismatch on the balance sheet of corporates, which is the source of the problem; (ii) ex ante prudential measures on FX exposures to discourage excessive risk taking during boom periods accompanied by EME local currency appreciation, such as price-based measures (taxes or capital requirements on FX borrowing) or quantity-based measures (aiming to slow down the speed of foreign borrowing by corporates and sovereigns, ie, capital flow management measures targeting banking and bond inflows); and (iii) ex post measures during bust periods accompanied by EME local currency depreciation, such as loosening quantity constraints on foreign borrowing or relaxing price-based measures to lower borrowing costs.

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A Appendix

A.1 Model

In this appendix, we outline a possible model that generates the key predictions. The model builds on Bruno and Shin (2015a) modified to include global bond investors who hold a diversified portfolio of EME sovereign bonds.

There is a continuum of potential EME corporate borrowers. Borrowers are risk-neutral entrepreneurs with access to a project that needs 1 dollar of fixed investment and one unit of labour input. Denote by r the interest rate on the loan, so that the borrowers must repay $1 + r$.

The disutility of the labour input is distributed in the population according to cumulative distribution function $H(\cdot)$ with support on $[0, \infty)$. Credit is granted at date 0 and the project realisation and repayment is due at date 1.

The entrepreneurs bear currency risk. The dollar value of the project depends on the bilateral exchange rate vis-à-vis the US dollar. Denote by V_t the local currency value of the project at date t and by θ_t the value of the local currency with respect to the US dollar, so that an increase in θ_t denotes the *appreciation* of local currency. The dollar value of the borrowers' project at date 1 follows the Merton (1974) model of credit risk, and is the random variable:

$$\theta_1 V_1 = \theta_0 V_0 \exp\left\{\mu - \frac{s^2}{2} + sW_j\right\}, \tag{4}$$

where W_j is a standard normal, and μ and s are positive constants. Since the borrowers are risk-neutral and have limited liability, borrower j with effort cost e_j undertakes the project if

$$E\left(\max\left\{0,\, \theta_1 V_1 - (1+r)\right\}\right) - e_j \geq 0. \tag{5}$$

Denote by $e^*(r)$ the threshold cost level where (5) holds with equality when the interest rate is r. Credit demand is the mass of entrepreneurs with effort cost below $e^*(r)$. Denoting by $C_d(r)$ the credit demand at interest rate r, we have

$$C_d(r) = H(e^*(r)). \tag{6}$$

Since $H(\cdot)$ has full support on $[0, \infty)$, $C_d(r) > 0$ for all $r > 0$ and is strictly decreasing in r.

The lender is a bank who can diversify across many borrowers and so can diversify away idiosyncratic risk. Credit risk follows the Vasicek (2002) model, a many borrower generalisation of Merton (1974). The standard normal W_j in (4) is given by the linear combination:

$$W_j = \sqrt{\rho}Y + \sqrt{1-\rho}X_j, \tag{7}$$

where Y and X_j are mutually independent standard normals. Y is the common risk factor while each X_j is the idiosyncratic risk facing borrower j. The parameter $\rho \in (0, 1)$ determines the weight given to the common factor Y.

The borrower defaults when the project realisation is less than the repayment amount of the loan, $1 + r$. The recovery value is zero when default occurs. Default occurs when $\theta_1 V_1 < 1 + r$, which can be written as

$$\sqrt{\rho} Y + \sqrt{1-\rho} X_j < -d_j, \tag{8}$$

where d_j is the *distance to default:*

$$d_j = \frac{\ln\left(\frac{\theta_0 V_0}{1+r}\right) + \mu - \frac{s^2}{2}}{s}. \tag{9}$$

Thus, borrower j repays the loan when $Z_j \geq 0$, where Z_j is the random variable:

$$\begin{aligned} Z_j &= d_j + \sqrt{\rho} Y + \sqrt{1-\rho} X_j \\ &= -\Phi^{-1}(\varepsilon) + \sqrt{\rho} Y + \sqrt{1-\rho} X_j, \end{aligned} \tag{10}$$

where ε is the probability of default of borrower j, defined as $\varepsilon = \Phi(-d_j)$, and Φ is the standard normal c.d.f.

Conditional on Y, defaults are independent. In the limit where the number of borrowers becomes large, the realised value of 1 dollar face value of loans can be written as a deterministic function of Y, by the law of large numbers. The realised value per one dollar face value of loans is the random variable $w(Y)$ defined as:

$$\begin{aligned} w(Y) &= \Pr\left(\sqrt{\rho} Y + \sqrt{1-\rho} X_j \geq \Phi^{-1}(\varepsilon) \,|Y\right) \\ &= \Phi\left(\frac{Y\sqrt{\rho} - \Phi^{-1}(\varepsilon)}{\sqrt{1-\rho}}\right). \end{aligned} \tag{11}$$

The c.d.f. of w is then given by

$$\begin{aligned} \Pr(w \leq z) &= \Pr\left(Y \leq w^{-1}(z)\right) \\ &= \Phi\left(w^{-1}(z)\right) \\ &= \Phi\left(\frac{\Phi^{-1}(\varepsilon) + \sqrt{1-\rho}\Phi^{-1}(z)}{\sqrt{\rho}}\right). \end{aligned} \tag{12}$$

From (12), the c.d.f. of w is increasing in ε, so that higher values of ε imply a first degree stochastic dominance shift left for the asset realisation density. Since ε decreases with local currency appreciation (that is, an increase in θ_0), therefore exchange rates have a direct impact on the credit environment in our model.

Credit supply to corporates is subject to a Value-at-Risk (VaR) constraint. Denote by C_s the credit supplied by global banks at date 0 (in dollars). Since the interest rate is r, the payoff of the bank at date 1 is given by the random variable:

$$(1 + r) C_s \cdot w. \tag{13}$$

Denote by E the book equity of the bank and by L the dollar funding raised by the bank and denote by f the dollar funding cost, which we assume is constant for simplicity. The bank is risk-neutral, and maximises expected profit subject only to its VaR constraint that stipulates that the probability of default is no higher than some fixed constant $\alpha > 0$. The bank remains solvent as long as the realised value of $w(Y)$ is above its notional liabilities at date 1. Since the funding rate on liabilities is f, the notional liability of the bank at date 1 is $(1+f)L$. Since the bank is risk-neutral, its VaR constraint binds:

$$\Pr\left(w < \frac{(1+f)L}{(1+r)C_s}\right) = \Phi\left(\frac{\Phi^{-1}(\varepsilon)+\sqrt{1-\rho}\Phi^{-1}\left(\frac{(1+f)L}{(1+r)C_s}\right)}{\sqrt{\rho}}\right) = \alpha. \tag{14}$$

Re-arranging (14), we can write the ratio of notional liabilities to notional assets as follows:

$$\frac{\text{Notional liabilities}}{\text{Notional assets}} = \frac{(1+f)L}{(1+r)C_s} = \Phi\left(\frac{\sqrt{\rho}\Phi^{-1}(\alpha) - \Phi^{-1}(\varepsilon)}{\sqrt{1-\rho}}\right). \tag{15}$$

We will use the shorthand:

$$\varphi(\alpha, \varepsilon, \rho) \equiv \Phi\left(\frac{\sqrt{\rho}\Phi^{-1}(\alpha)-\Phi^{-1}(\varepsilon)}{\sqrt{1-\rho}}\right). \tag{16}$$

Clearly, $\varphi \in (0,1)$. From (15) and the balance sheet identity $E + L = C_s$, we can solve for the bank's supply of dollar credit. We have[13]

$$C_s = \frac{E}{1 - \frac{1+r}{1+f}\cdot\varphi}. \tag{17}$$

The loan interest rate r is determined by market clearing that equates loan demand (6) with loan supply (17). Since φ is decreasing in ε, which in turn is decreasing in the current exchange rate θ_0, dollar credit supply given in (17) is increasing in θ_0. In other words, dollar credit supply to corporates is increasing as the domestic currency appreciates against the dollar today. For any fixed demand curve for dollar credit by entrepreneurs, increased dollar credit results in more projects being financed. We summarise this interim result as follows:

Lemma 1 *Aggregate investment by the corporate sector is increasing in the value of the domestic currency against the dollar.*

We now address the spillovers from the corporate sector to the sovereign bond market. The global lender is a bond fund manager who can diversify across many EME sovereign borrowers. Each sovereign borrower has a corporate sector that borrows in dollars, and for which Lemma 1 applies.

We assume that each EME government has a fixed amount of local currency sovereign bonds outstanding, and that the probability of default follows the Vasicek (2002) model, whereby EME government j defaults on its domestic currency sovereign bonds if

$$-\Phi^{-1}(\eta) + \sqrt{\beta}G + \sqrt{1-\beta}R_j < 0, \tag{18}$$

[13] Since $E > 0$ and $C_s > 0$, we need r, f and φ such that $\left(1 - \frac{1+r}{1+f}\cdot\varphi\right) > 0$.

where $\eta > 0$ is the probability of default of government j, G and R_j are mutually independent standard normal random variables and $\beta \in (0,1)$ is the parameter weight to the global factor G in default outcomes.

Our key assumption is that the probability of default η is decreasing in corporate investment in EMEs.

Assumption. *η is decreasing in the aggregate investment undertaken by corporate borrowers.*

Our assumption is motivated by the fact that the sovereign's fiscal position depends on underlying economic activity — at least in the short run — and that the sovereign's creditworthiness is increasing in the aggregate scale of investment undertaken by its corporate sector. This follows both from the broader macroeconomic effects, but is especially apposite for EME governments that rely on state-owned oil and gas companies which contribute directly to government coffers from their net income.

Conditional on the global factor G, defaults are independent across sovereigns. In the limit where the number of sovereign borrowers becomes large, the realised value of one unit of a diversified portfolio of local currency sovereign bonds is the random variable $v(G)$ defined as:

$$\begin{aligned} v(G) &= \Pr\left(\sqrt{\beta}G + \sqrt{1-\beta}R_j \geq \Phi^{-1}(\eta)\,|G\right) \\ &= \Phi\left(\tfrac{G\sqrt{\beta}-\Phi^{-1}(\eta)}{\sqrt{1-\beta}}\right). \end{aligned} \tag{19}$$

Denote by B the credit supplied by local currency bond investors at date 0. Here, B could be denominated in either local currency or foreign currency, and our results will not be sensitive to the currency denomination of the bond portfolio. The key is that the exchange rate impacts on fiscal positions, and that this has a bearing on the tail risk of a diversified portfolio of sovereign bonds.

Denote by y the yield on the sovereign bonds. The payoff of the bond investor at date 1 is given by the random variable:

$$(1+y)\,B \cdot v \tag{20}$$

The fund manager is risk-neutral and maximises expected return, but the portfolio decision is governed by an economic capital constraint — an analogue of the VaR constraint for non-leveraged investors.

Denote by E the *economic capital* of the fund manager. The fund manager's economic capital constraint stipulates that the probability that the loss from the bond portfolio defined as $B-(1+y)B\cdot v$ exceeds E is no more than some known constant $\alpha > 0$. Formally, the economic capital constraint is

$$\Pr\left(v < \frac{B-E}{(1+y)\,B}\right) = \Phi\left(\frac{\Phi^{-1}(\eta)+\sqrt{1-\beta}\Phi^{-1}\left(\frac{B-E}{(1+y)B}\right)}{\sqrt{\beta}}\right) \leq \alpha. \tag{21}$$

Since the fund manager is risk-neutral, this constraint binds with equality. Rearranging, we have

$$\frac{B-E}{(1+y)\,B} = \Phi\left(\frac{\sqrt{\beta}\Phi^{-1}(\alpha)-\Phi^{-1}(\eta)}{\sqrt{1-\beta}}\right) \tag{22}$$

Using the shorthand:

$$\psi \equiv \Phi\left(\frac{\sqrt{\beta}\Phi^{-1}(\alpha)-\Phi^{-1}(\eta)}{\sqrt{1-\beta}}\right), \tag{23}$$

and re-arranging, we can solve for the supply of credit by the bond fund manager:[14,15]

$$B = \frac{E}{1-(1+y)\,\psi}. \tag{24}$$

The yield y can be obtained from the market clearing where bond credit supply (24) is equated to the fixed supply of local currency bonds outstanding, denoted by S. We have

$$1+y = \frac{1-E/S}{\psi}. \tag{25}$$

Gathering together our earlier steps, we can thus state our main comparative statics result in terms of θ_0, the current value of the local currency against the dollar.

Proposition 1 *The yield on EME sovereign bonds is decreasing in θ_0.*

The proof follows from our earlier steps in derivation. From our assumption that default probability η is decreasing in corporate investment, and from Lemma 1, η is decreasing in θ_0. From (23), we know that ψ is decreasing in η. Therefore, from (25), an appreciation of the local currency against the dollar is associated with a higher ψ, and hence with lower y. This proves the proposition.

As well as our result on the yield y, our model also has a prediction regarding the size of the EME local currency sovereign bond portfolio held by the global bond investor. The expression for the demand for bonds by the investor given by (24) means that currency appreciation gives rise to larger local currency bond holdings. We therefore have the following corollary:

Corollary 1 *The holding of EME bonds by the global investor is increasing in θ_0.*

The proof follows straightforwardly from the expression for the demand for bonds (24) and the fact that ψ is increasing in θ_0.

With Proposition 1 and Corollary 1, we have the key predictions. Currency appreciation in EMEs is associated with lower local currency sovereign bond yields, higher global investment in sovereign bonds, and more buoyant economic conditions in EMEs underpinned by dollar-financed corporate investment.

[14] Since $E > 0$ and $B > 0$, we need y and ψ such that $1-(1+y)\psi > 0$ holds.

[15] We can define the loss more generally as $(1+k)B-(1+y)B\cdot v$. In this case, equation (24) becomes $B = \frac{E}{(1+k)-(1+y)\psi}$, and k, f and ψ should satisfy $(1+k)-(1+y)\psi > 0$.

A.2 Detailed data description

Appendix Table 2.1: 20 EMEs in the sample

Africa and the Middle East (3)	Israel, Turkey, South Africa
Emerging Asia (8)	China, India, Indonesia, Korea, Malaysia, Philippines, Singapore, Thailand
Emerging Europe (4)	Czech Republic, Hungary, Poland, Russia
Latin America and the Caribbean (5)	Brazil, Chile, Colombia, Mexico, Peru

Appendix Table 2.2: 14 EMEs for which the Du-Schreger spread is available

Africa and the Middle East (3)	Israel, Turkey, South Africa
Emerging Asia (5)	Indonesia, Korea, Malaysia, Philippines, Thailand
Emerging Europe (2)	Hungary, Poland
Latin America and the Caribbean (4)	Brazil, Colombia, Mexico, Peru

Appendix Table 2.3: 13 EMEs for which foreign currency bond yield is available

Africa and the Middle East (3)	Israel, Turkey, South Africa
Emerging Asia (4)	Indonesia, Korea, Malaysia, Philippines
Emerging Europe (2)	Hungary, Poland
Latin America and the Caribbean (4)	Brazil, Colombia, Mexico, Peru

Appendix Table 2.4: 36 EME local currency bond funds

No	Fund name	Benchmark
1	Aberdeen Global - Emerging Markets Local Currency Bond	JPM GBI-EM Global Diversified
2	Aberdeen Global II - Emerging Europe Bond Fund	JPM GBI-EM Global Diversified Europe
3	Ashmore SICAV Emerging Markets Local Currency Bond Fund	JPM GBI-EM Global Diversified
4	Aviva Investors - Emerging Markets Local Currency Bond Fund	JPM GBI-EM Broad Diversified
5	BankInvest Hojrentelande lokalvaluta	JPM GBI-EM Global Diversified
6	BlackRock Global Funds Emerging Markets Local Currency Bond Fund	JPM GBI-EM Global Diversified
7	BNY Mellon Emerging Markets Debt Local Currency Fund	JPM GBI-EM Global Diversified
8	Dreyfus Emerging Markets Debt Local Currency Fund	JPM GBI-EM Diversified
9	Eaton Vance Emerging Markets Local Income Fund	JPM GBI-EM Global Diversified
10	Goldman Sachs Growth & Emerging Markets Debt Local Portfolio	JPM GBI-EM Global Diversified
11	Goldman Sachs Local Emerging Markets Debt Fund	JPM GBI-EM Global Diversified
12	Invesco Emerging Local Currencies Debt Fund	JPM GBI-EM Global Diversified
13	Invesco Emerging Market Local Currency Debt Fund	JPM GBI-EM Global Diversified
14	Investec GSF Emerging Markets Local Currency Debt Fund	JPM GBI-EM Global Diversified
15	ISI Emerging Market Local Currency Bonds Fund	JPM GBI-EM Broad Diversified
16	JPMorgan Funds - Emerging Markets Local Currency Debt Fund	JPM GBI-EM Global Diversified
17	Jyske Invest Emerging Local Market Bonds	JPM GBI-EM Diversified
18	Lazard GIF Emerging Markets Local Debt Fund	JPM GBI-EM Global Diversified
19	LO Funds - Emerging Local Currency Bond Fundamental	JPM GBI-EM Global Diversified
20	MFS Investment Funds - EM Local Currency Debt Fund	JPM GBI-EM Global Diversified
21	MFS Meridian Funds - EM Debt Local Currency Fund	JPM GBI-EM Global Diversified
22	Morgan Stanley Emerging Markets Domestic Debt Fund	JPM GBI-EM Global Diversified
23	Morgan Stanley Investment Funds - Emerging Markets Domestic Debt	JPM GBI-EM Global Diversified
24	Natixis Intl Fds (Lux) Loomis Sayles Emerging Debt & Currencies Fund	JPM GBI-EM Global Diversified
25	Pictet - Emerging Local Currency Debt	JPM GBI-EM Global Diversified
26	Pictet - Latin American Local Currency Debt	JPM GBI-EM Global Latin America
27	PIMCO Emerging Local Bond Fund	JPM GBI-EM Global Diversified
28	PIMCO GIS Emerging Local Bond Fund	JPM GBI-EM Global Diversified
29	PineBridge Global Emerging Markets Local Currency Bond Fund	JPM GBI-EM Global Diversified
30	Pioneer Funds - Emerging Markets Bond Local Currencies	JPM GBI-EM Global Diversified
31	T Rowe Price SICAV Emerging Local Markets Bond Fund	JPM GBI-EM Global Diversified
32	TCW Emerging Markets Local Currency Income Fund	JPM GBI-EM Global Diversified
33	Threadneedle Emerging Market Local Fund	JPM GBI-EM Global Diversified
34	UBAM - Local Currency Emerging Market Bond	JPM GBI-EM Global Diversified
35	Vontobel Fund - Eastern European Bond	JPM GBI-EM Global Europe
36	WisdomTree Emerging Markets Local Debt Fund	JPM GBI-EM Global Diversified

Appendix Table 2.5: Description of variables used in regression analyses

Variable	Description	Unit	Sources
Local currency bond spread	5-year local currency sovereign bond yields over 5-year US Treasury yield	Percentage points	Bloomberg, Datastream, Global Financial Data, national data
Foreign currency bond spread	EMBI country-level yield over 5-year US Treasury yield	Percentage points	Datastream, JP Morgan Chase
Du-Schreger spread	5-year local currency bond yield over a synthetic risk-free rate calculated as the US Treasury yield adjusted for the forward currency premium constructed from cross-currency and interest rate swap rates	Percentage points	Du and Schreger (2016a): "Local currency sovereign risk"
VIX	CBOE volatility index	Percentage points	Bloomberg
CPI	CPI inflation (seasonally adjusted)	2000 Q1 = 100	National data
IP	Industrial production (seas. adjusted)	2000 Q1 = 100	National data
IR	3-month money market rate	Per cent	Bloomberg, Datastream, IMF International Financial Statistics, national data
BER	Exchange rate against the US dollar	US dollars per unit of local currency	National data
NEER	Nominal effective exchange rate, broad index	2000 Q1 = 100	National data

A.3 Supplementary regression tables

In the following supplementary tables, we present the full regression tables for the results reported in section 3.

	Dependent variable				
	Bond flows	FC spread	LC spread	DS spread	Swap rate
ΔBER_{t-1}	0.046***	−0.019***	−0.017***	−0.013**	−0.006
	[3.81]	[−4.74]	[−4.20]	[−2.39]	[−1.09]
y_{t-1}	0.651***	0.057*	0.232***	0.076***	0.155**
	[60.46]	[1.94]	[7.34]	[3.38]	[2.56]
ΔVIX_{t-1}	0.004***	0.003***	0.000	0.001	0.000
	[4.60]	[7.32]	[0.50]	[0.87]	[0.29]
ΔCPIUS_{t-1}	−0.297***	0.106***	0.095***	0.072***	0.065**
	[−9.58]	[9.36]	[4.11]	[4.34]	[2.26]
ΔIPUS_{t-1}	0.338***	−0.037***	−0.010	−0.006	−0.003
	[26.57]	[−5.95]	[−1.49]	[−1.20]	[−0.27]
ΔIRUS_{t-1}	−0.092	−0.159***	0.003	−0.104*	0.075
	[−1.23]	[−6.73]	[0.12]	[−1.89]	[1.11]
ΔCPI_{t-1}	−0.047	0.003	0.022*	0.004	0.036***
	[−0.90]	[0.16]	[1.86]	[0.36]	[2.59]
ΔIP_{t-1}	−0.008	0.003*	−0.002**	0.000	−0.001
	[−1.31]	[1.85]	[−2.16]	[0.04]	[−0.93]
ΔIR_{t-1}	0.117*	0.066**	0.028	0.030	−0.016
	[1.83]	[2.48]	[0.73]	[0.88]	[−0.35]
N	20	13	20	14	14
N×T	2,584	1,613	2,503	1,599	1,638
Within R^2	0.541	0.163	0.109	0.049	0.037

Appendix Table 3.1. Full regression results for Table 1(i). This table reports the regression results from monthly panel regressions with country fixed effects for various EME sovereign bond market indicators: (i) aggregate investor flows to EME bond funds as a percentage of net asset value (Bond flows); (ii) the change in the spread of the 5-year dollar-denominated foreign currency bond yield over the corresponding US Treasury yield (FC spread); (iii) the change in the spread of the 5-year local currency bond yield over the corresponding US Treasury yield (LC spread); (iv) the change in the Du-Schreger local currency sovereign risk spread defined as the spread of the 5-year local currency bond yield over a synthetic risk-free rate calculated as the 5-year US Treasury yield adjusted for the forward currency premium constructed from cross-currency and interest rate swap rates (DS spread); and (v) the change in the 5-year cross-currency swap rates (Swap rate) as a measure of the forward currency premium. The constant term and the coefficients on country fixed effects are not reported in the table. ΔBER is the log change in the bilateral US dollar exchange rate. Positive ΔBER is an appreciation of the EME currency. t-statistics for exchange rate coefficients reported in brackets are calculated based on cluster-robust standard errors. *, ** and *** denote, respectively, significance at the 10 percent, 5 percent and 1 percent level.

	Dependent variable				
	Bond flows	FC spread	LC spread	DS spread	Swap rate
ΔNEER_{t-1}	0.031	−0.008	−0.014**	−0.011	−0.003
	[1.64]	[−1.21]	[−2.36]	[−1.47]	[−0.32]
y_{t-1}	0.662***	0.110***	0.236***	0.085***	0.155**
	[63.77]	[3.84]	[6.71]	[3.37]	[2.39]
ΔVIX_{t-1}	0.003***	0.004***	0.001	0.001	0.001
	[3.55]	[7.88]	[1.64]	[1.13]	[0.48]
ΔCPIUS_{t-1}	−0.257***	0.090***	0.080***	0.060***	0.059**
	[−8.85]	[8.18]	[3.53]	[4.33]	[2.13]
ΔIPUS_{t-1}	0.333***	−0.039***	−0.010	−0.006	−0.003
	[27.36]	[−6.01]	[−1.47]	[−1.15]	[−0.29]
ΔIRUS_{t-1}	−0.163***	−0.122***	0.025	−0.087	0.081
	[−2.58]	[−5.96]	[0.93]	[−1.60]	[1.24]
ΔCPI_{t-1}	−0.050	0.001	0.022*	0.005	0.036***
	[−1.00]	[0.06]	[1.86]	[0.39]	[2.65]
ΔIP_{t-1}	−0.008	0.003*	−0.002**	0.000	−0.001
	[−1.31]	[1.96]	[−2.22]	[0.05]	[−0.91]
ΔIR_{t-1}	0.096	0.069***	0.032	0.034	−0.013
	[1.47]	[2.63]	[0.85]	[0.99]	[−0.27]
N	20	13	20	14	14
N×T	2,584	1,613	2,503	1,599	1,638
Within R^2	0.539	0.146	0.104	0.043	0.036

Appendix Table 3.2. Full regression results for Table 1(ii). This table reports the regression results from monthly panel regressions with country fixed effects for various EME sovereign bond market indicators: (i) aggregate investor flows to EME bond funds as a percentage of net asset value (Bond flows); (ii) the change in the spread of the 5-year dollar-denominated foreign currency bond yield over the corresponding US Treasury yield (FC spread); (iii) the change in the spread of the 5-year local currency bond yield over the corresponding US Treasury yield (LC spread); (iv) the change in the Du-Schreger local currency sovereign risk spread defined as the spread of the 5-year local currency bond yield over a synthetic risk-free rate calculated as the 5-year US Treasury yield adjusted for the forward currency premium constructed from cross-currency and interest rate swap rates (DS spread); and (v) the change in the 5-year cross-currency swap rates (Swap rate) as a measure of the forward currency premium. The constant term and the coefficients on country fixed effects are not reported in the table. ΔNEER is the log change in the nominal effective exchange rate. Positive ΔNEER is an appreciation of the EME currency. t-statistics for exchange rate coefficients reported in brackets are calculated based on cluster-robust standard errors. *, ** and *** denote, respectively, significance at the 10 percent, 5 percent and 1 percent level.

	Dependent variable				
	Bond flows	FC spread	LC spread	DS spread	Swap rate
ΔBER_{t-1}	0.107***	−0.061***	−0.029***	−0.026**	−0.021*
	[4.07]	[−7.02]	[−4.65]	[−2.19]	[−1.87]
ΔNEER_{t-1}	−0.081**	0.057***	0.017	0.018	0.020
	[−2.27]	[4.79]	[1.61]	[1.11]	[1.10]
y_{t-1}	0.645***	0.043	0.239***	0.072***	0.162**
	[66.65]	[1.57]	[6.96]	[3.16]	[2.44]
ΔVIX_{t-1}	0.004***	0.003***	0.000	0.001	0.000
	[4.55]	[6.79]	[0.20]	[0.83]	[0.22]
ΔCPIUS_{t-1}	−0.341***	0.137***	0.105***	0.082***	0.077**
	[−11.05]	[8.99]	[3.90]	[4.02]	[2.22]
ΔIPUS_{t-1}	0.345***	−0.040***	−0.011	−0.007	−0.004
	[26.51]	[−6.21]	[−1.60]	[−1.31]	[−0.37]
ΔIRUS_{t-1}	−0.002	−0.229***	−0.010	−0.127**	0.053
	[−0.04]	[−8.30]	[−0.37]	[−2.18]	[0.88]
ΔCPI_{t-1}	−0.049	0.001	0.023*	0.004	0.035**
	[−0.98]	[0.09]	[1.89]	[0.34]	[2.48]
ΔIP_{t-1}	−0.008	0.003*	−0.002**	0.000	−0.001
	[−1.36]	[1.96]	[−2.17]	[0.06]	[−0.94]
ΔIR_{t-1}	0.113*	0.064***	0.026	0.028	−0.021
	[1.72]	[2.60]	[0.66]	[0.86]	[−0.41]
N	20	13	20	14	14
N×T	2,584	1,613	2,503	1,599	1,638
Within R^2	0.542	0.189	0.111	0.051	0.040

Appendix Table 3.3. Full regression results for Table 2(i). This table reports the regression results from monthly panel regressions with country fixed effects for various EME sovereign bond market indicators: (i) aggregate investor flows to EME bond funds as a percentage of net asset value (Bond flows); (ii) the change in the spread of the 5-year dollar-denominated foreign currency bond yield over the corresponding US Treasury yield (FC spread); (iii) the change in the spread of the 5-year local currency bond yield over the corresponding US Treasury yield (LC spread); (iv) the change in the Du-Schreger local currency sovereign risk spread defined as the spread of the 5-year local currency bond yield over a synthetic risk-free rate calculated as the 5-year US Treasury yield adjusted for the forward currency premium constructed from cross-currency and interest rate swap rates (DS spread); and (v) the change in the 5-year cross-currency swap rates (Swap rate) as a measure of the forward currency premium. The constant term and the coefficients on country fixed effects are not reported in the table. ΔBER and ΔNEER are, respectively, the log change in the bilateral US dollar exchange rate and in the nominal effective exchange rate. Positive ΔBER/ΔNEER is an appreciation of the EME currency. t-statistics for exchange rate coefficients reported in brackets are calculated based on cluster-robust standard errors. *, ** and *** denote, respectively, significance at the 10 percent, 5 percent and 1 percent level.

	Dependent variable				
	Bond flows	FC spread	LC spread	DS spread	Swap rate
ΔBER_{t-1}	0.049***	−0.020***	−0.017***	−0.013**	−0.006
	[4.09]	[−4.52]	[−4.22]	[−2.37]	[−1.09]
$\Delta\text{NEER}^{orth}_{t-1}$	−0.073*	0.054***	0.012	0.005	0.022
	[−1.94]	[5.22]	[1.25]	[0.30]	[1.32]
y_{t-1}	0.646***	0.039	0.236***	0.076***	0.161**
	[65.65]	[1.52]	[7.00]	[3.35]	[2.54]
ΔVIX_{t-1}	0.004***	0.003***	0.000	0.001	0.000
	[4.65]	[6.70]	[0.26]	[0.88]	[0.20]
ΔCPIUS_{t-1}	−0.334***	0.135***	0.101***	0.074***	0.078**
	[−11.14]	[8.86]	[3.98]	[3.83]	[2.30]
ΔIPUS_{t-1}	0.344***	−0.039***	−0.011	−0.007	−0.004
	[26.50]	[−6.26]	[−1.56]	[−1.21]	[−0.37]
ΔIRUS_{t-1}	−0.023	−0.218***	−0.004	−0.109*	0.055
	[−0.39]	[−9.46]	[−0.15]	[−1.87]	[0.86]
ΔCPI_{t-1}	−0.046	−0.001	0.022*	0.004	0.034**
	[−0.91]	[−0.04]	[1.86]	[0.35]	[2.40]
ΔIP_{t-1}	−0.008	0.003*	−0.002**	0.000	−0.001
	[−1.35]	[1.93]	[−2.18]	[0.05]	[−0.91]
ΔIR_{t-1}	0.121*	0.061**	0.025	0.029	−0.022
	[1.84]	[2.35]	[0.66]	[0.89]	[−0.44]
N	20	13	20	14	14
N×T	2,584	1,613	2,503	1,599	1,638
Within R^2	0.541	0.184	0.110	0.049	0.040

Appendix Table 3.4. Full regression results for Table 2(ii). This table reports the regression results from monthly panel regressions with country fixed effects for various EME sovereign bond market indicators: (i) aggregate investor flows to EME bond funds as a percentage of net asset value (Bond flows); (ii) the change in the spread of the 5-year dollar-denominated foreign currency bond yield over the corresponding US Treasury yield (FC spread); (iii) the change in the spread of the 5-year local currency bond yield over the corresponding US Treasury yield (LC spread); (iv) the change in the Du-Schreger local currency sovereign risk spread defined as the spread of the 5-year local currency bond yield over a synthetic risk-free rate calculated as the 5-year US Treasury yield adjusted for the forward currency premium constructed from cross-currency and interest rate swap rates (DS spread); and (v) the change in the 5-year cross-currency swap rates (Swap rate) as a measure of the forward currency premium. The constant term and the coefficients on country fixed effects are not reported in the table. ΔBER and ΔNEER are, respectively, the log change in the bilateral US dollar exchange rate and in the nominal effective exchange rate. ΔNEER^{orth} is the residual from the regression of ΔNEER on ΔBER. Positive ΔBER/ΔNEER is an appreciation of the EME currency. t-statistics for exchange rate coefficients reported in brackets are calculated based on cluster-robust standard errors. *, ** and *** denote, respectively, significance at the 10 percent, 5 percent and 1 percent level.

	Dependent variable				
	Bond flows	FC spread	LC spread	DS spread	Swap rate
$\Delta\text{BER}^{orth}_{t-1}$	0.083***	−0.057***	−0.028***	−0.020**	−0.021*
	[2.64]	[−6.56]	[−4.56]	[−2.00]	[−1.82]
ΔNEER_{t-1}	0.032*	−0.009	−0.014**	−0.010	−0.003
	[1.74]	[−1.54]	[−2.30]	[−1.42]	[−0.28]
y_{t-1}	0.650***	0.052**	0.240***	0.079***	0.161**
	[69.13]	[2.00]	[6.94]	[3.18]	[2.44]
ΔVIX_{t-1}	0.004***	0.003***	0.000	0.001	0.000
	[4.03]	[7.07]	[0.39]	[0.93]	[0.24]
ΔCPIUS_{t-1}	−0.314***	0.130***	0.101***	0.076***	0.076**
	[−9.39]	[8.27]	[3.97]	[4.09]	[2.24]
ΔIPUS_{t-1}	0.341***	−0.039***	−0.011	−0.007	−0.004
	[25.73]	[−6.16]	[−1.59]	[−1.24]	[−0.34]
ΔIRUS_{t-1}	−0.044	−0.221***	−0.006	−0.119**	0.052
	[−0.70]	[−8.62]	[−0.23]	[−2.01]	[0.86]
ΔCPI_{t-1}	−0.045	0.000	0.021*	0.004	0.035**
	[−0.90]	[0.02]	[1.76]	[0.32]	[2.47]
ΔIP_{t-1}	−0.008	0.003*	−0.002**	0.000	−0.001
	[−1.35]	[1.95]	[−2.21]	[0.08]	[−0.91]
ΔIR_{t-1}	0.114*	0.061**	0.024	0.028	−0.021
	[1.75]	[2.37]	[0.62]	[0.86]	[−0.41]
N	20	13	20	14	14
N×T	2,584	1,613	2,503	1,599	1,638
Within R^2	0.541	0.180	0.109	0.048	0.039

Appendix Table 3.5. Full regression results for Table 2(iii). This table reports the regression results from monthly panel regressions with country fixed effects for various EME sovereign bond market indicators: (i) aggregate investor flows to EME bond funds as a percentage of net asset value (Bond flows); (ii) the change in the spread of the 5-year dollar-denominated foreign currency bond yield over the corresponding US Treasury yield (FC spread); (iii) the change in the spread of the 5-year local currency bond yield over the corresponding US Treasury yield (LC spread); (iv) the change in the Du-Schreger local currency sovereign risk spread defined as the spread of the 5-year local currency bond yield over a synthetic risk-free rate calculated as the 5-year US Treasury yield adjusted for the forward currency premium constructed from cross-currency and interest rate swap rates (DS spread); and (v) the change in the 5-year cross-currency swap rates (Swap rate) as a measure of the forward currency premium. The constant term and the coefficients on country fixed effects are not reported in the table. ΔBER and ΔNEER are, respectively, the log change in the bilateral US dollar exchange rate and in the nominal effective exchange rate. ΔBER^{orth} is the residual from the regression of ΔBER on ΔNEER. Positive ΔBER/ΔNEER is an appreciation of the EME currency. t-statistics for exchange rate coefficients reported in brackets are calculated based on cluster-robust standard errors. *, ** and *** denote, respectively, significance at the 10 percent, 5 percent and 1 percent level.

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