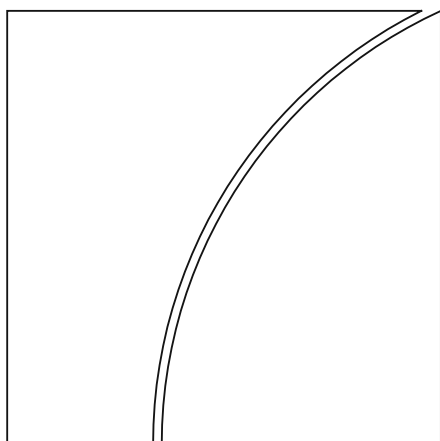BANK FOR INTERNATIONAL SETTLEMENTS

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by Marlene Amstad, Frank Packer and Jimmy Shek

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Does sovereign risk in local and foreign currency differ?

Marlene Amstad[1], Frank Packer[2] and Jimmy Shek[3]

Abstract

Historically, sovereign debt in local currency has been considered safer than debt in foreign currency. Yet the literature offers scant theoretical or empirical guidance as to why such a gap exists, or why it appears to have slowly and steadily diminished for all regions over the past two decades, as expressed in the ratings widely used by global investors and regulators to assess credit risk. We suggest and empirically test five hypotheses. We find that differences in inflation do not explain the assessed gaps between local and foreign currency credit risk. The banking sector's vulnerability to sovereign debt problems is a significant determinant of the spread, but does not account for its decline over time. Instead, the surge in global reserves, and to lesser extent the reduced reliance on overseas foreign currency borrowing (ie the decline of original sin), as well as lower global volatility, appear to have lessened the gap. But if these variables were to go into reverse, the gap could again widen.

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1. Introduction

This paper asks whether the sovereign risk in domestic currency differs in level and underlying determinants from its counterpart in foreign currency. The answers have wide-ranging consequences for regulators[4] and investors. With financial markets that are more and more global, and local and foreign currency instruments at times trading on the same platforms in any market, the distinction between local and foreign currency credit risk can be seen as increasingly important.

Sovereign debt in local currency has historically been considered safer than sovereign debt in foreign currency. Bonds issued by the same emerging market sovereign were almost always rated higher when denominated in the sovereign's own domestic currency rather than a foreign currency, reflecting the view that sovereigns are much less likely to default on local currency obligations as they can always tax their subjects or print their own currency to service the debt.

And yet, the view that local currency debt is safer has diminished over the past few decades. Graph 1 illustrates for a broad sample of 73 emerging economies[5] (EMEs) that the average difference in the average local currency rating minus its foreign counterpart used to be as large as three notches in 1996 but had almost fully closed by 2015. In part this may be due to the increased recognition that sovereigns do default in local currency: the seminal work of Reinhart and Rogoff (2009) documents that de jure defaults of sovereigns in their own currency have been rather common since 1800.

The earlier broad consensus concerning the higher relative creditworthiness of sovereign debt in local currency contrasts with a paucity of analyses that explain it. This paper contributes to the literature in several ways. First, we develop five hypotheses why currency denomination might matter for sovereign credit risk. Inflation or the option to monetize is the most prominent and often the only one cited in the literature. The additional factors we identify as potential determinants of the gap are the availability of foreign currency in form of foreign exchange (FX) reserves, the ability to borrow in international markets in domestic currency, the vulnerability of the banking system to sovereign debt problems, and – as a common global factor – the level of global volatility.

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[4] The practice of using credit ratings for regulatory purposes has a long tradition starting in the 1930s. While alternatives to ratings are part of the Basel III framework, the standardised approach of the framework offers the option of utilizing external ratings when assigning risk weights for bank exposures (BIS, 2013). The regulatory treatment of sovereign exposures remains under review by the Basel Committee on Banking Supervision, which put out a discussion paper in late 2017 (BCBS, 2017).

[5] In the definition of emerging economies we follow the categorization as given by the MSCI Emerging Market Index in 2015.

Second, we document a slow and steady convergence of sovereign risk in local and foreign currency over the past 20 years. The proportion of sovereigns without any gap has risen steadily, while gaps larger than one rating notch is now extremely rare. Third, we analyse the determinants of the difference in local versus foreign sovereign risk, and their statistical and economic significance. We do so first by estimating separate panel regressions for foreign and local currency sovereign risk between 1996 and 2015. Then we estimate the probability and extent of a gap in local and foreign currency risk using a panel trinominal ordered logistic regression. We also approximate the empirical relevance of different factors in explaining the observed closing of the gap over the past twenty years.

For measures of sovereign risk in both foreign and local currency, we take the *average of credit ratings* provided by the three major global agencies, Standard and Poor's, Moody's and Fitch. This is motivated by several considerations. First, global investors routinely reference credit ratings when measuring credit risk.[6] Second, while there have been international efforts to reduce the reliance on ratings (FSB, 2014), sovereign ratings remain a tool in many regulatory frameworks, e.g. to weigh the bank capital requirements for sovereign exposure.[7] Third, rating agencies provide assessments of both local and foreign credit risk across a very large number of countries; by contrast market-based measures of sovereign risk such as sovereign CDS are for the most part available only for foreign currency obligations. Further, market-based measures are impacted by various capital market frictions and near-term market conditions (including the pricing of liquidity and counterparty risk), while ratings are by construction aiming to abstract from these and focus on credit risk over the medium to longer term.[8] In addition, compared to ex-post realisations of credit risk, i.e. defaults, ratings are available over a much wider array of countries, and at regular frequencies.

We find limited evidence of sovereigns' willingness to inflate away their local debt in our measures of credit risk. Thus, declining trend inflation has little to do with a diminishing distinction between foreign and local currency sovereign risk. Instead, higher FX reserves, lesser dependence on foreign currency borrowing (decline of original sin), and lower global volatility better account for the observed narrowing of the gap. In particular, our results point towards the role of an unprecedented two-decade long surge in FX reserves[9] in lifting the relative creditworthiness of foreign

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[6] This is particularly the case for institutional investors, which are of increased importance in financial markets. For governance reasons, they need to strictly follow investment guidelines in which ratings often play a key role.

[7] See BIS (2013), BCBS (2017).

[8] Ratings are intended to look "through the cycle" and capture the relative risk of default. For an overview on differences in ratings and market credit spreads see Amstad and Packer (2015).

[9] The total level of FX reserves in our EME sample rose from US$476 billion to US$7.378 trillion between 1995 and 2015, moving from 11.2% to 20.8% of GDP.

currency debt. If FX reserves should drain, ability to borrow in local currency decline and global volatility further increase, more significant gaps in local and foreign currency sovereign risk may re-emerge.

The paper is organised as follows. Section 2 reviews the literature and develops five hypotheses about what might justify a gap between local and foreign currency sovereign risk. Section 3 introduces the data used to test the hypotheses as well as the empirical methodology. Section 4 reports the results, and Section 5 summarises and draws some policy conclusions.

2. What might justify a gap?

The literature on the factors determining sovereign credit risk is large. However, sovereign risk has almost always been discussed in the context of *external debt*.[10] As exceptions, Reinhart and Rogoff (2009, 2011) turned their attention to the so-called "forgotten history" of domestic debt and related defaults. Many models assume that domestic debt is always honoured, not least because governments could simply print money and inflate the problem away. In fact, Reinhart and Rogoff document that, while domestic default has been somewhat less frequent than for external debt, it has not been rare; there have been nearly 70 cases since 1800 vs. around 250 defaults on external debt.

Instead of focusing only on inflation, we propose five hypotheses why the credit risk entailed in local currency debt might differ from that of foreign currency sovereign debt. All of these hypotheses presume that local currency is more creditworthy, but that the degree of the difference depends on several factors. Section 2.1 presents the five hypotheses and related explanatory variables. Section 2.2 reviews commonly used control variables that are commonly related to sovereign creditworthiness in the literature, but for which we have no strong prior of a differential effect across local vs. foreign currency obligations.

2.1. Five hypotheses

The creditworthiness of domestic currency sovereign obligations is often viewed as higher than that of foreign currency debt, reflecting the presumed greater ability and willingness of sovereigns to service debt in their own currency. The empirical literature to date has generally focused exclusively on the determinants of sovereign risk in foreign currency, rather than on whether and how the determinants might differ between foreign and local currency sovereign risk. Below, we suggest five hypotheses

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[10] We use external debt and debt in foreign currency as well as domestic debt and debt in local currency interchangeably.

for how the gap between foreign and local currency risk might be related to observable factors. Our paper empirically estimates the influence and significance of the factors. To the best of our knowledge, we are the first to propose and test these hypotheses.

(1) Inflation hypothesis (H1): Higher inflation lowers sovereign creditworthiness but less so for domestic currency debt – thus increasing the gap.

The first factor we focus on is inflation. Most models of sovereign risk posit a negative relationship between a sovereign's inflation and the creditworthiness of its external debt. This is because high inflation is a good proxy for problems in the government's finances as well as political and other forms of institutional instability (Cantor and Packer, 1996). Such problems should negatively affect the creditworthiness of domestic debt as well.

However, the relationship between inflation and domestic currency debt has another dimension: namely, to the extent that printing currency is inflationary, the sovereign has the ability to generate inflation to reduce the real burden of local currency debt.[11] This consideration suggests that inflation has a positive aspect in the case of local currency debt, since the ability of sovereigns to repay may be positively affected by inflation in a fashion that is not the case with foreign currency debt. By this logic the gap between domestic and foreign currency risk should widen for high inflation countries.

A competing hypothesis with opposite implications should be kept in mind. Reinhart and Rogoff (2011) note high inflation episodes tend to go "hand in hand" with domestic default. This suggests that the sovereign's willingness to monetise rather than default on domestic debt may in fact be diminished in times of high inflation, perhaps because of increased awareness of the costs of hyperinflation and political resistance to further inflation at high levels.

(2) Reserves hypothesis (H2): High FX reserves (over GDP) increases creditworthiness, but more so for foreign currency obligations – thus diminishing the gap.

The second major factor we focus on is the sovereign's accumulation of FX reserves. All models of sovereign risk posit a positive relationship between foreign exchange reserves and external debt creditworthiness. The more readily available foreign currency is for a sovereign in the form of reserves, then the more a sovereign should be able to avoid default on foreign currency obligations. If they are first exchanged into domestic currency, FX reserves can also be used for domestic

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[11]   For a model in which less disciplined countries in terms of monetary policy tend to have less access to local currency debt due to the risk of currency debasement that inflates away the debt, see Engel and Park (2017). The rating agencies eliminated the distinction between local and foreign currency debt in euro area countries once they came under the framework of the common currency (see e.g., Fitch (1998)). Our sample does include only emerging markets and no sovereign that transitioned to a common currency or vice versa.

currency debt repayment, but this requires liquid FX markets and sterilisation of the side-effects on money supply. Due to fluctuating exchange rates, they are also not a natural hedge for those obligations. For these reasons, it might be expected that FX reserves would have a larger positive impact on the foreign currency creditworthiness of the sovereign than on domestic currency creditworthiness.

The importance of reserves to creditworthiness was taken to heart by many nations in the wake of the Asian financial crisis of the late 1990s, as illustrated by the massive build-up of reserves by central banks in the region over the past few decades. The Asian financial crisis was triggered by the inability of many countries in the region to service their foreign currency debts.

(3) Original sin hypothesis (H3): Lower original sin (greater international debt financing in local currency) raises sovereign creditworthiness and more so for foreign currency obligations – thus diminishing the gap.

Here we use the term "original sin" as short-hand for the lack of development of the local currency international debt markets relative to those in foreign currency.[12] The ability to raise funds internationally in local currency has been shown to be a general positive for the creditworthiness of external sovereign debt in many empirical models, though it may have lost some explanatory power since the global financial crisis (Amstad and Packer, 2015). There are many possible reasons for this importance, including the fact that the ability of a nation's borrowers to raise local currency funds in overseas markets may proxy for other aspects of financial, social and economic development. However, the reason we focus on here is that having large local currency borrowing in international markets is likely to be highly correlated for the degree to which the sovereign as well as large corporate borrowers in the country have debt burdens that are hedged against movements in the FX value of the currency, and thus less risky.[13]

To the extent that the lesser dependence on foreign currency debt improves sovereign creditworthiness through the currency risk hedging channel, we would expect the positive impact to be much more pronounced in the case of the creditworthiness of foreign currency liabilities. Local currency debt is already likely to

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[12]   When first introduced by Eichengreen and Hausmann (1999), the term referred to the difficulty many emerging market sovereigns have had in borrowing overseas in their own currency *and* in borrowing domestically at long-term maturities. In later work (Eichengreen et al (2007)), the authors chose to focus more on a narrow definition associated with the lack of overseas borrowing in domestic currency. Indeed, the past few 15 years have seen a considerable increase in bond issuance in domestic (local) currency markets (Du and Schreger (2016); Amstad et al (2016)).

[13]   It is also possible to estimate the degree to which a countries' overall structure of assets and liabilities is subject to currency risk, one example of this is the aggregate effective currency mismatch measure proposed by Goldstein and Turner (2004). These measures are highly correlated with the so-called "original sin" measures used here, but are not available for the full sample.

be supported by local currency revenue, whereas foreign currency debt can be influenced by the risks of currency mismatch.

(4) Banking sector exposure hypothesis (H4): Greater exposure of the banking sector to government bonds decreases sovereign creditworthiness, because of the mutual reinforcement of sovereign and financial system risk (the "doom loop"). Since this influence is expected to affect local currency obligations more strongly – banking sector exposure to sovereign risk will decrease the gap.

Another factor we concentrate on is the exposure of the banking sector to sovereign bonds. While it has been known for some time that the fiscal costs of banking crises are immense (Bordo et al, 2001), and thus banking system problems can threaten the creditworthiness of the sovereign, more recently there has been recognition of the damage that declines in sovereign creditworthiness can themselves impose on the banking sector. This suggests a reinforcing negative feedback loop.[14] In the well-known model of Acharya et al (2014), the channel for this is the sovereign debt owned by the bank, and the potential for collateral damage on the bank balance sheet. Gennaioli et al (2014) document how the decline in lending following a sovereign default is larger in those countries where financial institutions are more developed and banks hold more sovereign bonds, which in turn implies an even greater vulnerability for the sovereign.

Given that the domestic banking sector tends to hold domestic rather than foreign currency government debt, the domestic banking sector will be more damaged by defaults on domestic currency debt, and the "doom loop" will be more likely to operate through that channel. Thus, ceteris paribus, we would expect any advantage to local currency debt to be reduced in countries where banks have greater exposure to the sovereign, and for the gap between domestic and foreign currency sovereign obligations to be smaller.

Similar to the effects of inflation earlier, an alternative hypotheses with opposite implications should be kept in mind. Due to knowledge of the damage that banking sector crises can cause, the sovereign's willingness to pay can possibly be improved by banks' holdings of government bonds. Once again, this effect can be viewed to act more strongly on the local currency obligations more likely to reside on banks' balance sheets. The ultimate sign of the influence of bank holdings of sovereign debt on overall creditworthiness as well as the gap thus depends on the relative importance of its impact on the sovereign's ability versus willingness to pay.[15]

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[14]   Bank for International Settlements (2016) documents a greater correlation of sovereign and banking spreads when banking system exposure to sovereign debt is predominant.

[15]   Gennaioli et al (2014) also find that in countries where banks hold more government bonds, government defaults are less likely. However, in deriving this finding, they use a specification which focuses on unexpected defaults, while we are interested in anticipated risk which should generally be reflected in ratings.

(5) Global Volatility Hypothesis (H5): High global volatility (as measured by VIX) lowers sovereign creditworthiness and more so for foreign currency obligations – thus increasing the gap.

Our final hypothesis focuses on the impact of global market volatility and risk aversion, as measured by VIX. The VIX is widely used as a proxy metric for the level of risk and uncertainty in global financial markets. It also has been shown to be inversely related to global capital flows (Forbes and Warnock, 2012). Particularly for emerging market sovereigns integrated into the global financial system, greater global volatility and risk-aversion can threaten the availability of credit as well as trade flows financed by trade credit.[16] We thus would expect measures of creditworthiness to be negatively affected by times of high global volatility.[17]

It is likely that the impact from any shift in global market volatility would have more impact on foreign than local currency credit risk. For one, VIX measures implied volatility for a US dollar-based index, and thus should correlate more with the risks of foreign currency sovereign debt obligations, usually also denominated in US dollars. In addition, global credit markets respond to swings in the risk appetite of global investors, who trade more in foreign than local currency securities. Local currency debt should be more naturally sheltered from the spill-overs of global volatility. Indeed, Du and Schreger (2016) report the pass-through of VIX into their measure of the local currency credit spread as small and not statistically different from zero for most of the sample countries. In stark contrast they find the pass-through of VIX into the foreign currency credit spread as statistically significant and positive in most countries.

2.2. Control variables

With the above five hypotheses, we have proposed five variables that might influence sovereign risk in domestic debt differently from that of foreign debt. Needless to say, the literature suggests that many other variables that might influence sovereign credit risk more generally; but these do not necessarily have a differential effect. As control variables, we take measures of economic, fiscal and institutional strength as well as the default history. These variables include log per capita GDP, public debt/GDP, interest/revenue, short-term external debt over GDP, the exchange rate regime,

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[16]   Another potential channel with similar implications is that ratings tend to be inflated relative to fundamentals during times of market exuberance and high issuance activity – likely to be periods of low global volatility – because of incentive conflicts at the rating agencies (Dilly and Mahlmann, 2016; Bar-Isaac and Shapiro, 2013).

[17]   That VIX can be a significant determinant of US dollar-denominated market measures of sovereign risk such as sovereign CDS is well established (Pan and Singleton (2008), Amstad, Remolona and Shek (2016)). To some extent, this also reflects the general phenomenon that the price of risk frequently fluctuates more than the fundamental underlying sources of risk (Cochrane, 2011 AFA).

corruption perceptions (See Table 2a and 2b for a description of all variables used in the analysis).

2.3. Related Literature

Compared to research on foreign currency sovereign risk, the literature on the determinants of local currency sovereign risk measured by ratings, or more specifically, the distinction between local and foreign currency sovereign ratings, is relatively sparse. Packer (2003) provides an early overview of the sovereign ratings "gap", noting the discrepancy between the higher sovereign ratings for local versus foreign currency, and the lack of a uniform relationship between the denomination of debt and the likelihood of default.[18] As for the determinants of local versus foreign currency ratings, Kisselev and Packer (2006) undertake an analysis of the gap between local and foreign currency ratings for 101 countries. In contrast to our first hypothesis above, they found that higher inflation diminished local currency ratings more than foreign ratings and thus led to a smaller gap. The authors did not explore dependence on foreign currency borrowing, banks' holding of government debt and global volatility as possible determinants, however.[19] They also estimated regressions only over the period 1995-2003, when domestic currency ratings were still a relatively recent product of the ratings agencies.

Another related strand of literature uses foreign versus domestic currency defaults as the dependent variable. As noted earlier, Reinhart and Rogoff document the frequency of the two types of sovereign default, but in terms of assessing the determinants of the two types, the principal reference is now the recently published work of Jeanneret and Souissi (2016). They find evidence consistent with some of the above-mentioned hypotheses: ie, a larger banking sector would make a sovereign less likely to default on domestic debt. But they find that high levels of inflation make a sovereign more likely to default on local currency obligations not less. Further, they do not find evidence that global factors – as proxied by VIX and other metrics – make a difference for either local or foreign currency defaults.

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[18]   He also documents considerably more disagreement among the agencies for domestic than foreign ratings, suggesting the agencies were much less likely to agree on the local currency risk than foreign currency sovereign risk.

[19]   FX reserves were only used in the denominator of some explanatory variables.

3. Data and Methodology

3.1. Foreign and Local Currency Credit Ratings

We follow the practice of many global investors and regulators and measure sovereign creditworthiness in foreign and local currency using the sovereign credit ratings of the three major global rating agencies, Fitch, Moody's and Standard and Poor's. Our sample comprises 73 emerging market economies for which we are able to obtain both foreign and local currency sovereign ratings from at least one of the three major rating agencies at some point between 1996 and 2015 (Table 1). We take year-end ratings, as these are most likely to reflect economic developments of the year as captured in the annual data.

For some of the quantitative analysis, we transform the ratings data, drawing upon the method for estimating the determinants of sovereign ratings used by Cantor and Packer (1996). Namely, we convert ratings, averaged across the major agencies, into a linear variable, with AA+/Aa1=19, AA/AA2=18 and so forth.[20] For the most part, we rely on multinomial ordered logistic regressions where the average rating is treated as a qualitative dependent variable. While non-linearity may well characterise certain relationships between indicators and ratings, the alternative linear regression approximation has been fruitful in a wide array of empirical investigations, for use of ratings as both explanatory and dependent variables.[21] Therefore we also report OLS specifications, where ratings are measured numerically, as a sensitivity test.

Similarly, for our base case analysis of the ratings gap, we rely on trinomial ordered logistic regressions that only distinguish between the existence of a gap and no gap, as well as the existence of a large gap of two notches or more. But as a sensitivity test, we run linear regressions where the "gap" is calculated as the numeric difference between the numeric values of the local and foreign currency ratings (Annex Table 2).

Local currency sovereign ratings are a relatively recent product of the major rating agencies. The sovereign ratings given by the major rating agencies when they first entered the business in the early 2oth century were ratings on foreign currency

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[20]   Because countries with a AAA foreign currency rating, by definition, cannot be observed to have a local currency ratings higher than the foreign currency ratings, we do not include AAA-rated sovereigns in the sample. It is important to realise this reflects a limitation of the ratings symbols themselves, rather than an inability of AAA-foreign currency rated sovereigns to have less local than foreign currency credit risk.

[21]   For example, see Eichengreen and Mody (2000), Ferri et al (2001), Borio and Packer (2004), Ratha et al (2010), Becker and Milbourn (2011), Amstad and Packer (2015), and Dilly and Mahlmann (2016).

obligations, as sovereigns needed these to access international bond markets (Flandreau et al, 2011). However, starting in the 1990s, in part reflecting efforts to increase investor participation in domestic currency bonds, an increasing percentage of sovereigns obtained local currency ratings as well. From 5% of our EME sample in 1995, more than one-half had a local currency rating by 2000, and the share had steadily increased to include all EMEs in our sample from 2013 onwards (Graph 2).[22] This rapid increase in the provision of local currency ratings has been broadly shared among the regions of Emerging Asia, Latin America, Emerging Europe, and the Middle East and North Africa.

As mentioned in the introduction, the difference between local and foreign currency ratings for the same sovereign – or the "ratings gap" – has steadily declined over the sample period. The average ratings gap started at 3 notches in 1995, had fallen to 1 notch in 2005 and has been close to zero from 2013. Encompassing all regions, the gap has narrowed as a result of the foreign currency rating increasing towards a more stable local currency rating. In terms of frequencies, while a two or more notch gap existed for nearly four-fifth the sample in 1996, it had declined to 5% by 2015 (Graph 3). By contrast, the percent of sovereigns with no gap had risen from less than 20% in 1996 to 75% in 2015. In advanced economies, the decline in the ratings gaps occurred more rapidly and from a lower starting level.[23,24]

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[22]   By contrast, more than half of the 27 advanced economies with local currency ratings had ratings by 1995, and 100% by 2003.

[23]   For advanced economies, from 1 notch in 1996, the average gap had closed by 2005. In 1996 50% of advanced economies showed "no gap"; the share had risen to 95% by 2015. In AEs, the tendency was for local ratings to be lowered toward a more stable foreign currency rating. The collective action clause (CAC) became more commonly used in international bond contracts subsequent to the default of Argentina on its sovereign obligations in the early 2000s. In theory, CAC can facilitate restructuring of international bonds, lowering a potential disadvantage relative to domestic bonds with a more concentrated ownership structure. However, the evidence is that CACs have increased borrowing costs for borrowers of lower creditworthiness, likely due to the moral hazard of easier restructuring provisions (Eichengreen and Modi (2004)). At the same time, the decline in the absolute ratings gap since 2000 is not clearly greater for less creditworthy sovereigns in our sample. These two findings suggest that CAC is unlikely to materially account for the decline in the ratings gap among the sovereigns investigated in this study, though further examination may be warranted in future research.

[24]   As mentioned in the introduction, the local-foreign currency ratings gap can be expected to only loosely coincide with market-based measures derived from CDS and FX swap markets. Du and Schreger (2016), who construct such market measures over a more limited time period and fewer sovereigns, note several major sources of differentials between foreign and local currency credit spreads. These include factors that do not directly correspond to underlying sovereign default and recovery risk, such as positively correlated credit and currency risk, counterparty as well as liquidity risks in currency swap markets, and incomplete integration between domestic and external debt

3.2. Explanatory variables

The explanatory variables we use to test our main hypothesis described in the previous chapter are inflation, foreign reserves, international debt securities and loans issued in domestic versus foreign currencies ("original sin"), banking sector exposure to government debt, and VIX. The measurement for all variables except "original sin" is straightforward. As a robustness test, we include a narrow and a broad measure for original sin, whereby the narrow version includes only international debt securities, while the broad version also includes bank debt. The definitions and sources for the explanatory and control variables are provided in Tables 2a and 2b, and some summary statistics in Table 3. We also include country and/or time fixed effects in all specifications.

3.3 Methodology

We proceed to test the five main hypotheses using two complimentary methods.[25] First, we estimate two regressions, of foreign and local currency ratings, respectively, on the same set of explanatory variables and compare the sign, size and significance of the corresponding coefficients. Specifically, we run panel multinomial ordered logistic regressions separately for foreign and local currency ratings, where we estimate the probability of the ratings being in one of 19 categories between Ca/CC and AA+/Aa1. $y^{F,L}_{i,t}$ represents the rating of each sovereign i at time t, indexed to be either foreign or local:

$$Pr\ ((\ y^{F}_{i,t}\ )\text{ in each of 19 foreign rating categories)}\ =\ F\ (X_{i,t}^{hypothesis},\ X_{i,t}^{control}\ )$$

$$Pr\ ((\ y^{L}_{i,t}\ )\text{ in each of 19 local rating categories)}\ =\ F\ (X_{i,t}^{hypothesis},\ X_{i,t}^{control}\ )$$

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markets. The same holds true for CDS Quanto spreads (see e.g. Chernov et al. (2017)) that are available from around 2010 and are mostly limited to European countries.

[25] For both methods we use a country fixed effect panel as the base case model and provide results in the Annex tables for models that include time fixed effects both separately and jointly with country fixed effects.

We employ variables related to the main hypotheses $(X_{i,t}^{hypothesis})$ as well as the control variables $(X_{i,t}^{control})$ introduced above. We run statistical significance tests comparing the sign of the coefficient on the local and foreign currency rating regressions.[26] As another robustness check, we also report in the annex the result of the OLS regression, in which the same explanatory variables are used to estimate the average of the numerical value of the ratings, as calculated according the linear transformation described earlier: AA+/Aa1=19, AA/Aa2=18, and so forth.

Secondly, we focus on the gap itself, and estimate trinomial ordered logit models where we estimate the probability of the ratings gap being in one of three categories - less than or equal to zero; between zero and 2 notches, and 2 notches or greater - to be a function of the above explanatory variables, ie

$$Pr\,((\,y^{L}_{i,t}\;-\;y^{F}_{i,t})\quad <=0)\quad=\quad F\,(X_{i,t}^{hypothesis}\,,\,X_{i,t}^{control}\,)$$

$$Pr\,((\,y^{L}_{i,t}\;-\;y^{F}_{i,t})\quad >0)\quad and\quad Pr\,((\,y^{L}_{i,t}\;-\;y^{F}_{i,t})<2\;notches$$

$$=F\,(X_{i,t}^{hypothesis}\,,\,X_{i,t}^{control}\,)$$

$$Pr\,((\,y^{L}_{i,t}\;-\;y^{F}_{i,t})\quad >=2\;notches\quad=F\,(X_{i,t}^{hypothesis}\,,\,X_{i,t}^{control}\,)$$

Although this second exercise does take into account the degree of the ratings gap, it is much less granular than the earlier multinomial logits. Rather, the question asked is simply whether the existence or non-existence of a ratings gap, as well as the existence of a very large ratings gap, is consistent with the main hypotheses. Once again, we run robustness checks on the statistical significance of the estimates, reporting different definitions of the original sin variable, and reporting in the annex the result of OLS regressions of the same explanatory variables on the numerical value of the average gap in terms of notches.

4. Results

We now turn to regression models of foreign and local currency ratings that include variables that are directly related to our hypotheses introduced in section 2, and yet at the same time control for a number of key factors. In 4.1., referring to different specifications of an ordered logistic regression and checking against an OLS

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[26]   The significance test for the difference of the coefficients is taken to be whether the coefficient of the variable in a multinominal ordered logit in which the dependent variable is the gap in terms of notches is statistically significant.

regression, we report whether the sign and relative size of the coefficients in local and foreign currency risk regressions are consistent with our five hypotheses. In 4.2, focusing on regressions where the likelihood and extent of the gap is the dependent variable, we test which drivers of the gap are statistically significant, and in 4.3 we explore their quantitative contribution to the decline of the gap over the past two decades.

4.1. The drivers of foreign versus local currency sovereign risk

The separate ordered logistic regression samples for foreign currency ratings in columns (i) and (ii) comprise 56 EM sovereigns; the sample for local currency ratings in columns (iii) and (iv) comprise 47. Results from the base specification of the multinomial logit with country fixed effects are shown in Table 4 (results from alternative specifications using OLS are shown in Annex Table 1; results from logit models using different combinations of country and time fixed effects are shown in Annex Tables 3a and 3b). As in other work, we find that ratings both foreign and local are well explained by a relatively parsimonious set of variables, with adjusted R-squared of more than 44% for logit and around 90% in all reported OLS specifications. The control variables related to government debt, international short-term debt burden, economic development (per capita GDP), institutional development (corruption), default history and exchange rate regimes generally have the expected sign and the coefficients are usually at levels of statistical significance. In those few cases where the sign is not as expected, the coefficient is with only one exception insignificant.[27]

Inflation is a highly significant (negative) driver of credit risk in both regressions, however there is little evidence for a lesser impact on local currency credit risk as predicted by H1. Indeed, comparing Table 4's specification (i) with (iii), as well as (ii) with (iv), we see that the estimated negative impact of inflation is actually greater for local currency ratings than foreign, which goes against hypothesis H1. This latter outcome is consistent with the view that at high levels of inflation, the negative impact on *local* currency creditworthiness can be greater due to the increased costs of monetization and increased incentives to default on local currency debt. In fact, test statistics suggest that in the case of at least one specification, the impact of local currency creditworthiness is significantly more negative, in a statistical sense, than that on foreign creditworthiness. Similar to the findings of Jeanneret and Souissi (2016) with regard to default, we find that despite the sovereign's often cited ability to turn on the printing press and inflate out of local currency obligations, the relative benefits to local currency obligations from a high inflation environment are limited.

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[27] The only exception is short-term debt over gdp, the coefficient for which is unexpectedly positive in the rating regressions. This finding is likely due to a selection bias whereby less creditworthy sovereigns face difficulties in funding short term debt.

The alternative specifications using OLS (Annex table 1) or time fixed effects (Annex tables 3a and 3b) shows also an estimated impact of inflation on local currency creditworthiness that is more negative than that on foreign currency creditworthiness.

One possible reason that inflation does equal or more damage to the ratings of local currency obligations may be the fact that some sovereigns issue inflation-indexed bonds. In those cases, any incentive to tolerate higher inflation for the sake of relieving the burden of local currency obligations would presumably be reduced. We report in the Annex estimations where a variable has been added which interacts inflation with a dummy variable which is 1 in a given year when the share of inflation-indexed bonds of overall sovereign debt is higher than 5% and zero otherwise. In two of four specifications, the negative impact of inflation on both local and foreign ratings is reduced when the sovereign issues indexed bonds (Annex Table 4). However, for those sovereigns without indexing, the greater negative impact on local currency obligations relative to foreign currency obligations is maintained in all specifications.

As anticipated by H2, *FX reserves* have a positive impact of much higher economic and statistical significance for the assessed creditworthiness of foreign currency debt. The difference in coefficients is statistically significant regardless of which definition of the original sin variable is used in Table 4. For a rough estimate of their economic impact, we refer to the coefficients of the OLS specification of Annex Table 1, where an increase in the ratio of FX reserves to GDP by 10 percentage points will raise the foreign currency rating between 0.3-0.5 notches and local currency rating around 0.2 notches. This is consistent with the well-established view that reserves should help to protect against a shortage of foreign currency, and thus should improve foreign currency creditworthiness. The time fixed effect models in Annex Tables 3a and 3b also show FX reserves as expected to be positively related to creditworthiness but does not show as clear a difference between the coefficients on FX reserves in the foreign versus local currency equations.

So-called *original sin*, which reflects the degree to which a country's borrowers are dependent on foreign currency denominated debt to raise overseas funds, is also a significant determinant of sovereign creditworthiness, and consistent with H3, it has a disproportionate impact on foreign currency obligations. While less original sin improves the credit ratings of both local and foreign currency obligations, it does more so for foreign currency ratings (Table 4). When using the broad definition of original sin in the OLS regressions (i) and (iii) of Annex Table 1, a 10 percentage point decline in original sin corresponds to around a 0.4 notch increase in the foreign currency rating, as opposed to a 0.1 notch increase in the local rating. Similarly, when using the specifications with the narrower measure for original sin ((ii) and (iv) of Annex Table 1), the impact of a 10 percentage point decline in original sin corresponds to a 0.15 notch increase in the foreign currency rating, as opposed to an increase of 0.03 notch in the local rating, which is also of much lower statistical significance. In fact, test statistics suggest that in the case of both pairs of specifications reported in Table 4, the impact of original sin on foreign currency creditworthiness is significantly more negative, in a statistical sense, than that on local

creditworthiness. Similarly, the time fixed effects model documents a greater negative impact of original sin on foreign currency obligations.

The results also support H4, as *banking sector exposure* to government debt is significantly negatively related to sovereign creditworthiness in all specifications in Table 4. The negative relation is also stronger for local currency debt, indicating that the bank holdings of sovereign debt are associated with a narrower gap. In equations (i) and (ii) of Annex Table 1, a 10 percentage point increase in bank holdings of sovereign debt leads to a drop in foreign currency ratings of 0.08 notches and 0.11 notches, respectively, and 0.16 and 0.19 in local currency. That bank holdings of government debt are associated with a decline in the sovereign's creditworthiness strongly suggests that the increased risks of a feedback loop between financial institutions and sovereign debt, resulting from greater bank exposure to the sovereign, dominate any potential positives from increased willingness to pay on the part of the sovereign.[28]

Consistent with H5, *global volatility* does reduce creditworthiness, and much more so for foreign currency obligations in both an economic and a statistical sense (Table 4). This is consistent with the view that the risk on foreign – mostly USD denominated – currency obligations is more vulnerable to swings in USD referenced global factors such as VIX. Estimating the economic impact from the OLS regression result (i) reported in Annex Table 1, an increase of VIX by 10 percentage points lowers the foreign currency rating by more than 0.2 notches, and statistically significantly so, versus a much smaller and insignificant effect on the domestic currency rating.[29]

4.2. Predicting the gap

This section explores the determinants of the difference in credit risk from a different perspective, asking whether the same explanatory variables examined earlier affect the probability and extent of a gap in local and foreign currency sovereign risk for any single sovereign. To some extent, we have already done this when comparing the size of coefficients in the local and foreign currency regressions, though now we will estimate regressions where the gap itself is the dependent variable. We run a trinomial logistic regression on the same variables as before, distinguishing between

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[28]We found the level of bank exposure to government debt, measured as a percent of total bank assets, provided more consistent results than an interactive term which multiplied this exposure times the overall level of credit. This variable is also used in Gennaioli et al (2014).

[29] This result contrasts with that of Jeanneret and Souissi (2016), who provide evidence that global volatility does not help to explain the frequency of sovereign defaults in either local or foreign currency.

the three categories of no gap, a small gap above zero up to two notches, and a large gap that rounds to two notches or more. We include country fixed effects.[30]

The explanatory power of Table 5's specifications is greater than that reported in the earlier regressions of Table 4. The pseudo R-squared measure suggests that between 60-70% of the variation in outcomes can be explained by the variables.[31]

Despite the marked difference in empirical approach, there remains a lack of support for H1; rather, the contrary hypothesis that high levels of inflation might hurt local currency ratings more than foreign currency ratings, and thus reduce the gap is supported in one of the two specifications in Table 5. When the variable that interacts inflation with the existence of inflation-indexed bonds is added to that specification, the negative association of inflation with the gap is eliminated when there in indexing (Annex Table 5). However, in no case is a significant positive relationship between the gap and inflation uncovered. Conceivably, at high levels of inflation the risks of hyperinflation are too great to avoid default via the printing press.

On the other hand, the support in Table 5 for hypotheses (2), (3), (4) and (5) is quite solid. FX reserves are negatively associated with the difference between local and foreign currency creditworthiness, and the variable is highly significant independent of the specification. The hypothesised original sin effect, or the tendency of greater dependence on foreign currency borrowing to have a disproportionately negative impact on foreign currency risk, is supported by a positive sign for the coefficient on the gap in both specifications of Table 5, and is highly statistically significant for the broad definition (p=.0001) and only slightly less so for the narrow definition of original sin (p=.0561). Bank ownership of sovereign debt is negatively associated with the gaps between local and foreign currency creditworthiness, consistent with a stronger "doom loop" disproportionately reducing the local currency rating. The p-values for the statistical significance of the coefficients in the two specifications are 0.0891 and 0.0001, respectively.

The coefficients on global volatility, as represented by VIX, also support hypothesis (5). Global volatility tends to be associated with an increase in the gap between foreign and local currency credit risk. The earlier regressions of Table 4 suggest this is because foreign currency creditworthiness is more negatively impacted than local currency creditworthiness by global volatility.

Finally, all the main findings are robust to a transformation to a linear model. The OLS regression estimations in Annex Table 2, where the dependent variable is defined simply as the average notch difference in local and foreign currency ratings, reports

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[30]   Estimations of logit trinomial gap regressions including both country and time fixed effects did not converge.

[31]   The adjusted R-square of an OLS regression for the determinants of the gap (Annex Table 2) ranges between 55 and 60%.

similar results, supportive of the hypotheses on reserves (H2), original sin (H3), banking sector exposure (H4) and volatility (H5).[32]

4.3. Accounting for the gap's decline

At the outset of this paper, we noted that the gap between local and foreign currency ratings had declined over the last two decades. What light do the above results shed on the reasons for this? We focus on FX reserves, original sin, and global market volatility: three variables that the regression analysis suggests drive the gap. FX reserves has increased over the sample, while both reliance on foreign currency debt and VIX has declined. Combined with the signs on the coefficients in the ratings regressions, this implies that each of these three variables could have accounted for some of the declining gap over the sample period. (The measure of banking sector exposure, although a significant determinant in the panel regression and volatile over the period, was little changed at the end of the sample period from the beginning, which suggests it would not account for the declining gap.)

As an indicative exercise, we take a three-year rolling average of these three explanatory variables and multiply the change from the first to the last observations (2015 value-1997 value) by the different coefficients for the variables in the ratings gap OLS regressions, and reported in column (i) of Annex Table 2. The results indicate the movement of the gap that is consistent with the change of each explanatory variable over the sample period.

FX reserves, which on average more than doubled as percent of GDP over the sample period, stand out in importance among the country variables in terms of explaining the decline in the gap over the entire sample period. The increase in foreign reserves alone in our sample of emerging market economies over the period corresponds with 0.4 notch decline in the gap. Smaller is the impact of diminishing original sin, which corresponds with a declining gap of around 0.3, slightly less than one-third of a notch. The increase in VIX over the sample period corresponds with a relatively small 0.1 notch decline in the gap between foreign and domestic currency ratings. This exercise, while rough, suggests that among our explanatory variables, it was the increase in FX reserves that most accounts for the decline in the gap between the perceived risk of foreign and local currency debt over the sample period.

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[32] It has been suggested that because the local currency ratings were effectively not available for all sovereigns before 1999, sample selection may be playing some role in our results. However, estimating the regressions from 1999 on (the point at which virtually every sovereign with a foreign currency rating also had a local currency rating) does not the change the results in a material fashion. We have also estimated the ratings and gap regressions weighting the observations by the country's outstanding foreign currency debt, in case estimation of the gap is more uncertain in for countries with less foreign currency debt: though this also does not change the results.

5. Conclusions

Differences in sovereign risk denominated in local versus foreign currency matter for investors and regulators alike. Despite frequent reference to the greater creditworthiness of domestic currency obligations, a consistent theoretical framework has been so far missing in the literature. Often a remark that sovereigns can simply "inflate" their way out of domestic obligations is all that is provided.

This paper contributes to the literature in several ways. First, we document that the difference in the level of local versus foreign currency risk has steadily decreased over time for all regions. Second, we develop five hypotheses why the currency of denomination might matter for credit risk, and why there might be a gap between domestic and foreign currency creditworthiness. Four hypotheses result in implications for the relation of the gap to observable country-level variables – inflation, FX reserves, reliance on foreign currency debt markets, and banking sector ownership of government debt. Another hypothesis relates the gap to global risk and volatility, as proxied by VIX.

Based on our analysis of a panel of 73 EME rated sovereigns between 1995 and 2015, we find no support for the often cited hypothesis that high inflation might increase the relative creditworthiness of local currency obligations. Consistent with the default evidence found in other studies, sovereigns' willingness to inflate away their local debt appears to be limited, and higher inflation can even diminish the relative standing of local currency obligations.

At the same time, we find support for the hypotheses that higher FX reserves, less reliance on foreign currency borrowing (declining original sin), greater banking sector exposure to government debt, and lower global risk and volatility can narrow the gap. Among the explanatory variables, it is higher FX reserves that appear to have the most power to explain the trend decline of the gap among EMEs.

The analysis of this paper has focused on EMEs, but it would be of interest to extend the analysis to advanced economies. In many such jurisdictions, government debt burdens have been growing inexorably, and the value of the monetization option is more frequently entering public discourse.

Our results suggest there is little reason to think that the convergence of foreign and local currency risks is necessarily a permanent phenomenon. Particularly if FX reserves start to drain, foreign currency borrowing rebounds, and global volatility rises further, the distinction between local and foreign currency credits risks might once again grow in importance.

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Tables

Emerging economies (73)[1]

<div align="right">Table 1</div>

Emerging Asia (13)	Bangladesh, China, Chinese Taipei, Fiji, India, Indonesia, Korea, Malaysia, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam
Latin America (20)	Argentina, Bahamas, Barbados, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Guatemala, Jamaica, Mexico, Panama, Paraguay, Peru, Trinidad and Tobago, Uruguay, Venezuela
Emerging Europe (22)	Albania, Belarus, Bosnia & Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Georgia, Kazakhstan, Latvia, Lithuania, Macedonia, Montenegro, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Turkey, Ukraine
Middle East and N. Africa (9)	Bahrain, Egypt, Jordan, Kuwait, Lebanon, Morocco, Oman, Qatar, Saudi Arabia
Sub-Sahara Africa (9)	Botswana, Democratic Republic of Congo, Gabon, Ghana, Kenya, Nigeria, Senegal, South Africa, Uganda

[1] MSCI classification excluding AAA

Variables related to hypotheses (1)-(5)

<div align="right">Table 2a</div>

	Definitions
YCPI	Inflation, average consumer prices (In per cent)
FX	International reserves excl gold (As a percentage of GDP)
OSIN_NARROW	Max (1 – (securities in currency i / securities issued by country i), 0)
OSIN_BROAD	Max (securities and loans issued by country i in five major currencies / all securities and loans issued by country i, OSIN_NARROW)
BANK	Domestic banks' holdings of public debt using financial institutions' net claims to the government relative to their total assets, following Gennaioli et al (2014) and Kumhof and Tanner (2008): Sum of net claims minus liabilities on (central govt, local govt and public non-financial) / sum of net claims minus liabilities on (public and private sector (excluding claims on depository corporations by other financial corporations) by i) other depository corporations (excluding central banks) and ii) other financial corporations
VIX	Chicago Board Options Exchange S&P 500 implied volatility index; standard deviation (In percentage points per annum)

Control variables

<div align="right">Table 2b</div>

	Definitions
PD	General government gross debt (As a percentage of GDP)
IR	General government expense, interest (As a percentage of general government revenue)
STD	Consolidated cross-border claims of all BIS reporting banks on countries outside the reporting area with a maturity of up to one year plus international debt securities outstanding with a remaining maturity of up to one year (As a percentage of GDP)
dlog(YD)	Gross domestic product per capita, constant prices, changes in logarithm
TI	Corruption perception index (0-100) from Transparency International, which scores and ranks countries/territories based on how corrupt a country's public sector is perceived to be. It is a composite index, a combination of surveys and assessments of corruption, collected by a variety of reputable institutions.
DR	1/number of years since latest default
D4	Exchange rate regime: free floating = 1; otherwise = 0

Descriptive statistics for all EMEs

Table 3

Variables	Mean	Med	Std	Min	Max
YCPI	6.180	4.395	6.846	-1.6	55.035
FX	19.50	15.88	14.84	0.78	98.08
OSIN_BROAD	0.915	0.968	0.160	0.019	1
OSIN_NARROW	0.725	0.926	0.373	0	1
BANK	23.94	17.36	28.68	-31.55	169.22
VIX	20.91	17.80	6.61	12.70	32.69
PD	43.68	38.51	27.61	1.58	185.19
IR	11.10	7.80	10.92	0.09	74.92
STD	11.11	7.234	14.44	0.338	122.16
dlog(YD)	0.067	0.076	0.127	-0.433	0.423
TI	39.10	37	11.93	17	75
DR	0.035	0	0.126	0	1
D4	0.048	0	0.213	0	1

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Multinomial ordered logistic regressions for EME economies (19 rating categories) with country fixed effects

Table 4

	Foreign[1,2]				Local[1,3]					
	i		ii		iii			iv		
YCPI	-0.103***	(-5.64)	-0.056***	(-3.72)	-0.134***	+	(-5.21)	-0.103***		(-3.75)
FX	0.058***	(4.30)	0.072***	(6.22)	0.026	+	(1.49)	0.052***	+	(3.15)
OSIN_BROAD	-8.563***	(-7.79)			-2.444**	+	(-2.10)			
OSIN_NARROW			-2.888***	(-5.98)				-1.067*	+	(-1.87)
BANK	-0.012**	(-2.05)	-0.024***	(-4.24)	-0.023***	+	(-3.42)	-0.033***	+	(-4.38)
VIX	-0.051***	(-4.25)	-0.028**	(-2.55)	-0.024*	+	(-1.70)	0.003	+	(0.21)
PD	-0.105***	(-11.02)			-0.131***	+	(-10.62)			
IR			-0.136***	(-6.31)				-0.088***	+	(-3.21)
STD	0.031**	(2.35)	0.030**	(2.23)	0.011	+	(0.70)	0.040**	+	(2.49)
dlog(YD)	-0.117	(-0.17)	1.631***	(2.62)	-0.186		(-0.23)	1.956***		(2.63)
TI	0.096***	(4.76)	0.078***	(3.93)	0.082***		(3.30)	0.041*	+	(1.68)
DR	-3.068***	(-3.80)	-3.052***	(-3.68)	-5.135***		(-3.29)	-7.606***		(-4.53)
D4	-0.079	(-0.14)	-0.211	(-0.38)	-0.920		(-1.63)	-1.111**		(-2.11)
Pseudo R^2	0.4806		0.4403		0.5010			0.4554		
Country fixed effect	Y		Y		Y			Y		
Period fixed effect	N		N		N			N		
Groups (N)	56		56		47			47		
Periods (T)	21		21		19			19		
Observations	673		683		500			499		

+indicates coefficients that are significantly different (at 10 % level) from the parallel regressions with foreign currency rating. [1] The average of Moody's, Standard & Poor's and Fitch ratings. Numerical values for ratings are attached to ratings as follows: Ca/CC = 1, Caa3/CCC− = 2, Caa2/CCC = 3, Caa1/CCC+= 4, B3/B− = 5 and so on up to Aa1/AA+ = 19. [2] Long term foreign currency rating. [3] Long term local currency rating.

Trinominal ordered logistic gap regressions with country fixed effects Table 5

	(1)		(2)	
	Gap[1]		Gap[1]	
YCPI	-0.154*	(-1.66)	0.055	(0.64)
FX	-0.229***	(-3.13)	-0.164***	(-2.93)
OSIN_BROAD	55.94***	(5.65)		
OSIN_NARROW			2.838*	(1.91)
BANK	-0.022*	(-1.70)	-0.080***	(-3.89)
VIX	0.157***	(4.14)	0.140***	(4.33)
PD	-0.092**	(-2.41)		
IR			0.521***	(4.16)
STD	-0.156*	(-1.86)	-0.154**	(-2.06)
dlog(YD)	-0.972	(-0.48)	1.392	(0.79)
TI	-0.027	(-0.43)	-0.104**	(-1.97)
DR	-1.145	(-0.00)	-3.968	(-0.00)
D4	-1.309	(-0.55)	0.124	(0.09)
Pseudo R^2	0.6943		0.6107	
Country fixed effect	Y		Y	
Period fixed effect	N		N	
Groups (N)	47		47	
Periods (T)	19		19	
Observations	500		499	

[1] Rating gaps between foreign and local ratings are smaller than or equal to zero takes 1; those between zero and 1.5 take 2; all else greater than 1.5 takes 3.

Annex

OLS rating regressions for EME economies with country fixed effects   Annex Table 1

	Foreign[1,2]				Local[1,3]			
	i		ii		iii		iv	
YCPI	-0.049***	(-6.25)	-0.019***	(-3.22)	-0.054***	(-5.14)	-0.040***	(-3.03)
FX	0.034***	(5.37)	0.045***	(6.52)	0.016**	(1.98)	0.023**	(2.44)
OSIN_BROAD	-4.007***	(-7.81)			-1.038*	(-1.81)		
OSIN_NARROW			-1.452***	(-5.01)			-0.315	(-0.92)
BANK	-0.008***	(-2.94)	-0.011***	(-3.97)	-0.016***	(-5.48)	-0.019***	(-5.35)
VIX	-0.020***	(-3.20)	-0.010	(-1.36)	-0.005	(-0.63)	0.011	(1.39)
PD	-0.047***	(-11.22)			-0.059***	(-11.98)		
IR			-0.075***	(-6.83)			-0.062***	(-4.13)
STD	0.021***	(2.83)	0.019**	(2.28)	0.007	(0.84)	0.021**	(2.16)
Dlog(YD)	0.159	(0.46)	1.232***	(3.57)	0.067	(0.17)	1.258***	(3.00)
TI	0.047***	(4.53)	0.048***	(4.35)	0.043***	(3.56)	0.031**	(2.31)
DR	-1.595***	(-3.83)	-1.849***	(-4.00)	-2.325***	(-3.63)	-4.119***	(-5.72)
D4	-0.024	(-0.08)	-0.091	(-0.27)	-0.305	(-1.04)	-0.474	(-1.43)
Constant	14.671***	(19.66)	10.222***	(17.76)	14.339***	(17.64)	11.549***	(16.56)
Adj-R^2	0.916		0.895		0.915		0.890	
Country fixed effect	Y		Y		Y		Y	
Period fixed effect	N		N		N		N	
Fixed effect tests	36.48 (0.0000)		35.50 (0.0000)		34.33 (0.0000)		30.33 (0.0000)	
Groups (N)	56		56		47		47	
Periods (T)	21		21		19		19	
Observations	673		683		500		499	

[1] The average of Moody's, Standard & Poor's and Fitch ratings. Numerical values for ratings are attached to ratings as follows:

Ca/CC = 1, Caa3/CCC– = 2, Caa2/CCC = 3, Caa1/CCC+= 4, B3/B– = 5 and so on up to Aaa/AAA = 20   [2] Long term foreign currency rating.   [3] Long term local currency rating.

OLS gap regressions with country fixed effects

Annex Table 2

	Gap[1]			
	i		ii	
YCPI	-0.01	(-1.02)	-0.012*	(-1.67)
FX	-0.030***	(-6.12)	-0.018***	(-3.49)
OSIN_BROAD	2.728***	(7.98)		
OSIN_NARROW			0.654***	(3.44)
BANK	-0.009***	(-4.99)	-0.011***	(-5.66)
VIX	0.018***	(4.09)	0.022***	(4.77)
PD	-0.011***	(-3.81)		
IR			0.014*	(1.73)
STD	-0.010*	(-1.93)	-0.006	(-1.03)
dlog(YD)	-0.189	(-0.82)	0.295	(1.27)
TI	-0.023***	(-3.22)	-0.031***	(-4.04)
DR	-0.595	(-1.55)	-0.781*	(-1.95)
D4	-0.072	(-0.41)	-0.162*	(-0.88)
Constant	0.386	(0.80)	1.766***	(4.56)
Adj-R^2	0.601		0.549	
Country fixed effect	Y		Y	
Period fixed effect	N		N	
Fixed effect tests	10.17 (0.0000)		9.13 (0.0000)	
Groups (N)	47		47	
Periods (T)	19		19	
Observations	500		499	

[1] Subtracted average long term foreign currency ratings from average long term local currency ratings, rounded to the nearest integer.

Multinomial ordered logistic regressions for EME economies (19 rating categories) with both country and time fixed effects

Annex Table 3a

	Foreign[1,2]				Local[1,3]			
	i		Ii		iii		iv	
YCPI	-0.081***	(-4.14)	-0.037**	(-2.17)	-0.119***	(-4.32)	-0.098***	(-3.31)
FX	0.022	(1.59)	0.060***	(4.94)	0.036*	(1.86)	0.064***	(3.64)
OSIN_BROAD	-5.998***	(-5.09)			-3.439***	(-2.60)		
OSIN_NARROW			-2.146***	(-4.21)			-1.587***	(-2.59)
BANK	-0.010*	(-1.72)	-0.029***	(-4.71)	-0.028***	(-3.97)	-0.033***	(-4.20)
PD	-0.116***	(-11.47)			-0.144***	(-11.16)		
IR			-0.088***	(-3.73)			-0.119***	(-3.73)
STD	0.046***	(3.21)	0.039***	(2.63)	0.025	(1.49)	0.046***	(2.71)
dlog(YD)	0.241	(0.26)	2.768***	(3.38)	0.272	(0.25)	2.621**	(2.51)
TI	0.069***	(3.17)	0.056***	(2.58)	0.074***	(2.69)	0.046*	(1.73)
DR	-2.500***	(-2.96)	-2.375***	(-2.78)	-5.623***	(-3.54)	-8.803***	(-4.84)
D4	-0.656	(-1.16)	-0.544	(-1.01)	-0.939*	(-1.67)	-1.005*	(-1.88)
Pseudo R[2]	0.5022		0.4540		0.5089		0.4596	
Country fixed effect	Y		Y		Y		Y	
Period fixed effect	Y		Y		Y		Y	
Groups (N)	56		56		47		47	
Periods (T)	21		21		19		19	
Observations	673		683		500		499	

[1] The average of Moody's, Standard & Poor's and Fitch ratings. Numerical values for ratings are attached to ratings as follows: Ca/CC = 1, Caa3/CCC– = 2, Caa2/CCC = 3, Caa1/CCC+ = 4, B3/B– = 5 and so on up to Aaa/AAA = 20.   [2] Long term foreign currency rating.   [3] Long term local currency rating.

Multinomial ordered logistic regressions for EME economies (19 rating categories) with time fixed effects

Annex Table 3b

	Foreign[1,2]				Local[1,3]			
	i		Ii		iii		iv	
YCPI	-0.083***	(-6.63)	-0.050***	(-4.39)	-0.135***	(-7.24)	-0.113***	(-6.01)
FX	0.048***	(8.91)	0.031***	(6.04)	0.057***	(6.24)	0.028***	(3.21)
OSIN_BROAD	-5.248***	(-10.16)			-4.487***	(-8.12)		
OSIN_NARROW			-0.453**	(-2.26)			-0.446*	(-1.79)
BANK	0.003	(0.96)	0.005	(1.53)	-0.0001	(-0.02)	0.005	(1.06)
PD	-0.046***	(-12.52)			-0.044***	(-9.19)		
IR			-0.104***	(-11.07)			-0.108***	(-7.93)
STD	0.008	(1.64)	-0.035	(-0.75)	-0.024***	(-3.22)	-0.034***	(-4.21)
dlog(YD)	-0.062	(-0.08)	0.471	(0.65)	-1.190	(-1.24)	-0.192	(-0.21)
TI	0.090***	(12.00)	0.100***	(13.42)	0.111***	(11.16)	0.113***	(11.56)
DR	-5.289***	(-7.14)	-6.228***	(-8.52)	-6.850***	(-5.19)	-9.078***	(-7.07)
D4	0.250	(0.77)	0.359	(1.15)	0.556	(1.61)	0.532	(1.57)
Pseudo R^2	0.2183		0.1826		0.2410		0.2101	
Country fixed effect	N		N		N		N	
Period fixed effect	Y		Y		Y		Y	
Groups (N)	56		56		47		47	
Periods (T)	21		21		19		19	
Observations	673		683		500		499	

[1] The average of Moody's, Standard & Poor's and Fitch ratings. Numerical values for ratings are attached to ratings as follows: Ca/CC = 1, Caa3/CCC– = 2, Caa2/CCC = 3, Caa1/CCC+ = 4, B3/B– = 5 and so on up to Aaa/AAA = 20.   [2] Long term foreign currency rating.   [3] Long term local currency rating.

Multinomial ordered logistic regressions for EME economies (19 rating categories)

	Foreign[1,2]				Local[1,3]			
	i		ii		iii		iv	
YCPI	-0.1***	(-4.71)	-0.064***	(-4.22)	-0.147***	(-4.87)	-0.146***	(-4.93)
YCPI×TIPS	-0.007	(-0.23)	0.061**	(2.13)	0.029	(0.82)	0.13***	(3.19)
BANK	-0.012**	(-2.04)	-0.022***	(-3.68)	-0.024***	(-3.48)	-0.031***	(-4.05)
FX	0.057***	(4.3)	0.07***	(6.02)	0.026	(1.48)	0.047***	(2.79)
OSIN_BROAD	-8.562***	(-7.79)			-2.422**	(-2.08)		
OSIN_NARROW			-2.832***	(-5.86)			-0.849	(-1.47)
VIX	-0.051***	(-4.26)	-0.027**	(-2.44)	-0.023*	(-1.65)	0.005	(0.37)
PD	-0.105***	(-11.02)			-0.131***	(-10.6)		
IR			-0.156***	(-6.53)			-0.135***	(-4.33)
STD	0.031**	(2.34)	0.031**	(2.27)	0.012	(0.74)	0.042***	(2.62)
dlog(YD)	-0.129	(-0.18)	1.617***	(2.59)	-0.117	(-0.15)	2.191***	(2.89)
TI	0.096***	(4.76)	0.077***	(3.89)	0.081***	(3.29)	0.04	(1.64)
DR	-3.063***	(-3.79)	-3.178***	(-3.79)	-5.118***	(-3.31)	-7.998***	(-4.94)
D4	-0.086	(-0.15)	-0.141	(-0.26)	-0.888	(-1.57)	-1.009*	(-1.91)
Pseudo R^2	0.4806		0.4415		0.5012		0.4595	
Country fixed effect	Y		Y		Y		Y	
Period fixed effect	N		N		N		N	
Groups (N)	56		56		47		47	
Periods (T)	21		21		19		19	
Observations	673		683		500		499	

+ indicates coefficients that are significantly different (at 10 % level) from the parallel regressions with foreign currency rating. [1] The average of Moody's, Standard & Poor's and Fitch ratings. Numerical values for ratings are attached to ratings as follows: Ca/CC = 1, Caa3/CCC– = 2, Caa2/CCC = 3, Caa1/CCC+ = 4, B3/B– = 5 and so on up to Aa1/AA+ = 19. [2] Long term foreign currency rating. [3] Long term local currency rating.

Trinominal ordered logistic gap regressions

Annex Table 5

	(1)		(2)	
	Gap[1]		Gap[1]	
YCPI	-0.434***	(-3.11)	-0.012	(-0.12)
YCPI×TIPS	0.43***	(2.83)	0.187	(1.37)
BANK	-0.019	(-1.53)	-0.076***	(-3.64)
FX	-0.262***	(-3.25)	-0.166***	(-2.96)
OSIN_BROAD	60.654***	(5.55)		
OSIN_NARROW			2.72*	(1.85)
VIX	0.15***	(3.76)	0.137***	(4.18)
PD	-0.113***	(-2.75)		
IR			0.503***	(3.96)
STD	-0.153**	(-1.86)	-0.144*	(-1.9)
dlog(YD)	-1.071	(-0.49)	1.835	(1.02)
TI	0.015	(0.23)	-0.104**	(-1.99)
DR	0.815	(0.00)	3.488	(0)
D4	-2.046	(-0.94)	0.094	(0.07)
Pseudo R^2	0.7145		0.6151	
Country fixed effect	Y		Y	
Period fixed effect	N		N	
Groups (N)	47		47	
Periods (T)	19		19	
Observations	500		499	

[1] Rating gaps between foreign and local ratings are smaller than or equal to zero takes 1; those between zero and 1.5 take 2; all else greater than 1.5 takes 3.

Graphs

EME local currency rating, foreign currency rating and gap[1]

Graph 1

Lhs:
- Local ratings[2]
- Foreign ratings[3]

Rhs:
- Gaps[4]
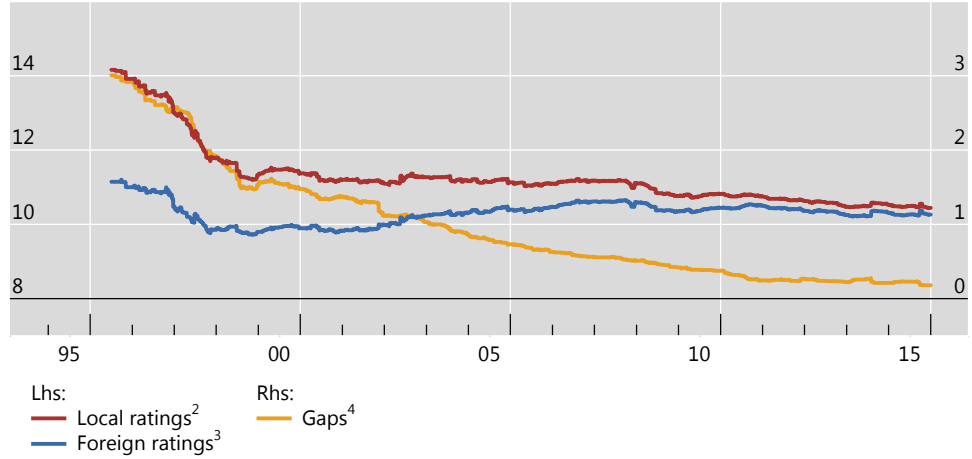
[1] Average ratings and gaps among the Fitch, Moody's and S&P of the emerging market economies in our sample. [2] Long term local currency debt rating. [3] Long term foreign currency debt rating. [4] Gap, subtracted foreign currency debt rating from local currency debt rating.

Sources: Bloomberg; authors' calculations.

Number of emerging market economies over case with at least one rating by the three rating agencies

Counts

Graph 2

- Local ratings[1]
- Foreign ratings[2]
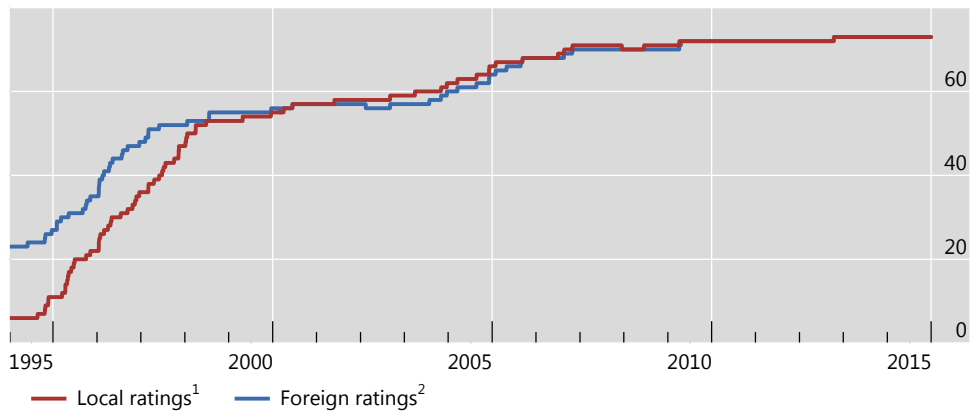
[1] Long term local currency debt rating. [2] Long term foreign currency debt rating.

Sources: Bloomberg; authors' calculations.

Rating gaps between local and foreign ratings[1]: frequency of outcome

In per cent

Graph 3

Legend:
- One-notch difference[2]
- Two-notch difference[3]
- No difference
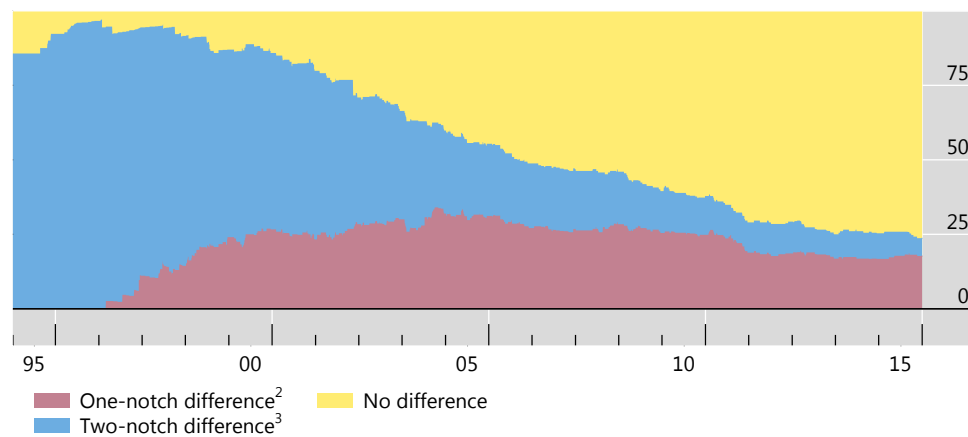
[1] Number of absolute difference between the local and foreign ratings for each rating agency.   [2] Greater than or equal to one notch but smaller than two notches; as a percentage of all ratings.   [3] Greater than two notches; as a percentage of all ratings.

Sources: Bloomberg; authors' calculations.

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