Working paper 4
Credit Risk, Exchange Rates, and Capital Requirements

1. Introduction

This paper examines the interplay between credit risk and exchange rates in the context of multilateral development banks' (MDBs) local currency (LC) financing activities. It approaches the subject from two key perspectives. First, it investigates the relative credit risk associated with lending in local versus foreign currency (FC). Second, it explores how exchange rate fluctuations and sovereign credit rating downgrades impact MDBs' own credit ratings and their capital adequacy.

The first central argument advanced in this paper is that, while credit risk on LC debt is not insignificant, it tends to be lower than that associated with FC debt. The second is that, when MDBs hedge against currency risk—or even in some cases where hedging is incomplete—the effect of a currency depreciation on MDBs' risk-weighted capital ratios is typically positive in comparison to their FC exposures.

This paper proceeds as follows: Section 2 examines the relative credit risk of local versus foreign currency debt, focusing on available data and sovereign defaults. Section 3 explores how increased exposure to LC debt may affect MDBs' credit ratings, with a particular focus on capital adequacy.

2. Existing evidence on credit risk and currency of denomination

MDBs lending to low and middle-income countries (LMICs) often involves a significant degree of credit risk. Borrowers in these countries, are more prone to default due to higher economic volatility and vulnerability to external conditions.[1] MDBs assume some of these risks, easing

[1] L Catão and B Sutton, 'Sovereign Defaults: The Role of Volatility' (2002) IMF Working Paper No. 02/149; L Martinez and others, 'Sovereign Debt' (2022) *IMF Working Papers* No. 2022/122.

access to credit for borrowers underserved by private-sector banks, partly due to their preferred creditor status (PCS), which helps reduce losses from potential defaults.[2]

Comprehensive data on defaults of MDB loans is collected through the Global Emerging Markets (GEMs) Risk Database, which has recently been updated and now includes information on default and recovery rates.[3] From the perspective of expanding LC financing by MDBs, the key question is the credit risk of local versus foreign currency (FC) debt. However, the GEMs database does not currently publish default rate statistics by currency, so it cannot be used for this specific purpose.

To gain some insights into the relative default risk of LC debt, we rely on other data sources. First, we examine credit rating data across our sample of LMICs from the three major credit rating agencies—Standard & Poor's (S&P), Fitch, and Moody's. Credit ratings provide a direct market indicator for assessing the credit risk of different borrowers.[4] Second, we use data on sovereign defaults from various sources, as described in more detail below.[5] Our analysis focuses primarily on sovereign debt rather than private borrowers, mainly due to data limitations, as no information is currently available on the default risk of LC debt versus hard currency debt for private borrowers. This highlights the need for more comprehensive, granular default data from MDBs and GEMs, including LC-specific data. Nevertheless, sovereign defaults remain important for understanding the relative risk of local versus hard currency debt, given the close link between sovereign and private credit risk—where sovereign defaults significantly limit private sector access to credit.[6]

In recent years, a large body of research has focused on collecting evidence and analysing sovereign debt defaults. The works of Reinhart and Rogoff,[7] Beers, Bhullar, and Nystrand,[8]

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[2] D Gurara, A Presbitero and M Sarmiento, 'Borrowing Costs and the Role of Multilateral Development Banks: Evidence from Cross-Border Syndicated Bank Lending' (2020) 100 *Journal of International Money and Finance* 102090.

[3] European Investment Bank, *Default Statistics: Private and Sub-Sovereign Lending 1994–2022* (Global Emerging Markets Risk Database Consortium (GEMs) 2024); European Investment Bank, *Recovery Statistics: Private and Sub-Sovereign Lending 1994–2022* (Global Emerging Markets Risk Database Consortium (GEMs) 2024); European Investment Bank, *Default Statistics: Sovereign and Sovereign Guaranteed Lending 1994–2022* (Global Emerging Markets Risk Database Consortium (GEMs) 2024).

[4] Another indicator are credit default swaps, but these do not exist for the vast majority of LMIC.

[5] A Erce, E Mallucci and MO Picarelli, 'A Journey in the History of Sovereign Defaults on Domestic-Law Public Debt' (2022) *European Stability Mechanism Working Paper*; D Beers, V Bhullar, and D Nystrand, 'BoC–BoE Sovereign Default Database: What's New in 2023?' (2023) Bank of Canada Staff Analytical Notes No 2023–10; S Horn, CM Reinhart and C Trebesch, 'Hidden Defaults' (2022) 112 *AEA Papers and Proceedings* 531.

[6] US Das, MG Papaioannou and C Trebesch, 'Hidden Defaults Capital in Emerging Markets' (2010) *IMF Working Papers* No. 010.

[7] CM Reinhart and K Rogoff, *This Time Is Different: Eight Centuries of Financial Folly* (Princeton University Press 2011).

[8] Beers, Bhullar, and Nystrand (n 5).

Asonuma and Trebesch,[9] and Erce, Mallucci, and Picarelli document a significant number of defaults over time and across countries.[10] A more recent question emerging from this literature is the likelihood and incidence of sovereign defaults involving LC debt, which had been previously overlooked.[11]

This oversight can be partly explained in two ways. First, conceptually, it could be argued that LC debt is unlikely to present a problem for sovereigns. After all, if governments retain control over their currency, they can always refinance local-currency debt. At the macroeconomic level, currency depreciation and high inflation, though harmful to the economy, reduce the real value of debt burdens.

Second, in LMICs, research and policy attention have historically focused on external and foreign currency debt, as this has been the dominant form of borrowing outside high-income economies. This phenomenon, traditionally called 'original sin', has been both a barrier to financial and economic development and a source of recurrent financial instability in developing and emerging economies.[12]

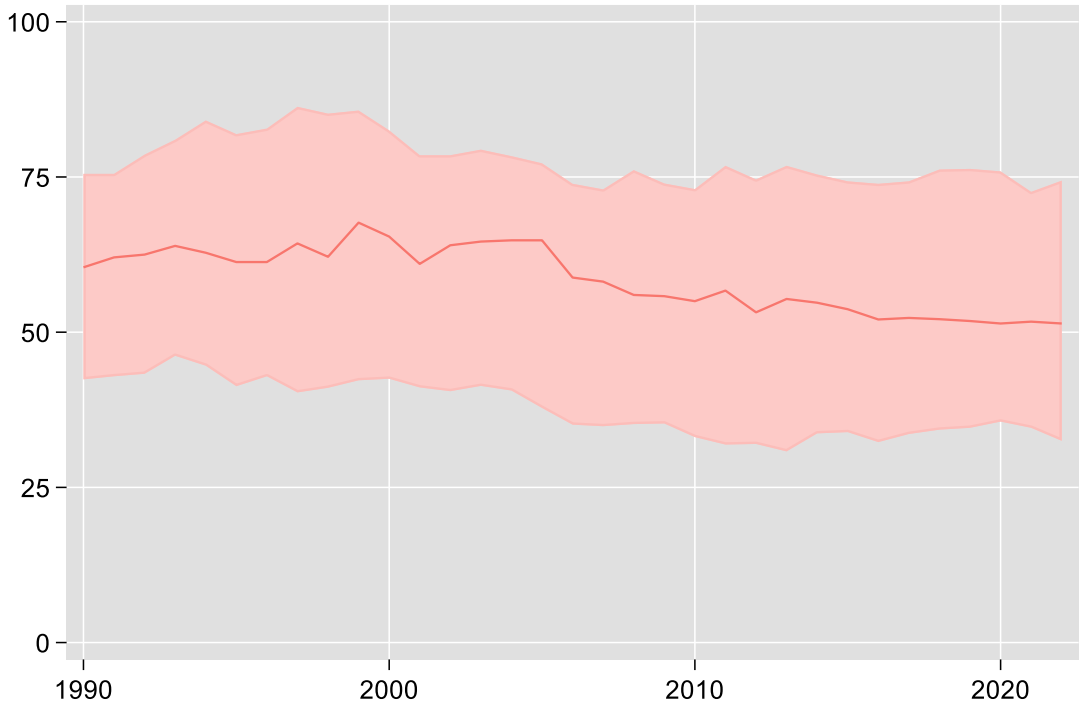
[9] T Asonuma and C Trebesch, 'Sovereign Debt Restructurings: Preemptive or Post-Default' (2016) 14(1) *Journal of the European Economic Association* 175.

[10] Erce, Mallucci and Picarelli (n 5).

[11] KJ Mitchener and C Trebesch, 'Sovereign Debt in the 21st Century: Looking Backward, Looking Forward' (2021) *CESifo Working Paper* No. 8959.

[12] B Eichengreen and R Hausmann, 'Exchange Rates and Financial Fragility' (1999) *NBER Working Paper* No. 7418.

Figure 1 Foreign currency debt share (% of total public debt)



Source: S Arslanalp and T Tsuda, 'Tracking Global Demand for Emerging Market Sovereign Debt' (2014) *IMF Working Paper* No. 14/39.

However, as LC debt in LMICs has become more prominent and domestic defaults more visible, LC debt defaults have started to attract more attention. As shown in Figure 1, while the median share of foreign currency debt remains above 50%, it has slowly declined over the past thirty years. Longer-term historical analyses reveal that average shares of LC debt in emerging markets have fluctuated, staying above 50% from the 1940s until the mid-1980s, and that defaults during earlier periods were not uncommon.[13]

As LC debt has grown in importance, more studies have been conducted on LC debt defaults. Recent evidence shows that LC debt defaults do occur, but they differ from FC defaults. Kohlscheen finds that default rates are lower for LC debt than for FC debt, though they are harder to predict.[14] Using a different sample focused on bonds from 1996 to 2012, Jeanneret and Souissi find that both LC and FC defaults are equally likely, but their causes differ—high inflation is the primary driver of LC defaults, while high government debt and short-term

[13] CM Reinhart and KS Rogoff, 'The Forgotten History of Domestic Debt' (2011b) 121(552) *The Economic Journal* 319.

[14] E Kohlscheen, 'Domestic vs External Sovereign Debt Servicing: An Empirical Analysis' (2010) 15(1) *International Journal of Finance & Economics* 93.

liabilities are more likely to lead to FC defaults.[15] Beers, Jones, and Walsh report that LC defaults are less frequent than foreign currency defaults and tend to reflect specific, isolated issues rather than widespread financial distress.[16] Panizza and Taddei argue that a higher share of LC debt does not increase the moral hazard problem, except in countries with weak institutions.[17]

Sovereign rating agencies have also recognised that LC defaults, while less common, are still possible. A report by Fitch highlights that while high inflation can reduce real debt burdens, this effect may be short-lived and politically costly if governments borrow primarily on short-term maturities and run persistent primary deficits.[18] As a result, governments may occasionally choose to default on LC debt as the least damaging option. Nonetheless, the authors conclude that LC defaults remain much less common, which is why LC credit ratings tend to be equal to or better than foreign currency ratings. This rating gap is often 'justified by the sovereign's ability to tax and appropriate domestic currency assets', as well as its capacity to 'print money to meet domestic currency obligations'.[19]

2.1. Credit ratings by currency

We first examine credit ratings as a measure of sovereign credit risk. Data from the three major credit rating agencies—Fitch, Moody's, and S&P—are collected and the latest average values are presented in Figure 2 and Figure 3.

[15] A Jeanneret and S Souissi, 'Sovereign Defaults by Currency Denomination' (2016) 60 Journal of International Money and Finance 197.

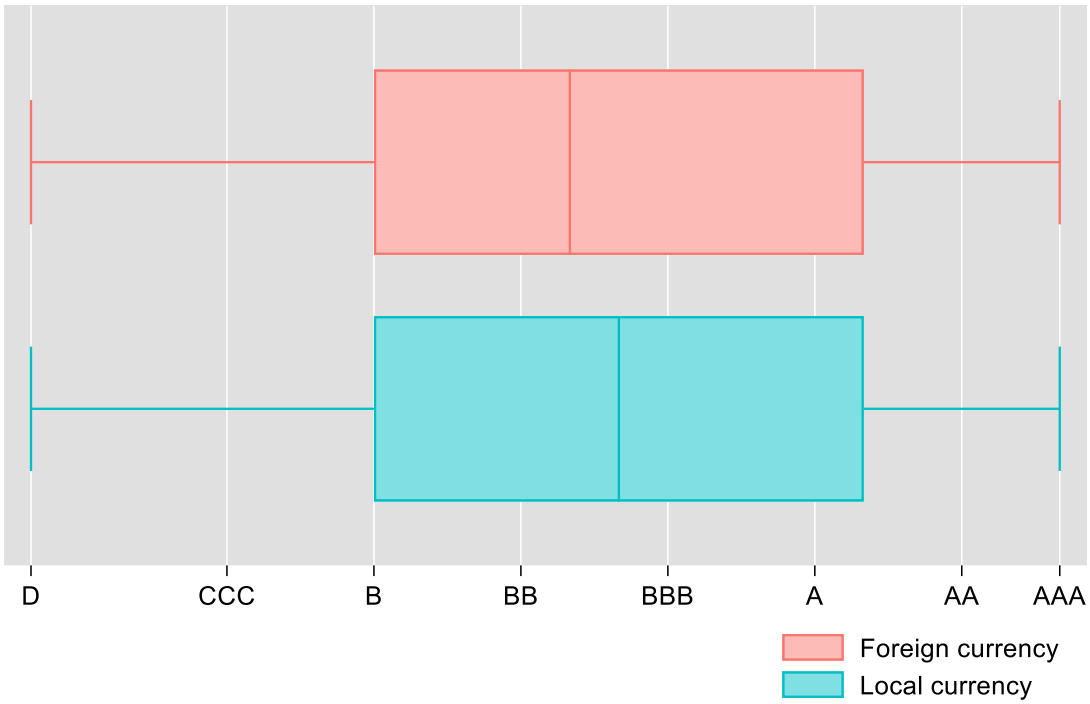
[16] D Beers, E Jones and J Walsh, 'Special Topic: How Frequently Do Sovereigns Default on Local Currency Debt?' (2020) *Bank of England* and *Bank of Canada* No. 2020–13.

[17] U Panizza and F Taddei, 'Local Currency Denominated Sovereign Loans – A Portfolio Approach to Tackle Moral Hazard and Provide Insurance' (2020) IHEID Working Paper 09-2020, Economics Section, The Graduate Institute of International Studies.

[18] E Parker and D Riley, 'Why Sovereigns Can Default on Local-Currency Debt' (2013) *Fitch Ratings Special Report*.

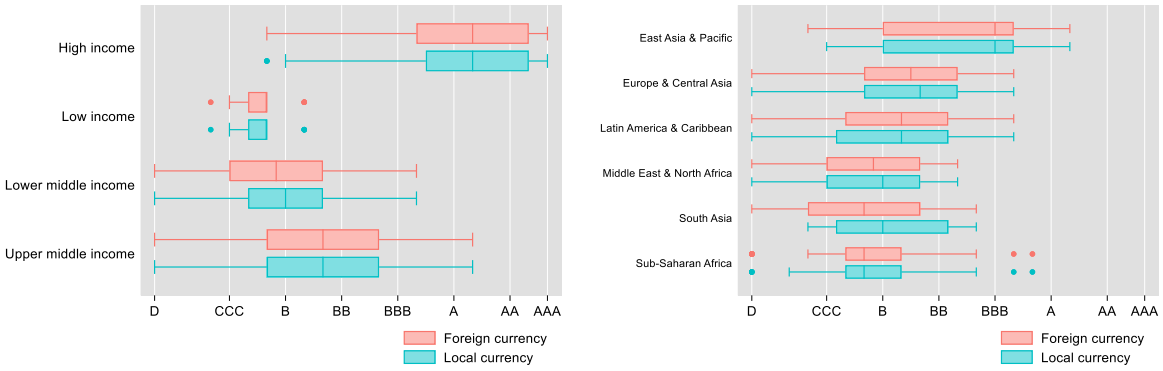
[19] ibid, 57.

Figure 2 Sovereign credit ratings by currency



Note: The figure shows the latest ratings for each country in foreign and local currency, calculated as an average of the ratings from Fitch, Moody's, and S&P. Data is current as of July 2024. The boxes represent the median and interquartile range, while the whiskers indicate the minimum and maximum values.

Figure 3 Sovereign credit ratings by currency, country group and region



Note: This figure illustrates the latest credit ratings for each country in foreign and local currency, averaged across Fitch, Moody's, and S&P. Data for regions excludes high-income countries and is current as of July 2024. The boxes show the median and interquartile range, whiskers show the minimum and maximum, and dots represent outliers—values that exceed 1.5 times the interquartile range from the median.

Credit rating data reveal no significant differences between sovereign ratings in local and foreign currencies, although a slight advantage is observed for LC ratings overall. Notably, in lower-middle-income countries, LC ratings are higher on average. In no region are FC ratings higher

than LC ratings, with a particularly pronounced positive gap in South Asia, Europe, and Central Asia. Similarly, most emerging market corporations have similar ratings in both LC and FC (Table 1). In about 10% of cases, a gap in favour of LC debt can be observed. Overall, credit ratings suggest that exposure to local currency debt does not increase credit risk exposure.

Table 1 Fitch credit ratings for emerging market corporates

Rating in foreign vs local currency	Count	Percentage
Same rating	494	90%
Local currency one notch above	48	9%
Local currency two or more notches above	8	1%
Total	**550**	100%

Source: Fitch as of 20/06/2024

2.2. Sovereign defaults

Is this perceived risk of default consistent with historical evidence? We combine data from various sources on sovereign debt defaults to provide an overview. Our primary source for LC debt default events is the dataset by Erce, Mallucci, and Picarelli.[20] This dataset tracks defaults and restructuring events between governments and private creditors on a monthly basis for instruments issued under domestic law, covering 134 sovereign defaults in 52 countries between 1980 and 2018. Unlike other datasets, [21] this one distinguishes between LC and FC debt defaults.[22]

We complement this data with information from Horn, Reinhart, and Trebesch, who compile data from several sources on sovereign defaults under foreign law with both Paris Clun and external private creditors.[23] Additionally, we use the dataset by Beers, Bhullar, and Nystrand, which offers a comprehensive view of sovereign defaults over time, including details about domestic LC debt defaults.[24] As a result, our analysis combines data on default events in LC and

[20] Erce, Mallucci and MO Picarelli (n 5).

[21] Reinhart and Rogoff (n 7); Asonuma and Trebesch (n 9).

[22] We thank the authors for sharing this data with us.

[23] Horn, Reinhart and Trebesch (n 5).

[24] Beers, Bhullar, and Nystrand (n 5). Unlike the other datasets considered, however, it does not include data for discrete default events.

FC from Erce, Mallucci, and Picarelli,[25] as well as Horn, Reinhart, and Trebesch,[26] with default amounts from Beers, Bhullar, and Nystrand.[27]

Despite being comprehensive, the data have some limitations. First, we assume that defaults under foreign law with foreign creditors are denominated in FC.[28] Second, our analysis lacks data on defaults involving only multilateral creditors. However, defaults involving *only* multilateral creditors are unlikely. According Beers, Bhullar, and Nystrand, only three countries (Haiti, Samoa, and Syria) have defaulted on debts owed exclusively to multilateral creditors,[29] making it unlikely that our figures underestimate the total number of defaults.

Using these datasets, we find that LC defaults are much less common than FC defaults (Table 2). Between 1990 and 2021, there were 72 LC debt defaults compared to 445 FC defaults. LC defaults also involved fewer countries—34 countries defaulted on LC debt, compared to 109 for FC debt.

We calculate default rates using the cohort method on a yearly basis, by taking the ratio of the number of countries defaulting (either in LC or FC) in a given year to the number of countries with public debt in the previous year.[30] This calculation is done separately for LC and FC. The results show that default rates on LC debt are significantly lower than on FC debt—around 1% compared to approximately 10%.

Table 2 Sample statistics about sovereign defaults

	Foreign Currency	**Local currency**
Number of events	445	72
Number of country defaults	109	34
Average default rate	10%	1.2%
Share of events involving face value reduction	30.8%	28.3%

[25] Erce, Mallucci and Picarelli (n 5).

[26] Horn, Reinhart and Trebesch (n 5).

[27] Beers, Bhullar, and Nystrand (n 5).

[28] This is unlikely to be a significant problem for our dataset: Erce, Mallucci, and Picarelli report excluding only one local currency under foreign law default event from their dataset. See Erce, Mallucci and Picarelli (n 5).

[29] Beers, Bhullar, and Nystrand (n 5).

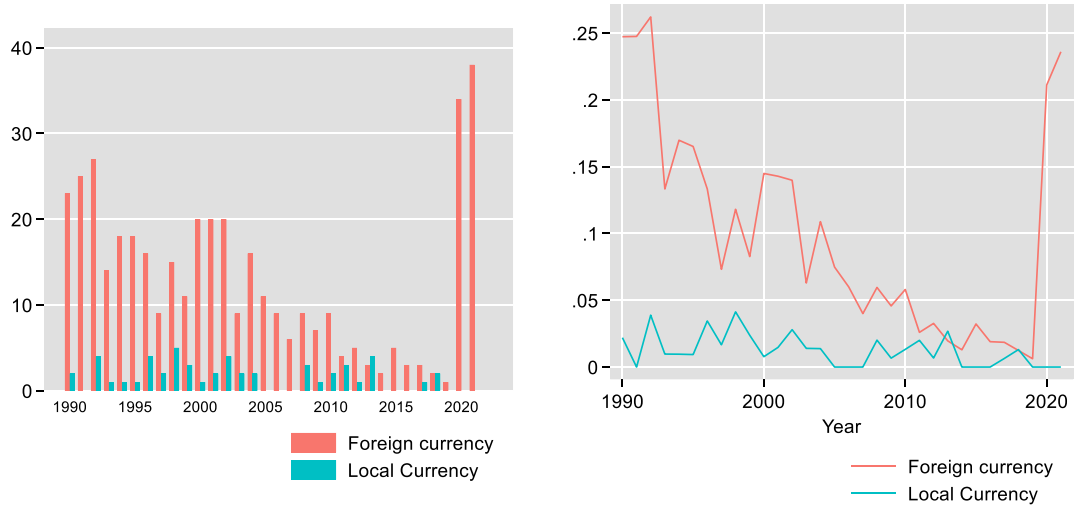
[30] European Investment Bank, *Default Statistics: Sovereign and Sovereign Guaranteed Lending 1994-2022* (n 3). The underlying idea is that the relevant 'cohort' is any country with public debt in the previous year, as this implies payments (due to servicing or repayment) in the current year.

Median amounts in default to total public debt	6.9%	5.4%

Source: Authors calculations based on S Arslanalp and T Tsuda, 'Tracking Global Demand for Emerging Market Sovereign Debt' (2014) IMF Working Paper No 14/39; D Beers, E Jones and J Walsh, 'Special Topic: How Frequently Do Sovereigns Default on Local Currency Debt?' (2020) *Bank of England* and *Bank of Canada* No. 2020–13; S Horn, CM Reinhart and C Trebesch, 'Hidden Defaults' (2022) 112 AEA Papers and Proceedings 531; and A Erce, E Mallucci and MO Picarelli, 'A Journey in the History of Sovereign Defaults on Domestic-Law Public Debt' (2022) *European Stability Mechanism Working Paper*.

Figure 4 and Figure 5 lustrate that over the last 30 years, LC defaults have consistently been less common than foreign currency defaults, with the exception of 2013. Foreign currency defaults have steadily declined, although there was a spike during the COVID-19 pandemic, likely due to the Debt Service Suspension Initiative, which involved many low-income countries (LICs).[31] Africa has experienced the majority of FC defaults, while Latin America has seen most LC defaults.

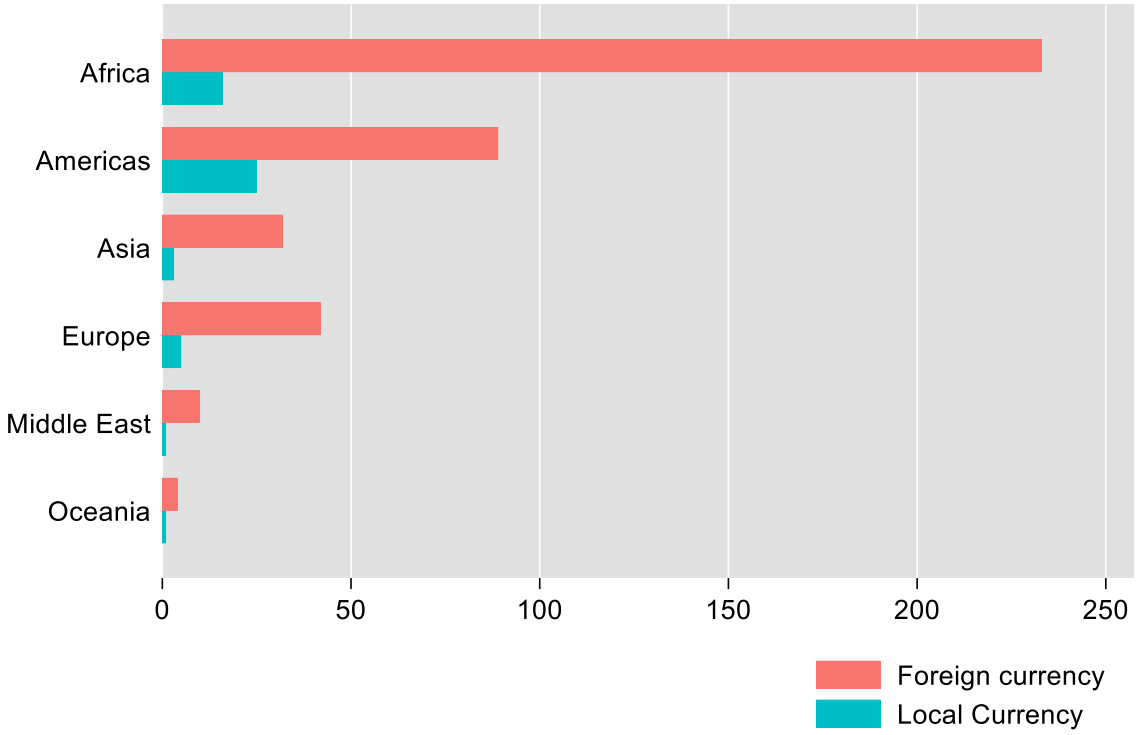
Figure 4 Default numbers and rates



Source: Authors calculations based on . The left panel shows the number of countries defaulting on a yearly basis, and the right panel shows the default rate, calculated as defined.

[31] For an updated list of countries, see World Bank, 'COVID-19: Debt Service Suspension Initiative' (World Bank, 2023) https://www.worldbank.org/en/topic/debt/brief/covid-19-debt-service-suspension-initiative accessed 13 October 2024.

Figure 5 Number of defaults by region



Source: Authors calculations based on S Arslanalp and T Tsuda, 'Tracking Global Demand for Emerging Market Sovereign Debt' (2014) IMF Working Paper No 14/39; A Erce, E Mallucci and MO Picarelli, 'A Journey in the History of Sovereign Defaults on Domestic-Law Public Debt' (2022) European Stability Mechanism Working Paper; and S Horn, CM Reinhart and C Trebesch, 'Hidden Defaults' (2022) 112 AEA Papers and Proceedings 531. The left panel shows the number of countries defaulting on a yearly basis, and the right panel shows the default rate, calculated as defined.

2.3. Characteristics of defaults by currency

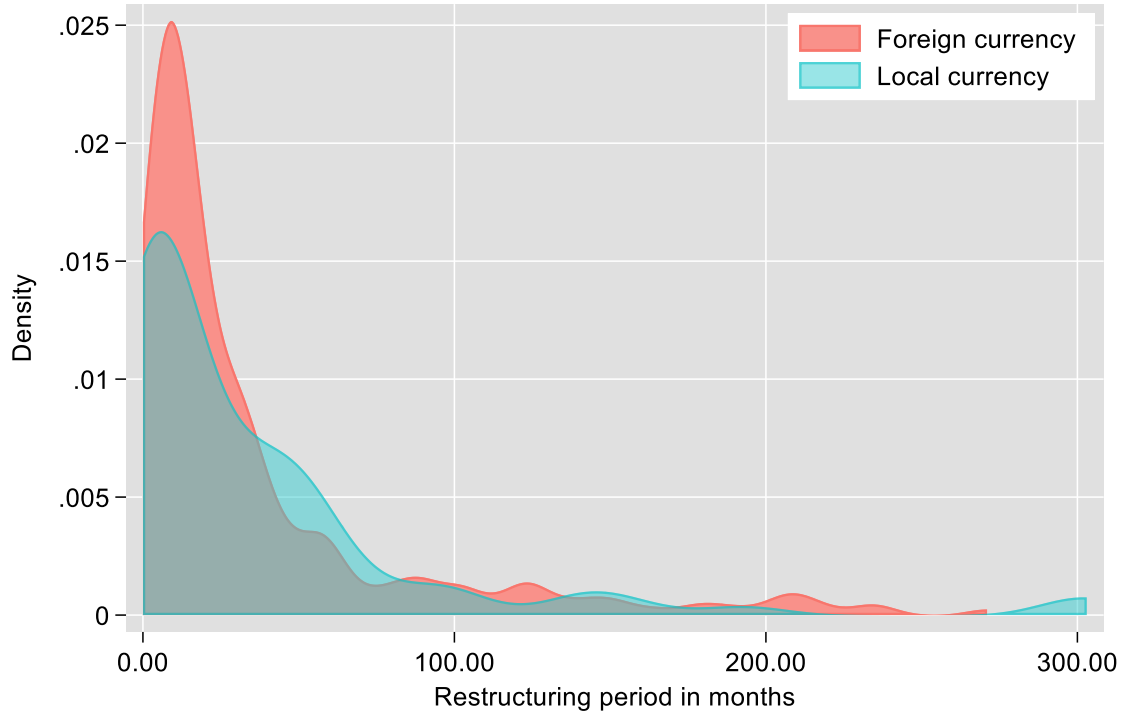
LC defaults exhibit some differences compared to foreign currency defaults. First, a slightly lower proportion of LC defaults involve face value reductions.[32] While haircut values (i.e., the net present value loss from restructuring) are not included in our dataset, other studies indicate that haircuts for domestic-law debt tend to be slightly higher on average.[33] Second, foreign currency defaults generally take longer to resolve, with a median duration of 16 months compared to 12 months for LC defaults. Long restructurings are rare but are slightly more common for foreign currency defaults lasting more than five years, as shown in Figure 6. This may be due to the complexities of restructuring external debt involving multiple creditors under

[32] Restructuring can take various forms, including face value reductions, and changes to maturity or coupon terms.

[33] Erce, Mallucci and Picarelli (n 5).

foreign law. The longest restructuring in our dataset is a LC default that took over 25 years (Peru, 1992).

Figure 6 Distribution of default events by duration

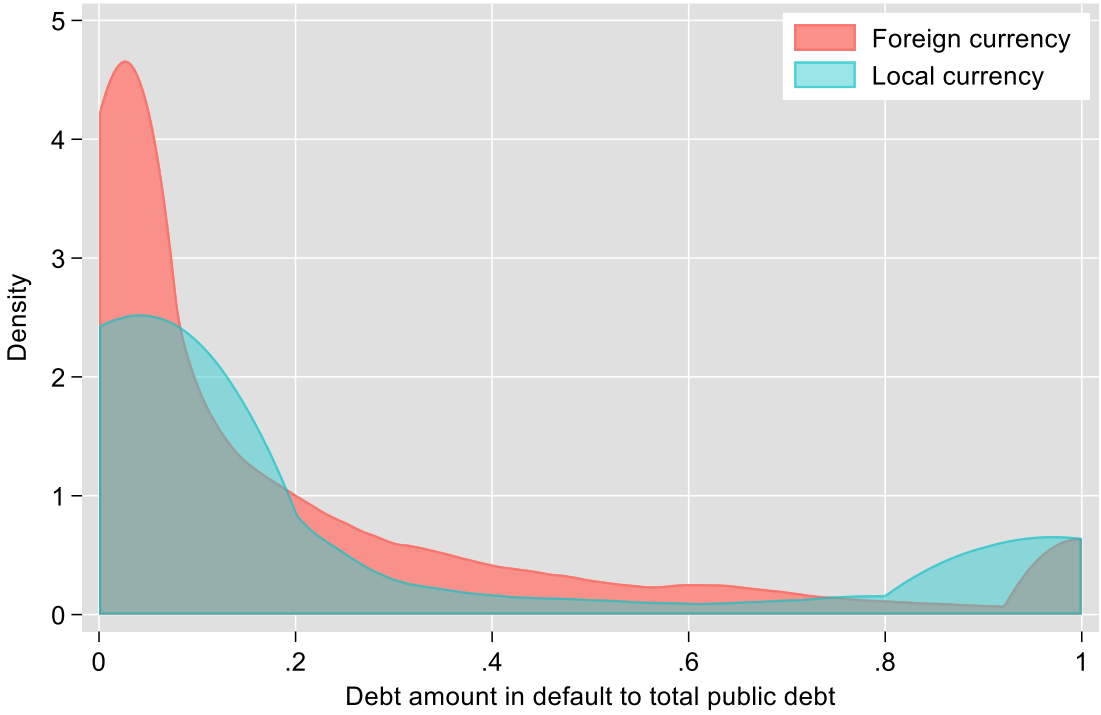


Source: authors' calculations based on S Horn, CM Reinhart and C Trebesch, 'Hidden Defaults' (2022) 112 AEA Papers and Proceedings 531; and A Erce, E Mallucci and MO Picarelli, 'Sovereign Defaults at Home and Abroad' (2024) European Stability Mechanism Working Paper. Kernel density plots estimated with the Epanechnikov kernel function, with a Bandwith chosen through the Silverman method.

In absolute terms, the amounts in default for LC debt are smaller, partly because LMICs tend to have lower levels of public debt. Even relative to the total amount of debt outstanding, LC default amounts tend to be lower, with a median of 5.4% compared to 6.9% for FC defaults (Table 2). Looking at the distribution, FC default amounts are higher across most of the distribution.[34]

[34] However, there is scope for tail events where the total amount of debt outstanding is in default. This likely reflects data limitations regarding public debt outstanding by currency, which may be underestimated. In a few instances, the amounts in default exceeded the reported total outstanding debt, with values higher than 100%, indicating underreporting of the latter. These values have been capped at 100%.

Figure 7 Distribution of amounts in default to public debt outstanding



Source: Authors' calculations based on S Arslanalp and T Tsuda, 'Tracking Global Demand for Emerging Market Sovereign Debt' (2014) *IMF Working Paper* No. 14/39; and D Beers, E Jones and J Walsh, 'Special Topic: How Frequently Do Sovereigns Default on Local Currency Debt?' (2020) *Bank of England* and *Bank of Canada* No. 2020–13. The figures show the distribution of amounts in default scaled by total public debt outstanding. Kernel density plots estimated with the Epanechnikov kernel function, with a Bandwith chosen through the Silverman method.

Figure 7 presents the distribution of default amounts as a proportion of total public debt outstanding. Overall, the evidence shows that LC defaults, while less frequent, are significant in terms of their relative size and duration. However, the smaller sums involved, and their lower frequency suggest that credit ratings may underestimate the gap between local and foreign currency default risks.

3. Currency risk and credit rating agencies' assessments of MDBs' capital adequacy

MDBs have low exposure to local currency financing due to their aversion to currency risk, driven by the need to protect their capital, satisfy shareholders, and maintain their high credit ratings from Credit Rating Agencies (CRAs). The previous section demonstrated that the actual default risk of local currency (LC) debt is lower than that of foreign currency debt, which is reflected in CRAs' equal or slightly better ratings for LC sovereign debt. This section examines

how a larger exposure of MDBs to LC debt might impact their credit ratings, particularly in relation to capital adequacy.

As indicated in the *Independent Review of Multilateral Development Banks' Capital Adequacy Frameworks (CAF)* report, MDBs are not regulated like conventional banks under Basel rules; instead, they rely on their own internal ratings.[35] Furthermore, MDBs benefit from preferred creditor status, which means their exposure to credit risk differs fundamentally from other banks. In practice, MDBs heavily rely on the methodologies and ratings provided by CRAs, making those institutions' assessments crucial for MDB asset allocation and risk management. For many MDBs, maintaining AAA ratings from CRAs is an explicit goal, which reduces their risk tolerance and limits the financing available to many borrowers. As the G20 CAF report highlights, no other type of financial institution achieves this rating, except for a few state-backed ones.

In principle, given CRAs' equal or better ratings for local currency debt compared to foreign currency debt, a higher exposure to LC debt by MDBs should not negatively affect their ratings—and could potentially improve them. However, LC debt carries additional risks, such as exchange rate and convertibility risks, which might influence CRAs' assessments. This section will explore the potential implications of increased MDB exposure to LC sovereign debt on their credit ratings, based on existing frameworks and assessments. This highlights the need for more comprehensive data on MDBs' credit risk exposure.

To examine various aspects of the relationship between MDBs' LC exposure and their credit ratings, Section 3.1. introduces the general CRA rating criteria for MDBs. It explores how relevant LC financing exposure and currency risk are to CRAs' assessment criteria. The analysis shows that the main factor driving CRAs' ratings of MDBs is capital adequacy, for which LC financing exposure and currency risk are not primary considerations. Currency risk is a secondary consideration, assessed within broader market risk metrics and the qualitative evaluation of MDBs' hedging practices. As mentioned earlier, because borrowers generally have equal or better credit ratings in LC than in foreign currency, higher local currency financing exposure might improve MDBs' balance sheets from a credit risk perspective. The potential negative impact of LC exposure may arise from unhedged positions in the context of market risk considerations.

Building on this, Section 3.2 explores how currency depreciation affects MDBs' capital adequacy and credit ratings when MDBs lend in LC. The findings suggest that, with full currency hedging, depreciation of the risky asset would reduce the MDB's nominal exposure to that asset, improving the risk-weighted capital ratio. The reduction in risk-weighted assets is more significant when LC financing makes up a larger share of the MDBs' portfolio. If the MDB has

[35] Capital Adequacy Frameworks Panel, *Boosting MDBs' Investing Capacity: An Independent Review of Multilateral Development Banks' Capital Adequacy Frameworks* (2022).

only a partially hedged position, depreciation would reduce risk-weighted assets but also lower the level of capital. In this case, the overall effect on the risk-weighted capital ratio depends on the level of currency hedging, the share of LC financing in the total portfolio, and the initial capital ratio. These factors will determine whether the effect is positive or negative. Additionally, even if depreciation leads to a negative net effect on capital levels due to unhedged currency exposure, this may be offset over time by increased internal capital generation (profitability) from these currency exposures, given the average returns of these positions.

Finally, to fully assess the impact of LC financing on MDBs' capital adequacy, it is important to consider the potential co-movement between CRAs' credit ratings of MDB borrowers and exchange rates. If credit downgrades lead to significant currency depreciations, the negative impact of a credit rating downgrade on MDBs' portfolios could be offset by the positive valuation effect of LC exposure, as discussed above. In line with this, Section 3.3 examines the empirical relationship between exchange rates and sovereign credit ratings, and later analyses how depreciations and borrowers' credit rating downgrades affect MDBs' capital adequacy. The empirical analysis suggests that there is no systemic relationship between exchange rate depreciations and credit downgrades. However, even when downgrades and depreciations occur simultaneously, increased LC financing exposure will not result in a more severe deterioration of MDBs' ratings. This is because downgrades typically occur in both foreign and local currency. In such scenarios, while the value of risk-weighted assets may be negatively affected by the downgrade, the impact on LC positions will not be more severe.

3.1. Credit rating agencies' assessments of MDBs' capital adequacy

The three main Credit Rating Agencies (CRAs)—Moody's, Fitch, and S&P—share similar assessment criteria for rating MDBs. These ratings are based on two elements: the MDB's Standalone Credit Profile, which primarily relates to the entity's past and expected performance, and the support (and other additional considerations) the MDB might receive from its shareholders, such as callable capital, guarantees, or other support commitments. The Standalone Credit Profile is in turn based on an assessment of capital adequacy,[36] liquidity, operating governance, and the business environment, including risks associated with institutional strategy and the countries in which the MDB operates.[37]

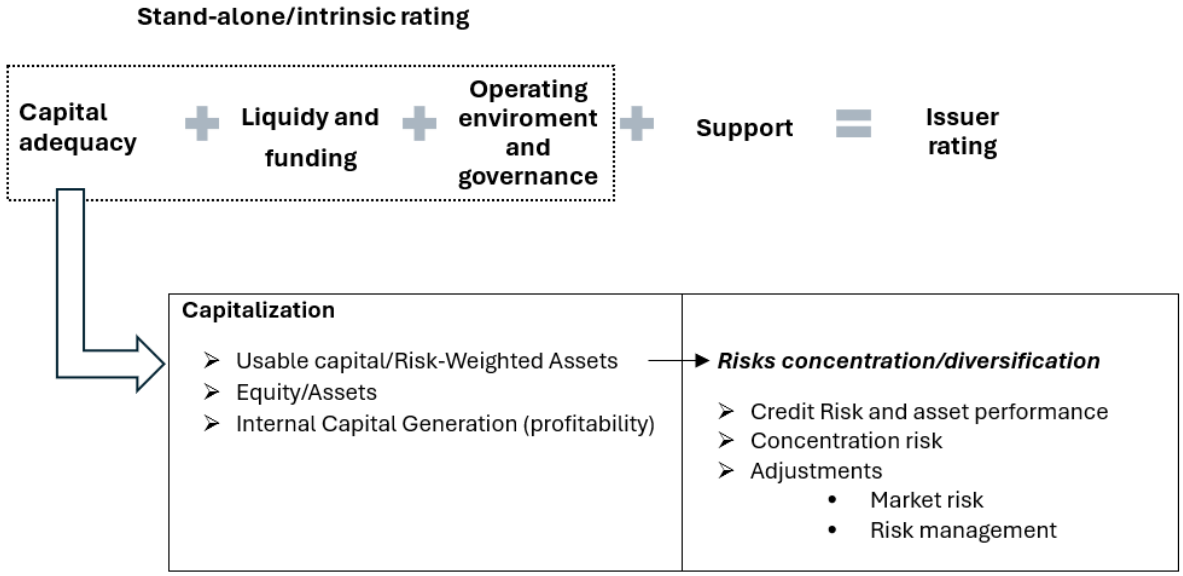
[36] The capital adequacy assessment evaluates the institution's capacity to absorb losses through its capital position without impairing its ability to meet liabilities. In turn, the liquidity assessment examines how effectively MDBs manage their liquid assets and funding structure to meet short-term obligations and maintain operational flexibility.

[37] To assess business profile risks, CRAs typically consider factors such as the size and quality of the banking portfolio, governance and strategy risks, non-sovereign sector financing, and the significance of the public mandate. For the operating environment, they evaluate the credit quality, income per capita, and political risks of the countries where the MDB operates, along with the political risks associated with the head office and the operational support from member states.

The capital adequacy assessment focuses on the MDB's level of capitalisation (capital ratios) and risk exposures (credit risk, concentration risk, market risk, and internal risk management policies). Currency exposures, as will be explained in detail later, are factored into CRAs' assessments indirectly through credit risk and directly through market risk and risk management practices.

Figure 8 presents a simplified overview of the rating criteria used by the main CRAs, focusing on key indicators in the capital adequacy assessment.[38] The capital adequacy analysis is broadly similar across the CRAs and is based on three main indicators: 1) a credit risk measure, which calculates usable capital relative to risk-weighted assets (primarily based on the ratings of the MDB's borrowers); 2) the equity-to-assets ratio; and 3) internal capital generation (profitability). As will be discussed later, the most complex and significant aspect of the CRAs' assessments is the calculation of risk-weighted assets, which considers factors like risk concentration and diversification. This includes two key elements: (a) credit and concentration risk, and (b) additional risks not included in the ratios, such as market risks and risk management considerations, which may lead to adjustments in the final assessment.

Figure 8 Credit Rating Agencies criteria for MDBs



Source: own elaboration based on Fitch Ratings, Moody's Investors Service and S&P Global Ratings.

While the internal capital generation (profitability) and unweighted equity-to-assets ratios are relatively straightforward, the risk-weighted capital ratio and associated risk exposure analysis

[38] Moody's IS, *Multilateral Development Banks and Other Supranational Entities Methodology* (2020); Fitch, *Supranationals Rating Criteria* (2023); S&P GR, *Multilateral Lending Institutions and Other Supranational Institutions Ratings Methodology* (2023).

are more complex and could be affected by larger exposure to LC financing. This analysis is based on a qualitative assessment of the MDB's portfolio, including credit risk and concentration risks. Additionally, as will be explored later, market risks and risk management considerations are included as adjustments to the rating outcome, affecting both the sub-rating for the risk-weighted capital ratio and the overall capital adequacy rating.

The first element, credit risk and asset performance, is based on a weighted average of loan exposures, with weights determined by the CRA ratings of the MDB's borrowers. Weights are applied to treasuries, loans, and guarantees according to their rating category (adjusted for PCS and other mitigants).[39] For unrated borrowers, the rating committees usually assess the average credit risk of the borrower, and Fitch may use external ratings from other sources. In cases where no information is available, CRAs typically assume a very weak credit quality for the borrower (e.g., CCC, Caa1, or B+ for Fitch, Moody's, and S&P, respectively). Within capital adequacy assessments, the risk-weighted assets measure plays a critical role. For example, Fitch Ratings reports that almost half of the capital constraints for rated MDBs are explained by the capital-to-risk-weighted assets ratio (FRA), rather than the unweighted capital ratio.

Currently, CRAs do not mention currency denomination as a significant factor in their credit quality assessments. Only S&P notes that for risk weights for sovereign, regional, and local authorities, they generally use the foreign currency credit rating of the sovereign. They use the LC rating only when they know the amount of domestic securities issued in LC by a central government in the MDB's portfolio. As discussed earlier, sovereign LC ratings are equal to or slightly higher than FC ratings. Therefore, from a credit risk perspective, higher LC exposure in MDB portfolios could have a neutral or positive effect on their rating assessments. Additionally, the limited impact of convertibility risk on risk assessments is not considered a significant risk factor for LC financing. Fitch also notes that MDBs with large exposures to private sector borrowers may receive a higher rating (+1) in this category due to the PCS, which has historically provided exemptions from FC restrictions. Fitch excludes from liquid assets any deposits in banks and securities denominated in non-convertible currencies, except when loans and capital are also denominated in the same currency.

The second main factor CRAs assess in relation to risk-weighted capital ratios is concentration risk, including borrower, geography, and sector concentration, as well as single-counterparty concentration, which tends to be higher for MDBs than for commercial banks. Fitch measures concentration risk by the ratio of the five largest exposures relative to the total banking portfolio. S&P's concentration adjustments are based on assumed correlations across sectors, geographies, and business lines, with penalties for single-sovereign concentration. Moody's adjusts its Development Asset Credit Quality indicator for high single-name exposures (or a limited number of entities), potentially incorporating sector and country concentration based

[39] Fitch Ratings focuses on the MDB's banking portfolio, while treasury portfolio is part of the liquidity analysis.

on the Herfindahl-Hirschman Index. Again, currency exposure is not mentioned as a factor in the CRAs' concentration risk assessments.

CRAs also make small adjustments to the value of capital before adjusting assets to calculate capital adequacy. Fitch's usable capital-to-risk-weighted assets ratio includes shareholders' equity plus 10% of callable capital from 'AAA'/'AA' shareholders.[40] More relevant to this report, S&P deducts paid-in capital contributions made by MDB members in non-convertible or hard-to-convert currencies when calculating their Total Adjusted Capital (TAC) measure. However, S&P also states that they may include these LC contributions if the MDB has significant financing in the same currency. Therefore, an increase in LC financing, coupled with capital contributions in that currency, would not negatively affect capital measures for this CRA.

Besides the two main elements of credit quality and concentration risks, CRAs also adjust risk-weighted positions based on market risks. This is where currency risks are directly mentioned as one of the main market risks considered, along with interest rate risks. However, market risks—particularly currency market risk—play a minor role in CRAs' capital adequacy assessment criteria for MDBs, as these entities typically do not engage in market activities and maintain small treasury portfolios compared to their large banking portfolios. Only difficult-to-hedge currency or interest rate exposures are considered within this analysis.[41] The assessment of these risks is generally based on the MDBs' exposure data (including internally authorised limits for these exposures), along with qualitative considerations, such as market uncertainty and volatility.[42]

For instance, Fitch Ratings measures currency mismatches relative to the MDB's shareholder equity, accounting for hedging techniques and the historical profit and loss volatility of these positions. S&P adjusts RWA ratios for additional risks, including currency risk, through stress testing based on the MDBs' hedging policy.[43] As a result, larger unhedged LC financing exposures could increase the role of market risk in these assessments, while hedged positions would have a minimal impact. In the case of partially unhedged LC financing exposures, both credit risk and internal capital generation should be considered, as these positions tend to generate higher returns. Additionally, as discussed earlier, CRAs may adjust capital levels based on the currency in which shareholder contributions are made. Capital contributions in the

[40] During 2023, Fitch Ratings started contemplating some changes in their criteria, including increasing the weight of usable capital in the FRA ratio, making this ratio the main anchor of the MDB's capitalisation assessment.

[41] This is relevant for MDBs financing borrowers in emerging markets, where the currencies have a lower presence and liquidity in derivative markets such as swaps. As a result, hedging instruments may be difficult or costly to obtain.

[42] We know very little how these qualitative considerations are formed.

[43] The CRAs' assessment criteria provide limited detail on how they evaluate these policies.

borrower's LC are considered part of the capital measure if the MDB holds assets in that currency.

In conclusion, currency risk exposure is not a primary driver in the main CRAs' rating criteria, even for hard currency exposures (e.g., US dollar financing by Euro-based MDBs). The limited focus on currency risk may be due to the low current LC exposure among MDBs, which makes it a low-risk factor. However, CRAs' methodologies are not designed to change frequently in response to evolving business models of MDBs. Therefore, increased LC financing exposure is unlikely to affect rating assessments in the short term.

Moreover, despite varying levels of LC exposure among MDBs, currency exposure does not appear to drive differences in MDBs' credit ratings in CRA reports. If currency risk were a major factor in these ratings, it would be frequently mentioned in reports for MDBs with higher LC financing exposure, which is not the case. This suggests that while MDBs' LC financing is not a significant concern for CRAs, these agencies may also fail to acknowledge the lower credit risk associated with these instruments, as explored in the previous section.

Although LC financing does not directly affect credit ratings—and may even improve MDBs' balance sheets from a credit risk perspective—there may still be indirect and dynamic effects from increased LC exposure on MDBs' risk-weighted assets if exchange rates depreciate. The following section explores how capital adequacy ratios respond to currency depreciation when MDBs have LC financing exposure, taking into account different levels of hedging.

3.2. Capital adequacy and borrowers' exchange rates

Based on CRAs' methodologies, it can be assumed that a larger exposure of MDBs to LC financing could reduce the value of risk-weighted assets, as MDB borrowers' credit ratings in LC tend to be equal to or better than in foreign currency. Unhedged LC positions, however, can increase market risks and reduce the value of MDBs' equity, which also affects CRAs' capital adequacy assessments. The impact of unhedged positions should be analysed together with their effect on internal capital generation, i.e., the relative returns of these assets compared to foreign currency positions. This section further explores these effects, focusing on the dynamic changes in MDBs' capital adequacy once currency risk has materialised—after a depreciation. First, we explore the effect of an exchange rate depreciation on MDBs' risk-weighted assets, and then on their risk-weighted capital ratio, which is the main driver of their capital adequacy assessment, as discussed above.

3.2.1. Risk-weighted assets

As previously described, CRAs' assessments of MDBs' capitalisation are strongly influenced by their measures of risk-weighted assets, which are based on the ratings of MDBs' borrowers. A

simple way to illustrate how currency risk affects this measure is to define the risk-weighted asset value of an MDB's portfolio as:

$$RWA = \frac{A^{LC}}{FX} * \omega^{LC} + A^{HC} * \omega^{HC} \quad (1)$$

Here, the risk-weighted value of the financing A in the LC of the borrower LC depends on the value of the asset measured in the MDB's hard currency using the exchange rate FX between these local and hard currencies. It also depends on the risk-weight ω^{LC}, which is based on the LC credit rating of the borrowers (and their countries) provided by a rating agency. Lower credit ratings imply higher risk weights. Similarly, the risk-weighted value of the financing in hard currency HC depends on the risk-weight ω^{HC}, which is based on the FC credit rating of the borrowers. Since this position is already denominated in hard currency, the exchange rate does not directly affect this measure.

It is straightforward to show that a depreciation of the LC (an increase in the value of FX) reduces the value of the risk-weighted assets measured in hard currency:

$$\downarrow RWA = \frac{A^{LC}}{\uparrow FX} * \omega^{LC} + A^{HC} * \omega^{HC} \quad (2)$$

3.2.2. Risk-weighted capital ratio

To analyse how this impacts the risk-weighted capital ratios, we need to consider how currency exposures affect the MDBs' capital. This ratio compares the measure of capital E to the risk-weighted assets described above:

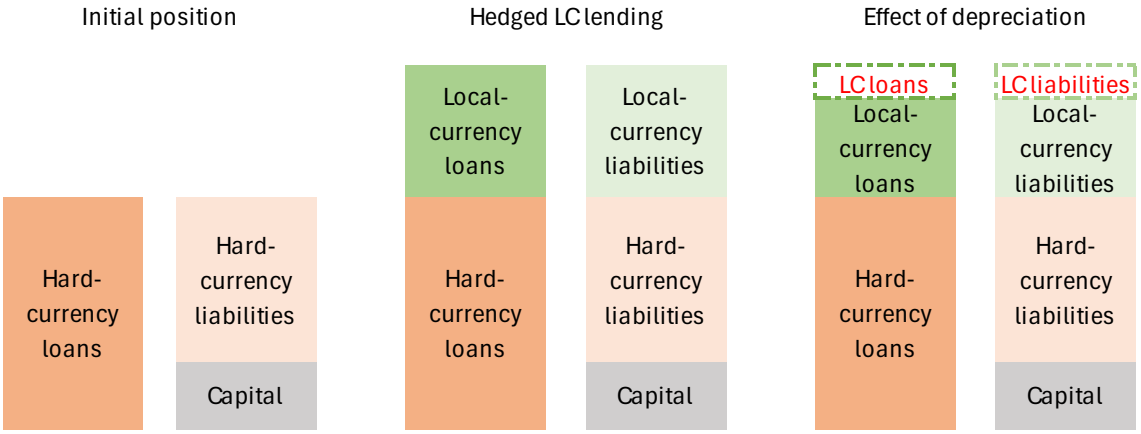
$$\frac{E}{RWA} = \frac{A - L}{RWA} \quad (3)$$

Simplifying the measure of capital as the difference between total assets and liabilities allows us to focus on the effect of exchange rate variations on these two components. In this decomposition, a depreciation reduces the value of total assets through the valuation effect. However, the impact on capital will depend on the denomination of liabilities, which can also be affected by exchange rate movements:

$$\frac{E}{RWA} = \frac{\frac{A^{LC}}{FX} + A^{HC} - \frac{L^{LC}}{FX} - L^{HC}}{\frac{A^{LC}}{FX} * \omega^{LC} + A^{HC} * \omega^{HC}} \quad (4)$$

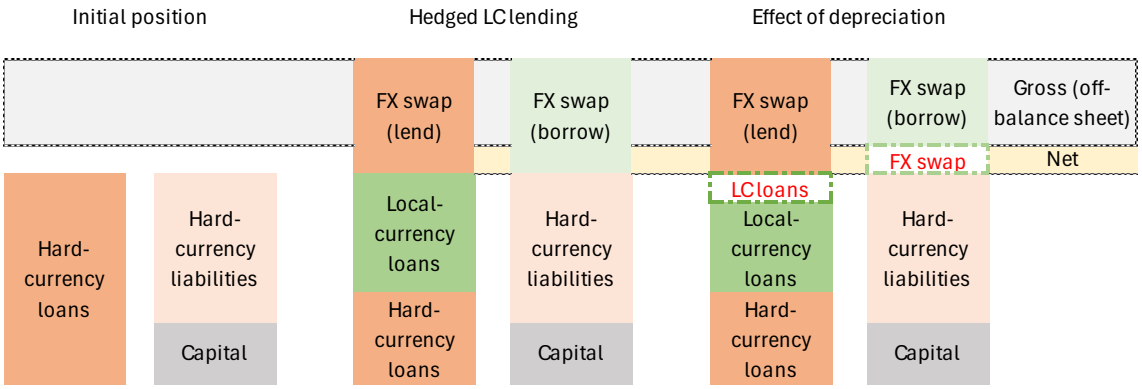
Typically, MDBs hedge most currency mismatches using various instruments. For instance, a depreciation that reduces the value of assets will also reduce the value of MDBs' LC liabilities used to hedge currency risk:

Figure 9 MDB balance sheet



If the hedging instrument is a foreign exchange (FX) swap, the effect is the same, but the accounting is more complex. Since only a portion (the net replacement value) of the FX swap is recorded on the balance sheet, the rest of the gross position (and the currency matching) is not observable. However, exchange rate gains/losses are recorded on the balance sheet.[44] Therefore, the effect on capital is null:

Figure 10 MDB balance sheet with FX swaps hedging



In this scenario, if the MDB has no currency mismatches, the depreciation will have no effect on capital levels. In such cases, the impact of an exchange rate movement on the risk-weighted

[44] BB Barkbu and LL Ong, 'FX Swaps: Implications for Financial and Economic Stability' (IMF Working Paper WP/10/55, March 2010).

capital ratio will depend solely on the dynamics of the risk-weighted assets. The risk-weighted assets experience larger reductions when the LC financing share in MDB portfolios is higher.

If the MDB only has a partial hedge, the positive effect on the ratio from the depreciation of risk-weighted assets will be offset by the negative effect on capital. The net effect will depend on the level of currency hedging, the share of LC financing in the total portfolio, and the current gap between risk weights for local and hard currency:

$$\downarrow\uparrow \frac{\downarrow E}{\downarrow\downarrow RWA} = \frac{\frac{A^{LC}}{\uparrow FX} + A^{HC} - \frac{L^{LC}}{\uparrow FX} - L^{HC}}{\frac{A^{LC}}{\uparrow FX} * \omega^{LC} + A^{HC} * \omega^{HC}} \tag{5}$$

To clarify the conditions under which the risk-weighted capital ratio decreases after a depreciation, we define the LC exposure as a ratio of equity $m = (A^{LC} - L^{LC})/E$ and the ratio of LC assets to total assets as $w = A^{LC}/A$. Using these ratios, the risk-weighted capital ratio will decrease after a depreciation if the unhedged currency exposure to equity ratio is less than the share of LC assets over total assets, adjusted for the risk-weight differential between assets in different currencies:

$$m < \frac{w\omega^{LC}}{\omega^{HC} + \mathrm{w} * (\omega^{LC} - \omega^{HC})} \tag{6}$$

If we assume that the risk weights are equal for both currencies, which is often the case, this condition simplifies to:

$$m < \mathrm{w} \tag{7}$$

Therefore, if the initial LC exposure as a ratio of capital is smaller than the initial share of LC assets over total assets, depreciation improves the risk-weighted capital ratio. The appendix provides a detailed derivation of this result.

An important consideration when discussing unhedged positions is to account for not only the effects of risk realisations (such as currency depreciations) but also the average dynamics of exchange rates. Excess returns in lower-income economies tend to be positive on average. While tail risks exist and can be significant, MDBs' countercyclical mandates suggest that these institutions should not be driven by excessive risk aversion. In this context, if unhedged LC financing generally offers higher profits but carries larger, less diversifiable tail risks, MDBs could use the higher returns and lower credit risks to boost internal capital (profits) during stable periods. This capital could then be used to absorb losses during turbulent times, allowing MDBs to continue their countercyclical financing activities.

In this section, we have assumed that risk weights remain stable. However, if credit rating changes are systematically related to exchange rate movements, changes in either variable could impact MDBs' balance sheet quality and, consequently, CRAs' assessments. In the case of LC financing, this could result in a negative impact from a credit rating downgrade and, as discussed above, a positive impact from exchange rate depreciation, as the nominal exposure to the risky asset declines. To explore this potential effect, the next and final section analyses how depreciations and credit rating downgrades of MDB borrowers affect MDBs' capital adequacy. It also empirically examines the relationship between exchange rates and sovereign credit ratings, which are representative of MDB borrowers and relevant for exchange rate dynamics.

3.3. Capital adequacy and borrowers' exchange rates: credit ratings dynamics

An indirect channel through which a larger exposure of MDBs to LC financing could affect their credit ratings is the interplay between borrowers' exchange rate dynamics and their credit ratings. While exchange rate variations affect the value of these positions (as discussed in the previous section), borrowers' credit ratings influence the value of risk-weighted assets and capital ratios.

The connection between exchange rates and sovereign credit ratings can be bidirectional. Credit ratings are used by passive and active international investors for benchmarking and internal risk-exposure restrictions. As a result, downgrades can trigger a reversal in foreign demand for the issuing country's local assets, leading to LC depreciation. Downgrades can also worsen economic expectations if they convey new information to the market. In turn, depreciation can negatively impact the credit quality of borrowers with FC liabilities, as the increased burden of these liabilities can lead to downgrades.

Assuming that risk weights are correlated with exchange rates, and vice versa, the risk-weighted assets can be expressed as:

$$RWA = \frac{A^{LC}}{FX(\omega)} * \omega^{LC}(FX) + A^{HC} * \omega^{HC}(FX) \tag{8}$$

In this case, depreciation will reduce the value of risk-weighted assets through its effect on the value of LC financing but could increase the value of both LC and hard currency financing through an increase in risk weights following a downgrade:

$$\downarrow\uparrow RWA = \frac{A^{LC}}{\uparrow FX(\omega \uparrow)} *\uparrow \omega^{LC}(\uparrow FX) + A^{HC} *\uparrow \omega^{HC}(\uparrow FX) \tag{9}$$

The net effect depends on which of these two channels dominates. As previously discussed, CRAs typically assign the same rating to both local and foreign currency instruments, or a slightly better rating to LC. This gap generally does not react to exchange rate dynamics. Therefore, we can assume that ω^{LC} is equal or lower than ω^{HC}. Given this assumption, when there is a depreciation, if ratings are negatively affected, the effect on ω^{LC} and ω^{HC} will be equal, making the total effect on risk-weighted assets depend on whether the effect on the risk weight or the valuation effect is stronger.

$$\uparrow\downarrow RWA = \left(\frac{A^{LC}}{\uparrow FX} + A^{HC}\right) * \omega\ (\uparrow FX) \tag{10}$$

Regardless of which effect dominates, for a given exposure to a set of borrowers, the larger the exposure to their LC financing, the smaller the increase (or larger the reduction) in risk-weighted assets after a depreciation. We can thus conclude that if borrowers' credit ratings in local and foreign currency behave similarly during a depreciation, the larger the MDBs' LC exposure, the smaller the negative effect on risk-weighted assets. Consequently, the negative effect on the risk-weighted capital ratio will be smaller (or even positive) with larger LC exposures, especially if the unhedged currency exposure to capital is smaller. In this case, the effect of depreciation on the (unweighted) equity-to-asset ratio will be positive, as potential downgrades to borrowers' credit ratings play no role.

Similarly, if there is a significant relationship between exchange rate dynamics and credit rating downgrades, the effect of one variable on MDBs' balance sheets could be counteracted in the case of LC financing (or exacerbated in the case of foreign currency financing). To explore this potential counteracting impact on MDBs' balance sheets, the next section empirically examines the relationship between sovereign credit ratings and exchange rates using various statistical and econometric methods.

3.4. Borrowers' exchange rates-credit ratings dynamics

The literature has explored the relationship between sovereign credit ratings and exchange rate dynamics. For example, Sy presents evidence that CRA sovereign credit ratings do not predict currency crises; rather, currency crises predict sovereign credit rating downgrades.[45] Conversely, Alsakka and ap Gwilym, using non-pooled data from various CRAs, find that both positive and negative credit news affect exchange rates (within 1 to 30 days after the credit event). Their findings suggest that credit actions have, on average, a 2.5% impact on exchange

[45] The paper defines 'currency crises' as events where a country's exchange market pressure index (a weighted average of depreciations and declines in foreign exchange reserves) exceeds its mean by more than three standard deviations. See A Sy, 'Rating the Rating Agencies: Anticipating Currency Crises or Debt Crises?' (2004) 28 Journal of Banking & Finance 2845.

rate variations 30 days ahead. They further show that exchange rates react to both downgrades and upgrades, with a stronger effect for downgrades, especially multi-notch ones.[46] Similarly, using ratings from S&P and a treatment effect methodology, Balima and others find that rating events influence monthly exchange rate variations, with a larger effect for negative events. Their results indicate that a positive sovereign credit rating event leads to a 0.11% increase in the rate of appreciation, while a downgrade leads to a 0.42% increase in the depreciation rate on average.[47] In this vein, Fitch notes that the nominal exchange rate of emerging market currencies against the US dollar is strongly correlated with these countries' sovereign ratings. According to Fitch, a stronger US dollar deteriorates these countries' sovereign credit profiles through depreciation pressures and declines in international reserves, given their large shares of debt denominated in FC.[48]

To examine the effects of downgrades on exchange rates, we conducted various statistical exercises. We used nominal exchange rates from 105 LMICs and their sovereign credit ratings from the three main CRAs.

3.4.1. Average correlation

First, we calculated the correlation between changes in credit ratings and monthly depreciation (compared to the previous month) for each country. This coefficient is negative for most countries but only significant for high-income countries, where a downgrade is associated with a 3% depreciation. However, when considering exchange rate depreciation from the month of the credit rating action to 12 months later, the correlation is positive, indicating that a downgrade is associated with a 2% cumulative appreciation over the following 12 months (mainly compensating for the initial depreciation) in high-income economies. For lower-middle-income countries, the correlation becomes significant but also positive.

Table 3 Correlation between downgrades and 12 months ahead depreciations

Income group	Monthly	After 12 months
High income	-0.03***	0.02***
Upper middle income	0.00	0.01
Lower middle income	-0.01	0.05***
Low income	-0.02	0.03

[46] R Alsakka R and O Gwilym, 'Foreign Exchange Market Reactions to Sovereign Credit News' (2012) 31 Journal of International Money and Finance 845.
[47] H Balima, A Minea, and C Vinturis, 'Do Sovereign Credit Rating Events Affect the Foreign Exchange Market? Evidence From a Treatment Effect Analysis' (2023) 90 Southern Economic Journal 156.

[48] Fitch, *Risk of Stronger US Dollar Could Affect Emerging Market Credit Momentum* (2024).

3.4.2. Non-linear effects and multi-notch downgrades

To further investigate the relationship between downgrades and exchange rates in our sample, we focused solely on negative credit actions. However, a downgrade from an AAA rating may differ from one from a BBB rating. Additionally, although rare, multi-notch downgrades can occur, potentially exerting stronger pressures on exchange rates.

To address these non-linearities, we followed Sy (2004) and rescaled the ratings according to the initial rating:

$$Scaled\ Rating = ln\left(\frac{Rating}{22 - Rating}\right) \tag{11}$$

By re-expressing the ratings on a scale with a maximum value of 21, the 22 ensures a positive value for this indicator. This scaling accounts for the fact that a downgrade from a high rating is not equivalent to one from an already low rating. Second, we explored the exchange rate dynamics at different horizons depending on the size of the downgrade. Using these scaled ratings, Figure 11 shows the percentage depreciation of nominal exchange rates against the US dollar (vertical axis) 1, 6, 12, and 24 months ahead (horizontal axis), after downgrades larger than 2 and 4 notches (first and second charts).

Figure 11 The impact of downgrades on currency depreciation

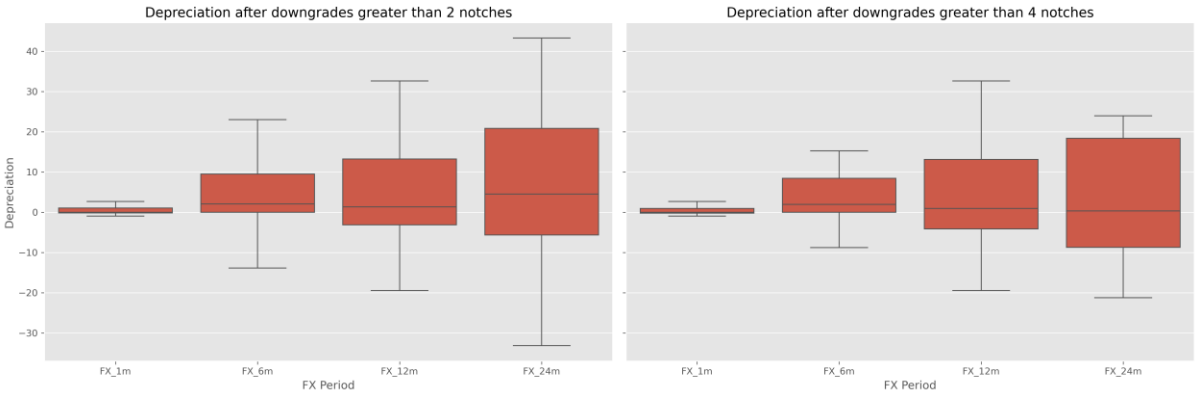


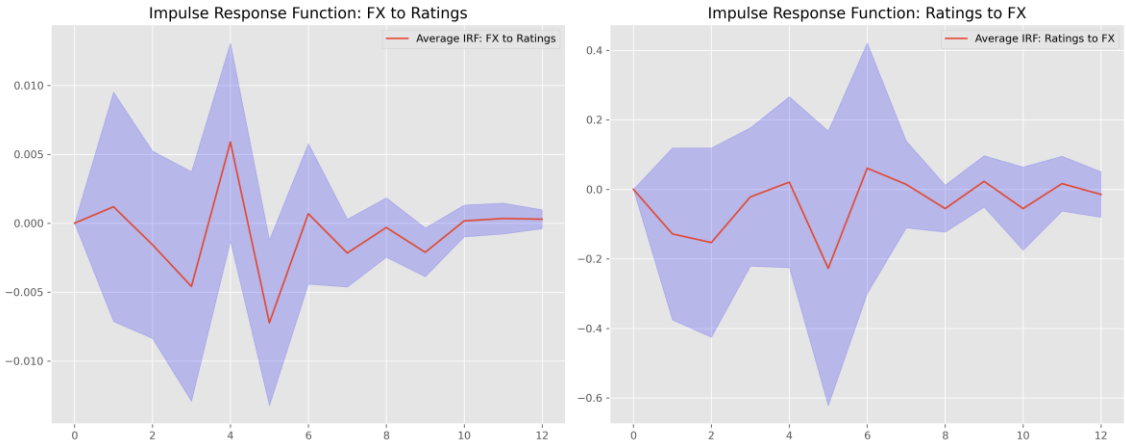
Figure 11 shows that currencies tend to depreciate after 2-notch downgrades on average, especially for horizons beyond six months, although there is significant variation across currencies. When observing downgrades greater than 4 notches, the average results are similar but continue to show a large dispersion. However, since such events are rare, this dispersion is smaller at different time horizons when considering downgrades of more than 4 notches. These

results do not differentiate between CRAs predicting negative developments that could also cause depreciations, and the causal effect of downgrades on exchange rates.

3.4.3. Dynamic effects

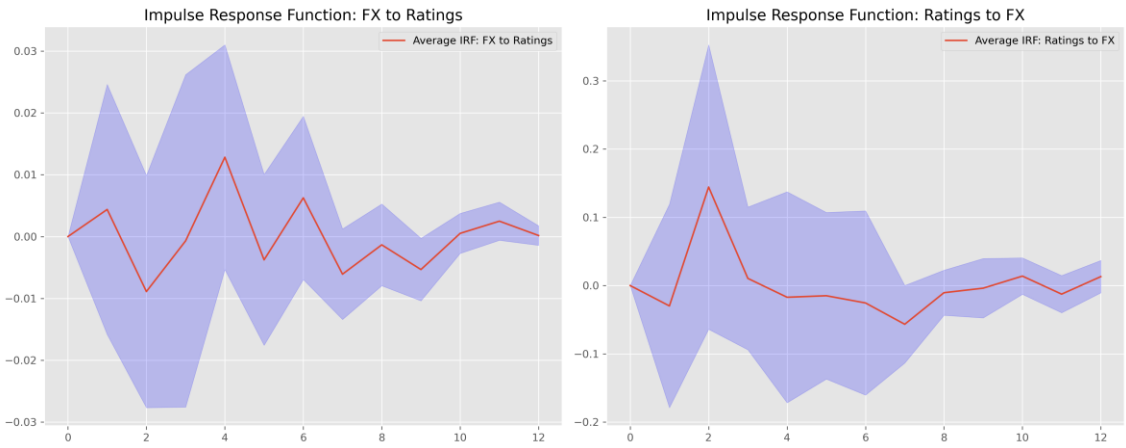
As mentioned before, exchange rates and credit ratings can influence each other. To explore the dynamic and bilateral relationship between them in more detail, we implemented a Vector Autoregressive (VAR) model with 12 lags. We ran the model for each country and plotted the distribution of the coefficients. The results show considerable variance across countries, with no significant effects over time for either of the two relationships (from depreciations to ratings and vice versa).

Figure 12 Impulse response from VAR



To explore differences across income groups, we ran the same VAR, but focused only on low- and lower-middle-income countries, obtaining similar results.

Figure 13 Impulse response from VAR for Low and Lower middle income countries



3.4.4. Extending the currency tail risks model

Finally, to explore whether downgrades affect not the average depreciation but the risk of large depreciations, we extend a quantile regression model to include downgrades as a factor influencing exchange rate risk. This model incorporates various country-level macroeconomic variables and common explanatory variables such as commodity prices. We found that CRAs' rating decisions have no significant effect on the tail of the distribution of exchange rate depreciations in the selected panel of countries for 1, 2, 3, and 4 quarters ahead. Table 4 presents the estimated coefficients.

Table 4 The impact of downgrades on tail risk: Estimated coefficients from panel quantile regression of nominal rate of depreciation, 95th quantile

Quarters ahead	1	2	3	4
Downgrades [0.95]	-0.341 (-0.217)	-0.284 (-0.187)	-0.046 (-0.152)	0.033 (-0.096)

Notes: Estimated coefficients from panel quantile regression of the nominal rate of depreciation (in %), 95th quantile, with horizon h=1, 2, 3, 4. Bootstrapped standard errors are in parentheses. None of the coefficients is significant at the 10% level of statistical significance.

In summary, our results indicate that credit rating downgrades do not have a significant correlation with exchange rate depreciations over longer horizons. The statistical evidence shows that, while exchange rates and credit ratings may co-move on average, this is not a consistent regularity. However, the dispersion of the results suggests that it is not possible to rule out the occurrence of both depreciations and downgrades together. There are many country-specific cases supporting this relationship, and prior economic literature has found a statistically significant effect of downgrades on exchange rates, though perhaps not one that is economically significant for the purposes of this analysis.

Bibliography

Alsakka R and O Gwilym, 'Foreign Exchange Market Reactions to Sovereign Credit News' (2012) 31 Journal of International Money and Finance 845.

Asonuma T and Trebesch C, 'Sovereign Debt Restructurings: Preemptive or Post-Default' (2016) 14(1) *Journal of the European Economic Association* 175.

Balima H, Minea A, and Vinturis C, 'Do Sovereign Credit Rating Events Affect the Foreign Exchange Market? Evidence From a Treatment Effect Analysis' (2023) 90 *Southern Economic Journal* 156.

Barkbu BB and Ong LL, 'FX Swaps: Implications for Financial and Economic Stability' (IMF Working Paper WP/10/55, March 2010).

Beers D, Bhullar V and Nystrand D, 'BoC–BoE Sovereign Default Database: What's New in 2023?' (2023) Bank of Canada Staff Analytical Notes No 2023–10.

Beers D, E Jones and J Walsh, 'Special Topic: How Frequently Do Sovereigns Default on Local Currency Debt?' (2020) Bank of England and Bank of Canada No. 2020–13.

Capital Adequacy Frameworks Panel, *Boosting MDBs' Investing Capacity: An Independent Review of Multilateral Development Banks' Capital Adequacy Frameworks* (2022).

Catão L and Sutton B, 'Sovereign Defaults: The Role of Volatility' (2002) IMF Working Paper No. 02/149.

Das US, MG Papaioannou and C Trebesch, 'Hidden Defaults Capital in Emerging Markets' (2010) IMF Working Papers No. 010.

Eichengreen B and Hausmann R, 'Exchange Rates and Financial Fragility' (1999) in Federal Reserve Bank of Kansas City, *New Challenges for Monetary Policy*, Economic Policy Symposium Proceedings, 329–368.

Erce A, Mallucci E, and Picarelli MO, 'A Journey in the History of Sovereign Defaults on Domestic-Law Public Debt' (2022) European Stability Mechanism Working Paper.

European Investment Bank, *Default Statistics: Private and Sub-Sovereign Lending 1994–2022* (Global Emerging Markets Risk Database Consortium (GEMs) 2024).

European Investment Bank, *Default Statistics: Sovereign and Sovereign Guaranteed Lending 1994–2022* (Global Emerging Markets Risk Database Consortium (GEMs) 2024).

Fitch, *Risk of Stronger US Dollar Could Affect Emerging Market Credit Momentum* (2024).

Fitch, *Supranationals Rating Criteria* (2023).

Gurara D, A Presbitero and M Sarmiento, 'Borrowing Costs and the Role of Multilateral Development Banks: Evidence from Cross-Border Syndicated Bank Lending' (2020) 100 Journal of International Money and Finance 102090.

Horn S, Reinhart CM, and Trebesch C, 'Hidden Defaults' (2022) 112 *AEA Papers and Proceedings* 531.

Jeanneret A and Souissi S, 'Sovereign Defaults by Currency Denomination' (2016) 60 *Journal of International Money and Finance* 197.

Kohlscheen E, 'Domestic vs External Sovereign Debt Servicing: An Empirical Analysis' (2010) 15(1) International Journal of Finance & Economics 93.

Mitchener KJ and Trebesch C, 'Sovereign Debt in the 21st Century: Looking Backward, Looking Forward' (2021) CESifo Working Paper No. 8959.

Moody's IS, *Multilateral Development Banks and Other Supranational Entities Methodology* (2020).

Panizza U and Taddei F, 'Local Currency Denominated Sovereign Loans – A Portfolio Approach to Tackle Moral Hazard and Provide Insurance' (2020) IHEID Working Paper No. 09-2020.

Parker E and Riley D, 'Why Sovereigns Can Default on Local-Currency Debt' (2013) Fitch Ratings Special Report.

Reinhart CM and Rogoff KS, *This Time Is Different: Eight Centuries of Financial Folly* (Princeton University Press 2011).

Reinhart CM and Rogoff KS, 'The Forgotten History of Domestic Debt' (2011) 121(552) *The Economic Journal* 319.

Standard & Poor's GR, *Multilateral Lending Institutions and Other Supranational Institutions Ratings Methodology* (2023).

Sy A, 'Rating the Rating Agencies: Anticipating Currency Crises or Debt Crises?' (2004) 28 Journal of Banking & Finance 2845.

Appendix: Impact of Depreciation on Risk-Weighted Capital Ratios with Currency Exposure

In this appendix we explore how a depreciation affects the risk-weighted capital ratio when the institution has currency exposure (partially unhedged positions). To facilitate the reading of the algebra, we use different ratios to re-express the risk-weighted capital ratio.

First, we express the exchange rate as how many units of the hard currency are necessary to buy one unit of the local currency:

$$FX = 1/x \tag{A.1}$$

In this way, depreciations are reductions in the value of x.

Second, grouping assets and liabilities in the same currency, we can express the net exposure to each of these currencies:

$$E = x * (A^{LC} - L^{LC}) + A^{HC} - L^{HC} = x * E^{LC} + E^{HC} \tag{A.2}$$

Expressing the currency exposure in local currency as a ratio of total equity as:

$$m = E^{LC}/E \tag{A.3}$$

The ratio of local currency assets over total assets as:

$$w = A^{LC}/A \tag{A.4}$$

And the unweighted capital ratio as:

$$k = E/A \tag{A.5}$$

The risk-weighted capital ratio can be expressed as:

$$\frac{E}{RWA} = \frac{(x * m + (1 - m)) * k}{x * w * \omega^{LC} + \omega^{HC} * (1 - w)} \tag{A.6}$$

Then, the marginal effect of an appreciation on the ratio is:

$$\frac{\partial \frac{E}{RWA}}{\partial \mathrm{x}} = \frac{(m * k) * \left(x * w * \omega^{LC} + \omega^{HC} * (1 - w)\right) - ((x * m + (1 - m)) * k) * (w * \omega^{LC})}{\left(x * w * \omega^{LC} + \omega^{HC} * (1 - w)\right)^2} \tag{A.7}$$

In order to know under which conditions a depreciation improve the risk-weighted capital ratio, we evaluate when this derivative has negative values (since depreciations are reductions in x). This derivative would be negative if:

$$\frac{\partial \frac{E}{RWA}}{\partial x} < 0 \; if: \quad m * \omega^{HC} * (1 - w) - w * \omega^{LC}(1 - m) < 0 \tag{A.8}$$

If we express the risk-weights of the local currency assets as the risk-weights of the foreign currency assets multiplied by ρ (which usually is zero or negative):

$$\omega^{LC} = \omega^{HC} + \rho \tag{A.9}$$

Then, the effects of a depreciation of the local currency will improve the risk-weighted capital ratio, when the currency exposure as ratio of equity is smaller than this ratio:

$$m < \frac{w(\omega^{HC} + \rho)}{\omega^{HC} + \mathrm{w} * \rho} \tag{A.10}$$

This implies than, the higher the weight of local currency assets both through their non-risk weighted shares and their risk-weight relative to the hard currency risk-weight, the larger can be the unhedged currency exposure. This is clearer considering the case where the risk-weights are equal both for local currency and hard currency assets ($\rho = 0$):

$$m < \mathrm{w} \tag{A.11}$$

Therefore, if the initial currency exposure as ratio of capital is smaller than the initial share of local currency assets over total assets, depreciations improve the risk-weighted capital ratio.

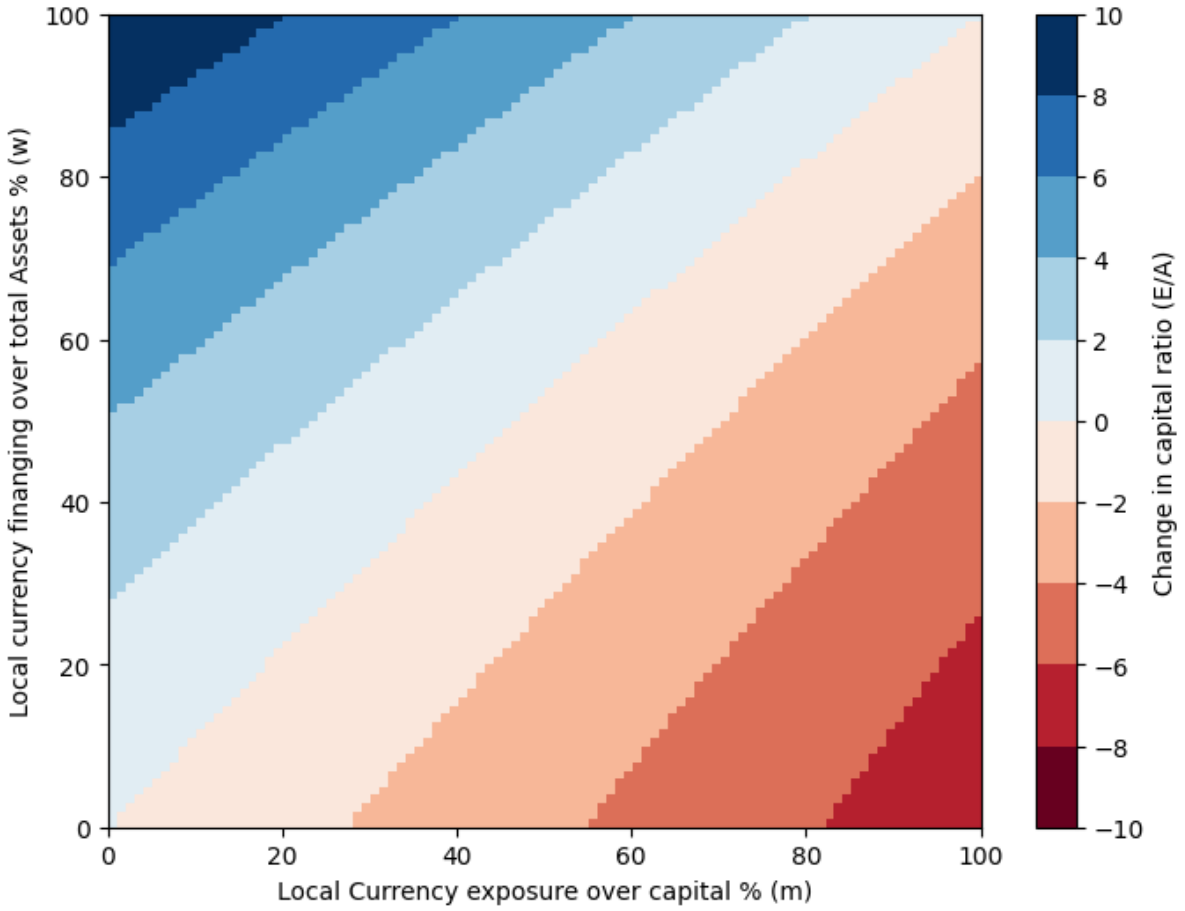
Finally, remembering that $m = (A^{LC} - L^{LC})/E$ and $w = A^{LC}/A$, we can rearrange the inequality:

$$(A^{LC} - L^{LC})/A^{LC} < \mathrm{E}/A \tag{A.12}$$

This equation emphasises that higher shares of unhedged positions over the local currency financing, require higher capital ratios.

To show this effect, the following figure simulates the effect of a 20% depreciation in the local currency on the capital ratio, for different values of the initial currency exposure as ratio of capital and the initial share of local currency assets over total assets.

Figure A-1 Effect of a 20% depreciation on the capital ratio for different values of the currency exposure to capital and the share of local currency assets over total assets



Note: the initial value of the capital ratio is calibrated to 35%.