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Emerging market local currency sovereign bond yields: The role of exchange rate risk

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ABSTRACT

This paper explores the role of exchange rate risk in determining local currency sovereign bond yields in emerging market economies (EMEs). We find that EME local currency sovereign bond yields are indeed influenced by exchange rate risk (volatility and expected depreciation of the exchange rate). This finding holds when controlling for endogeneity and a number of key domestic and international factors. We also show that the effect of exchange rate volatility has strengthened over time, particularly since the US Federal reserve announced in May 2013 that it would reduce the pace and size of its large-scale asset purchases. The influence of exchange rate volatility is less pronounced in EMEs with higher shares of foreign ownership of local currency sovereign bonds, larger capital account openness and greater exchange rate flexibility. Our findings have a number of implications for policymakers, in particular as to how emerging market economies can be vulnerable to perception of greater exchange rate risk as global monetary conditions tighten.

1. Introduction

This paper asks whether risks associated with exchange rate movements ("exchange rate risk" hereafter) play an important role in asset pricing in emerging market economies (EMEs). In particular, we ask whether the first and second moments of exchange rate movements, that is, market expectations about the rate of exchange rate depreciation and exchange rate volatility, play a role in dictating local currency bond yields in EMEs.[2] This is an important question as exchange rate volatility has been associated with episodes of stress in EMEs. More recently, risks associated with exchange rate movements appear to have gained in importance.

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[2] A key financial market development in EMEs over the past decade has been the expansion of domestic bond markets, partly encouraged by domestic and international policymakers (eg the Chiang Mai initiative and the Asian Bond Fund, as well as other country and regional initiatives; see CGFS (2007)). EMEs faced difficulties borrowing in their own currencies in the 1980s and 1990s, a phenomenon often characterised as the "original sin" (Eichengreen and Hausmann (1999)). But from 2004 to 2014 the stock of domestic debt securities issued by EMEs increased more than fourfold, from $2.8 trillion to $12.9 trillion. That seemed to vindicate the views of Burger and Warnock (2006, 2007) that EMEs were not inherently dependent on foreign currency borrowing. Deeper domestic bond markets had broadened the range of financing options for both sovereign and corporate borrowers and helped cushion the negative impact of financial shocks on the real economy in EMEs. Moreover, foreign investors were showing a growing preference for EME local currency sovereign debt.

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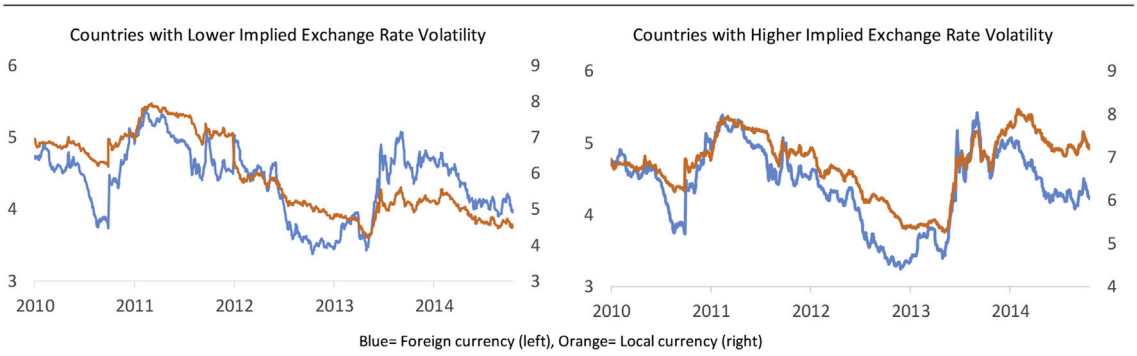


Graph 1. Emerging market sovereign foreign currency and local currency bond yields, in per cent.
Sources: JP Morgan EMBI Global and GBI EM Global indices. ER = exchange rate; authors' calculations

Marking an important break with the past, in 2010 exchange rate risk ceased to hinder capital inflows to EMEs. Between 2010 and early 2013, the general appreciation of EME currencies against the US dollar made investing in EME local currency bonds an attractive proposition for investors. Some observers (eg Eichengreen and Hausmann (1999)) argued that in the early 2010s, EMEs were no longer subject to the "original sin", as they were able to borrow in their own currencies.

Yet, more recently, exchange rate risk has regained prominence. Since May 2013, EMEs experienced a period of turbulence triggered by the Federal Reserve's announcement that it might start reducing its large-scale asset purchases earlier than previously expected. Local currency EME bond yields rose again sharply in the first half of 2015. This has been associated with large movements in EME exchange rates, pointing to an increasingly important role of exchange rate risk in EME sovereign debt markets (BIS (2014a)). That, in turn, has had important implications for investors, domestic and foreign alike, as well as EME central banks[3] (see, for instance, BIS (2014b) or Belke and Schnabl (2015)). The growing literature on the "risk taking channel" has given prominence to EME exchange rate appreciation against the "funding currencies" such as the US dollar or the euro in compressing local currency bond yields in EMEs through a reduction in risk premia (see Hofmann, Shim and Shin (2016) for a discussion).

To illustrate the role of exchange rate risk, Graph 1 plots local currency sovereign bond yields against their foreign currency counterpart during 2010–15 for EMEs with high and low exchange rate volatility (implied by the market pricing of option contracts). Local and foreign currency yields tended to move broadly in parallel until the taper tantrum of May 2013, pointing to the influence of similar risk factors (eg credit and liquidity risks). At the time of the taper tantrum, local currency yields surged above foreign currency yields. Subsequently, in countries with relatively low exchange rate volatility like Colombia, Hungary, and Poland, (see left panel of Graph 1, and Graph A4 of the Appendix for country level plots), the gap subsided as yields returned to historical level following the taper tantrum. However, the gap persisted for those with high exchange rate volatility such as Indonesia and Peru (right panel of Graph 1, and Graph A5).[4]

Against this backdrop, this paper explores the role of exchange rate risk in determining local currency sovereign bond yields in EMEs. In particular, we investigate the effects of two measures of exchange rate risk: (i) the expected rate of exchange rate depreciation calculated from investor surveys and (ii) uncertainty around it measured by exchange rate volatility implied by pricing of option contracts.

Our results show that EME local currency sovereign bond yields are indeed influenced by exchange rate risk. Most notably, when implied exchange rate volatility, one of our measures of exchange rate risk, increases in EMEs, investors require a larger yield compensation for holding these bonds. The results are broadly unchanged when subjected to a number of robustness checks. We also show that investors have been attaching greater importance to exchange rate risk since May 2013, when they realised for the first time that the Federal Reserve may reduce the scale of its asset purchases sooner than previously expected. Further, we provide significant evidence that the influence of exchange rate volatility is less pronounced in EMEs with higher shares of foreign ownership of local currency sovereign bonds, and larger capital account openness. Lastly, we present evidence, though weaker, that the influence of exchange rate volatility is less pronounced in EMEs with greater exchange rate flexibility.

To our knowledge, our paper is the first to explicitly consider implied exchange rate volatility in an empirical model of EME local currency sovereign bond yields. The influence of exchange rate volatility has been discussed in the literature, albeit only qualitatively.[5] Our paper is also related to the literature which discusses the linkages between the returns and volatility of exchange rates and sovereign

[3] Reflecting the importance of exchange rate risk in influencing domestic asset prices and economic activity, central banks in EMEs have taken actions to help smooth exchange rate movements in times of market stress.

[4] Gadanecz, Miyajima and Shu (2014) provide further evidence about the growing role of exchange rate risk in local currency sovereign bond markets in EMEs by conducting a parsimonious econometric investigation. They apply a GARCH approach to daily data spanning the period of January 2012–June 2014.

[5] High average returns on local currency assets can reflect the high volatility of EME exchange rates (Miyajima et al. (2015)), or a risk of sudden and large depreciation of the "target" EME currencies (Gyntelberg and Remolona (2007)). Particularly during times of market stress, the capacity of local currency assets to preserve value could weaken significantly (Turner (2012)). The importance of exchange rate movements for local currency bond yields varies with the availability of instruments to hedge exchange rate exposures (McCauley, Shu and Ma (2014)).

credit risk (eg Duyvesteyn and Martens (2015)). However, we focus on the relationship between the volatility of the exchange rate and sovereign yields and build more explicitly onto an uncovered interest rate parity (UIP) and macroeconomic framework.

The rest of the paper is organised as follows. Section 2 reviews the relevant literature. Section 3 discusses the modelling methodology and the data, and Section 4 reports the empirical results. Section 5 assesses the robustness of our key result. Section 6 develops an extension discussing the relationship between exchange rate volatility, bond yield volatility and the yield curve, and Section 7 draws conclusions.

2. Determinants of EME local currency sovereign yields: the literature

This section reviews the literature and argues that exchange rate risk plays a key role in influencing local currency sovereign bond yields in EMEs, in addition to the influence exerted by traditional domestic and international factors.

2.1. The influence of exchange rate risk

Investors are exposed to gains and losses from exchange rate movements on their holdings of local currency sovereign bonds. In other words, exchange rate volatility and broader exchange rate risk are non-diversifiable and affect the performance of financial assets. Thus, exchange rate risk can represent an important channel of transmission of market sentiment, uncertainty and default risk to local currency bond yields.

The UIP is the first and most obvious mechanism at play. The UIP condition establishes a non-arbitrage relationship between the interest rate spread (defined as the difference between domestic and foreign interest rates) and expected changes in the exchange rate. (Lustig, Roussanov, and Verdelhan (2014), Hofmann and Takáts (2015), Obstfeld (2015)). This implies that local currency bond yields can be driven by expected exchange rate risk (reflected in expected movements in the exchange rate.

In addition to expected exchange rate movements, we are going to argue that the uncertainty around such expectations should also significantly affect local currency sovereign bond yields in EMEs. Caporale, Ali, and Spagnolo (2015) make the case that exchange rate volatility and broader exchange rate risk are non-diversifiable, basing their proposition on a number of research articles (Eun and Resnick (1988), Levich et al. (1999), Choi and Rajan (1997), Fidora et al. (2007) and Borensztein and Loungani (2011)). Caporale et al. (2015) also provide evidence that, in the presence of risk aversion, exchange rate uncertainty induces a home bias and causes investors to reduce their financial activities in order to maximise returns and minimise exposure to uncertainty.

One implication for our paper is that, under such circumstances, international investors would reduce exposures to local currency sovereign bonds in EMEs. Turner (2014) provides evidence that expectations of currency depreciation can drive down the prices of local currency bonds in EMEs, particularly after financial shocks, as observed in 2013 and again in 2015, which increased both the level of uncertainty and investors' sensitivity to a given level of uncertainty (so-called risk aversion). Miyajima, Mohanty, and Chan (2015) show that the high returns on EME local currency bonds could be offset by the high volatility of EME exchange rates. This is particularly the case during times of market stress, when the capacity of local currency assets in EMEs to preserve value could weaken significantly (Turner (2012)). Lastly, Gyntelberg and Remolona (2007) find that high average returns on local currency assets in EMEs reflect a large downside risk of sudden and large depreciation of the target currencies – and/or appreciation of the funding currencies. Likewise, Duyvesteyn and Martens (2014) decompose local-currency total returns on emerging market sovereign debt into local currency interest rate returns and exchange rate returns. To the extent that in times of large market stress, exchange rate volatility jumps across EMEs, part of the exchange rate volatility can be considered as representing undiversifiable risk.[6]

Second, local currency performance indirectly affects the default risk of local currency sovereign bonds via default risks in the corporate, banking or household sectors in EMEs with currency mismatches (Chui and Fender (2014)). The emerging literature on "the risk-taking channel" attributes movements in local currency sovereign yields to the performance of the local currency (Hofmann et al. (2016)). Local currency appreciation may improve the creditworthiness of borrowers in EMEs who have incurred debt in foreign currency and increase the capacity of lenders to extend credit to those EME borrowers. This entails improvements in the EME sovereign's fiscal position and can directly influence and compress the sovereign's local currency yields.

Third, local currency bond yields can be subject to a perception of exchange rate risk. Exchange rate risk tends to affect liquidity conditions in both foreign exchange and domestic bond markets, which tend to be relatively low in many EMEs even in tranquil times. If the local currency is expected to depreciate, investors may face one sided foreign exchange markets with low liquidity. Unexpected local currency depreciation could have a sharper effect, prompting investors to move out of the assets denominated in that currency. This would reduce liquidity in foreign exchange and domestic bond markets (Peiris (2010)), pushing local currency sovereign yields up. Thus, both the central expectation of exchange rate performance and uncertainty around it should affect local currency sovereign bond yields in EMEs.

2.2. Domestic and international determinants

The literature identifies several key domestic and international determinants of bond yields, which have become quite standard. Key domestic factors include monetary and fiscal conditions and related policy credibility (Gale and Orszag (2003), Baldacci and Kumar (2010),

[6] Miyajima et al. (2015) provide a model of local currency sovereign bond yields which links the latter to domestic, international, and exchange rate factors. They combine a term structure model of Caporale and Williams (2002) with a version of UIP in a bid to account more explicitly for additional risks faced by foreign investors. In their model, the local currency sovereign yield spread to the global safe asset yield is conjectured to be affected partly by exchange rate risk.

Peiris (2010), Miyajima et al. (2015)).[7] As for international factors (ie external shocks common to all EMEs) most existing studies focus on them as determinants of foreign currency bond yields and spreads. We consider these factors as determinants of local currency bond yields. They are indicators of global liquidity (international interest rates) and risk sentiment (the VIX, or high-yield corporate bond spreads in advanced and emerging economies; see, for instance Amstad, Remolona and Shek (2016) and Miyajima et al. (2015)).[8]

The views are mixed about the relative importance of international factors over domestic factors. Some studies find that domestic macroeconomic factors, particularly monetary policy stance and inflation, can be more important than global factors for domestic government bond markets in EMEs (Piljak (2013)). However, others argue that the influence of international factors has probably strengthened as EMEs have become increasingly integrated into the global economy and financial markets (Kumar and Okimoto (2011)). The increasing cross-country correlations of long-term government bond yields over the past two decades may hint at the rising importance of international factors.

3. Methodology and data

For our empirical analysis we investigate the influence of exchange rate risk on local currency sovereign bond yields, controlling for domestic and international factors. In this section we discuss the model specification, the variables used, and the estimation technique employed, with particular attention paid to addressing potential reverse causality.

3.1. Model specification

To assess the impact of exchange rate risk on local currency sovereign bond yields, we estimate a reduced form model comprising three sets of determinants of these yields: (i) exchange rate risk factors, (ii) domestic fundamentals and (iii) international factors. Our reduced form model of local currency sovereign bond yields follows, for instance, Jaramillo and Weber (2013a, 2013b), Miyajima et al. (2015) and Peiris (2010), with the important extension of considering exchange rate factors. The following baseline equation is estimated:

$$y_{k,t} = \alpha_0 + \sum_j \alpha_{1,j} ER_{j,k,t} + \sum_m \alpha_{2,m} DOM_{m,k,t} + \sum_n \alpha_{3,n} INT_{n,t} + \theta_k + \varepsilon_{k,t} \quad (1)$$

For the dependent variable, y, we mainly use the five-year local currency sovereign bond yield. This maturity is consistent with the choice of Duyvesteyn and Martens (2015). We also use the ten-year yield to check whether the results change. *ER* represents exchange rate risk factors; *DOM* domestic factors, *INT* international factors (including time dummies), θ_k is country fixed effects and ε is an error term. Subscripts k and t refer to country and time, respectively. Subscript j denotes the exchange rate risk proxy being considered and can take two values (1 = expected exchange rate depreciation and 2 = exchange rate volatility). Subscripts m and n correspond to domestic and international factors. The three sets of explanatory variables are discussed in detail below. This study covers 20 EMEs,[9] using monthly data spanning from January 2005 to May 2014.

3.1.1. Exchange rate risk

As the key factor under consideration, exchange rate risk is represented by two variables: expected exchange rate depreciation and implied exchange rate volatility. As discussed above, both can influence local currency bond yields: while the former directly impacts the expected future performance of foreign-based investors converted into their home currency, the latter creates additional uncertainty around that performance.

A key innovation of our paper is the inclusion of exchange rate *volatility* in a regression model of sovereign local currency bond yields. This variable, noted *iv*,[10] is the exchange rate volatility implied by the pricing of at the money option contracts on EME exchange rates with a 3-month tenor. Higher exchange rate volatility represents greater uncertainty about the future path of the exchange rate. This should prompt investors to demand higher risk premia on domestic assets, increasing local currency bond yields. The expected exchange rate depreciation over a 12-month horizon, s^e, represents the rate of change between the expected exchange rate level 12 months ahead, at a constant forecast horizon, and relative to the prevailing spot exchange rate. Local currency depreciation incurs a loss to dollar-based investors in local currency bonds in EMEs and they would thus demand a higher yield as compensation. Currency depreciation may also increase yields by lifting inflation expectations. We expect the coefficient sign on this variable to be positive.

3.1.2. Domestic fundamentals

For the domestic macroeconomic variables, we construct forecast variables with a constant forecast horizon in order to help alleviate

[7] Earlier research tends to examine such determinants in advanced economies, mainly the United States. Related studies on EMEs often concentrate on bonds denominated in foreign currency (Gonzalez-Rozada and Levy-Yeyati (2008), Longstaff, Pan, Pedersen, and Singleton (2011)). But the literature focusing on local currency bonds is emerging. Baldacci and Kumar (2010) study a panel of both advanced economies and EMEs over the past three decades. The literature focusing exclusively on EME local currency bonds include Peiris (2010), Jaramillo and Weber (2013a, 2013b) and Miyajima et al. (2015).

[8] Also Bellas et al. (2010), Dailami, Masson, and Padou (2008), Eichengreen and Mody (2000), Gonzalez-Rozada and Levy-Yeyati (2008), Hartelius, Kashiwase and Kodres, (2008), Longstaff et al. (2011), McGuire and Schrijvers (2003), and Remolona, Satigna, and Wu (2008).

[9] Brazil, Chile, China, Colombia, Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, the Philippines, Poland, Russia, Singapore, South Africa, Thailand and Turkey.

[10] See Table 1 for a summary of variable notations, sourcing, calculations and expected signs in the estimation.

the issue of endogeneity. This is done using forecast data published by Consensus Economics. An empirical issue in estimating a reduced-form bond yield equation is the downward bias in coefficients arising from possible reverse causality from the left to the right side variables. For example, bond yields and the fiscal balance may be negatively associated due to a common factor such as the business cycle, creating potential biases in the estimation. An economic slowdown may be associated with lower interest rates (through monetary policy easing) while at the same time worsening the fiscal balance (through automatic stabilisers). Such an identification problem is difficult to resolve without a structural model, but can at least be reduced by using forecast variables (as shown in Laubach (2009)).[11]

The domestic short-term interest rate, i^e represents the monetary policy stance. Indicators of macroeconomic fundamentals such as inflation π^e, GDP growth g^e and the fiscal balance f^e determine domestic and international investors' risk assessment with respect to the economic outlook. Local currency bond yields are likely to rise as investors expect a higher short-term interest rate and inflation. These yields are expected to decline as investors forecast higher GDP growth and improved fiscal conditions and therefore a lower country risk premium. That being said, a larger output gap is inflationary and would lift bond yields. Therefore, we leave the expected sign on the GDP coefficient a priori open.

Domestic fundamentals may also be captured by two summary measures – credit ratings (*rating*) and sovereign credit default swap (CDS) spreads (*cds*). Local currency sovereign credit ratings are introduced as level dummy variables, following the standard approach in the literature. As the relationship between yields and ratings levels is non-linear, we introduce dummy variables for each rating notch (rather than a numeric conversion of the ratings notches). Sovereign CDS spreads are used as an indicator of foreign currency sovereign creditworthiness.[12] Lower sovereign CDS spreads are expected to lower local currency sovereign bond yields.

3.1.3. International factors

EM local currency sovereign yields tend to move together with US long-term interest rates. Easy US liquidity conditions reduce the yields on US fixed-income securities, leading to search for yield, reaching also outside the United States. This has been particularly so since the "global financial cycle" has had a strong impact on EMEs (Rey (2013)). Furthermore, the low cost of funding US dollar liquidity should have a large impact on global portfolio allocation after international US dollar markets have expanded rapidly as documented by He and McCauley (2012). Duyvesteyn and Martens (2014) show empirically that factors used to predict advanced economy (AE) bond markets can also predict emerging market EM local currency debt returns.[13] US monetary conditions are represented by the estimated US 10-year term premia (*USTP*) and we expect their coefficient to be positive.

In addition, we introduce time dummy variables (*time*) to help capture common shocks to local currency bond yields across all countries.

3.2. Data

The three sets of variables of the model are summarised in Table 1, along with the expected signs, sourcing and construction as discussed above. The Appendix provides further discussion on the data.

The data on expected exchange rate depreciation is taken from Consensus Economics and exchange rate volatility series were obtained from JP Morgan. We used the Consensus Economics database to construct the projected values of the domestic fundamentals. Ratings are an unweighted average of Moody's, S&P and Fitch (where at least one of the three agencies has attributed a rating to long-dated sovereign paper) and CDS spreads were obtained from Markit. Lastly, we used US term premium data calculated according to the methodology described in Hördahl and Tristani (2014).[14]

Panel unit root tests, the results of which are reported in Table 2, show that most variables are stationary at the 1% level. Borderline variables are bond yields, and the US term premium. Bond yields are stationary at the 10% level using the Akaike Information Criterion (AIC), and at a level slightly exceeding 10% when the Bayesian Information Criterion (BIC) or the Hannan-Quinn information Criterion (HQIC) are used. The US term premium is stationary using AIC and HQIC.

3.3. Addressing potential reverse causality

Our estimation may suffer from potential reverse causality with respect to the exchange rate risk variables. As discussed earlier, we have tried to address potential reserve causality with respect to macroeconomic variables by using forecasts, as guided by the literature. However, there is a possibility that the left hand side variable, EM local currency sovereign bond yields, may influence expected exchange rate depreciation and exchange rate volatility on the right hand side.

One view, which has influenced our analysis, is that causality runs from exchange rate risk to local currency sovereign yields (see, for instance, BIS (2014)). When uncertainty about the future path of the exchange rate increases, foreign investors with exchange rate exposures would require greater yield compensation for holding local currency bonds. If these investors were unable to roll over their exchange rate hedges and wanted to sell their bond holdings, yields would rise.

[11] Macroeconomic forecasts are expected to be less affected by the current state of the business cycle and reduce reverse causality running from local currency yield movement to, for instance, monetary and fiscal policy response.

[12] Sovereign CDS spreads have greater country coverage than a commonly-used alternative measure, the EMBI (Emerging Market Bond Index) spreads.

[13] Specifically, they find that while total returns on emerging market dollar debt are highly correlated with those on US Treasuries, the total returns on EM local currency debt are more highly correlated with those on US high yield securities.

[14] The authors use a joint model of macroeconomic and term structure dynamics to estimate inflation risk premia and inflation expectations in the United States and the euro area, relying on macro data and survey data on inflation and interest rate expectations at various future horizons, as well as term structure data from both nominal and index-linked bonds.

Table 1
Model variables and expected signs of coefficients.

Dependent variable		Units	Source
y	five-year (respectively, ten-year) local currency sovereign bond yield.	%	Bloomberg JP Morgan

Explanatory variables		Units	Source	Expected sign
i) Exchange rate risk factors (specific to each EME)				
s^e	Twelve-month ahead projected rate of deprecation of the bilateral exchange rate[a,b]	% yoy	Consensus Economics	+
iv	Volatility of bilateral exchange rates implied by 3-month at the money options	%	JP Morgan	+
ii) Domestic fundamentals (specific to each EME)				
i^e	Twelve-month ahead forecast of short-term interest rates[c]	%	Consensus Economics	+
π^e	Twelve-month ahead forecast of inflation[c]	% yoy	Consensus Economics	+
g^e	Twelve-month ahead forecast of GDP growth[c]	% yoy	Consensus Economics	+/−
f^e	Twelve-month ahead forecast of the fiscal balance[c]	% of GDP	Consensus Economics	–
rating	Local currency sovereign credit ratings dummy[d]	n/a	Moody's, S&P; Fitch	–
cds	Sovereign CDS spreads	bp	Markit	+
iii) International factors (common to all EMEs)				
time	Time dummy	n/a	n/a	n/a
USTP	Estimated US 10-year term premia[e]	%	Bloomberg; authors' calculations	+

[a] A positive value of s^e represents a depreciation of the domestic currency.
[b] The twelve month ahead projected exchange rate level is reported by Consensus Economics and the prevailing spot exchange rate is used to compute the twelve month ahead projected rate of exchange rate depreciation.
[c] The twelve month ahead forecasts are constructed as a moving weighted average of the current year and the following year's forecasts. If in the z-th month of the current year, the current end year and the following end year GDP growth forecasts were x% and y%, respectively, the 12 month ahead forecasts would be (12-z)/12*x % + z/12*y%.
[d] The ratings dummy tracks the unweighted average of the Fitch, Moody's and S&P ratings when at least one agency rates the sovereign credit. Letter ratings are converted to integer values following Table A1 of the Appendix, and the average is rounded to the nearest integer value on a scale of 0–20. A dummy variable is then used for each integer value, because of the non-linear relationship between ratings and yields.
[e] The term premium has been calculated using the methodology described in Hördahl and Tristani (2014), "Inflation risk premia in the euro area and the United States", *International Journal of Central Banking*, September, pp. 1-47.

Table 2
Stationarity tests.

	AIC			BIC			HQIC		
	AIC statistic	p-value	optimal lag length	BIC statistic	p-value	optimal lag length	HQIC statistic	p-value	optimal lag length
Local currency sovereign bond yield	−1.55	0.060*	3.50	−1.25	0.105	1.15	−1.27	0.102	1.20
One year ahead exchange rate depreciation forecast	−10.14	0.000***	1.70	−13.46	0.000***	0.10	−12.89	0.000***	0.20
Implied exchange rate volatility	−6.39	0.000***	2.75	−8.35	0.000***	0.90	−6.64	0.000***	1.95
CDS spread	−3.93	0.000***	3.55	−3.98	0.000***	1.50	−4.11	0.000***	2.55
One year ahead short-term interest rate forecast	−3.04	0.001***	2.50	−2.67	0.004***	1.25	−3.02	0.001***	1.60
One year ahead inflation forecast	−7.50	0.000***	2.40	−6.99	0.000***	1.40	−7.47	0.000***	1.80
One year ahead GDP growth forecast	−6.70	0.000***	3.20	−6.99	0.000***	1.80	−7.34	0.000***	2.35
One year ahead fiscal balance forecast	−2.20	0.014**	2.10	−1.51	0.066*	0.85	−1.57	0.058*	0.90
US term premium	−1.82	0.035**	3.00	−0.17	0.435	2.00	−1.82	0.035**	3.00

Note: *, **, and *** signify statistical significance at the 1 percent, 5 percent, and 10 percent levels.
Source: Authors' calculations.

However, another view is that shocks can be transmitted from the local currency bond market to the foreign exchange market. Because the former is usually shallower and less liquid, foreign investors tend to rely on foreign exchange instruments to hedge their holdings of local currency bonds, eg foreign exchange options that protect against extreme market volatility. Such position taking in turn tends to move the exchange rate. Pericoli and Taboga (2012) argue that time-varying bond risk premia account for a significant portion of the variability of the exchange rate.

Our analysis suggests that the causality between exchange rate risk and local currency sovereign bond yields can run both ways. Using exchange rate volatility, a key variable of our focus, we performed bivariate Granger-Wald tests to check the direction of causality. The test results (reported in Table A2 in the Appendix) confirm that for about one half of EMEs in our sample, the direction of the causality runs from exchange rate volatility to local currency sovereign bond yields. This is especially the case in Asia and eastern Europe. In these two regions, local currency sovereign bond markets are relatively liquid and foreign participation relatively large (for the period of 2005–13, foreigners held 10% of total local currency sovereign bonds outstanding on average in Asia, and 20% in eastern Europe). Therefore, exchange rate risk, if not hedged, has probably had a greater impact on local bond yields. However, in several EMEs the direction of causality runs the other way as well – bond yields affect exchange rate volatility. In a small number of EMEs, the test results suggest no causality at all.

To attenuate the issue of potential reserve causality, we use an instrumental variables (IV) and two-stage least squares approach for

panel-data models. We apply this technique to exchange rate volatility, and also to two other market-based variables – expected exchange rate depreciation and sovereign credit default swap spreads. Our monthly estimations could pick up the very quick reaction of these variables as reverse causality. In applying the technique to the three variables, each variable is instrumented by the lagged values of all three variables, an approach commonly followed in the bond yield literature (see Table A3 of the Appendix for a summary, in particular Ebeke and Kyobe (2015), Ebeke and Lu (2014), Hofmann et al. (2016) and Duyvesteyn and Martens (2015)).

Econometrically, the choice of the lagged values as instruments is justified by the persistence of the auto-regressive component in the market variables, which we test following the approach described in Menknoff, Sarno, Schmeling, and Schrimpf (2012). In these so-called "momentum" regressions depicted in equations (2)–(4) below, we regress the market variables – expected rate of depreciation x, foreign exchange volatility y and CDS spreads z – on their own lags as well as the lags of other market variables. We control for country effects Θ and time effects T. Subscripts i, r, and s refer to lag depths, country and time. We repeat the analysis using four different lag depths ($i = 1, 3, 6, 12$) and three different standard error structures: time series-robust, robust for cross section (Huber-White), and both time series and cross-section robust.

$$x_{r,s} = \alpha_{x,0} + \alpha_{x,1} x_{r,s-i} + \alpha_{x,2} y_{r,s-i} + \alpha_{x,3} z_{r,s-i} + \theta_{x,r} + T_{x,r} + \varepsilon_{x,r,s} \quad (2)$$

$$y_{r,s} = \alpha_{y,0} + \alpha_{y,1} x_{r,s-i} + \alpha_{y,2} y_{r,s-i} + \alpha_{y,3} z_{r,s-i} + \theta_{y,r} + T_{y,r} + \varepsilon_{y,r,s} \quad (3)$$

$$z_{r,s} = \alpha_{z,0} + \alpha_{z,1} x_{r,s-i} + \alpha_{z,2} y_{r,s-i} + \alpha_{z,3} z_{r,s-i} + \theta_{z,r} + T_{z,r} + \varepsilon_{z,r,s} \quad (4)$$

Several key observations emerge from the results reported in Tables A4–A6 of the Appendix. First, these variables have varying degree of dependence on their own lags and on other variables. Expected exchange rate depreciation depends on all variables, exchange rate volatility mainly on exchange rate variables, and sovereign CDS spreads mainly on their own lags. Second, the one-month lag of the dependent variable naturally tends to be the most important factor in terms of the size of the coefficient and its statistical significance.[15] The size and statistical significance decline as the lag depth is increased to three, six, and 12 months. Third, standard errors accounting for cross-sectional heteroscedasticity of the residuals lead to more conservative estimates (result in lower adjusted R^2 values) than standard errors accounting for time-variant heteroscedasticity. Accounting for both cross-sectional and time-variant heteroscedasticity does not add value. Consequently, in the rest of the paper, we rely on cross-section robust standard errors when using the lagged values of the market variables as instruments to help correct for potential endogeneity.

4. Benchmark results

In this section we discuss the benchmark results across a number of different model specifications, starting with a small number of regressors and subsequently introducing additional controls. We estimate the multivariate panel fixed effects model using the ordinary least squares and instrumental variables two-stage least squares approaches. As discussed in the previous section, we instrument the three market variables using their own lags, as well as other lagged market variables.

The estimation results reported in Table 3 confirm that greater exchange rate risk leads to higher local currency sovereign bond yields (results were similar when 10-year yields were used on the left-hand side).[16] A one percentage point increase in exchange rate volatility is associated with a 11 basis point rise in local currency bond yields after controlling for expected exchange rate depreciation and CDS spreads. The value of the coefficient declines by one half but remains statistically significant after controlling for domestic and international factors. The impact of expected exchange rate depreciation is economically and statistically significant in the most parsimonious model specification. However, it declines and loses statistical significance after controlling for domestic and international factors. It appears that inflation forecasts account for at least some of the elements underlying expected exchange rate depreciation.

Sovereign CDS spreads come out as an important determinant of local currency sovereign yields across different specifications. They are statistically and economically significant. A one hundred basis point rise in sovereign CDS spreads is associated with a 40–90 basis point rise in local currency sovereign bond yields, depending on the model.

The coefficients on the domestic and international factors remain stable across different specifications. Those on domestic short-term interest rate forecasts, inflation forecasts and fiscal balance forecasts are consistently significant and largely stable in terms of magnitude across different models. In particular, a 100 basis point rise in short rate forecasts is associated with a 56–65 basis point increase in the sovereign bond yield. Movements in inflation forecasts have a similar impact – a one percentage point increase in the variable is associated with a 42–64 basis point increase in sovereign bond yields. A one percentage point of GDP improvement in the fiscal balance leads to up to a 15 basis point reduction in the sovereign yield. GDP growth is, however, not a significant determinant.

We find a large degree of pass-through of global liquidity conditions to local currency sovereign bond yields in EMEs. A one percentage point increase in the US 10-year term premia leads to a 55 basis point increase in EM local bond yields. This result is consistent with Obstfeld (2014), who finds cross-country evidence that long-term US interest rates affected those in EMEs in recent years. It is also in line with Miyajima and Shim (2014) who find that a significant impact of the US 10-year bond yield.

The regression results are broadly similar between OLS and IV approaches. However, as discussed later in Section 4.4, specification

[15] As a related observation, as the impact of the lagged dependent variable fades, the impact of lagged other variables increases albeit only marginally.

[16] Reported in Table A7 of the Appendix. Due to data availability, the size of the sample with ten-year yields is limited to two thirds of the baseline sample with five-year yields. In the rest of the paper we use the five-year bond yields as the dependent variable.

Table 3
Fixed effects panel model of local currency 5-year sovereign bond yields in EMEs, benchmark results.

Dependent variable: local currency sovereign bond yields, 5 years	OLS				IV			
One year ahead exchange rate depreciation forecast	0.076***	0.025	0.018	0.015	0.095***	0.029	0.022	0.021
Implied exchange rate volatility	0.106**	0.059**	0.059**	0.014	0.112***	0.060*	0.060**	0.009
CDS spread	0.009***	0.007***	0.006***	0.004**	0.009***	0.007***	0.006***	0.004**
One year ahead short-term interest rate forecast	…	0.569***	0.581***	0.653***	…	0.564***	0.578***	0.650***
One year ahead inflation forecast	…	0.429***	0.492***	0.637***	…	0.420***	0.487***	0.633***
One year ahead GDP growth forecast	…	…	−0.11	0.001	…	…	−0.108*	0.002
One year ahead fiscal balance forecast	…	…	−0.146***	−0.127***	…	…	−0.146***	−0.127***
US term premium	…	…	…	0.544***	…	…	…	0.546***
Constant	6.872***	4.186***	4.136***	3.837***	6.681***	4.151***	4.111***	3.840***
Ratings dummies	Y	Y	Y	Y	Y	Y	Y	Y
Time dummies	Y	Y	Y	N	Y	Y	Y	N
N	2177	2177	2159	2159	2177	2177	2159	2159
R2	0.420	0.737	0.802	0.781	0.433	0.736	0.802	0.781

Authors' estimates using monthly data. The estimation period is from January 2005 to May 2014. The country sample includes Brazil, Chile, China, Colombia, Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, the Philippines, Poland, Russia, Singapore, South Africa, Thailand and Turkey. ***, ** and * stand for significance at the 1, 5 and 10% levels, respectively. OLS = Ordinary Least Squares. IV = A panel instrumental variables method with fixed effects where the exchange rate volatility, expected exchange rate depreciation and the CDS spreads were each instrumented using their own lags and those of the other two instrumented variables.
Sources: Bloomberg; Fitch; GFD; Consensus Economics; JP Morgan; Markit; Moody's; S&P; IMF.

tests suggest that our IV approach is preferred over an OLS approach. Therefore, in the remainder of the paper we discuss results from IV approaches only.

4.1. *Controlling for the effects of short-term rates in the yield data*

One question is whether our specification that includes a short-term rate on the right-hand side can distort estimated results. EM local currency long-term bond yields can be split into a local currency short-term yield and an excess yield over that. Hedged bond returns would depend on these excess yields, to the extent that movements in the short-term rate could be reflected in valuation changes in the FX forward contracts that investors generally use to hedge their positions. If the expected rate of depreciation used in our regressions tends to co-move with FX forwards, then having short-term interest rates on the right-hand side might distort the results.

In order to ascertain that our specification with short-term interest rates on the right-hand side is not affecting the results, the benchmark model was re-estimated using five- and ten-year *term spreads* as the dependent variable (sovereign local currency bond yields minus policy rates), and without expected short-term interest rates on the right-hand side. Using a term spread as the dependent variable, rather than modelling a long yield and controlling for the effects of policy rates in the regression, can lead to qualitatively different results. For instance, the latter approach may capture the transmission of expected monetary stance to the longer end of the yield curve better. Quantitatively, in the latter specification, which is our baseline approach, a little over one-half of expected short term interest rates are subtracted from the five-year yields (see Table 3 for estimated coefficients).

The results of this robustness check, reported in the Appendix, show that the effect of exchange rate volatility on ten-year sovereign EME term spreads (Table A9) is comparable in significance and magnitude to their effect on five- or ten-year EME local currency yields (Table 3 and Table A7). A one percentage point increase in exchange rate volatility is associated with a 6–9 basis point rise in ten-year EME sovereign term spreads, depending on the model specification, controlling for the same macroeconomic factors (Table A9). This suggests that our benchmark results are robust to term spread dynamics. However, we note that implied exchange rate volatility is not significantly associated with five-year EME term spreads (Table A8). This may stem from the fact noted in the previous paragraph, namely that explicitly controlling for policy rates on the right-hand side of the regression may better capture the transmission of expected monetary stance to the longer end of the yield curve. Another reason could be that yields in different maturity buckets can behave differently due to the incompleteness of yield curves. Lastly, the lack of liquidity often cited for EME bond markets suggests that investors' propensity to hedge may be different depending on the maturity bucket.

Based on the results of this robustness check, in what follows we proceed using the five-year bond yields as the dependent variable.

4.2. *Increased sensitivity of EME local currency sovereign bond yields to exchange rate volatility post taper tantrum*

Are our findings biased by major structural breaks in global financial markets? As has been documented in many articles, the global financial crisis has led to important changes in both the behaviour of international investors (eg Miyajima and Shim (2014))[17] and the global monetary and financial environment (Rey (2013)).[18] Another important event was the "taper tantrum" in May 2013, when an adjustment to market expectations about the US Fed's move created a market jitter. To investigate whether these events have changed

[17] Miyajima and Shim (2014) argue that asset managers have become important players in EME asset markets, a shift that has coinicided with a prolonged period of very low interest rates in advanced economies. That has led investors to look for higher-yielding (albeit riskier or less liquid) assets in the hope of greater returns.
[18] Rey (2013) argues that unconventional monetary policy measures in large advanced economies can strongly affect the global financial cycle. .

Table 4
Fixed effects instrumental variable panel model of local currency 5-year sovereign bond yields in EMEs, by subperiod.

Dependent variable: local currency sovereign bond yields, 5 years	Without time dummy				With time dummy			
	Whole period	Jan 05 – Jun 07	Jun 09 – May 14	Jun 13 – May 14	Whole period	Jan 05 – Jun 07	Jun 09 – May 14	Jun 13 – May 14
One year ahead exchange rate depreciation forecast	0.021	0.027	0.039*	0.089*	0.022	0.042	0.031	0.076
Implied exchange rate volatility	0.009	0.034	0.074***	0.059	0.060**	0.061**	0.101***	0.160*
CDS spread	0.004**	0.010***	0.006***	0.009	0.006***	0.012***	0.008***	0.009
One year ahead short-term interest rate forecast	0.650***	0.581***	0.399***	0.238**	0.578***	0.526***	0.371***	0.182
One year ahead inflation forecast	0.633***	0.694***	0.438***	0.374	0.487***	0.659***	0.346***	0.208
One year ahead GDP growth forecast	0.002	0.209***	−0.069***	−0.042	−0.108*	0.356***	−0.115**	0.034
One year ahead fiscal balance forecast	−0.127***	−0.153***	−0.002	−0.225	−0.146***	−0.087*	0.014	−0.185
US term premium	0.546***	−0.158	0.590***	0.578***	…	…	…	…
Constant	3.840***	−1.417*	2.327***	0.76	4.111***	−2.903***	2.178***	0.106
Ratings dummies	Y	Y	Y	Y	Y	Y	Y	Y
Time dummies	N	N	N	N	Y	Y	Y	Y
N	2159	840	1099	234	2159	840	1099	234
R2	0.781	0.654	0.745	0.796	0.802	0.576	0.727	0.747

Authors' estimates using monthly data. The estimation period is from January 2005 to May 2014. The country sample includes Brazil, Chile, China, Colombia, Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, the Philippines, Poland, Russia, Singapore, South Africa, Thailand and Turkey. The estimations were made using a panel instrumental variables method with fixed effects where the exchange rate volatility, expected exchange rate depreciation and the CDS spreads were each instrumented using their own lags and those of the other two instrumented variables. ***, ** and * stand for significance at the 1, 5 and 10% levels, respectively.
Sources: Bloomberg; Fitch; GFD; Consensus Economics; JP Morgan; Markit; Moody's; S&P; IMF.

the role of exchange rate volatility (and other factors), we split the sample period.

From the estimation results reported in Table 4, we confirm the view that investors attached greater importance to exchange rate risk in more recent periods. In other words, the sensitivity of EME local currency sovereign bond yields to exchange rate volatility increases after the global financial crisis, and further after the taper tantrum in mid-2013. With respect the models including time dummy variables, a one percentage point increase in implied exchange rate volatility is associated with a 6 basis point rise in bond yields before the Lehman bankruptcy, which rises to 10 basis points following the Lehman bankruptcy. The sensitivity rises to 16 basis points when the window is narrowed to the post-tapering period, between June 2013 and the end of 2014.[19] The role of GDP growth forecasts changes from before the global financial crisis to after. During 2005–07, stronger economic activity primarily boosted bond yields as expectations of rate hikes transmitted to the longer end of the yield curve. However, during 2009–14, stronger economic activity compressed bond yields via lower sovereign credit risk despite CDS spreads being included in the models. Results from the models with the US term premium are broadly similar, and, additionally, indicate that the role of the US term premium rose since the onset of the global financial crisis.

4.3. Results by region

A related question is whether our results can change when estimated over different country samples. As a natural way of disaggregation, the benchmark model is re-estimated for three regions – Asia, Latin America, and eastern Europe, Middle East and Africa (EMEA) – for the post-Lehman period, where the impact of exchange rate volatility is found to be strong. The results reported in Table 5 confirm that exchange rate volatility importantly affects local currency sovereign bond yields, albeit with some regional variation. Exchange rate volatility has the strongest effect in Asia, where a one percentage point increase in exchange rate volatility is associated with an 8–11 basis point rise in local currency bond yields. It is less strong in EMEA (7–8 basis points) and insignificant in Latin America. Across regions, the coefficient estimates on the domestic and international controls are comparable in sign and significance to the benchmark results which include all regions. The exceptions are inflation forecasts, which are not significant in Latin America. Stronger GDP growth forecasts lead to lower sovereign yields in the Asian and EMEA regions, but to higher yields in Latin America. The effects of fiscal balance forecasts are more mixed.

4.4. Specification tests

In this section we check the appropriateness of our estimation methodology, which uses fixed effects and IV-techniques, by comparing it to alternative estimation techniques.

For our IV panel model, fixed effects are more appropriate than random effects for capturing country specificities. A first Hausman test, whose results are reported in Table 6, is used to compare the consistency of our baseline model (IV panel model using fixed effects) to that of an IV panel model using random effects. The null hypothesis that the equation is adequately modelled by random effects is rejected.

We then proceed to verify, using a second Hausman test (also reported in Table 6), that an IV panel estimation using fixed effects is

[19] Consistent with this result, Arslanalp and Tsuda (2015) report an increase in *benchmark-driven* investors' sensitivity to foreign exchange risk at the time of the taper tantrum.

Table 5
Fixed effects instrumental variable panel model of local currency 5-year sovereign bond yields in EMEs, by region, post-Lehman period.

Dependent variable: local currency sovereign bond yields, 5 years	Without time dummy			With time dummy		
	Asia	Latin America	EMEA	Asia	Latin America	EMEA
One year ahead exchange rate depreciation forecast	0.060*	0.074	0.041	−0.004	0.05	0.039
Implied exchange rate volatility	0.109***	0.06	0.088*	0.077***	0.022	0.066*
CDS spread	0.002	0.005	0.007***	0.011***	0.030**	0.008***
One year ahead short-term interest rate forecast	0.431***	0.522***	0.301***	0.404***	0.341**	0.232***
One year ahead inflation forecast	0.539***	−0.086	0.414***	0.507***	−0.357	0.184**
One year ahead GDP growth forecast	−0.067**	0.05	−0.112***	−0.079*	0.189*	−0.289***
One year ahead fiscal balance forecast	−0.056	−0.248*	0.083	−0.027	−0.247*	0.038
US term premium	0.453***	0.658**	0.686***	…	…	…
Constant	1.381***	4.018***	2.192***	0.733*	1.64	3.599***
Ratings dummies	Y	Y	Y	Y	Y	Y
Time dummies	N	N	N	Y	Y	Y
N	450	236	413	450	236	413
r_a^2	0.757	0.494	0.704	0.876	0.481	0.427

Authors' estimates using monthly data. The estimation period is from June 2009 to May 2014. The country sample includes Brazil, Chile, China, Colombia, Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, the Philippines, Poland, Russia, Singapore, South Africa, Thailand and Turkey. The estimations were made using a panel instrumental variables method with fixed effects where the exchange rate volatility, expected exchange rate depreciation and the CDS spreads were each instrumented using their own lags and those of the other two instrumented variables. ***, ** and * stand for significance at the 1, 5 and 10% levels, respectively.
Sources: Bloomberg; Fitch; GFD; Consensus Economics; JP Morgan; Markit; Moody's; S&P; IMF.

Table 6
Hausman tests of alternative estimation techniques.

Alternative specification being tested	Chi^2	$Prob(Chi^2)$
IV with fixed or random effects		
H0: An estimator under an IV panel with random effects is efficient	13729.76	0.0000
Fixed effects with or without IV		
H0: An estimator without IV is efficient	279	0.0000

superior to a standard panel estimation with fixed effects. The finding is consistent with the results of our bivariate Wald test results discussed in Section 3. The Wald test results show that the direction of causality runs from sovereign bond yields to exchange rate risk for several EMEs in our sample, which calls for the IV estimation.

5. Additional drivers of local currency bond yields

We have implemented additional robustness checks to verify how a number of additional drivers may influence the importance of exchange rate risk in determining local currency sovereign bond yields. In particular, (i) we introduced additional variables to capture foreign holdings of local currency sovereign bonds, (ii) we classified the countries of the sample into different groups by capital account openness and exchange rate regime, and (iii) we introduced interaction terms to capture different regimes by inflation and fiscal circumstances. We report the results of these robustness checks including time dummies, which corresponds to the model specification in which exchange rate risk tended to be consistently significant.

5.1. Foreign holdings of local currency sovereign bonds

A key development over the past several years has been the rising interest of foreign investors in EME local currency sovereign bonds. Such bonds have become relatively more attractive and accessible over time (thanks to a greater degree of capital account openness and the development of local currency sovereign bond markets in EMEs). While foreign capital inflows to EMEs can be underpinned by cyclical factors, such as carry trade incentives, institutional investors globally are believed to have also been reallocating funds into EME assets on a structural basis.

To capture this development, we created a dummy variable which takes value of "1" if the share held by foreigners of a country's total stock of local currency sovereign bonds outstanding is above the cross-country average of such foreign holding shares[20] in the particular year, and value of "0" otherwise. The dummy variable was then interacted with the country's exchange rate volatility. In addition, we also introduced as a separate right-hand side variable the month-on-month change[21] in the share held by foreigners of a country's total stock of local currency sovereign bonds outstanding.

[20] The share of an EM's local currency sovereign bonds held by foreign banks (foreign nonbanks) as a share of the total stock outstanding of such bonds rose from around 4 percent to 6 percent (9 percent to 20 percent) on average during the period of estimation. Taking the median instead of the average yields very similar results.
[21] Stationarity tests, available from the authors upon request, show that the shares held by foreigners of countries' total outstanding stock of local currency sovereign bonds are non-stationary in levels, but stationary in first differences.

The sign of the coefficient on the share of foreign holdings is difficult to predict a priori. One view in the literature is that high foreign investor penetration into local currency EME bond markets can raise domestic currency yields due to a greater chance of sudden withdrawals (Calvo and Talvi (2005), Ebeke and Kyobe (2015)). Another view is that greater capital account openness would entail lower domestic interest rates (Eichengreen and Rose (2014)). Yet another view is that foreign investors compress local currency sovereign yields by pushing up bond prices through their purchases (Gadanecz, Miyajima and Urban (2015)). Warnock and Warnock (2009) argue that official sector investment into US bond tends to lower the yields on those bonds.

The first thing to note about the results obtained when controlling for foreign holdings of local currency sovereign bonds is that the influence of exchange rate volatility on local currency sovereign bond yields remains broadly unchanged. As shown in Table 7, a one percentage point increase in implied exchange rate volatility raises bond yields by 6–11 basis points. This is similar to the baseline result.

Second, the yield-increasing impact of higher exchange rate volatility is smaller when foreign holdings of EME local currency sovereign bonds are higher. Of the two different types of foreign investors, banks and non-banks, both have the same so-to-speak stabilizing effects, even though the latter has a larger impact.

Our findings are consistent with Peiris (2010) who notes that "greater foreign participation does not necessarily result in increased volatility in bond yields in EMEs and, in fact, could even dampen volatility in some instances." However, this is somewhat in contrast with what Ebeke and Lu (2014) find, that is, an increase in foreign holdings of local bonds is associated with lower but somewhat volatile yields in Poland during the period 2000–09.

5.2. Capital account openness and the exchange rate regime

The importance of exchange rate risk for local currency bond yields can vary according to the degree of capital account openness and the exchange rate regime. Cross-border capital flows may respond more to changes in exchange rate forecasts and their uncertainty when capital account openness is greater. The type of exchange rate regime could influence the degree of pass-through of exchange rate factors to domestic bond yields in EMEs. For instance, investors' propensity to hedge exchange rate exposures may be lower when the exchange rate is less flexible, which can increase the sensitivity of EM domestic yields to exchange rate factors.

To check whether our key finding about the role of exchange rate risk is biased by such factors, we classified the 20 EMEs of our sample into two groups relying on two commonly used indicators: (i) the Chinn-Ito index of capital account openness and (ii) the IMF classification of de facto exchange rate regime.

The results reported in Table 8a confirm that exchange rate volatility influences local currency sovereign bond yields, but the magnitude varies depending on the degree of capital account openness. The coefficient on implied exchange rate volatility is relatively higher (approximately 1.5 times as large as the benchmark result) in countries with less open capital accounts. One interpretation is that when a country reduces the openness of its capital accounts, a given level of exchange rate volatility can correspond to a larger uncertainty and can create a greater impact on local currency bond yields.

Controlling for the flexibility of the exchange rate (Table 8b) results in exchange rate volatility losing its significance as a determinant of local currency bond yields. The coefficients turn significant at the 20 percent level, and the impact of a given level of exchange rate volatility is larger in EMEs with less flexible exchange rate regimes. One interpretation is that the local financial markets in economies with less flexible exchange rates are probably less prepared to absorb the shock.

Table 7
Fixed effects instrumental variable panel model of local currency 5-year sovereign bond yields in EMEs, by various levels of foreign bond holdings.

Dependent variable: local currency sovereign bond yields					
One year ahead exchange rate depreciation forecast	0.022	0.058**	0.055**	0.056**	0.056*
Implied exchange rate volatility	0.060**	0.085***	0.101***	0.084***	0.109***
CDS spread	0.006***	0.006***	0.006***	0.006***	0.006***
One year ahead short-term interest rate forecast	0.578***	0.665***	0.707***	0.666***	0.705***
One year ahead inflation forecast	0.487***	0.509***	0.546***	0.507***	0.549***
One year ahead GDP growth forecast	−0.108*	−0.177**	−0.222**	−0.185**	−0.132*
One year ahead fiscal balance forecast	−0.146***	−0.206***	−0.201***	−0.203***	−0.175***
US term premium	…	…	…	…	…
Change in foreign banks' bond holdings	…	−0.217	−0.198	…	…
High foreign banks' bond holdings x exchange rate volatility	…	…	−0.035**	…	…
Change in foreign nonbanks' bond holdings	…	…	…	0.164*	0.162
High foreign nonbank's bond holdings x exchange rate volatility	…	…	…	…	−0.058**
Constant	4.111***	3.539**	3.306**	3.561**	2.818**
Ratings dummies	Y	Y	Y	Y	Y
Time dummies	Y	Y	Y	Y	Y
N	2159	1136	1136	1136	1136
R2	0.802	0.739	0.712	0.735	0.738

Authors' estimates using monthly data. The estimation period is from January 2005 to May 2014. The country sample includes Brazil, Chile, China, Colombia, Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, the Philippines, Poland, Russia, Singapore, South Africa, Thailand and Turkey. The estimations were made using a panel instrumental variables method with fixed effects where the exchange rate volatility, expected exchange rate depreciation and the CDS spreads were each instrumented using their own lags and those of the other two instrumented variables. ***, ** and * stand for significance at the 1, 5 and 10% levels, respectively.
Sources: Bloomberg; Fitch; GFD; Consensus Economics; JP Morgan; Markit; Moody's; S&P; IMF.

Table 8a
Fixed effects instrumental variable panel model of local currency 5-year sovereign bond yields in EMEs, by openness of the capital account.

Dependent variable: local currency sovereign bond yields			
	Benchmark	Countries with more open capital accounts	Countries with less open capital accounts
One year ahead exchange rate depreciation forecast	0.022	0.023	0.021
Implied exchange rate volatility	0.060**	0.040	0.093***
CDS spread	0.006***	0.007***	0.005**
One year ahead short-term interest rate forecast	0.578***	0.533***	0.609***
One year ahead inflation forecast	0.487***	0.434***	0.511***
One year ahead GDP growth forecast	−0.108*	−0.228**	−0.014
One year ahead fiscal balance forecast	−0.146***	−0.093**	−0.244***
US term premium	…	…	…
Constant	4.111***	3.063***	5.024***
Ratings dummies	Y	Y	Y
Time dummies	Y	Y	Y
N	2159	1151	1008
R2	0.802	0.797	0.843

Authors' estimates using monthly data. The estimation period is from January 2005 to May 2014. The country sample includes Brazil, Chile, China, Colombia, Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, the Philippines, Poland, Russia, Singapore, South Africa, Thailand and Turkey. The estimations were made using a panel instrumental variables method with fixed effects where the exchange rate volatility, expected exchange rate depreciation and the CDS spreads were each instrumented using their own lags and those of the other two instrumented variables. ***, ** and * stand for significance at the 1, 5 and 10% levels, respectively.
Sources: Bloomberg; Fitch; GFD; Consensus Economics; JP Morgan; Markit; Moody's; S&P; IMF.

5.3. *Inflation and fiscal conditions*

Conceivably, the impact of exchange rate volatility on local currency sovereign bond yields may vary depending on the country's inflation and fiscal conditions. A given level of exchange rate volatility would raise local currency sovereign bond yields to a greater extent in countries with higher inflation and a lower fiscal surplus, insofar as investors demand a greater compensation for the additional risk.

To check whether such inflation and fiscal conditions can bias estimated influence of exchange rate volatility, dummy variables were created, which classify countries into those with high or low inflation or fiscal deficits.[22] These dummies were interacted with our exchange rate variables as the baseline model was re-estimated.

The results, reported in Table 9, confirm yet again that local currency sovereign bond yields are influenced by exchange rate volatility. Moreover, the sensitivity is broadly unchanged across EMEs with different inflation or fiscal conditions. Instead, fiscal conditions matter more for the transmission of expected exchange rate depreciation to bond yields: the impact is greater in EMEs with higher fiscal deficits.

6. Extension: the role of bond yield volatilities

One question is whether bond yield volatility highlighted as an important indicator of "the price of convexity" in AEs also play a similar role in EMs. A related question is whether our key variable of interest, implied exchange rate volatility, is related to bond yield volatility in any way. Litterman, Scheinkman, and Weiss (1991) discuss the linkage between the yield curve and the volatility of short-term interest rates in AEs. Among several interesting findings, they quantitatively show that interest rate volatility is associated with the curvature of the yield curve and argue that interest rate volatility represents "the price of convexity" which is related to the extent to which the yield curve is hump-shaped.[23]

We applied our model and findings on exchange rate volatility to the yield curve framework of Litterman et al. (1991)'s using two different approaches. First, we regressed EME local currency sovereign bond yield volatilities on short-, medium- and long-term bond yields. Bond yield volatility was estimated as the rolling two-year standard deviation of monthly percentage point changes in five-year local currency sovereign bond yields. As Table A10 shows, in the model specification with no autoregressive term, bond yield volatility is related to the extent to which the yield curve is hump-shaped in EMEs, similar in sign and magnitude to the findings of Litterman et al. (1991) for the US market. A one percentage point increase in one-year sovereign yields and three-month Libor rates is associated with a 5–7bp and 2–4bp *decrease* in bond volatility, respectively. Conversely, a one percentage point increase in five-year bond yields is associated with a 4–9bp *increase* in bond volatility. However, a caveat applies to our results because of stationarity issues: additional unit root tests reported in Table A12 indicate that one-year and ten-year bond yields are non-stationary.

Second, we examined the effects of bond yield volatility on exchange rate volatility with different lags. The estimation results, reported in Table A11, show that higher bond yield volatility is significantly and positively associated with higher foreign exchange volatility. The yearly pass-through (sum of the twelve monthly coefficients) is equal to 0.14–0.15, depending on the model specification, while the long-run coefficient is equal to 1.1–1.6. One potential and likely important channel of transmission is capital outflows, especially after foreign participation in local bond markets rose in EMEs. Foreign investors exiting local currency positions because of

[22] High (low) inflation or fiscal deficit is defined as being above (below) the median value of all countries in a given year.

[23] Two opposing effects cause the yield curve to be hump-shaped. On the one hand, increased short-term rate volatility increases expected future short rates, raising long-term yields. This effect dominates for shorter maturities. On the other, increased short-term rate volatility increases the convexity of the discount factor function, thereby reducing long-term yields. This effect prevails for longer maturities.

Table 8b
Results by flexibility of the exchange rate regime.

Dependent variable: local currency sovereign bond yields			
	Benchmark	Countries with more flexible exchange rate regimes	Countries with less flexible exchange rate regimes
One year ahead exchange rate depreciation forecast	0.022	0.001	0.038**
Implied exchange rate volatility	0.060**	0.033	0.064
CDS spread	0.006***	0.006***	0.007**
One year ahead short-term interest rate forecast	0.578***	0.649***	0.349***
One year ahead inflation forecast	0.487***	0.546***	0.319***
One year ahead GDP growth forecast	−0.108*	−0.097	−0.213*
One year ahead fiscal balance forecast	−0.146***	−0.161***	−0.138**
US term premium	…	…	…
Constant	4.111***	6.262***	3.123***
Ratings dummies	Y	Y	Y
Time dummies	Y	Y	Y
N	2159	1512	647
R2	0.802	0.866	0.759

Authors' estimates using monthly data. The estimation period is from January 2005 to December 2013. The country sample includes Brazil, Chile, China, Colombia, Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, the Philippines, Poland, Russia, Singapore, South Africa, Thailand and Turkey. The estimations were made using a panel instrumental variables method with fixed effects where the exchange rate volatility, expected exchange rate depreciation and the CDS spreads were each instrumented using their own lags and those of the other two instrumented variables. ***, ** and * stand for significance at the 1, 5 and 10% levels, respectively.
Sources: Bloomberg; Fitch; GFD; Consensus Economics; JP Morgan; Markit; Moody's; S&P; IMF.

Table 9
Fixed effects instrumental variable panel model of local currency 5-year sovereign bond yields in EMEs, by type of inflation and fiscal regime.

Dependent variable: local currency sovereign bond yields	With time dummies	
	Inflation conditions	Fiscal conditions
High inflation x One year ahead exchange rate depreciation forecast	0.02	…
Low inflation x One year ahead exchange rate depreciation forecast	0.022	…
High inflation x exchange rate volatility	0.064**	…
Low inflation x exchange rate volatility	0.054**	…
High fiscal deficit x One year ahead exchange rate depreciation forecast	…	0.034**
Low fiscal deficit x One year ahead exchange rate depreciation forecast	…	−0.003
High fiscal deficit x exchange rate volatility	…	0.053**
Low fiscal deficit x exchange rate volatility	…	0.057*
CDS spread	0.006***	0.006***
One year ahead short-term interest rate forecast	0.575***	0.580***
One year ahead inflation forecast	0.473***	0.492***
One year ahead GDP growth forecast	−0.106*	−0.109*
One year ahead fiscal balance forecast	−0.144***	−0.153***
US term premium	…	…
Constant	4.209***	4.013***
Ratings dummies	Y	Y
Time dummies	Y	Y
N	2159	2159
R2	0.804	0.807

Authors' estimates using monthly data. The estimation period is from January 2005 to May 2014. The country sample includes Brazil, Chile, China, Colombia, Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, the Philippines, Poland, Russia, Singapore, South Africa, Thailand and Turkey. The estimations were made using a panel instrumental variables method with fixed effects where the exchange rate volatility, expected exchange rate depreciation and the CDS spreads were each instrumented using their own lags and those of the other two instrumented variables. ***, ** and * stand for significance at the 1, 5 and 10% levels, respectively.
Sources: Bloomberg; Fitch; GFD; Consensus Economics; JP Morgan; Markit; Moody's; S&P; IMF.

significant bond yield volatility may cause large swings in the exchange rate. In view of the results of the first model, discussed in the previous paragraph, one implication is that an increase in bond yield volatility, and therefore exchange rate volatility, is associated with an increase in the five-year bond yields, which is consistent with the key finding throughout the paper.[24]

[24] Results from regressing implied exchange rate volatility on interest rates and bond yields for different maturities confirmed this observation. Results are not reported.

7. Conclusion

Understanding the pricing of sovereign risk in EME domestic bond markets is important for global investors and EME central banks. Recent EME exchange rate movements have strongly affected EME asset returns measured in foreign currency. This paper has attempted to fill the gap in the literature by explicitly accounting for exchange rate factors – in particular expected exchange rate depreciation and uncertainty (ie exchange rate volatility) – in modelling local currency sovereign bond yields in EMEs.

Our empirical analysis suggests that exchange rate volatility is a key determinant of EME local currency sovereign bond yields. The effect of exchange rate volatility has strengthened over time, particularly since the US Federal reserve announced in May 2013 that it would reduce the pace and size of its large-scale asset purchases. A battery of robustness checks confirmed that our key message about exchange volatility remains broadly unchanged.

Our paper builds on the results of Duyvesteyn and Martens (2015), who are among the first to explicitly consider exchange rates in affecting sovereign bonds. Using a Merton type model, they show that exchange rate volatility is strongly correlated with sovereign CDS spreads. Our paper builds on these micro foundations for considering exchange rate dynamics, and considers a wider set of variables in a UIP framework, relating exchange rate volatility and local currency sovereign bond yields.

Our analysis provides several additional key messages with respect to the transmission of exchange rate risk to local currency sovereign yields. These considerations – namely, beneficial externalities in terms of lower government bond yields – are also relevant for policymakers in general, and for central banks in particular, when they decide – or not – to intervene on foreign exchange markets to smooth the volatility of the exchange rate (Ostry, Ghosh, and Chamon (2012), Sahay et al. (2014)).

First, the presence of more established international investors based in local currency sovereign bond markets can act as a stabilizing force in some cases in the sense that their investments are less susceptible to sudden withdrawals or reversals. Investors generally demand a larger risk premium to compensate for higher expected default risk and greater uncertainty about the future path of exchange rates. However, greater foreign ownership of local currency sovereign bonds leads to weaker transmission of exchange rate volatility to those yields.

Second, as also noted in Hale, Jones, and Spiegel (2016), macroeconomic fundamentals in EMEs can attenuate such transmission. We find that EMEs with greater capital account openness, higher exchange rate volatility raises local currency sovereign bond yields to a smaller extent. Similarly, less favourable fiscal conditions tend to increase the sensitivity of local currency bond yields to expected exchange rate depreciation (but not exchange rate volatility).

Our paper contributes to the growing literature on the risk-taking channel, which ties directly exchange rate performance with asset returns or domestic lending in EMEs. For instance, Hofmann et al. (2016) argue that EME exchange rate appreciation against the US dollar tends to lower the risk premium, which compresses local currency bond yields. This paper found that lower exchange rate volatility reduces uncertainty around expected exchange rate performance and systematically compresses local currency bond yields.

Exploring the implications of exchange rate hedging for local currency yields can be a useful area for future research. McCauley, Shu and Ma (2014) argue that such hedging conducted in forward markets, particularly offshore, has implications for local currency bond yields. Indeed, some of our results also suggest that, when exchange rate exposure is hedged less – owing for instance to a less flexible exchange rate regime – the impact of exchange rate volatility on local currency bond yields could be larger. In this context, the further developing local currency securities and hedging markets continues to be a relevant issue for policymakers.

Appendix

We plot the data used in the regression analysis in terms of simple averages across the 20 EMEs. The local currency 5-year sovereign bond yields (used as the dependent variable) traded at around 7% prior to 2008. They rose to around 8% as the global financial crisis intensified, and subsequently, trended downward. They surged when expectations for US tapering of asset purchases intensified in May 2013 and have remained relatively volatile.

The explanatory variables can be classified into three groups: domestic, exchange rate and international factors. Graph A1 shows domestic factors. Short-term interest rate forecasts had already declined, notably through the middle of the 2000s, reflecting rapid disinflation across EMEs. During 2005–08, they remained in a 6–7% range, but have fallen to around 4–5% since 2009, reflecting monetary accommodation EMEs provided to support economic growth. Inflation forecasts have been broadly stable at around 4% yoy over the last decade, reflecting generally better macroeconomic management and stronger monetary policy credibility. GDP growth forecasts were stable at around 5% through 2011, except for the drop in 2008–09. They have fallen to 4% yoy in the last couple of years. Fiscal balance forecasts continued to improve until the Lehman shock in 2008 prompted EMEs to take forceful fiscal response. Fiscal balance forecasts improved from the 2009 trough but have plateaued at around −2% of GDP in the last few years.

Apart from a number of downgrades which occurred in 2009 as capital outflows followed the Lehman crisis, sovereign credit ratings have generally and steadily improved between 2005 and 2013 across EMEs. Sovereign CDS spreads surged in the aftermath of the Lehman collapse, but have returned to pre-crisis levels since. The share of local currency sovereign bonds held by foreign nonbank investors has risen to above 20% of total stock outstanding, exceeding the pre-Lehman level of up to 18%.

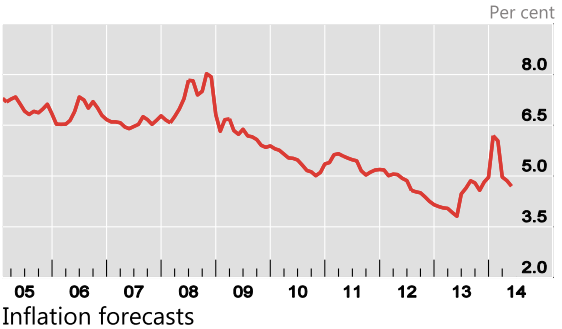
Exchange rate factors represent a distinct group and are the focus of our paper. Graph A2 shows that there were persistent expectations of EME currency appreciation against the US dollar since 2009 reflecting strong capital inflows to EMEs. However, since the middle of 2013 market participants have expected EME currency depreciation. Despite the directional shift in exchange rate expectations, implied exchange rate volatility has generally fallen to near pre-Lehman lows.

As far as international factors are concerned, Graph A3 shows that US 10-year term premia fell steadily since 2008 toward negative territory before starting to return in the middle of 2013 to around zero.

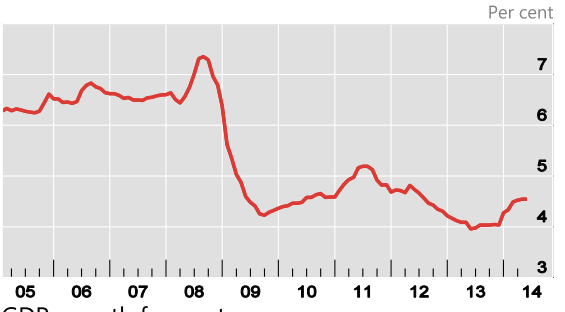
Domestic factors

Graph A1

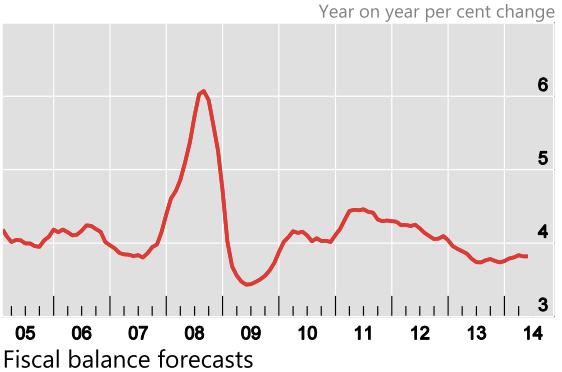
Local currency bond yields



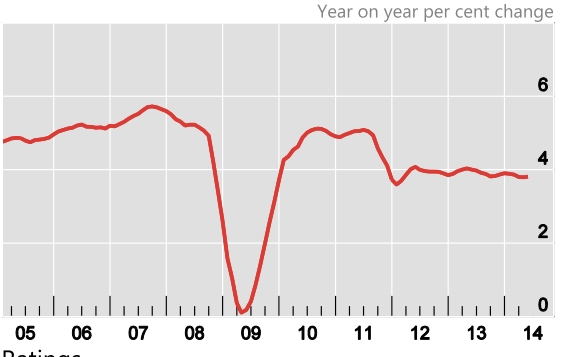
Short-term interest rate forecasts



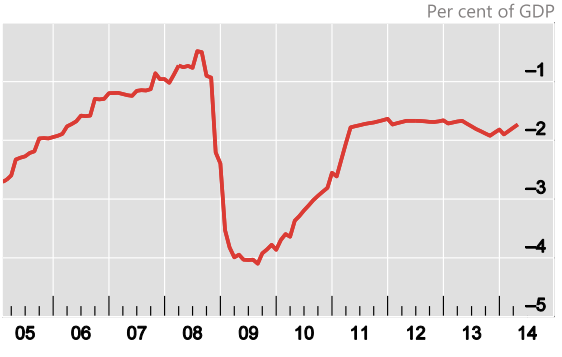
Inflation forecasts



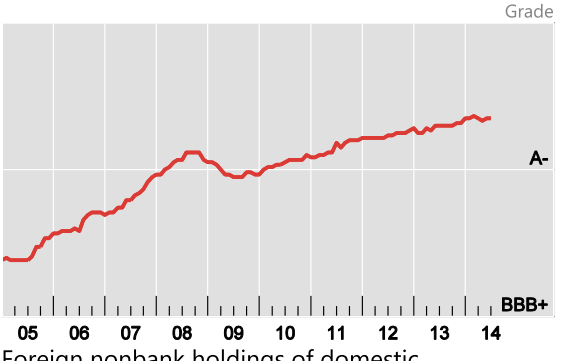
GDP growth forecasts



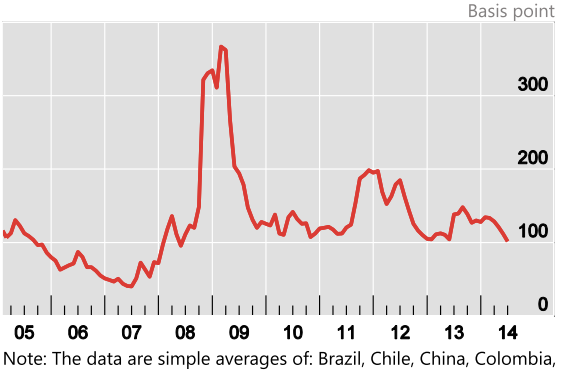
Fiscal balance forecasts



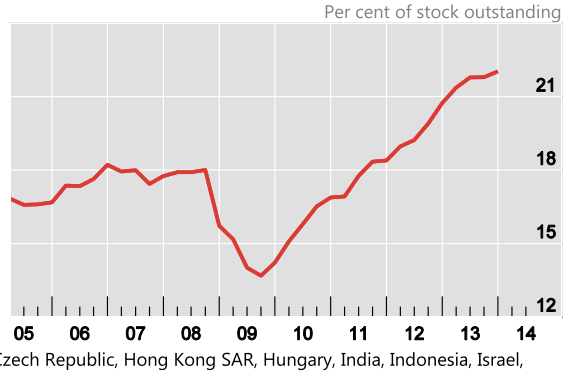
Ratings



CDS spreads



Foreign nonbank holdings of domestic government bonds



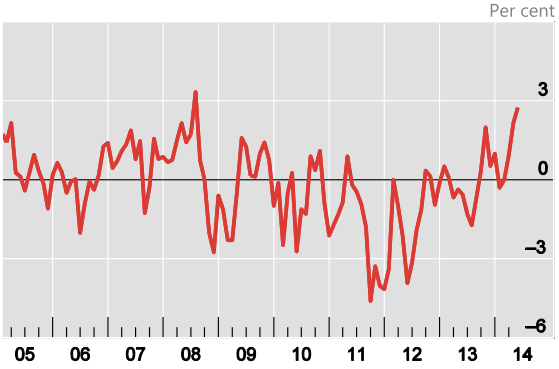
Note: The data are simple averages of: Brazil, Chile, China, Colombia, Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, the Philippines, Poland, Russia, Singapore, South Africa, Thailand and Turkey.

Sources: Bloomberg; Fitch; GFD; Consensus Economics; JP Morgan; Markit; Moody's; S&P; IMF; authors' calculations.

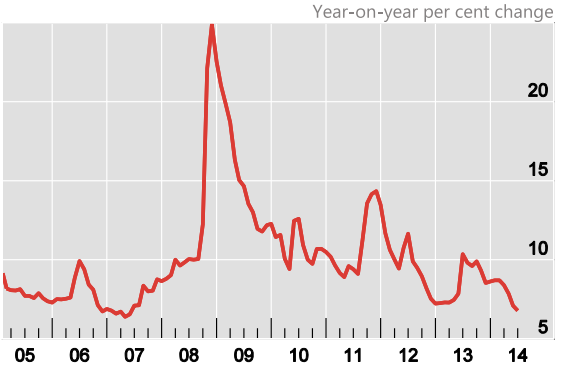
Exchange rate factors

Graph A2

Exchange rate change forecasts



Implied exchange rate volatility



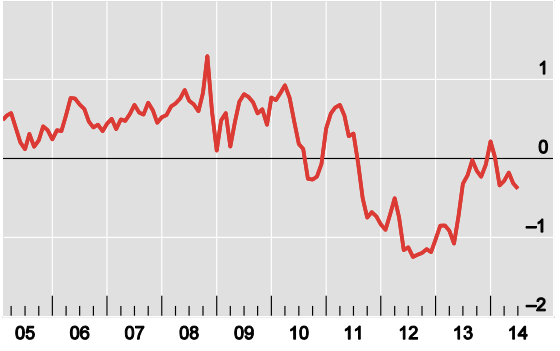
Note: The data are simple averages of: Brazil, Chile, China, Colombia, Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, the Philippines, Poland, Russia, Singapore, South Africa, Thailand and Turkey.

Sources: Consensus Economics; JP Morgan; authors' calculations.

Global factors

Graph A3

US term premium

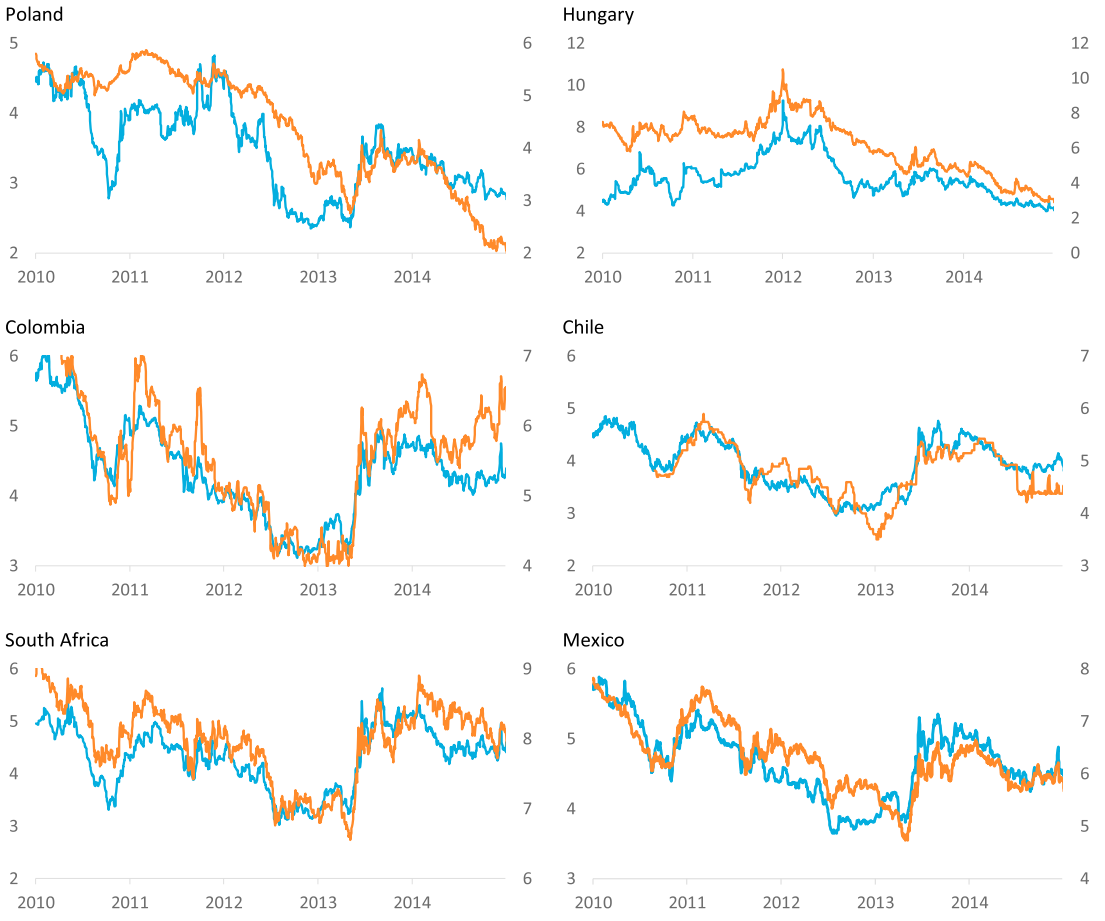


Note: The data are simple averages of: Brazil, Chile, China, Colombia, Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, the Philippines, Poland, Russia, Singapore, South Africa, Thailand and Turkey.

Sources: Bloomberg; authors' calculations.

Sovereign international and domestic bond yields: EMEs with lower FX volatility

In per cent Graph A4

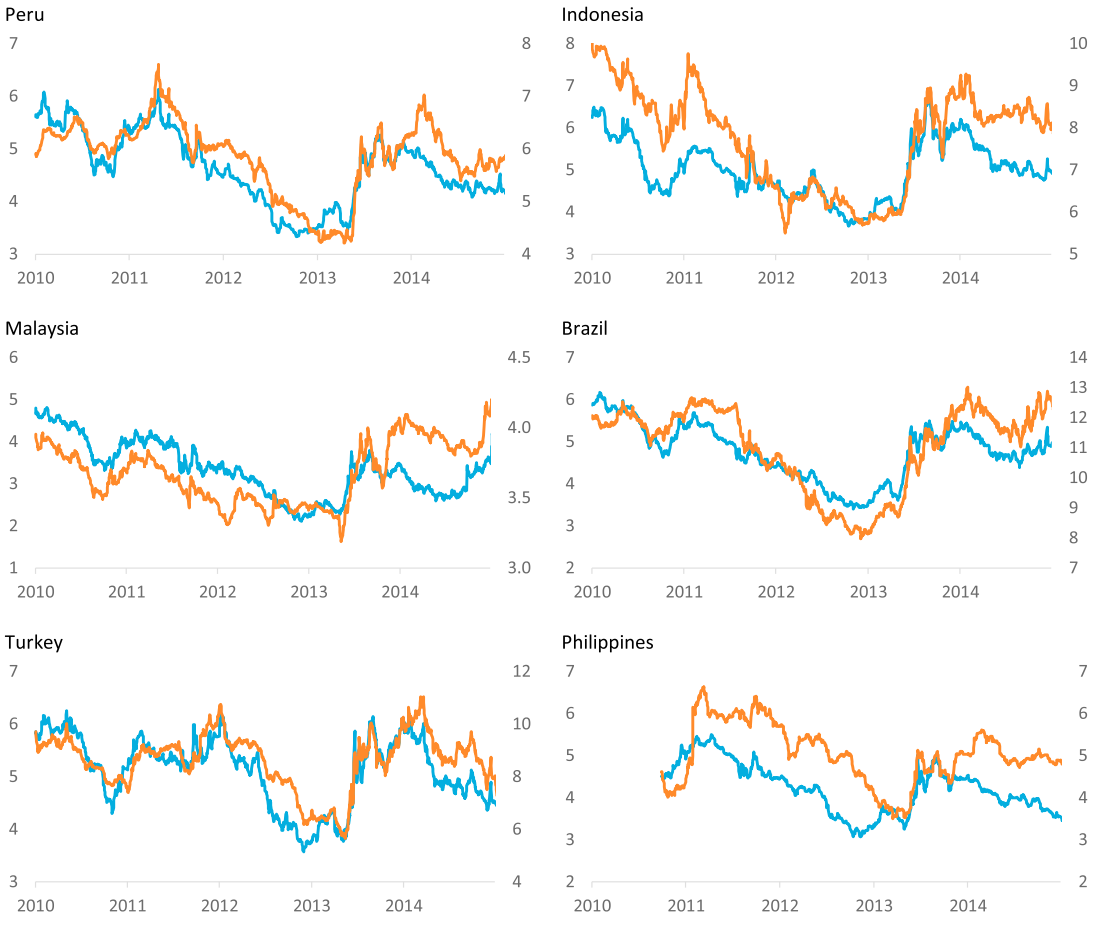


Blue= Foreign currency (left), Orange= Local currency (right)

Sources: JP Morgan EMBI Global and GBI EM Global indices; authors' calculations.

Sovereign international and domestic bond yields: EMEs with higher FX volatility

In per cent Graph A5



Sources: JP Morgan EMBI Global and GBI EM Global indices; authors' calculations.

Table A1
Mapping table for assigning integer values to ratings of local currency long-term debt

Moody's		Fitch		S&P	
A1	16	A	15	A	15
A2	15	A-	14	A-	14
A3	14	A+	16	A+	16
Aa1	19	AA	18	AA	18
Aa2	18	AA-	17	AA-	17
Aa3	17	AA+	19	AA+	19
Aaa	20	AAA	20	AAA	20
B1	7	B	6	B	6
B2	6	B-	5	B-	5
B3	5	B+	7	B+	7
Ba1	10	BB	9	BB	9
Ba2	9	BB-	8	BB-	8
Ba3	8	BB+	10	BB+	10
Baa1	13	BBB	12	BBB	12
Baa2	12	BBB-	11	BBB-	11
Baa3	11	BBB+	13	BBB+	13
Ca	1	C	0	CC	1
Caa1	4	CC	1	CCC	3
Caa2	3	CCC	3	CCC-	2
Caa3	2	CCC-	2	CCC+	4
C	0.5	CCC+	4	D	0
WR	0	D	0	NR	0
		DD	0	SD	0
		DDD	0		
		NR	0		
		RD	0		
		WD	0		

Table A2
Bivariate Wald tests on the direction of the causality between exchange rate volatility and bond yields January 2005–December 2013

H0:	Exchange rate vol → bond yields[1]		Bond yields → exchange rate vol[2]	
Number of lags (months)	7	12	7	12
China	*	**	**	***
Hong Kong SAR			**	***
India			*	
Indonesia	*			
Korea	*			
Malaysia				
Philippines				
Singapore				
Thailand	***	***	**	
Brazil				
Chile			*	
Colombia	*			***
Mexico			*	**
Peru	*	***		
Czech Republic	*	**		
Hungary	***	***		*
Poland				
Russia	***	***		
Turkey	***	***		
Israel	*	*	*	
South Africa			**	**

Authors' estimates using monthly data.

[1] p-values associated with the null hypothesis that exchange rate volatility does not Granger-cause local currency sovereign bond yields.

[2] p-values associated with the null hypothesis that local currency sovereign bond yields do not Granger-cause exchange rate volatility. ***, ** and * stand for significance at the 1, 5 and 10% levels, respectively.

Table A3
Recent econometric studies of the determinants of EME bond yields

Paper	Levels or changes	Exchange rate as right hand variable	IV
Bellas, Papaioannou, and Petrova (2010)	Log of spreads	No	No (fixed effects panel and pooled group mean estimations)
Ebeke and Kyobe (2015); Ebeke and Lu (2014), Ebeke and Lu (2015)	Both: yield levels on exchange rate levels and yield volatility on exchange rate volatility	Yes	Both OLS-fixed effects and IV; IV done using 2 types of instruments: first and second lags and an independent variable.
Duyvesteyn and Martens (2015)	Levels of returns	Yes	No IV
Menknoff et al. (2012)	Return levels and exchange rate levels or return changes and exchange rate changes in same model	Yes	No IV
Eichengreen and Mody (2000)	Log of spreads	No	No IV
Gonzalez-Rozada and Levy-Yeyati (2008)	Logs of spreads regressed on logs of rhs variables	No	Yes
McGuire and Schrijvers (2003)	Changes and levels of secondary market spreads	No	No
Hofmann, Shim and Shin (2016)	Changes in spreads regressed on exchange rate changes	Yes	No (because of the difficulty of finding good instruments for the exchange rate)
Miyajima et al. (2015)	Levels	No	No
Obstfeld (2014)	Changes regressed on changes	No, just type of fx regime	No
Jaramillo and Weber (2013)	Levels	No	No
Peiris (2010)	Yield levels and volatilities	No	Done only as a robustness
Pericoli and Taboga (2012)	Levels and volatilities	Yes	Yes
Warnock and Warnock (2009)	Levels	No	No

Table A4
Momentum of market-related variables: one year-ahead exchange rate depreciation forecast January 2005–December 2013

Adjustment type	Newey-West				Huber-White				Time and ID cluster			
Number of lags (months)	1	3	6	12	1	3	6	12	1	3	6	12
Dependent variable: one year ahead exchange rate depreciation forecast												
One year ahead exchange rate depreciation forecast	0.716***	0.478***	0.248***	0.067	0.716***	0.478***	0.248***	0.067	0.716***	0.478***	0.248***	0.067
(Standard error)	(0.021)	(0.034)	(0.045)	(0.053)	(0.02)	(0.032)	(0.039)	(0.05)	(0.029)	(0.045)	(0.069)	(0.065)
Implied exchange rate volatility	−0.062**	−0.044	−0.026	−0.072	−0.062*	−0.044	−0.026	−0.072	−0.062*	−0.044	−0.026	−0.072
(Standard error)	(0.026)	(0.046)	(0.051)	(0.051)	(0.033)	(0.054)	(0.054)	(0.043)	(0.035)	(0.055)	(0.046)	(0.046)
Sovereign CDS spread	0.005***	0.008***	0.010***	0.009***	0.005***	0.008***	0.010***	0.009***	0.005***	0.008***	0.010***	0.009***
(Standard error)	(0.001)	(0.002)	(0.003)	(0.003)	(0.001)	(0.002)	(0.003)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
N	2179	2143	2089	1981	2179	2143	2089	1981	2179	2143	2089	1981
r_a^2	0.739	0.575	0.475	0.439	0.623	0.391	0.254	0.214	0.739	0.575	0.475	0.439

Note: All models control for time effects and country fixed effects. The lag depth refers to that of the independent variable. Constant not shown.
Source: Authors' calculations.

Table A5
Momentum of market-related variables: implied exchange rate volatility January 2005–December 2013

Adjustment type	Newey-West				Huber-White				Time and ID cluster			
Number of lags (months)	1	3	6	12	1	3	6	12	1	3	6	12
Dependent variable: implied exchange rate volatility												
One year ahead exchange rate depreciation forecast	0.024**	0.076***	0.136***	0.140***	0.024**	0.076***	0.136***	0.140**	0.024***	0.076***	0.136***	0.140**
(Standard error)	(0.012)	(0.022)	(0.035)	(0.04)	(0.01)	(0.022)	(0.043)	(0.059)	(0.008)	(0.022)	(0.046)	(0.059)
Implied exchange rate volatility	0.872***	0.612***	0.366***	0.125**	0.872***	0.612***	0.366***	0.125*	0.872***	0.612***	0.366***	0.125
(Standard error)	(0.019)	(0.042)	(0.054)	(0.059)	(0.018)	(0.045)	(0.068)	(0.066)	(0.022)	(0.063)	(0.093)	(0.103)
Sovereign CDS spread	0.001	0.001	0.002	0.004*	0.001	0.001	0.002	0.004*	0.001	0.001	0.002	0.004**
(Standard error)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)
N	2197	2161	2107	1999	2197	2161	2107	1999	2197	2161	2107	1999
r_a^2	0.954	0.874	0.829	0.808	0.913	0.764	0.682	0.644	0.754	0.334	0.097	−0.014

Note: All models control for time effects and country fixed effects. The lag depth refers to that of the independent variable. Constant not shown.
Source: Authors' calculations.

Table A6
Momentum of market-related variables: sovereign CDS spreads January 2005–December 2013

Adjustment type	Newey-West				Huber-White				Time and ID cluster			
Number of lags (months)	1	3	6	12	1	3	6	12	1	3	6	12
Dependent variable: CDS spreads												
One year ahead exchange rate depreciation forecast	−0.106	−0.041	−0.123	0.942	−0.106	−0.041	−0.123	0.942	−0.106	−0.041	−0.123	0.942
(Standard error)	(0.138)	(0.362)	(0.613)	(0.74)	(0.092)	(0.351)	(0.753)	(1.235)	(0.095)	(0.293)	(0.644)	(1.123)
Implied exchange rate volatility	−0.115	−0.875	−1.919*	−1.886**	−0.115	−0.875	−1.919	−1.886	−0.115	−0.875	−1.919	−1.886
(Standard error)	(0.25)	(0.671)	(0.994)	(0.945)	(0.3)	(0.882)	(1.407)	(1.256)	(0.29)	(0.92)	(1.515)	(1.387)
Sovereign CDS spread	0.941***	0.811***	0.630***	0.378***	0.941***	0.811***	0.630***	0.378***	0.941***	0.811***	0.630***	0.378***
(Standard error)	(0.013)	(0.037)	(0.061)	(0.067)	(0.01)	(0.037)	(0.071)	(0.082)	(0.016)	(0.056)	(0.096)	(0.102)
N	2195	2155	2095	1975	2195	2155	2095	1975	2195	2155	2095	1975
r_a^2	0.967	0.895	0.826	0.779	0.953	0.851	0.752	0.686	0.893	0.648	0.376	0.122

Note: All models control for time effects and country fixed effects. The lag depth refers to that of the independent variable. Constant not shown.
Source: Authors' calculations.

Table A7
Fixed effects panel model of local currency 10-year sovereign bond yields in EMEs

Dependent variable: local currency sovereign bond yields, 5 years	OLS				IV			
One year ahead exchange rate depreciation forecast	0.070***	0.037**	0.022	0.014	0.095***	0.050**	0.029*	0.022
Implied exchange rate volatility	0.116**	0.105***	0.091***	0.051*	0.132***	0.121***	0.104***	0.057**
CDS spread	0.006***	0.003*	0.003*	0	0.006***	0.004**	0.003**	0
One year ahead short-term interest rate forecast		0.479***	0.482***	0.502***		0.461***	0.472***	0.497***
One year ahead inflation forecast		0.342***	0.417***	0.481***		0.321***	0.402***	0.471***
One year ahead GDP growth forecast			−0.221**	−0.078*			−0.211**	−0.068
One year ahead fiscal balance forecast			−0.086*	−0.099*			−0.085*	−0.098*
US term premium				0.495***				0.486***
Constant	4.513***	2.653***	3.329***	2.923***	4.234***	2.558***	3.221***	2.869***
Ratings dummies	Y	Y	Y	Y	Y	Y	Y	Y
Time dummies	Y	Y	Y	N	Y	Y	Y	N
N	1453	1453	1435	1435	1453	1453	1435	1435
R2	0.378	0.684	0.664	0.69	0.38	0.676	0.661	0.692

Authors' estimates using monthly data. The estimation period is from January 2005 to May 2014. The country sample includes Brazil, Chile, China, Colombia, Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, the Philippines, Poland, Russia, Singapore, South Africa, Thailand and Turkey. ***, ** and * stand for significance at the 1, 5 and 10% levels, respectively. OLS = Ordinary Least Squares. IV = A panel instrumental variables method with fixed effects where the exchange rate volatility, expected exchange rate depreciation and the CDS spreads were each instrumented using their own lags and those of the other two instrumented variables.
Sources: Bloomberg; Fitch; GFD; Consensus Economics; JP Morgan; Markit; Moody's; S&P; IMF.

Table A8
Fixed effects panel model of local currency 5-year sovereign bond term spreads in EMEs

Dependent variable: local currency sovereign term spreads, 5 year yields less policy rate	OLS				IV			
One year ahead exchange rate depreciation forecast	−0.031	−0.026	−0.032	−0.026	−0.044	−0.041	−0.049	−0.038
Implied exchange rate volatility	0.001	0.004	0.004	−0.023	−0.005	−0.001	−0.001	−0.033
CDS spread	0.005**	0.006***	0.005***	0.004**	0.005**	0.006***	0.006***	0.004**
One year ahead inflation forecast		−0.244*	−0.188	−0.148		−0.244*	−0.187	−0.149
One year ahead GDP growth forecast			−0.122	−0.033			−0.130*	−0.034
One year ahead fiscal balance forecast			−0.139***	−0.227***			−0.138***	−0.225***
US term premium				0.447***				0.471***
Constant	−0.542	0.285	0.343	0.069	−0.495	0.256	0.384	0.078
Ratings dummies	Y	Y	Y	Y	Y	Y	Y	Y
Time dummies	Y	Y	Y	N	Y	Y	Y	N
N	2177	2177	2159	2159	2177	2177	2159	2159
r_a^2	0.091	0.097	0.22	0.189	0.085	0.088	0.21	0.173

Authors' estimates using monthly data. The estimation period is from January 2005 to May 2014. The country sample includes Brazil, Chile, China, Colombia, Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, the Philippines, Poland, Russia, Singapore, South Africa, Thailand and Turkey. ***, ** and * stand for significance at the 1, 5 and 10% levels, respectively. OLS = Ordinary Least Squares. IV = A panel instrumental variables method with fixed effects where the exchange rate volatility, expected exchange rate depreciation and the CDS spreads were each instrumented using their own lags and those of the other two instrumented variables.
Sources: Bloomberg; Fitch; GFD; Consensus Economics; JP Morgan; Markit; Moody's; S&P; IMF.

Table A9
Fixed effects panel model of local currency 10-year sovereign bond term spreads in EMEs

Dependent variable: local currency sovereign term spreads, 10 year yields less policy rate	OLS				IV			
One year ahead exchange rate depreciation forecast	−0.011	−0.005	−0.018	−0.025	−0.02	−0.017	−0.035	−0.039
Implied exchange rate volatility	0.073*	0.076**	0.064**	0.026	0.088**	0.092***	0.077***	0.027
CDS spread	0	0.001	0.001	0	0	0.002	0.001	0
One year ahead inflation forecast		−0.290**	−0.222*	−0.279**		−0.292**	−0.220*	−0.282**
One year ahead GDP growth forecast			−0.187**	−0.07			−0.191**	−0.066
One year ahead fiscal balance forecast			−0.08	−0.211**			−0.08	−0.208**
US term premium				0.399**				0.417**
Constant	0.135	1.176*	1.713**	2.289***	0.079	1.071	1.670***	2.257***
Ratings dummies	Y	Y	Y	Y	Y	Y	Y	Y
Time dummies	Y	Y	Y	N	Y	Y	Y	N
N	1453	1453	1435	1435	1453	1453	1435	1435
r_a^2	0.086	0.205	0.206	0.173	0.092	0.213	0.212	0.174

Authors' estimates using monthly data. The estimation period is from January 2005 to May 2014. The country sample includes Brazil, Chile, China, Colombia, Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, the Philippines, Poland, Russia, Singapore, South Africa, Thailand and Turkey. ***, ** and * stand for significance at the 1, 5 and 10% levels, respectively. OLS = Ordinary Least Squares. IV = A panel instrumental variables method with fixed effects where the exchange rate volatility, expected exchange rate depreciation and the CDS spreads were each instrumented using their own lags and those of the other two instrumented variables.
Sources: Bloomberg; Fitch; GFD; Consensus Economics; JP Morgan; Markit; Moody's; S&P; IMF.

Table A10
Fixed effects panel model of bond volatility in EMEs: the effect of local currency sovereign bond yields.[1]

Dependent variable: bond volatility		Without AR term				With AR term			
Bond volatility$_{t-1}$		…	…	…	…	0.960***	0.963***	0.950***	0.952***
Local currency sovereign bond yields	One-year	−0.073**	…	−0.045**	…	0	…	−0.001	…
	Three-month (Libor)	…	−0.041**	…	−0.022**	…	0.001	…	0
	Five-year	0.092**	0.074*	0.040*	0.026	0	−0.001	−0.001	−0.002
	Ten-year	0.042	0.028	0.031	0.018	0.003	0.003	0.003	0.002
Time dummies		N	N	Y	Y	N	N	Y	Y
Constant		−0.011	0.031	0.271***	0.307***	−0.006	−0.004	0.018**	0.019**
N		1469	1467	1469	1467	1460	1458	1460	1458
r_a^2		0.031	0.035	0.038	0.057	0.976	0.977	0.98	0.98

Authors' estimates using monthly data. The estimation period is from January 2005 to May 2014. The country sample includes Brazil, Chile, China, Colombia, Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, the Philippines, Poland, Russia, Singapore, South Africa, Thailand and Turkey. ***, ** and * stand for significance at the 1, 5 and 10% levels, respectively. The estimation was performed using OLS.

[1] Defined as a two-year rolling standard deviation of monthly percentage point changes in five-year local currency sovereign bond yields.

Sources: Bloomberg; Fitch; GFD; Consensus Economics; JP Morgan; Markit; Moody's; S&P; IMF.

Table A11
Fixed effects panel model of implied exchange rate volatility in EMEs: the effect of bond volatilities.[1]

Dependent variable: implied exchange rate volatility				
Implied exchange rate volatility$_{t-1}$		…	0.905***	0.878***
Volatility of local currency sovereign bond yields	At period t	9.256**	1.358	0.372
	t-1	0.074	−0.645	0.521
	t-2	−0.735	−0.859	−0.966
	t-3	−0.217	0.533	0.211
	t-4	−1.392*	−0.538	0.336
	t-5	−1.060**	−0.432	−0.571
	t-6	0.479	1.568***	0.867**
	t-7	0.112	−0.503	−0.632
	t-8	−0.75	−0.869	−0.383
	t-9	−0.336	0.453*	0.432**
	t-10	−0.306	−0.144	−0.102
	t-11	−0.514	0.231	0.05
Time dummies		N	N	Y
Constant		8.947***	0.939***	0.695***
N		1994	1994	1994
r_a^2		0.056	0.903	0.951
Memo item:				
Bond volatility				
Yearly pass-through[2]		4.611	0.153	0.135
F test statistics		28.91	30.3	7.66
P value		0	0	0.0001
Long run pass-through[3]		…	1.61	1.11
F test statistics		…	13079.24	2129.03
P value		…	0	0

Authors' estimates using monthly data. The estimation period is from January 2005 to May 2014. The country sample includes Brazil, Chile, China, Colombia, Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, the Philippines, Poland, Russia, Singapore, South Africa, Thailand and Turkey. ***, ** and * stand for significance at the 1, 5 and 10% levels, respectively. The estimation was performed using OLS.

[1] Defined as a two-year rolling standard deviation of monthly percentage point changes in five-year local currency sovereign bond yields.

[2] Sum of coefficients on the various lagged values of bond volatility.

[3] Defined as the sum the yearly pass-through divided by one minus the autoregressive term on foreign exchange volatility.

Sources: Bloomberg; Fitch; GFD; Consensus Economics; JP Morgan; Markit; Moody's; S&P; IMF.

Table A12
Additional stationarity tests

	AIC			BIC			HQIC		
	AIC statistic	p-value	optimal lag length	BIC statistic	p-value	optimal lag length	HQIC statistic	p-value	optimal lag length
Bond volatility[1]	−3.2626***	0.0006	2.95	−2.2117**	0.0135	1.1	−2.3986***	0.0082	1.8
One-year local currency yield	0.0976	0.5389	1.6	0.4424	0.6709	0.65	−0.0195	0.4922	1.05
Ten-year local currency yield	−0.772	0.2201	1.65	−0.5027	0.3076	0.75	−0.8916	0.1863	1.05
Three-month local currency money market rate	−1.5685*	0.0584	2.3	−1.1757	0.1199	1.2	−1.2903*	0.0985	1.35
5 year yield spread to policy rate	−4.3022***	0	1.7	−3.9258***	0	0.6	−3.9708***	0	0.8
10 year yield spread to policy rate	−4.8742***	0	2.16	−3.94***	0	0.63	−4.7816***	0	1.42

Note: *, **, and *** signify statistical significance at the 1 percent, 5 percent, and 10 percent levels.
[1] Defined as a two-year rolling standard deviation of monthly percentage point changes in five-year local currency sovereign bond yields.
Source: Authors' calculations.

References

Amstad, M., Remolona, E., & Shek, J. (2016). *How do global investors differentiate between sovereign risks? The new normal versus the old*. BIS Working Papers No. 541, January.
Arslanalp, S., & Tsuda, T. (2015). *Emerging market portfolio Flows: The role of benchmark-driven investors*. IMF Working Paper WP/15/263.
Baldacci, E., & Kumar, M. (2010). *Fiscal deficits, public debt and sovereign bond yields*. IMF Working Paper 10/184.
Bank for International Settlements. (2014a). *Emerging economies respond to market pressure*. Quarterly Review, March.
Bank for International Settlements. (2014b). *The transmission of unconventional monetary policy to the emerging markets*. BIS Papers No. 78, August.
Belke, A., & Schnabl, G. (2015). Exchange rate challenges in emerging markets and developing countries—introduction. *Review of Development Economics, 19*(3), 449–454.
Bellas, D., Papaioannou, M. G., & Petrova, I. (2010). *Determinants of emerging market sovereign bond spreads: Fundamentals vs financial stress*. IMF Working Paper, WP/10/281.
Borensztein, E., & Loungani, P. (2011). *Asian financial Integration: Trends and interruptions*. IMF WP/11/14. International Monetary Fund, Washington, DC.
Burger, J., & Warnock, F. (2006). *Local currency bond markets*. IMF Staff Papers 53 (pp. 115–132).
Burger, J., & Warnock, F. (2007). Foreign participation in local currency bond markets. *Review of Financial Economics, 16*, 291–304.
Calvo, G., & Talvi, E. (2005). *Sudden stops, financial factors and economic collapses in Latin America: Lessons from Argentina and Chile*. NBER Working Paper Series, No. 11153.
Caporale, G. M., Ali, F. M., & Spagnolo, N. (2015). Exchange rate uncertainty and international portfolio flows: A multivariate GARCH-in-mean approach. *Journal of International Money and Finance*, 70–92. June.
Caporale, G., & Williams, G. (2002). Long-term nominal interest rates and domestic fundamentals. *Review of Financial Economics, 11*, 119–130.
Choi, J. J., & Rajan, M. (1997). A joint test of market segmentation and exchange risk factor in international capital markets. *Journal of International Business Studies, 28*(1), 29–49.
Chui, M., & Fender, I. (2014). *Risks related to EME corporate balance sheets: The role of leverage and currency mismatch*. BIS Quarterly Review, September.
Committee on the Global Financial System. (2007). *Financial stability and local currency bond markets*. CGFS Papers No 28.
Dailami, M., Masson, P. R., & Padou, J. J. (2008). Global monetary conditions versus country-specific factors in the determination of emerging market debt spreads. *Journal of International Money and Finance, 20*(1).
Duyvesteyn, J., & Martens, M. (2014). Emerging government bond market timing. *Journal of Fixed Income*, 36–49. Winter.
Duyvesteyn, J., & Martens, M. (2015). Forecasting sovereign default risk with Merton's model. *Journal of Fixed Income*, 58–71. Fall.
Ebeke, C., & Kyobe, A. (2015). *Global financial spillovers to emerging market sovereign bond markets*. IMF Working Paper WP/15/141.
Ebeke and Lu. (2014). *Emerging market local currency bond yields and foreign holdings in the post-Lehman period—a fortune or misfortune?*. IMF Working Paper No. 14/29.
Ebeke, C., & Lu, Y. (2015). Emerging market local currency bond yields and foreign holdings – A fortune or misfortune? *Journal of International Money and Finance, 59*, 203–219.
Eichengreen, B., & Hausmann, R. (1999). Exchange rates and financial fragility. In *New challenges for monetary policy*. published by the Federal Reserve Bank of Kansas City.
Eichengreen, B., & Mody, A. (2000). "What explains changing spreads on emerging market debt?" NBER Chapters. In *Capital flows and the emerging Economies: Theory, evidence, and controversies* (pp. 107–136). National Bureau of Economic Research.
Eichengreen, B., & Rose. (2014). *Capital controls in the 21st century*. VOX http://www.voxeu.org/article/capital-controls-21st-century, 05 June.
Eun, C. S., & Resnick, B. G. (1988). Exchange rate uncertainty, forward contracts, and international portfolio selection. *Journal of Finance, 43*, 197–215.
Fidora, M., Fratzscher, M., & Thimann, C. (2007). Home bias in global bond and equity markets: The role of real exchange rate volatility. *Journal of International Money and Finance, 26*, 631–655.
Gadanecz, B., Miyajima, K., & Shu, C. (December 2014). *Exchange rate risk and local currency sovereign bond yields in emerging markets*. BIS Working Papers No. 474.
Gadanecz, B., Miyajima, K., & Urban, J. (2015). Optimized Taylor rules with domestic bond yields in emerging market economies. *Applied Economic Letters, 22*(9) .
Gale, W. G., & Orszag, P. (2003). Economic effects of sustained budget deficits. *National Tax Journal, 56*, 463–485.
Gonzalez-Rozada, M., & Levy-Yeyati, E. (2008). Global factors and emerging market spreads. *The Economic Journal, 118*.
Gyntelberg, J., & Remolona, E. (2007). Risk in carry trades: A look at target currencies in Asia and the Pacific. *BIS Quarterly Review*, 73–82. December.
Hale, G. B., Jones, P., & Spiegel, M. M. (2016). *The rise in home currency issuance, federal reserve bank of san francisco*. Working Paper No. 2014-19, May.
Hartelius, K., Kashiwase, K., & Kodres, L. E. (2008). *Emerging market spread Compression: Is it real or is it liquidity?*. IMF Working Paper 08/10.
He, D., & McCauley, R. (June 2012). Eurodollar banking and currency internationalization. *BIS Quarterly Review*, 33–46.
Hofmann, B., Shim, I., & Shin, H. S. (2016). *Sovereign yields and the risk-taking channel of currency appreciation*. BIS Working Papers No. 538.
Hofmann and Takáts. (September 2015). International monetary spillovers. *BIS Quarterly Review*, 105–118.
Hördahl, P., & Tristani, O. (2014). Inflation risk premia in the euro area and the United States. *International Journal of Central Banking*, 1–47. September.
Jaramillo, L., & Weber, A. (2013a). Bond yields in emerging economies: It matters what state you are in. *Emerging Markets Review, 17*, 169–185.
Jaramillo, L., & Weber, A. (2013b). *Global spillovers into domestic bond markets in emerging market economies*. IMF Working Paper 13/264.
Kumar, M., & Okimoto, T. (2011). Dynamics of international integration of government securities' markets. *Journal of Banking & Finance, 35*(1), 142–154. January.
Laubach, T. (2009). New evidence on interest rate effects of budget deficits and debt. *Journal of the European Economic Association, 7*(4).
Levich, R. M., Hayt, G. S., & Ripston, B. A. (1999). *1998 survey of derivative and risk management practices by U.S. Institutional investors*. Survey conducted by the NYU Salomon Center, CIBC World Markets, and KPMG. Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id¼204388.
Litterman, R., Scheinkman, J., & Weiss, L. (1991). Volatility and the yield curve. *Journal of Fixed Income*, 49–53, 1991.1.1.
Longstaff, F. A., Pan, J., Pedersen, L. H., & Singleton, K. J. (2011). How sovereign is sovereign credit risk? *American Economic Journal: Macroeconomics, 3*, 75–103. April.
Lustig, H., Roussanov, N., & Verdelhan, A. (2014). Countercyclical currency risk Premia. *Journal of Financial Economics, 111*(3), 527–553.
McCauley, R., Shu, C., & Ma, G. (March 2014). Non-deliverable forwards: 2013 and beyond. *BIS Quarterly Review*, 75–88.
McGuire, P., & Schrijvers, M. A. (December 2003). Common factors in emerging market spreads. *BIS Quarterly Review*, 65–78.
Menknoff, L., Sarno, L., Schmeling, M., & Schrimpf, A. (2012). Currency momentum strategies. *Journal of Financial Economics, 106*, 660–684.
Miyajima, K., Mohanty, M., & Chan, T. (2015). Emerging market local currency bonds: Diversification and stability. *Emerging Markets Review, 22*, 126–139. March.
Miyajima, K., & Shim, I. (September 2014). Asset managers in emerging market economics. *BIS Quarterly Review*, 19–34.
Obstfeld, M. (2014). Trilemmas and Tradeoffs: Living with financial globalization. In *Proceedings of the 13th BIS annual conference held in Luzern (June)*.
Obstfeld, M. (2015). Trilemmas and Tradeoffs: Living with financial globalization. In *Proceedings of the 13th BIS annual conference held in Luzern (June)*.
Ostry, J., Ghosh, A., & Chamon, M. (2012). *Two targets, two instruments: Monetary and exchange rate policies in emerging market economies*. IMF Staff Discussion Note, no 12/01, February.
Peiris, S. (2010). *Foreign participation in emerging markets' local currency bond markets*. IMF Working Papers 10/88.
Pericoli, M., & Taboga, M. (2012). Bond risk premia, macroeconomic fundamentals and the exchange rate. *International Review of Economics & Finance, 22*, 42–65.
Piljak, V. (2013). Bond markets co-movement dynamics and macroeconomic factors: Evidence from emerging and frontier markets. *Emerging Markets Review, 17*, 29–43.
Remolona, E., Satigna, M., & Wu, E. (2008). The dynamic pricing of sovereign risk in emerging markets: Fundamentals and risk aversion. *Journal of Fixed Income*, 57–71. Spring.

Rey, H. (2013). Dilemma not Trilemma: The global financial cycle and monetary policy independence. In *Paper presented at the Jackson Hole Symposium, august 2013*. Available at: http://www.kansascityfed.org/publications/research/escp/escp-2013.cfm. Revised version forthcoming as a CEPR Discussion Paper.

Sahay, R., Arora, V., Arvanitis, T., Faruqee, H., N'Diaye, P., & Mancini-Griffoli, T. (2014). *Emerging market volatility: Lessons from the taper tantrum*. IMF Staff Discussion Note SDN/14/09.

Turner, P. (2014). *The global long-term interest rate, financial risks and policy choices in EMEs*. BIS Working Papers No 441.

Turner, P. (2012). *Weathering financial crisis: Domestic bond markets in EMEs*. BIS Papers No 63, January.

Warnock, F. E., & Warnock, V. C. (2009). International capital flows and US interest rates. *Journal of International Money and Finance, 2*.