THE EFFECTS OF DERIVATIVES REGULATION ON INFRASTRUCTURE FINANCE: SOME EVIDENCE FROM EMERGING MARKETS

WHITE PAPER

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Glossary

AE	Advanced Economy
AIRB	Advanced Internal Ratings-Based
CAR	Capital Adequacy Ratio
CCS	Cross Currency Swap
CDS	Credit Default Swap
CVA	Credit Valuation Adjustment
DFI	Development Finance Institution
ECA	Export Credit Agency
EMDE	Emerging Market and Developing Economies
EMEA	Europe, the Middle East and Africa
EU	European Union
FSB	Financial Stability Board
FX	Foreign Exchange
G20	Group of Twenty
GFC	Global Financial Crisis
G-SIBs	Global Systemically Important Banks
HCY	Hard Currency
IFC	International Finance Corporation
IRS	Interest Rate Swap
LCY	Local Currency
LCR	Liquidity Cover Ratio
LR	Liquidity Ratio
NSFR	Net Stable Funding Ratio
OTC	Over-the-Counter
PPP	Public Private Partnership
SA-CCR	Standardized Approach to measure Counterparty Credit Risk
USA	United States of America
USD	United States Dollar
WBG	World Bank Group

Contents

Executive summary

This study seeks to assess the effects of post-crisis regulatory reforms on derivatives used to hedge infrastructure finance transactions in Emerging Market and Developing Economies (EMDEs). The regulatory reforms that followed the Global Financial Crisis (GFC) are considered to have largely achieved the aims of more accurately pricing derivative risk, which was underpriced, and increasing the resilience of the financial system. However, the impact of the reforms on the financing of strategic sectors of the real economy are only recently being assessed. The study aims to provide information on the effects on the cost and availability of derivatives hedges for infrastructure finance transactions. It looks to supplement existing FSB research on the effects of the reforms on infrastructure financing in EMDEs. The study suggests areas where further analysis and research may be needed. It serves as a starting point for EMDE policy makers to understand the impact and relevance of the reforms on the use of derivatives in infrastructure financing in EMDEs. It is not the intention of this study to challenge the achievements of the regulatory reforms, to conclude on the impact of the reforms, or to propose specific policy recommendations or specific regulatory actions.

The motivation for this analysis stems from the importance of infrastructure in EMDEs, the mandate of the WBG to mobilize financing for infrastructure, and the role that derivatives play in the structuring of infrastructure financing transactions. Infrastructure is a key driver of economic growth in EMDEs. Long-dated over-the-counter (OTC) derivatives are used extensively to hedge the financial risks of infrastructure finance transactions, and the ability to hedge such risks is considered critical to financing. While the impact of the changes in capital and regulation resulting from post-crisis reforms on lending to infrastructure in EMDEs has been assessed, the effects of regulatory reform specifically on the provision of derivatives used to hedge infrastructure financing transactions remains a key element that has not been. Therefore, this study has been undertaken.

This study takes a survey[1] **and interview-based approach with industry participants to assess the impact of post-crisis reforms on the pricing, tenor and availability of derivatives used to hedge EMDE infrastructure projects.** Given the methodology and approach, there are key limitations to this study that should be recognized upfront. The study should be considered as an expert-informed study, which reflects the inherent biases of industry participants. However, the World Bank takes an independent approach. Although the sample size may be considered small, the survey respondents represent the majority of the most active banks. Data on OTC derivatives transactions are not readily available, and this precludes an empirical, data-based analysis. Given these concerns, conclusions are not drawn from the results, and specific policy recommendations have not been proposed. The study aims to conduct an analysis that provides information to policymakers and prompts discussion on an under-researched subject.

The derivatives used to hedge infrastructure finance transactions are typically over-the-counter (OTC). These instruments are long-dated, usually uncollateralized and have large size or notional value. In addition, infrastructure projects in EMDEs typically carry higher counterparty risk and lower credit ratings than Advanced Economy (AE) infrastructure

[1] Ten banks that play a role as either derivatives providers or project financiers participated in the survey

projects, which makes them more credit intensive for banks. These characteristics differentiate them from derivatives used to hedge corporate finance transactions. Post-crisis reforms revised the regulatory requirements for the categories of market risk, counterparty credit risk, collateral and margin posting requirements, and capital and liquidity charges. Survey participants indicated that the Credit Valuation Adjustment (CVA) charge, which requires allocating capital for changes in counterparty credit, is the largest constraint on the ability to provide long-dated derivatives and accounts for most of the regulatory impact. Among the capital and liquidity ratios introduced by Basel III, the Capital Adequacy Ratio (CAR) is reported to be the largest constraint for derivatives hedging by product providers and infrastructure sponsors.

This study suggests that reforms put in place since the GFC have increased the cost, somewhat reduced tenors, and decreased the availability of long-dated derivatives. The reported increase in cost has been higher for cross currency swaps (CCS) than for interest rate swaps (IRS), although the historical lack of CCS markets in many EMDEs has meant that the increase in cost is less significant overall to infrastructure financing. The impact on pricing is reported to be larger for less liquid and less credit-worthy markets. Reported hedging tenors have remained relatively stable in a few high-credit EMDEs but shortened (or remained short) in lower credit EMDEs, with the most impact on trades of over seven years maturity and BB rating or lower. Survey participants reported that there are fewer providers of long-term hedging instruments across EMDEs.

Survey participants indicate that the effect of derivatives regulation on the financing of infrastructure in EMDEs, as determined by the bankability of and appetite for projects, is medium-to-high but not critical. Approximately 78 percent of respondents report a lower appetite for doing infrastructure transactions in EMDEs based on the inability to hedge risk. Profit margins per unit of capital for derivative providers have dropped by 10-25 percent, and over 80 percent of the cost increase is being passed to end customers. As a result, survey participants reported that:

- Projects are running more risk by hedging less or hedging for shorter tenors,
- Governments and end-users are taking on more risk either directly, by absorbing currency or interest rate risk in their balance sheets, or indirectly, by indexing cross-currency fluctuations to the user fees, and
- Projects have capital structures with lower debt to equity ratios, thereby increasing the overall cost of the infrastructure financing.

Although this study suggests that there has been an impact resulting from regulatory reforms, the effect on infrastructure finance transactions in EMDEs has been mitigated by the following factors:

- The EU corporate exemption has reduced the impact of CVA charges on infrastructure finance, even though this was not the primary rationale for its introduction, by enabling EU banks to continue to provide derivatives at reasonable cost.
- In some EMDEs there has been a substitution effect, with local and regional banks—subject to different regulatory frameworks and funding models—playing a larger role in infrastructure financing. Such regional participants can offer lower cost of funding and hedges.

- Institutional investors are beginning to play a role in larger EMDEs and are considering lower credit EMDEs. Such investors can offer fixed rate loans, reducing the need for interest rate hedging.
- Alternative products and financing structures such as options-based hedges, embedding the derivative in the loan, guarantees, and mini-perms, have helped mitigate the effects of derivatives regulation.

Infrastructure projects have specific characteristics of structure, quality and recovery rate that suggest there is scope for further analysis to explore enhancements to the regulatory framework affecting the instruments used to hedge the risks of investing in infrastructure assets – without undermining the achievement of the overall regulatory objectives. Infrastructure projects have been shown to exhibit higher recovery value than corporate finance transactions and are typically well-structured with various targeted enhancements such as insurance and guarantees. The tenor of infrastructure transactions is much longer than that of corporate transactions, and the credit risk of infrastructure projects substantially declines over time. In addition, this study finds that, aside from banks, there are currently no other market participants well placed to make markets in long-dated derivatives. A risk-based approach should underpin any such enhancements. Enhancements should aim to accurately capture the specific risk characteristics of infrastructure finance in EMDEs, rather than discounting them completely. This requires further detailed research and analysis, including a regulatory cost-benefit analysis.

Adjustments for investors based on the characteristics of infrastructure in EMDEs could also be considered. The participation of institutional investors in infrastructure finance who can offer long-term fixed rate and LCY financing is the most significant way to reduce the requirement for derivative hedging of infrastructure finance transactions. Adjustments to the capital charges for institutional investors may be worth considering, while keeping in mind their risk profile and fiduciary responsibilities.

Findings in this study indicate that policies to expand infrastructure finance are dependent on the level of financial sector development. Countries at a higher level of development could transition faster to a different development model using local financial systems and domestic capital markets to provide LCY financing through local and international banks and investors, including domestic institutional investors. For countries with underdeveloped local financial systems and local currency bond markets the impact of the post-crisis reforms on maturity and pricing is not as large or observable, as these countries have less LCY long-term financing and liquidity to begin with.

However, for all EMDEs seeking ways to increase investment in infrastructure the previous model—which relied on banks to fund and hedge infrastructure projects—can no longer be used as a path. EMDEs can no longer develop infrastructure based on a reliance on banks alone. However, banks are still needed, particularly in the early stages of infrastructure financing (and for hedging). Institutional investors become more important in the latter stages of this process. The relevance of capital markets development has increased, including the growth of the institutional investor base.

In order to move toward new patterns of infrastructure financing, risk management in infrastructure projects will become more important than previously. This includes improved

project preparation, increased transparency, better management and improved efficiency of projects—to attract a broader investor base. Governments should promote a conducive environment for risk sharing and risk transfer. This should comprise non-hedgeable risks inclusive of institutional factors such as rule of law, regulatory risk **(**including better PPP frameworks), and the careful design and use of guarantees and credit enhancements. This will allow the mobilization of private capital while ensuring the fair distribution of risks between public and private investors.

Section 1. Objectives and Motivation

This study seeks to assess the effects of post-crisis regulatory reforms on derivatives used to hedge infrastructure finance transactions in Emerging Market and Developing Economies (EMDEs). The study is based on evidence gained through a survey of banks that play a role as either derivative providers or project financiers. It aims to provide a pragmatic overview of the use of derivatives in infrastructure financing in EMDEs, and how the current regulatory environment appears to have shaped the availability and cost of hedging solutions for infrastructure financing. It highlights the challenges from an industry perspective of providing long-dated, Over-the-Counter (OTC) derivatives for infrastructure finance in EMDEs.

The objectives of the study are as follows:

- To conduct an analysis that provides information and prompts discussion on the subject;
- To supplement the FSB report "Evaluation of the effects of financial regulatory reforms on infrastructure finance",[2] with which the findings of this report are aligned;
- To suggest areas where further analysis and research may be needed; and
- To provide a starting point that lays out the current landscape of what may be a less-known market for EMDE policy makers, and thereby assist policy makers and practitioners to understand the impact and relevance of the reforms with respect to EMDE infrastructure financing.

It is not the intention of this study to challenge the achievements of the regulatory reforms, whose purpose has largely been met. The information gained through the survey is not considered sufficient to propose specific policy recommendations or regulatory reforms at this time. Therefore, the study does not conclude on the impact of the reforms, nor does it make recommendations on or propose specific regulatory actions. Rather, this report aims to present the information gained from practitioners.

The motivation for this analysis stems from the importance of infrastructure in EMDEs, the mandate of the WBG to mobilize financing for infrastructure, and the role that derivatives play in the structuring of infrastructure financing transactions. Infrastructure is a key driver of economic growth in EMDEs, which face an annual infrastructure financing gap of USD 1.5 trillion.[3] The ability to hedge the financial risks resulting from the financing of infrastructure projects is considered crucial by project sponsors and lenders in both Advanced Economies (AEs) and EMDEs. Without the ability to hedge interest rate and foreign exchange risk through derivatives such as interest rate swaps (IRS) and cross currency swaps (CCS), project sponsors and investors may choose to avoid EMDE infrastructure projects, given uncertain cash flows—due in particular to the longer-term nature of such lending. Therefore, the infrastructure sector is one of the most intense users of long-dated derivative instruments. Regulations that affect the cost of long-dated, over-the-counter (OTC)

[2] https://www.fsb.org/2018/11/evaluation-of-the-effects-of-financial-regulatory-reforms-on-infrastructure-finance/
[3] Kim, "Speech by World Bank President Jim Yong Kim - The World Bank Group's Mission: To End Extreme Poverty."

derivatives, and the ability of AE banks to provide these derivatives are relevant to the provision of infrastructure finance.

This study takes a survey and interview-based approach with industry participants to assess the impact of post-crisis reforms on the pricing, tenor and availability of derivatives used to hedge EMDE infrastructure projects. It should therefore be considered an expert-informed study. This study has benefited from the expert opinions and perspectives of the many professionals of derivative banks and infrastructure project structurers and sponsors who gave of their time to be interviewed. While previous FSB analysis on the impact on the provision of infrastructure debt financing was conducted on both a qualitative and quantitative basis, data on OTC derivatives transactions are not readily available. This has required a purely qualitative approach, however, in the absence of available data considerable value can be drawn from these expert opinions. Although survey responses are not independent, the survey itself was conducted independently by the World Bank.

A survey for banks that provide derivatives for infrastructure and are involved as project structurers in EMDEs was conducted. Project finance and dealer desks from ten banks responded to the survey. The survey included a balanced sample of banks covering four regions: Latin America, Asia, Sub-Saharan Africa, and the Middle East. Although the sample size may be considered small, as noted in the FSB study, infrastructure debt finance, particularly in EMDEs, remains concentrated in a few global banks. An even smaller subset of bank debt providers are derivatives providers and even fewer are active in EMDEs. Thus, the survey respondents represent the majority of the most active banks. Interviews, however, were conducted with a broader set of market participants including derivative users such as project financiers, institutional investors, regulatory bodies and the most relevant regional institutions. For a full set of interview participants please see Annex A. Surveys and interviews were conducted over the period from November 2017 to March 2018. A roundtable was held in London in March 2018 bringing together project sponsors and derivative providers.

Given the methodology and approach, there are key limitations to this study that should be recognized upfront. Firstly, the lack of readily available data, due to the OTC nature of the transactions, preclude an empirical data-based analysis and limits this study to a qualitative approach. Secondly, the survey respondents are entirely providers of derivatives hedges and project structurers, and consequently the survey results give an industry perspective, which will reflect the viewpoint and inherent biases of industry participants. The small sample size may also raise concerns as to the extent to which the survey is representative, however, the survey respondents are members of the banks providing derivatives to EMDEs that fall under the regulatory reforms discussed in this study. Given the above, conclusions are not drawn from the results, and specific policy recommendations have therefore not been proposed.

Section 2. Regulatory Background

Post-crisis regulatory reforms were driven by a need to more accurately price derivative risk and increase the stability of the financial system. The Global Financial Crisis of 2008 exposed excessive risk-taking by banks through the trading of derivatives, and the underpricing of derivative risk. In response to the crisis, stricter regulatory requirements around derivatives offered and held by banks were imposed by regulators in the EU and US. This was done to more accurately price risk and thereby increase the resilience of the global financial system. Reforms are considered to have achieved overall net benefits in terms of financial resilience by reducing the likelihood and severity of financial crisis. However, their effects on the financing of strategic sectors of the real economy are only recently being assessed.

Analysis has been conducted on some, but not all important elements of the impact of the regulatory reform agenda on infrastructure financing. In particular, the FSB study, "Evaluation of the effects of financial regulatory reforms on infrastructure finance"[4] has analyzed the effects on infrastructure debt financing, mainly lending by the financial sector. It focuses on both corporate and project debt financing by the financial sector in AEs and EMDEs.[5] The FSB analysis suggests that the effect of G20 financial reforms on infrastructure financing is of a second order relative to other factors.

More specifically:

- The overall amount of infrastructure finance has grown since the financial crisis, but remains concentrated in a few global banks, particularly for financing to EMDEs,
- While lending spreads in AEs have lowered since the crisis, they remain above pre-crisis levels. However, for EMDEs spreads have increased since the crisis and remain high,
- EMDEs rely mainly on bank finance, with a large proportion of financing on a cross border basis, and a significant part primarily in USD,
- Survey respondents note that the limited ability to hedge currency risks creates disincentives for infrastructure investments in EMDEs,
- While new financing models and market participants have led to a greater diversity in the sources of infrastructure finance and changes in market practices, this is mainly in AEs,
- The survey suggests that banks rank currency risk first and financial regulation second, in terms of negative drivers of infrastructure finance, though perceived impact is limited,
- The analysis shows a reduction of maturities of infrastructure loans by AE banks (an effect that is not necessarily unintended), and
- OTC derivatives reforms have materially impacted the provision of infrastructure finance through changes in the availability and cost of hedging across AEs and EMDEs.

[4] "Evaluation of the Effects of Financial Regulatory Reforms on Infrastructure Finance."
[5] The report conducts both a qualitative and quantitative analysis on the initial Basel III capital and liquidity requirements (agreed in 2010) and over-the-counter (OTC) derivatives reforms, and a qualitative analysis on other subsequent G20 reforms.

These findings are relevant as a basis for the present study and are broadly aligned with responses to survey questions on lending in EMDEs included in Annex C of this study.[6]

However, the effects of regulatory reform specifically on the provision of derivatives used to hedge infrastructure financing transactions are a key element that have not been analyzed before. This is the purpose of the present study. The impact of derivative regulation on infrastructure finance in EMDEs is less examined and understood than the impact on lending—predominantly because the impact of derivatives regulation is often indirectly experienced through the underlying cost and availability of financing. Derivatives are often viewed as intra-financial, rather than as important instruments for infrastructure funding. The complexity involved in derivative pricing and hedging further complicates analysis. This study therefore complements previous analyses through an expert survey of the observable supply side effects of the reforms. This is important because derivatives for hedging infrastructure transactions have specific characteristics that experts suggest are particularly affected by the reforms.

Derivative instruments used to hedge infrastructure projects share characteristics that differentiate them from derivatives used to hedge corporate finance transactions and from portfolio hedging.[7] In particular, the derivatives used to hedge infrastructure projects are typically:

- Over-the-Counter (OTC), that is, bilateral contracts negotiated and traded between counterparties, rather than standardized contracts traded through an exchange. OTC derivatives can be tailored to the precise nature and needs of the underlying infrastructure asset, including maturity and payoff profile;
- Long-dated to match the funding structure of projects, usually loans with maturities of between 7-20 years;
- Large in terms of nominal value; and
- Typically, uncollateralized, as margining adds complexity and cost to a transaction for the hedger or borrower.

In addition, infrastructure projects in EMDEs carry higher counterparty risk and lower credit ratings than AE infrastructure projects, which make them more credit intensive for banks.[8] These characteristics are relevant to an analysis of the impacts of derivative regulations on the sector.

[6] To assess the impact of regulatory reforms on lending to EMDE infrastructure projects, market participants were surveyed as to whether reforms had affected the tenor of loans and the cost of a 15-20-year loan on a running basis (for a project rated BB-BBB). Survey respondents suggested that regulatory reforms had reduced the tenor of loans and increased lending costs.

[7] Corporate finance and portfolio hedging is typically smaller, more standardized and shorter-dated. This study covers only derivatives used to hedge project finance transactions.

[8] Therefore, they require more regulatory capital than similar projects in AEs, particularly given that most infrastructure derivatives are uncollateralized

Section 3. Role of Derivatives Hedging in Infrastructure in EMDEs

Only a handful of EMDEs have financial systems and capital markets that are developed enough to allow local and foreign banks to provide long-term local currency (LCY) lending. The lack of availability of long-term LCY debt is predominantly the result of under-developed local currency bond markets (particularly government bond markets). In AEs, infrastructure projects raise long-term funding in hard currency (HCY), either from the international banking system, or through international bond issues. In EMDEs, countries that have more developed local financial systems and domestic capital markets can provide financing for domestic infrastructure in LCY through local and international banks. In South Africa and India, the vast majority of financing is in local currency. In Morocco approximately a third of financing is in local currency. In EMDE countries where underdeveloped local financial systems and capital markets cannot provide local currency long-term financing, infrastructure financing is raised from development agencies, export credit agencies (ECAs) and international banks, predominantly in HCY variable rate loans. Post-crisis, there has been an increase in institutional investor financing of infrastructure in AEs, however this investment in EMDEs has lagged.[9]

Although EMDE project revenues, comprising user tariffs and fees, are mostly generated in LCY,[10] they can be linked to HCY through various mechanisms:

- In some instances, usage fees are paid in LCY but indexed to HCY. In this case, the impact of currency movements is passed on to end users of the infrastructure service through tariff increases linked to the currency depreciation. That is, end users effectively bear the currency risk. For example, electricity tariffs and transport fees are often indexed to hard currency. However, in the event of severe currency fluctuations, it is often politically difficult to pass the full extent of the fluctuation to end-users through tariffs.
- In other instances, governments assume currency risk. However, there is a limit to the amount of currency risk governments can assume without affecting their own credit worthiness.

Whether derivatives hedging is necessary depends on the currency composition of the loan and project revenues.[11] The limited availability of long-term LCY lending, and therefore the need to hedge currency risk is one of the greatest challenges to infrastructure development in EMDEs.

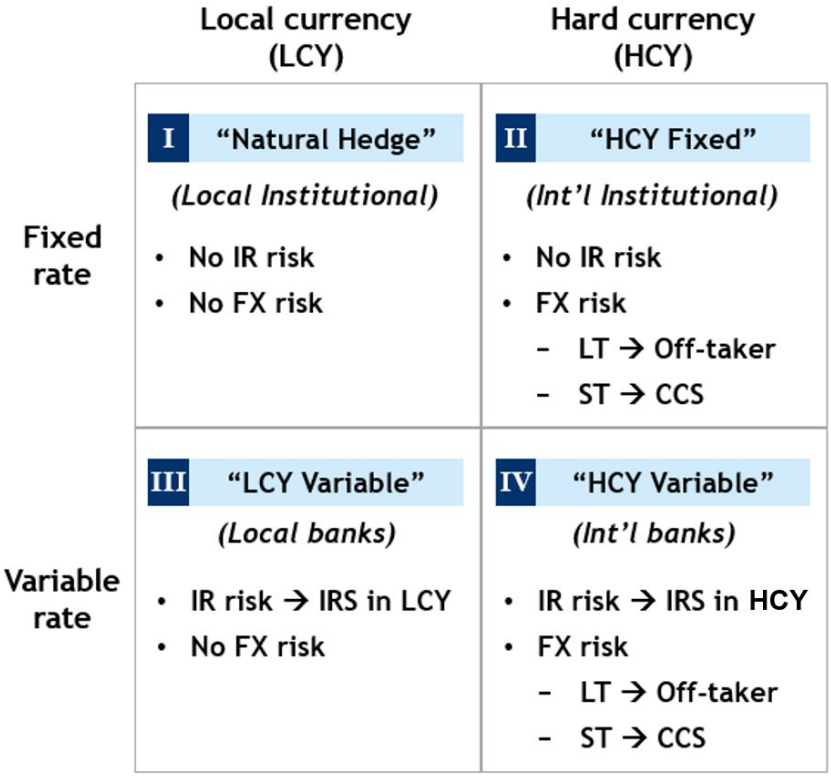
[9] According to a recent Organisation for Economic Co-operation and Development (OECD) survey of 71 large pension funds ("Annual Survey of Large Pension Funds and Public Pension Reserve Funds."), slightly more than one percent of aggregate investments were in infrastructure finance, with almost none in EMDEs.

[10] However, some infrastructure assets, such as ports, airports, and oil and gas, often generate revenues in HCY.

[11] Infrastructure projects are typically exposed to three key financial risks: interest rate risk, currency risk, and commodity risk. This study focuses on derivatives used for hedging interest rate risk and currency risk. Commodity risk arising from exposure to commodity price fluctuations typically affects extraction projects, as in mining or oil and gas, and generation projects, as in those that produce electrical power. Given historical volatility of commodity prices, many lenders refrain from extending capital to an infrastructure project unless commodity risk is hedged in a commercially viable manner.

- For projects with revenues in HCY (or indexed to HCY) with HCY funding, there is no currency risk and currency hedging is not required. Interest rate hedging is still required if the funding is provided at a variable rate.
- If tariff revenues or usage fees are purely denominated in LCY with no indexation, while the funding is denominated in HCY, a currency mismatch arises that needs to be hedged. Interest rate hedging is also usually required.

Figure 1. Simplified schematic of funding scenarios in EMDE infrastructure depicting the necessity of a derivative hedge as a function of the type of funding currency, whether LCY or HCY, and whether loans are fixed or variable rate (parentheses indicate typical funding source). In all cases it is assumed that project revenues are in LCY and not indexed to, nor guaranteed in HCY.



Legend: IR = Interest Rate, FX = Foreign Exchange, IRS = Interest Rate Swap, CCS = Cross Currency Swap, LCY = Local Currency, HCY = Hard Currency, LT = Long Term, ST = Short Term, Off-taker = The party who is buying the infrastructure product or service.

Figure 1 maps various scenarios where interest rate and currency derivative hedging is used in EMDE infrastructure projects with purely LCY revenues that are not indexed to HCY or guaranteed. It considers four scenarios. In Scenario I, the availability of a LCY fixed rate loan (against LCY revenues) means that the financing package does not carry interest rate or currency risk and

Commodity hedges are mainly implemented through futures or options. Many international players are present in commodity markets; thus, participants have access to a large pool of potential hedge providers.

therefore a derivative hedge is not required. In Scenario II, a HCY fixed rate loan is provided, and therefore carries currency risk, which would be hedged through a CCS, but no interest rate risk. In Scenario III, lending is through a LCY variable rate loan, which carries interest rate risk that could be hedged with a long-dated IRS denominated in LCY, but no currency risk. In Scenario IV, the HCY variable rate loan carries both interest rate risk and currency risk, thus it would require a combination of both a CCS and long-dated IRS.

In general, infrastructure deals do not happen in countries without LCY funding (that is, those that are funded in HCY), unless they are also accompanied by a mechanism for revenue delivery in or linked to HCY, such as indexation. The underlying investment performance and feasibility of a project can be materially impacted by currency volatility, particularly a currency depreciation that reduces the ability to make both interest payments and the ultimate ability to repay the loan. The availability of currency derivatives is also linked to local bond market development and the length and tenor of the yield curve. Therefore, currency derivatives of maturities that match HCY infrastructure lending are often not available, and very few long-dated CCSs are traded on EMDE currencies. As a result, the majority of currency hedging consists of short to medium-term CCSs, particularly to hedge currency risk during the construction period prior to the start of project revenues.[12]

Banks are the only providers of long-dated derivative hedges in EMDEs. Where local financial systems and capital markets enable long-term local funding, local and international banks are usually able to provide interest rate derivative hedges. Local banks are often not able to provide cross currency derivatives, which are most often sourced from international banks, but are sometimes not available at all. In countries with less developed financial sectors that cannot provide LCY long term lending, and where lending is provided in HCY, international banks are typically the only providers of derivative hedges. Although many international banks provide derivatives to AE counterparts, not all international banks are providers of long-dated, OTC derivatives for EMDE infrastructure projects. These mostly comprise around a dozen large international banks, the majority of which were survey participants. The local market characteristics of each EMDE country influence the extent to which derivatives form part of the financing package of infrastructure projects (see Box 1).

[12] Further, in some EMDEs currency convertibility issues can become a barrier to infrastructure projects.

Box 1. Use of Derivatives Depends on Local Capital Market Characteristics

Local capital market characteristics influence the extent to which derivatives form part of the financing package. Some LCY interest rate and currency markets are relatively liquid with long government yield curves, while others are significantly less so. Liquidity and credit quality are two key drivers of the ability to hedge and its cost. It is considerably more difficult to offer hedging solutions in countries with low liquidity and low credit quality (below investment-grade). In a stylized fashion, EMDEs fall within one of the following three market archetypes:

- *Robust credit and liquid markets*: Derivatives hedging is very relevant. These markets use both LCY funding and HCY funding for infrastructure projects, hence, the products used to hedge are long-dated LCY and HCY IRS, and either short-dated CCS for construction or LCY funding, as well as longer dated CCS and inflation hedges. Example countries include South Africa and Thailand. Aside from market frictions, these countries should be viewed as similar to advanced country markets, but with a higher risk-return profile.
- *Robust credit but illiquid markets*: The same derivatives as for the above countries are relevant. These markets enjoy some level of LCY funding, but the aggregate lending limit of the local market is not enough to facilitate large infrastructure initiatives, hence the need for offshore banks to develop certain infrastructure sectors such as transport, and the critical need for hedging instruments to support these sectors. Example countries: Colombia and Philippines.
- *Weak credit and illiquid*: Lack of long-term LCY financing, therefore lending is denominated in HCY (typically USD). The hedging products commonly used are long-dated IRS denominated in HCY, and 1 to 2-year cross-currency forwards for the construction period. In these markets the gap for providing financing and managing currency risk through derivatives is extremely large, with limited solutions currently available. Example countries: Nigeria, Ghana, Paraguay.

Section 4. Post-Crisis Reforms Relevant to OTC Derivatives

Post-crisis reforms relevant to derivatives

Post-crisis regulatory reforms were designed to address a crisis that arose from particular conditions in AEs and had the objectives of financial stability and risk mitigation. The reforms did not specifically target the types of derivatives used to hedge infrastructure finance transactions, however, these reforms can potentially impact these transactions. The Global Financial Crisis (GFC) of 2008 exposed the problem of mispricing of derivative risk on banks' balance sheets, particularly relating to credit exposure. In response, developed country regulatory authority reforms, pertaining to the treatment of derivative exposure on banks' balance sheets, were aimed at achieving a more accurate pricing of risk, increasing financial stability, improving transparency, and preventing market abuse. These reforms are wide-ranging[13] and include the Basel III regulations. For US banks, the Dodd–Frank Wall Street Reform and Consumer Protection Act (passed in 2010), including the Volcker Rule, imposed additional requirements. A synthesis of the G20 post-crisis reforms is seen in Box 2.

With respect to derivatives, the reforms imposed more stringent requirements in the categories of market risk, counterparty credit risk, collateral and margin posting requirements, and capital and liquidity costs. The aim of Basel III was in part to reduce the risk held on banks' balance sheets and constrain their ability to take on low-rated derivative exposures (through increased regulatory charges). As noted previously, low-rated derivative exposure is a characteristic of many derivatives used to hedge infrastructure finance transactions in EMDEs.

[13] "Global Financial Stability Report—A Decade after the Global Financial Crisis: Are We Safer?"

Box 2. Synthesis of G20 post-financial crisis reforms[14]

Basel III introduced a package of reforms aimed at strengthening the regulation of both bank capital and liquidity, to improve the stability and resilience of individual banks and the banking sector as a whole[15]**:**

- In terms of capital, Basel III requires banks to display a higher and better-quality capital base through two metrics:
    - First, it focuses on the definition of eligible capital and imposes minimum Capital Adequacy Ratio (CAR) requirements. The CAR metric includes credit risk, market risk, and operational risk—and measures the minimum percentage of risk-weighted assets to be set aside with respect to these risks.
    - Second, Basel III imposes a simple leverage ratio (LR) that restricts the buildup of leverage in the banking sector and complements the risk-based capital framework.
- In terms of liquidity, Basel III introduces two metrics:
    - The Liquidity Coverage Ratio (LCR), which aims to ensure that the level of High Quality Liquid Assets at a bank are sufficient to cover significant cash outflows over the next 30 days in the event of a stressed market environment.
    - The Net Stable Funding Ratio (NSFR), is designed to ensure that the amount of available stable funding at a bank is commensurate with the minimum stable funding based on the nature and maturity of its assets and off-balance sheet activities. The time horizon of the NSFR is one year.

In addition to the Basel III capital ratios and liquidity ratios, other G20 post-financial crisis reforms introduced requirements specific to derivative transactions, with the aim of improving transparency, mitigating risk, and protecting against market abuse:

- *Trade repositories*: All OTC derivative contracts must be reported to trade repositories.
- *Central clearing*: All standardized OTC contracts should be traded on exchanges or electronic platforms and cleared through central counterparties.
- *Capital*: Non-centrally cleared OTC derivatives are subject to higher capital requirements, with emphasis on counterparty credit risk.
- *Margins*: Non-centrally cleared OTC derivatives are required to exchange initial and variation margin.

[14] "Basel Committee on Banking Supervision Reforms - Basel III."
[15] "High-Level Summary of Basel III Reforms"; Bertholon-Lampiris, "Basel III Framework: The Butterfly Effect."

The Credit Valuation Adjustment (CVA)

Major bank defaults and subsequent legal claims on outstanding payments and obligations under derivative contracts during the GFC, highlighted the need for regulators to incorporate counterparty credit risk into the determination of regulatory capital.[16] Derivatives contracts are useful tools for hedging specific risks such as currency and interest rate risks, but derivative contracts themselves create risks (as was evidenced during the GFC). In general, derivatives create two types of risk exposure: I) exposure arising from movements in the price of the instrument underlying the contract – known as market risk; and II) counterparty credit risk exposure which is the risk of non-payment of the obligations of the derivative contract due to the default of one of the parties in the derivatives transaction.

Basel III requires banks to hold regulatory capital against the counterparty credit risk arising from derivatives and funding costs by requiring several adjustments,[17] the most relevant of which is the Credit Valuation Adjustment (CVA).[18] CVA is an adjustment to the price of derivatives instruments to account for counterparty credit risk for a portfolio of OTC derivatives, based on the expected mark-to-market losses due to a deterioration of counterparty credit quality. Given the credit risk, the magnitude of CVA is influenced by three main factors: i) the larger the size of a derivative, measured by high notional amounts, the higher the CVA, ii) the tenor of transactions with long-dated trades attracting higher CVA charges; and iii) the overall complexity of the transaction. The first two factors—high notional amounts and long tenor—are characteristic of derivatives used for hedging infrastructure finance transactions. This study refers to the Basel III regime introduced in 2010. The CVA framework revised in December 2017, to be implemented in 2022, is briefly discussed in Box 3 (however it is not the focus of this study.)

Collateralization and margining can reduce the CVA charge; however, infrastructure finance transactions are typically uncollateralized. Margining and collateralization involve the periodic payment of mark-to-market losses by the counterparty bearing the loss. As losses are effectively paid as they occur over the life of the derivative transaction, a large outstanding one-off payment at the maturity of the transaction is avoided, and counter-party risk is reduced, thereby reducing the CVA charge applicable to the derivative provider. For the hedger or borrower, however, margining adds complexity to a transaction. As margin payments cannot be predicted, they add an uncertain cash flow to the transaction metrics. In addition, borrowers are required to set up internal systems to calculate and make margin payments under the terms of the derivative contract. Hence, infrastructure projects rarely post collateral, and do not benefit from the reduced CVA charge to the derivative provider, that results from margining.

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[16] During the GFC, two-thirds of counterparty credit losses were suffered not as a result of actual defaults of the counterparty, but because credit market volatility negatively impacted bank earnings. (Reynolds et al., "Basel III Framework: The Credit Valuation Adjustment (CVA) Charge for OTC Derivative Trades.").

[17] Counterparty credit risk on exchange traded derivatives is mitigated through a central clearing counterparty and a system of initial and variation margins charged on the daily valuation of the derivatives transaction.

[18] Other important adjustments include Debt Valuation Adjustment (DVA) and Funding Valuation Adjustment (FVA). DVA corresponds to the CVA of the bank viewed from the perspective of its counterparty. In other words, banks themselves are risky and thus counterparty risk must be understood from a bilateral perspective. FVA arises from the fact that in the credit valuation context, the assumption of risk-free asset used for financing is not sustainable. For details on these and other adjustments see Crépey, "XVA: About CVA, DVA, FVA and Other Market Adjustments."

Box 3. Review of the CVA risk framework

The initial phase of Basel III reforms introduced the CVA charge, a capital charge to account for potential mark-to-market losses of derivative instruments as a result of the deterioration in the creditworthiness of a counterparty. More generally, as described in Box 2, the initial phase of Basel III aimed to provide the foundation for a resilient banking system and to avoid the build-up of systemic vulnerabilities. Thus, it focused on strengthening the regulatory framework by enhancing capital and liquidity requirements, and improving risk capture, including global standards for market risk and counterparty credit risk.

In December 2017, the Basel Committee[19] agreed to revise the CVA framework to:

- Enhance risk sensitivity: the initial CVA framework does not cover exposure variability, that is, changes to the mark-to-market price of derivative transactions due to daily changes of market risk factors (as opposed to counterparty credit spreads that are already covered), which is an important driver of CVA risk. The revised CVA framework takes into account the exposure component of CVA risk along with its associated hedges.
- Strengthen robustness: The revised framework removes the use of the Advanced Approach method to calculate CVA instead allowing: (i) a standardized approach; and (ii) a basic approach.[20] In addition, a bank with an aggregate notional amount of non-centrally cleared derivatives less than or equal to €100 billion may calculate their CVA capital charge as a simple multiplier of its counterparty credit risk charge.
- Improve consistency: CVA risk is a form of market risk as it is realized through a change in the mark-to-market value of a bank's exposures to its derivative counterparties. As such, the standardized and basic approaches of the revised CVA framework have been designed and calibrated to be consistent with the approaches used in the revised market risk framework.

In this study we assess the impact of the CVA charge as introduced in the initial phase of the post-crisis reforms. The revised CVA risk framework will be implemented in January 2022. The CVA risk framework is a key building block of the reforms, and the one that most affects derivatives. The revised CVA framework does indeed improve consistency, robustness and risk capture. However, it may increase the CVA charge for long-dated derivatives involving lower-rated counterparties (such as in infrastructure projects in EMDEs), thus potentially further increase cost.

Other revisions to be implemented from January 2022 onward may decrease appetite for infrastructure finance in EMDEs. For instance, the standardized approach to counterparty credit risk and CVA risk will be used when calculating the output floor that places a limit on regulatory capital benefits that a bank using internal models can derive relative to the standardized approaches. Additionally, the revised standardized approach for credit risk includes a standalone treatment for exposures to project finance, which will be risk-weighted at 130 percent during the pre-operational phase and 100 percent during the operational phase.

[19] See "Basel III: Finalising Post-Crisis Reforms." for provisions, calculations, eligible hedges, risk factors, sensitivities.
[20] The current CVA framework sets forth two approaches for calculating the CVA capital charge: (i) the "Advanced CVA risk capital charge" method that allows banks to estimate risk components based on their own pricing models; and (ii) the "Standardized CVA risk capital charge" method. In the advanced method, banks can use a value-at-risk model to estimate losses to a 99% confidence level over 10-days.

Impact of the Basel III components on the provision of derivative hedges

Survey participants were asked to assess which component of the Basel III reforms is the main constraint on the provision of long-dated OTC derivative solutions for infrastructure finance in EMDEs.[21] The respondents indicated that counterparty credit risk and the associated credit valuation adjustment (CVA) charge was seen as the largest constraint on the ability to provide long-dated derivatives. The impacts are experienced even in well-structured transactions that had strong credit mitigation, such as government guarantees. For full survey responses see Annex D. Respondents indicated that the Basel III requirements have led to 2-5 times increases in capital held on long-dated OTC derivatives, with the CVA charge accounting for 90 percent of the regulatory impact, and the most substantial regulatory impact on trades of over seven years and BB rating or lower.

Among the capital and liquidity ratios introduced by Basel III, the Capital Adequacy Ratio (CAR) is indicated to be the highest constraint on derivatives hedging by product providers and infrastructure transaction sponsors. The CAR captures the two types of exposure created by derivative contracts: market risk and counterparty credit risk exposure. It requires that banks allocate capital for potential changes in the credit spread of the borrower. In other words, the bank's mark-to-market on derivatives is affected not only by changes in the value of the underlying asset, but also by the counterparty's credit performance. This effect is particularly damaging for long-dated CCS due to their credit intensity, as payments under a CCS are typically back-loaded, that is, concentrated at the maturity of the CCS.[22] The Leverage Ratio (LR), intended to restrict the build-up of leverage in the banking sector, has reportedly had a minor impact on hedging because it is not a risk-based measure but instead a balance sheet constraint. The two liquidity ratios, Net Stable Funding Ratio (NSFR) and Liquidity Cover Ratio (LCR), have reportedly had almost no impact on derivatives used for infrastructure finance transaction hedging, as both the CCS and IRS denominated in hard currency have relatively small liquidity implications. Survey respondents and interviewees did caution that capital requirements and risk-weighted asset calibration floors will likely continue to be key constraints for infrastructure financing and hedging going forward. This is due to the fact that most banks will likely continue to have relatively larger capital constraints, including EMDE banks. Survey respondents do not point to the collateral and margin requirements of Basel III as a main constraint for infrastructure hedging, as these transactions very rarely have a margining agreement in place for the reasons described earlier in this section—despite the fact that margining and collateral would reduce the cost of the transaction.

[21] Respondents were asked to assess the regulatory impact of market risk, counterparty credit risk, collateral and margin posting requirements, capital cost, and CVA charge as low, medium, high and very high.
[22] Unlike IRS where payments are made throughout the life of the transaction.

Section 5. Effects of Regulation on Long-Dated OTC Derivatives for Infrastructure

When assessing the impact of regulation on derivatives, it is important to separate market-driven effects from regulatory-driven effects. A sizeable portion of the cost of a derivative comes from the underlying market risk, the very risk against which a derivative is meant to hedge. For example, the volatility and level of interest rates will be a significant determinant of the price of an interest rate swap. The survey data collected for this study attempt to isolate the regulatory effect on long-dated OTC derivative instruments used to hedge infrastructure finance transactions in EMDEs from underlying market factors.

The impact of regulation on pricing

The impact of regulation on pricing is reported to be more significant for CCS than IRS and larger for less liquid and less credit-worthy markets. The reported impact on CCS has been far larger than that on IRS, because of the high volatility of currency risk and credit intensity of CCS.[23] Figures B2 and B3 present the survey responses by EMDE region. More detailed country-by-country responses are found in Annex D. Broadly speaking, survey respondents indicated that the price of a 5-year CCS increased by 10-25 basis points (bps) (around 25-50 bps for the most volatile currencies), while the price of a 10-15-year CCS increased by 25-50 bps across markets (and well over 50 bps for the most volatile currencies). The IRS denominated in LCY has also become costlier, but less so than CCS. Broadly speaking, the price of a 5-year IRS increased by 5-10 bps (above 15 bps in the more volatile markets of Africa and Latin America), while the price of the longer dated 10-15-year IRS increased by 10-25 bps.

[23] Although out of scope for the present study, inflation hedges, similar to CCS, can be highly back-loaded and costly from a market risk standpoint. These hedges are important in infrastructure and are affected by both their long maturity and cost of capital. Even though they provide useful protection, some investors (particularly equity) are avoiding inflation swaps, as they are costly.

Figure 2. As a result of Basel III, price change of IRS denominated in LCY for infrastructure. Average range of respondents, n=10.

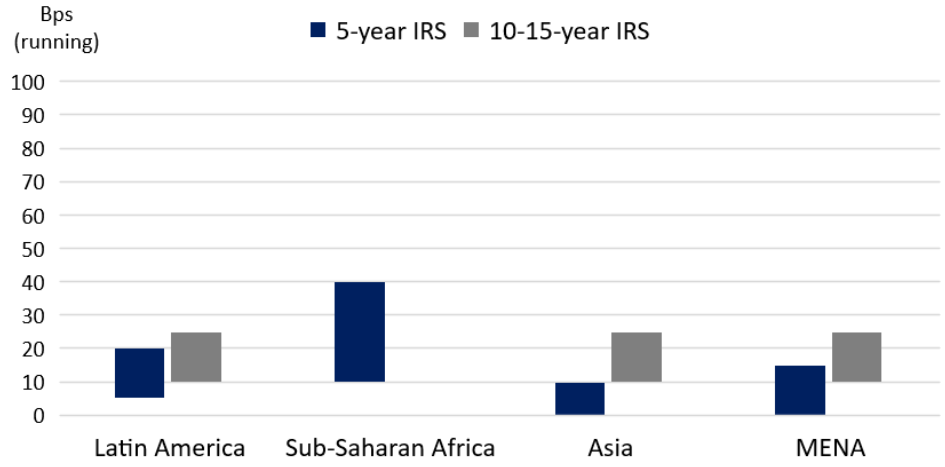
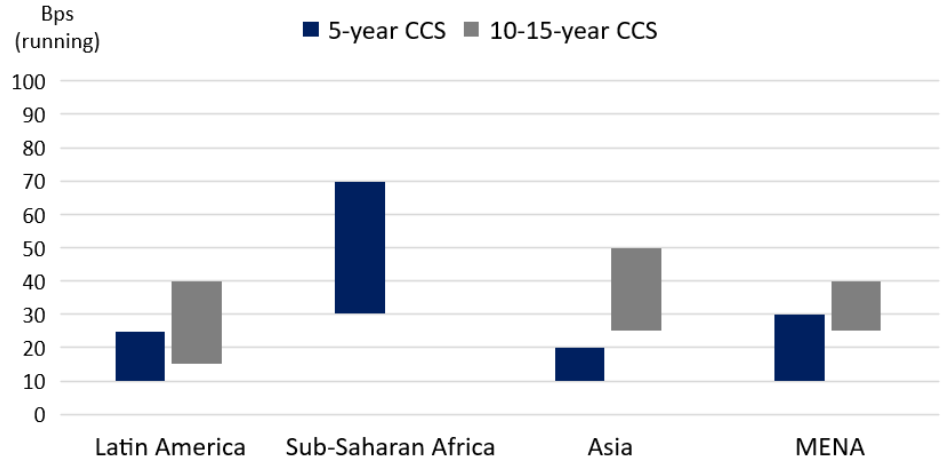


Figure 3. As a result of Basel III, price change of CCS (LCY to USD) for infrastructure.[24] Average range of respondents, n=10.



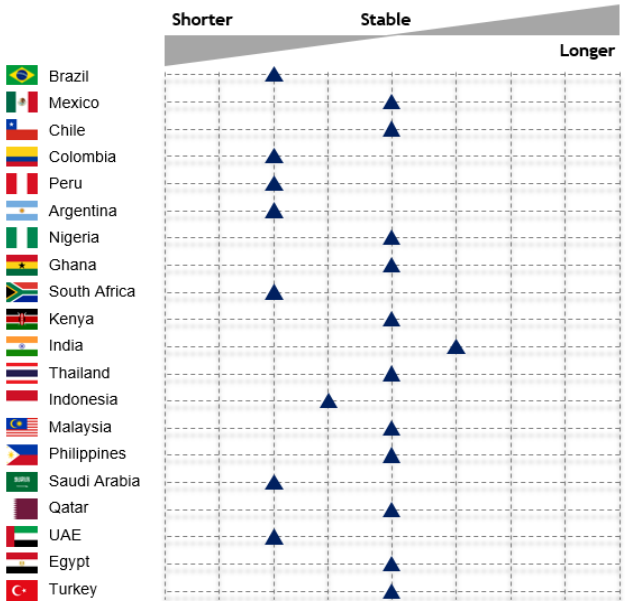
The impact of regulation on maturity

According to survey respondents, maturity shortened or remained stable (but short to medium term) in most EMDEs. In general IRS extend to longer maturities than CCS, and IRS tenors were less affected than CCS tenors. As regulatory capital charges increase with the tenor of a derivative, survey and interview participants reported that banks are less willing to offer long-dated derivatives and that maturities have decreased. Typically maturity was reported to be stable in countries where liquidity was already scarce, and tenors already short, prior to the GFC. Whereas

[24] Most Sub-Saharan countries (with the exception of South Africa) do not have meaningful long-term swap markets.

in EMDEs that had longer maturities prior to the GFC, a shortening was usually reported. As hedging maturity is project-specific, the maturity of the derivative is most affected by the underlying project term rather than the cost of the derivative instrument. However, wherever projects had the flexibility to do shorter dated hedging sponsors reported a reduction in the maturity of hedges implemented. The higher regulatory costs on longer dated maturities have driven the development of shorter-term structures such as mini-perms and hedges with a break clause, as well as the reduced use of hedging, which will be further discussed in Section 4.

Figure 4. As a result of Basel III reforms, change in maturity of hedging instruments in LCY for infrastructure. Respondents = 12.



The impact of regulation on availability

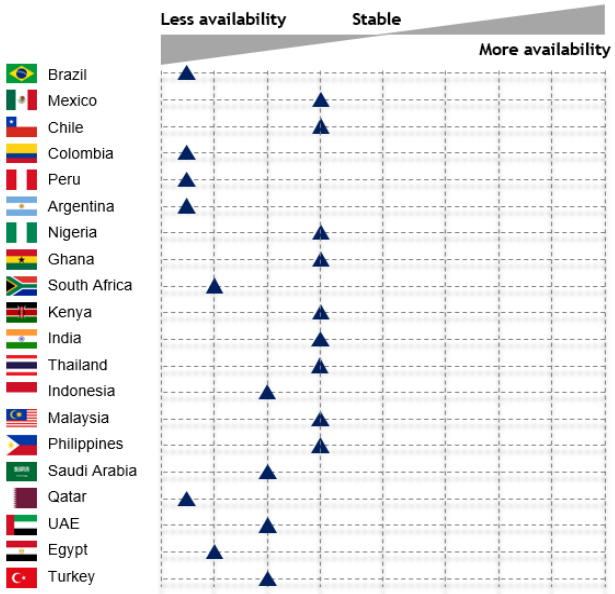
Survey results indicate that the availability of derivative hedges has decreased, with fewer providers of long-term OTC derivatives for infrastructure finance transactions across all EMDEs. Countries with a lower credit rating and illiquid markets had the largest reported reductions in availability. AE banks, often facing higher capital consumption due to regulatory charges, have retreated from or even exited certain markets, particularly those with lower credit quality that results in higher CVA charges.

The appetite of banks to take unhedged risk or to do proxy hedges has abated, due to higher Basel III regulatory charges for unmatched derivatives positions on banks' balance sheets. If banks do not fully hedge—or match the underlying risk that results from client derivative positions by doing offsetting trades, through the market with other counterparties—they run open market risk. Derivatives also give rise to counterparty risk, which is difficult to hedge in EMDEs that typically lack

credit default swap (CDS) markets.[25] At long tenors, derivatives markets become significantly shallower and it is even more difficult to fully hedge OTC positions. Banks may run hedge mismatches or roll hedges using shorter dated derivatives. Unmatched positions attract higher regulatory capital and are therefore more expensive to run from a capital perspective. Therefore, regulation imposes limits on unmatched positions and restricts banks' ability to provide such derivatives.

In addition, post-crisis regulatory reforms have made it more complex and costlier to run a derivatives business, due to increased requirements and the complexity of functions such as compliance, monitoring, and validation. This has contributed to lowering the availability—some banks are no longer willing to provide derivatives for transactions, or a portion of a transaction for which they did not provide the loan. Prior to Basel III banks would make prices on derivatives over and above their portion of lending, whereas banks are now only willing to provide hedges up to their pro-rata share of lending, reducing the overall availability of hedges in the market. As not all lenders are derivative providers, this means that there is often a portion of lending for which a hedge is difficult to find.

Figure 5. As a result of Basel III reforms, change in availability (more or fewer providers) of long-dated OTC hedging instruments in LCY for infrastructure.[26] Respondents = 12.



Impact on market structure

Differences in the application and implementation of regulatory reforms across countries and regions has led to an uneven playing field, with interview participants suggesting that AE

[25] Sovereign or index CDS can provide a generic insurance but are not a perfect hedge tailored to the underlying asset and credit exposure. Further, from a capital alleviation standpoint the current regulation recognizes indices and single-name CDS, but a sovereign proxy is not recognized. Hence, it provides a hedge but no capital alleviation.
[26] In Sub-Saharan Africa, only South Africa has a meaningful LCY swap market.

banks have lost market share to local and regional banks that have lower regulatory requirements.[27] Other non-regulatory factors, such as jurisdictional differences in funding models, constraints on cost of funds, and cost of capital for long tenors have also led to uneven competition. In some EMDE regions this has mitigated the impact of regulatory reform on availability, as local and regional banks are able to provide both funding and derivatives. In Asia local and regional banks (subject to lower regulatory requirements and more favorable funding models) have been expanding their activity, partially replacing international banks who are less willing or less able to compete, even in higher quality transactions.[28]

Discrepancies also exist among international banks. US banks are subject to the Volcker Rule, which imposes higher requirements on derivatives than Basel III. European banks have a corporate exemption on CVA charges (see Box 4) that is commonly applied to infrastructure finance transactions, reducing hedging costs compared to other jurisdictions. Some European banks have grown their market share compared to US peers in Project Finance. Thus, the corporate exemption has mitigated the effects of derivatives regulation on infrastructure in EMDEs.[29]

[27] Implementation of Basel III varies by jurisdiction, with many emerging markets at an advanced stage of implementation (for example, Argentina, Brazil, Saudi Arabia), but many others where Basel III has not yet been implemented.

[28] For example, interview participants indicate that certain Asian banks can lend 20-year tenors at spreads of 150-200 bps. This lending is not achievable for international banks, who generally lend at 300 bps or more.

[29] According to Woodall, "US CVA Charges over Seven Times Higher than EU.", the median CVA capital charge for US global systemically important banks (G-SIBs) was 7.7 times larger than for European banks at end-2017. CVA charges for US banks should be higher than for their EU peers on account of the US banks' larger non-cleared derivatives portfolios, as a percentage of total derivatives held (53% for US G-Sibs, 40% for Eurozone, 46% for UK banks). However, the difference in charges is so large that much must be attributed the corporate exemption.

Box 4. EU Corporate Exemption on CVA Charge

The EU corporate exemption has mitigated the impact of the CVA charge on infrastructure finance in EMDEs for EU banks, even though this was not the primary rationale for its introduction. The EU's Capital Requirements Regulation allows EU banks to waive CVA capital charges for non-cleared derivative trades conducted with certain types of counterparties – including corporations, pension funds, and sovereign entities. The exemptions were put in place to protect non-financial counterparties from an increase in hedging costs. European policy makers believed that the CVA provisions should be applied to the banking sector which was largely responsible for the financial crisis, and that the application of the CVA charge would increase costs for business (large and small) and discourage the flow of credit.[30] Therefore, European international banks track CVA against these counterparties, but do not apply the charge against capital.

If the CVA corporate exemption were lifted EU banks would be required to hold more capital, increasing the cost of hedging for EMDE infrastructure transactions. They would aim to hedge the specific counterparty credit risk that contributes to the CVA charge, typically through credit default swaps (CDS). However, as these are often not available in EMDE markets they would instead use a credit index or sovereign credit hedge, not fully recognized as a hedge from a capital alleviation standpoint. Interviewees indicated that charges on derivatives in low investment grade countries could rise by 50-100 bps for maturities above 4-5 years. Under Basel III's new CVA framework, to be implemented in 2022, only the standardized approach to calculating credit risk will be allowable—internal value-at-risk models will not. The standardized approach calculates the charge, taking into account the external credit rating of each counterparty as well as the effective maturity and exposure-at-default of each position.

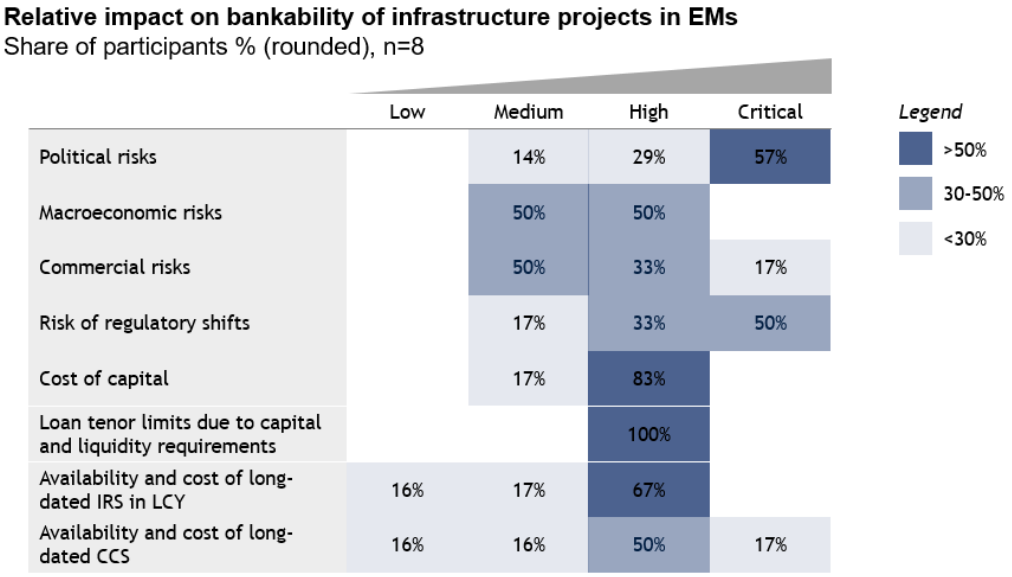
[30] Raeburn and Zubrod, "What Does Europe Know About Derivatives Reform That The White House Doesn't?"

Section 6. Impact of Derivatives Regulation on Infrastructure Finance in EMDEs

Effects on bankability and appetite

Survey participants indicate that the impact of regulation on financing infrastructure in EMDEs, as determined by bankability of infrastructure projects, is medium-to-high but not critical. Respondents were asked to assess how various risk factors affect the bankability of projects (Figure 6). Survey results discussed in earlier sections suggest that Basel III reforms have increased the pricing, somewhat decreased the tenor, and reduced the availability of long-dated OTC derivatives. Respondents indicate that the availability and cost of hedging solutions are highly relevant to bankability, that is, the financial viability of infrastructure transactions in EMDEs. The relative importance of currency hedging versus interest rate hedging varies by specific market but is overall in line with previous discussions on the importance of the hedge, whereby the availability and cost of long-dated derivatives is considered as either high or critical by the majority (67 percent) of respondents.

Figure 6. Relative impact on bankability of infrastructure projects in EMDEs.

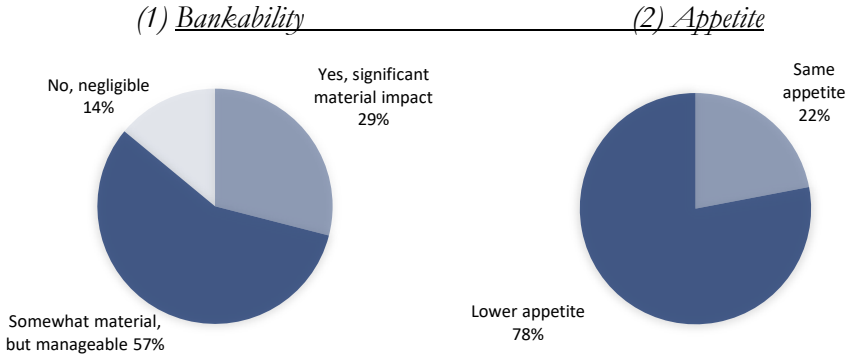


The risk of regulatory changes deserves specific mention, both in the context of the bankability of projects, but also with respect to the pricing of derivatives and the appetite of derivative providers to make markets in derivatives. Political risk and the risk of regulatory changes are consistently viewed as critical risk factors that impact bankability. The rate of regulatory change since the GFC has increased substantially. This frequency of regulatory changes has resulted in a conservative approach to policy-setting by banks, which is further impacting the cost and availability of hedging.

Survey respondents further indicate that the impact of Basel III derivative reforms on infrastructure bankability in EMDEs has been "somewhat material but manageable". The materiality of the impact varies for different infrastructure assets in different regions. In Sub-Saharan Africa the impact of the derivatives reforms has been material for IRS, but less so for CCS hedges (mostly because such instruments were not available before Basel III, due to underdeveloped markets). In many Latin American countries, the impact has been material both for IRS and short-term CCS hedging in construction.

However, approximately 78 percent of respondents report a lower appetite for doing infrastructure transactions in EMDEs, based on the inability to hedge risk. Typically, a bank's appetite for infrastructure finance transactions is driven by: (i) strength of asset cash flows, (ii) currency risk or government offtake if any, (iii) sovereign country ratings, (iv) pricing and tenor, and (v) macroeconomic risk (market and currency). The lower availability and higher cost of long-term derivatives to hedge currency and interest rate risk has affected banks appetite for infrastructure finance transactions.

Figure 7. *(1)* Impact of changes in hedging availability and cost upon bankability of infrastructure in EMDEs. *(2)* Extent to which inability or difficulty to hedge risk (availability and cost of IRS and CCS) impacted appetite for doing infrastructure business in EMDEs. Share of participants, n=11.



Hedging difficulties can result in the inability to close otherwise well-structured deals. Participants reported that well-structured transactions in EMDEs with a complete finance structure and sufficient lenders have struggled to put the derivative hedge in place. The bank or lead arranger could not provide a solution due to the very limited appetite of banks for providing long-dated hedging instruments. Without the hedge the financing transaction could not be closed.

The impact across regions is varied. In Asia projects are still being undertaken but the cost structure has changed, and fewer transactions meet the criteria required by international banks to justify financing. However, local and regional sponsors are providing financing. In the Middle East, many international banks that were dominant in the past have closed their infrastructure operations or reduced their mandate to refocus on their home markets. In Latin America, US banks have reportedly lost share and most of the hedging is provided by EU banks, who are exempt from CVA charges, or by subsidiaries subject to local regulation. In Sub-Saharan Africa banks have experienced

a sharp reduction in return on capital, with long-tenor transactions being costlier by several orders of magnitude,[31] directly impacting bankability.

Compromises in risk management and transaction structure

Survey results suggest that the increased regulatory costs on derivative transactions are often transmitted to the infrastructure project. Survey participants were asked whether the increased costs due to derivatives regulation have been passed on to customers or have decreased banks margins. Nine out of 11 derivative providers reported that over 80 percent of the cost increase is passed to end customers, with the remaining two reporting that 50-80 percent is passed on (Figure 8). Half of respondents indicated that banks' profit margins have dropped by 10-25 percent, with a quarter indicating a decrease of 25-50 percent (Annex D).

Figure 8. Split of increased derivatives costs between dealers/derivative providers and end customers. To what extent has cost increase of long-dated OTC derivatives for infrastructure in EMs been passed to the end customer or absorbed by squeezing dealer margins? Share of participants %, n=11

To reduce the impact of increased costs and reduced availability of derivatives project sponsors and structurers have made adjustments to project structure, and compromises in risk management, including:

- projects running more risk;
- governments and end-users absorbing more risk; and
- sub-optimal capital structures.

While it may be argued that such structures reflect a more accurate pricing of risk on banks' balance sheet, a consequence of such adjustments may be the higher, but often hidden, costs for the end-users of infrastructure.

Participants in this study reported that some projects are running under-hedged as a result of the increased cost, shorter tenors and lower availability of derivatives, which leaves investors

[31] As broad reference, interviewees indicated that a long-term deal that might have previously cost 20-30 bps could now cost over 100 bps.

and financiers partially exposed to fluctuations in currency and interest rates. Under-hedging can occur with respect to:

- the nominal amount hedged: for example, in the power sector respondents indicated that while previously projects were fully hedged to completion and 80-90 percent thereafter, currently hedging is between 50-75 percent on average. This leaves a significant portion of the loan exposed to changes in interest rates.
- the tenor of the loan versus the hedge: for example, a 20-year loan may be hedged with a 3-5-year CCS, exposing the project to rollover risk once the derivative hedge has matured, and subsequent currency fluctuations.

In both scenarios, either holding unhedged interest rate risk or being required to roll over a short-dated hedge, the result may be potential increased costs of the financing transaction. This is because project sponsors price in a buffer to cover for unhedged movements in interest rates or currencies, and future market uncertainty.

To facilitate financing, particularly in the absence of hedging instruments, governments and end-users are absorbing more risks. Government guarantees and tariff indexation passed to end users provide protection to investors. EMDE governments assume the risk of currency and interest rate fluctuations on their balance sheet through guarantees, often by the PPP authority backed by government. However, there is ultimately a limit to the amount of risk a government can assume without impacting its credit rating, which constrains the deal flow that can be channeled and sustained through this mechanism. The indexation of tariffs and usage fees passes the impacts of a currency depreciation to the end-users of the infrastructure service. As discussed previously there are limits on the amount and speed with which fluctuations can be passed through tariffs to end consumers, particularly in the event of a sharp currency depreciation.

Study participants reported that sub-optimal capital structures with a lower debt to equity ratio are becoming prevalent in transactions across regions. Project arrangers have become more cautious regarding leverage due to the uncertainty that arises from leaving part of the loan unhedged and exposed to movements in the currency or interest rates.[32] Given the choice between under-hedging or lower leverage, projects are being arranged with what is considered by financiers to be a sub-optimal capital structure. The reduction in the debt to equity ratio raises the overall cost of the deal (as equity is more expensive than debt), which in turn can translate into higher end-user tariffs.

Alternative financing structures

To reduce or bypass the impact of the changes in derivatives regulation, banks have reported using or devising alternative financing structures, including product adaptations such as:

[32] Exceptions exist, particularly in the more mature EMDEs. For instance, in Thailand local banks are largely unhedged and maintain high leverage ratios of projects. However, it still holds that for most markets in the region (for example, Indonesia or Vietnam) projects have decreased leverage. As a recent example, in Taiwan two large windfarms are structured with hedging of 75 percent for 7 years. Sub-optimal capital structure is especially noticeable with smaller sponsors with weaker balance sheets.

- *Options-based hedges*: To reduce capital consumption banks are exploring structured options solutions in more liquid EMDEs to manage risk. These include zero cost or reduced cost collars that decrease the premium or price paid for the option. Some governments are also testing these products. For example, the Government of Argentina offered 2-3 year zero cost collars on the real exchange rate.[33] Although these structures provide some flexibility they are often expensive and do not provide sufficient protection;
- *Embedding the derivative in the loan:* Banks embed derivatives within loan structures in the form of an inflation adjusted or interest rate adjusted loan, to reduce regulatory charges. Although it is a simpler arrangement for project sponsors as it involves only an interest payment on the loan, there are concerns related to unwinding costs in the event of debt restructuring;[34]
- *Guarantees:* These are sought by infrastructure financiers to de-risk and enhance the credit-worthiness of infrastructure projects in EMDEs. Export Credit Agency (ECA) coverage is the main support to improve credit exposure on a transaction, but it does not cover hedging and is often unavailable in sub-investment grade countries. DFI guarantees and sovereign swap guarantees are sought by banks to alleviate capital costs; and
- *Short-term lending structures such as mini-perms:* Instead of amortizing facilities, mini-perms and cash sweeps after 7-8 years are increasingly popular. These are being used to reduce loan and swap tenors, however they do not mitigate uncertainty in the long term, raise refinancing risk and can increase the cost of a transaction through a price buffer. Mini-perms are therefore attractive in countries and projects without high refinancing risk. Mini-perms with multiple funds involved are prevalent in AEs (for example, USA, Australia), but this avenue is often unavailable in EMDEs.

Changes to business models for lending

Interviews with market participants suggest that due to the reduced profitability of derivatives trades, the profitability of an infrastructure finance transaction that combines a loan with a derivative has decreased, reducing bank's appetite to lend. Long-term lending has traditionally been subsidized by other more profitable activities attached to loans, such as derivatives, as lending itself does not have high margins and therefore does not provide significant returns. Prior to the GFC banks recorded larger profits from large OTC derivatives trades and for many institutions they provided a major business rationale for lending to infrastructure. As the regulatory costs applicable to derivatives have increased, thereby making these products less profitable for banks, the profitability of the loan plus derivative financial package has significantly decreased. Regulatory costs for lending and derivatives are higher in EMDE countries that typically have lower credit ratings than in AEs, and as a result some banks are reducing or even beginning to stop long-term lending to EMDEs, focusing instead on activities such as origination, syndication and distribution of infrastructure transactions. Banks are also becoming more selective as to which projects and clients they lend to as a result of lower profitability on transactions. Many banks interviewed now channel their more limited lending

[33] A zero-cost collar is an option trading strategy that offsets the volatility risk and cost of a single derivative by purchasing derivatives that provide both a cap and a floor for underlying prices. To implement this strategy, the premiums (or prices) of the put and call options must match exactly.

[34] The agreement would include a clause such that in the case of termination the client would be required to compensate the bank for unwinding costs.

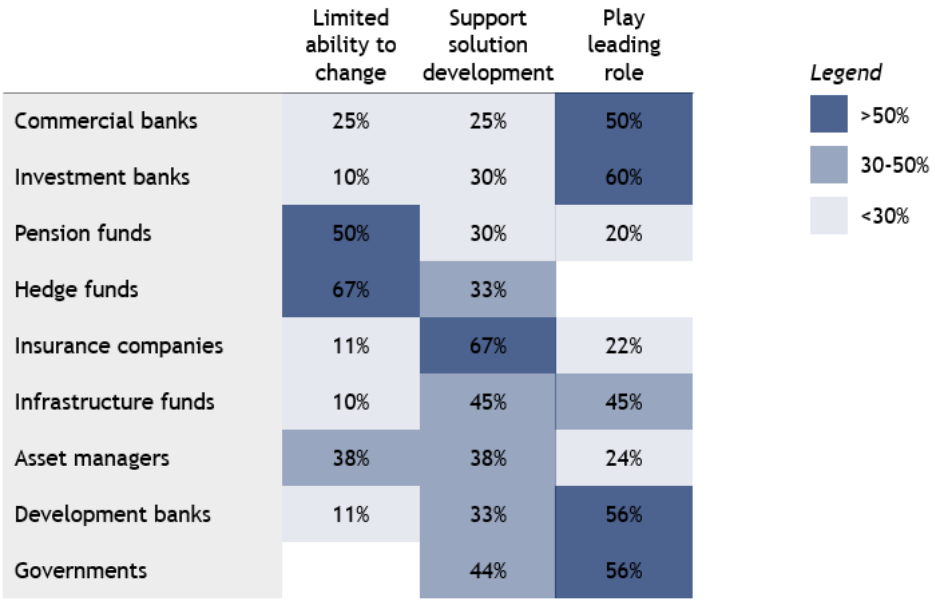
to priority and high-quality clients, with the result that only the highest quality projects are being funded. This is of particular concern to EMDEs, who have fewer highly rated projects.

Section 7. New Trends in Infrastructure Financing

The move towards a model of increased institutional investor participation in infrastructure financing is well understood and was a recurring theme in interviews. Discussions suggest that an overall approach to the financing of infrastructure is required, that considers the ability to hedge financial risks in combination with new patterns of lending. This study suggests that the reduced availability and increased costs of derivatives, which in turn has led to a reduced ability to hedge infrastructure finance transactions, is further decreasing the relevance and role of banks in providing financing for infrastructure in EMDEs. Therefore, an assessment of the ability of other market participants to play a larger role in infrastructure hedging is warranted.

No clear consensus exists on the extent to which different market participants could contribute to provide infrastructure hedging, but banks surveyed agree on their continued leading role. Survey participants were asked who was best placed to provide hedging solutions at a reasonable cost for infrastructure in EMDEs (Figure 9). Commercial and investment banks, as well as Development Finance Institutions (DFIs) and governments were seen as playing a leading role.

Figure 9. Role of different market participants in providing hedging solutions at a reasonable cost for infrastructure in Emerging Markets. Which market participants are best placed to provide hedging solutions at a reasonable cost for infrastructure development in EMDEs? Share of participants % (rounded), n=11.



Institutional investors, DFIs and governments have a role in providing hedging solutions or financing solutions that by their nature can facilitate hedging or reduce the need for derivative instruments. Hedge funds, while having the expertise to price and manage derivative risk, lack sufficiently high credit ratings or large enough balance sheets to be acceptable as derivative counterparts at scale. They also do not have a lending stake in the underlying transaction. Recently, Private Equity funds have become some of the most active developers of infrastructure in regions such as Asia.[35] These funds have a different risk-reward profile and shorter-term horizon (5-7 years) compared to traditional developers (who seek annuity type returns and require hedging). Insurance companies have begun to offer insurance on derivatives, but they are not yet meaningful in the overall market.

The future role of institutional investors

The shift towards greater direct involvement of institutional investors and less reliance on banks in infrastructure financing has begun in AEs. However, it is progressing much more slowly in EMDEs.[36] EU pension funds are starting to invest in infrastructure transactions in the larger, more credit worthy EMDEs such as Mexico, Turkey, South Africa, and Colombia. With a DFI first loss guarantee, they are also starting to consider lower credit countries. However, there is still overall extremely limited risk appetite for the less developed EMDEs, where the need for infrastructure investment is greatest.

Institutional investors can lend long-term at fixed rates, and are well-placed to meet the needs of project sponsors, who look to borrow long-term at fixed interest rates. Project financing should have a balanced asset-and-liability matching, as institutional investors are not structured to manage market risk actively, which may be fixed-rate or inflation linked depending on the project context. For institutional investors, the top determinants for financing infrastructure debt investments are:[37] currency, rating, country risk, and regulatory risk (in that order).[38] Regulation such as Solvency II appears to be helping to increase participation of institutional investors in long-term lending to infrastructure in some regions, for example in Eastern Europe, by defining qualifying infrastructure investment criteria, moving from investment buckets to a risk capital approach, and accepting internal ratings in the first pillar.

Mechanisms to bring institutional investors earlier into infrastructure projects are valuable in EMDEs.[39] To attract institutional financing into infrastructure, some banks have experimented with products analogous to a "monoline wrap", but with limited success. In this arrangement, the bank provides a currency hedge guarantee through a wrapped project. However,

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[35] Market participants indicate that Private Equity infrastructure funds are increasing their presence, participating in about 2 out of 10 deals.

[36] Institutional investors' participation in infrastructure finance currently accounts for approximately USD 50 billion globally, predominantly in AEs. Study participants expect strong growth towards approximately USD 100 billion in three years and between USD 300-500 billion in five to ten years. However, even at the higher estimations this is unlikely to fill the infrastructure financing gap in EMDEs. Participants indicated that in AEs, institutional investors participate in about 1 out of 2 projects (typically refinancing), whereas in EMDEs they participate in about 1 out of 10 projects.

[37] Fintzen, "Effects of Financial Regulatory Reform on Financing for Infrastructure Investments."

[38] Rating implies investment grade risk metrics. Country risk includes political risk, convertibility risk, insolvency laws.

[39] Such models need to remain cognizant of overall costs and refinancing risk. Although imperfect, some of the benefits of these models are captured through distribution of risk and reward offering different rates and amortization speeds.

as banks need in practice to back the guarantee through other instruments, the product has not achieved scale. A monoline type of structure has been used by GuarantCo in Nigeria, but at small scale, to allow pension funds and insurers to buy a wrapped Naira-based project and invest long-term as a way to remove currency risk, especially for roads and the power sector. There are currently no institutions that can provide the model on a scale large enough to impact infrastructure finance.

Direct involvement of DFIs and government

DFIs have a variety of roles to play in infrastructure finance, including development of EMDE capital and derivative markets, mitigating counterparty risk and its associated costs by providing various forms of risk guarantees, and mitigating currency mismatches. DFIs offer a wide range of guarantee instruments that can be issued in different currencies to match the needs of individual transactions, thereby helping de-risk projects.[40] The World Bank Group works with institutional investors to promote LCY lending. DFIs such as the International Finance Corporation (IFC) facilitate currency hedging through commercial banks for infrastructure projects by intermediating derivatives and retaining counterparty risk,[41] which allows them to provide derivatives for lower credit EMDE infrastructure projects. However, this is not in large scale and there remains significant scope for a larger role for DFIs.

Governments continue to play an important role by assuming financial risks on their balance sheets. With regards to derivative hedging, governments can help reduce counterparty credit risk via guarantees. Further, they can strive to reduce political risk and develop local capital markets.

The ongoing role of banks as derivative providers

It is unlikely that market participants other than banks would be suitable and able to take the role of derivative providers. While institutional investors can, to some extent, reduce the need for interest rate hedging by providing fixed rate loans, and while domestic institutional investors can increase the amount of LCY financing removing the need to hedge currency risk, the transition to institutional investor-led funding is progressing slowly in EMDEs. For the large majority of transactions some form of derivatives hedge is still required. Banks remain as the only providers of derivative instruments, as other participants either do not have (and should not have) the appetite or mandate to run derivative risk on their balance sheet; and do not have and do not want to bear the cost of the internal controls, mechanisms and expertise to do so—including compliance. However, as banks continue to reduce both their exposure and lending to infrastructure in EMDEs, they also have less appetite for providing the long-term hedge on a transaction. A scenario in which banks are required to provide the hedge but not the loan would complicate market dynamics.

[40] Including a range of risk-mitigation instruments in the poorest countries, via International Development Association.
[41] The counterparty bank faces the IFC, which has AAA credit rating, making the hedge workable for the bank.

Section 8. Areas for Further Analysis

Risk characteristics in terms of recovery rate, structure and quality specific to infrastructure finance transactions

Infrastructure projects have specific characteristics that could form the basis for further analysis to consider potential enhancements to the regulatory framework for derivatives to hedge EMDE infrastructure transactions. While substitution effects due to an uneven regulatory landscape,[42] an increase in institutional investor participation, and adjustments to the structure of transactions are masking the impact of regulations, this study suggests that further analysis around the regulatory treatment for derivative instruments for EMDE infrastructure finance may be justified. This study has gathered insights that suggest the behavior of banks, as derivatives providers, has changed with regards to infrastructure finance as a result of regulatory reforms. These findings, together with the importance of infrastructure for EMDEs, and the lack of other market participants well placed to make markets in and hold and manage long-dated derivatives, suggest further analysis is warranted to consider potential enhancements to the regulatory framework for derivatives for infrastructure finance in EMDEs. The characteristics highlighted below differentiate the risk in infrastructure transactions from that arising in corporate finance transactions.

Infrastructure projects have a higher recovery value than corporate finance operations. Recovery rates for infrastructure transactions are estimated at around 82 percent (comparable to senior secured corporate loans), which is not reflected in counterparty risk calculations.[43] Some reasons for higher recovery rates may include risk-attenuating features such as the fact that infrastructure involves a physical revenue-producing asset that is often pseudo-monopolistic in nature, and the willingness of banks to work through project challenges and restructure infrastructure deals. The higher recovery value is not reflected in the regulation of derivatives, particularly for OTC derivatives of long tenor. Counter-arguments may suggest that the low rate of default partly responds to the recent benign macroeconomic environment and to self-selection, as mostly high-quality transactions are financed.

Infrastructure projects are typically well-structured with various targeted enhancements and guarantees that are often not fully recognized through project credit ratings or by regulatory authorities. While most infrastructure borrowers are highly leveraged, well structured transactions with underwriting discipline, incentive structures, insurance and guarantees from DFIs and governments strengthen transactions and appear effective in reducing default risk and achieving high stable recoveries, even in EMDEs.

The credit risk of infrastructure projects declines over time; however, long-dated derivatives bear higher capital charges under Basel III than short-dated ones. This has been a key factor in reducing banks' ability to provide long-dated derivatives for infrastructure. Current capital requirements imply that the credit risk of infrastructure projects evolves like that of corporates,

[42] Including local versus regional banks, and EU versus US banks.
[43] Jobst, "Credit Risk Dynamics of Infrastructure Investment."

whereas infrastructure debt has a different risk profile with a lower marginal probability of default after the initial years of a project.[44]

Key areas for further analysis

The characteristics of infrastructure projects in terms of structure, quality and recovery rate suggest that there is scope for further analysis and study to explore enhancements to the regulatory framework affecting the instruments used to hedge the risks of investing in infrastructure assets—without undermining the achievement of the overall regulatory objectives. As discussed above these characteristics include higher recovery values than for corporate finance transactions, credit resilience through well-structured transactions with targeted enhancements and guarantees (that are sometimes not fully recognized by regulatory regimes), and the declining credit risk of infrastructure transactions over time. Currency hedges for EMDE infrastructure also often exhibit the characteristics of "right-way risk"[45] that are not recognized by the regulatory framework.

A risk-based approach should underpin any such enhancements. Enhancements should aim to accurately capture the specific risk characteristics of infrastructure finance in EMDEs, rather than discounting them completely. This requires further detailed research and analysis, including a regulatory cost-benefit analysis.[46]

Criteria-based definitions of qualifying infrastructure companies exist under Basel II and Solvency II, and several institutions[47] are advancing the definition—however, an infrastructure-specific long-term risk assessment would be needed for the purpose of considering adjustments for infrastructure projects in EMDEs. Further, a risk assessment of hedging for infrastructure should be conducted and take into account the specific characteristics of such hedges. Also, the concrete nature of possible adjustments must be determined, and be in line with the overall regulatory objectives. Finally, any analysis of potential adjustments for derivatives used to hedge infrastructure projects must include the implications from a risk standpoint, the accounting treatment, and the expected impact on the structure of infrastructure deals that would facilitate capital flows into infrastructure.

As highlighted by survey respondents, credit risk and the CVA charge impose the highest constraints on the ability of banks to offer long dated derivatives. So far, the EU corporate exemption has allowed European banks to continue to offer long dated derivatives to corporates at lower prices than US banks. Removing the EU corporate exemption would increase the CVA risk capital charges for EU banks,[48] and the effect would particularly impact the credit-intensive, large, long dated, OTC derivatives used to hedge infrastructure finance transactions. Recent Basel III

[44] Jobst.
[45] Right-way risk refers to the case in which counterparty exposure decreases when its credit quality deteriorates. Conversely, the case in which counterparty exposure increases when its credit quality deteriorates, referred to as wrong-way risk, can have great impact on CVA, economic capital and collateralized exposures with margins (Rosen and Saunders, "CVA the Wrong Way.")
[46] This study does not recommend such actions, it merely suggests them as areas for further study.
[47] "Global Infrastructure Company Classification Standard."
[48] Woodall, "EU Banks' CVA Capital to Triple If Exemptions Axed."

regulatory efforts[49] focus on adjusting the CVA risk framework in terms of its sensitivity, robustness, and consistency.

Adjustments for investors based on the characteristics of infrastructure in EMDEs could also be considered. Although not specific to the post-crisis regulatory reforms applicable to derivatives, as discussed in this study the participation of institutional investors in infrastructure finance who can offer long-term fixed rate and LCY financing is a significant way to reduce the requirement for derivative hedging of infrastructure finance transactions. A recent report by EIOPA[50] indicates that differentiated treatment of capital charges through Solvency II for EU insurers investing in infrastructure appears to be increasing capital flows into these assets. However, institutional funding is still limited compared with bank funding, and particularly so for infrastructure in EMDEs. Adjustments to the capital charges for other institutional investors may be worth considering, while keeping in mind their risk profile and fiduciary responsibilities. An examination of other related topics,[51] outside the scope of the post-crisis regulation discussed in this study may also be helpful, including tax withholding laws[52] that remain significant impediments to institutional investors and banks. These features could help increase appetite for infrastructure investment in EMDEs.

[49] "Basel III Monitoring Report"; "High-Level Summary of Basel III Reforms."

[50] See EIOPA's "Investment Behavior Report", which shows that 60 percent of surveyed European insurers have shifted new investment into more illiquid assets, including infrastructure exposures as a result of a differentiated treatment since 2016. Other jurisdictions have implemented a similar approach (China, South Korea) or are actively considering it (Argentina, Hong Kong, Singapore).

[51] With regards to derivatives hedging, additional analysis could explore the extension of ECA coverage to hedging. ECA insurance can reduce the effect of risk-weighted assets on bank capital, but it does not cover hedging and is often unavailable in sub-investment grade countries. Extending ECA to derivatives may not be plausible but can be discussed.

[52] Many EMDE jurisdictions (for example, Latin American) impose withholding taxes on corporate bonds (not sovereign) that restrain the potential for project bonds and hence domestic institutional investor participation in EMDE infrastructure. Adjusting the tax withholding laws for infrastructure projects could encourage LCY investment. International investors would also benefit from reducing withholding tax. Some AEs are already exploring this issue, the UK for example has introduced withholding tax exemptions for qualifying private placements.

Section 9. Policy Considerations for EMDEs

Findings in this study indicate policies to expand infrastructure finance are strictly dependent on the level of financial sector development. When considering how to promote infrastructure financing given the evidence found in this study, policy makers in EMDEs should first understand the context with regards to their credit quality, the maturity of their banking sector, the size of their institutional investor base, the development and liquidity of their capital markets (particularly the length and depth of the domestic yield curve), and the existence of other market participants, to consider a policy approach. As discussed in Box 1, the use of derivatives depends on local capital market characteristics.

Countries at a higher level of development could transition faster to a different development model. Countries that have developed local financial systems and domestic capital markets can provide financing in LCY through local and international banks and investors, in addition to HCY for infrastructure projects. They typically have local and regional banks with the capacity to price and manage derivatives risk, banks that are already mitigating some of the effects of the post GFC regulatory reforms. They are likely to have a larger local institutional investor base that can be harnessed to fund infrastructure projects. Their higher credit rating also makes them attractive to foreign institutional investors.[53]

For countries with underdeveloped local financial systems and local currency bond markets the impact of the post-crisis reforms on maturity and pricing is not as large or observable as these countries did not have, or had illiquid, derivatives markets to start. These countries have no, or very limited, LCY long-term financing, and because liquidity was already scarce, derivatives activity (particularly CCS) was already low to start. However, countries with a lower credit rating and illiquid markets had the largest reported reductions in availability due to post-crisis reforms.

For any EMDE looking at ways to increase investment in infrastructure, the model used previously—that is, relying on banks to fund and hedge infrastructure projects—may no longer be used as a path. Although derivatives continue to be an important component of infrastructure financing, and local and international banks remain best placed to provide derivatives—EMDEs can no longer develop infrastructure based on financing and hedging by banks alone. In these countries the relevance of capital markets development has increased, including the growth of the domestic institutional investor base. However, banks are still needed. The reinforcing effect of banks and institutional investors remains extremely important, with banks still best placed to finance the initial stages of infrastructure projects and institutional investors participating in later stages.

To move towards new patterns of infrastructure financing, risk management in infrastructure projects has, and will continue to become more important than before. In circumstances with less availability of shorter dated and more costly hedging instruments, governments and end-users will be required to absorb more risks. Project preparation will become increasingly important, particularly with respect to the increased transparency, better management and improved efficiency of projects—

[53] http://documents.worldbank.org/curated/en/672231533669107669/pdf/129287-WP-PUBLIC-PromotingtheUseofCapitalMarketsforInfrastructureFinancing.pdf

to attract a broader investor base. As the capacity of governments to take on such risk is limited, they must improve their management of contingent liabilities and risks while promoting a conducive environment for greater risk mitigation, sharing and transfer. Governments should focus on mitigating non-hedgeable risks including institutional factors such as rule of law, and regulatory risks also via improved PPP frameworks. In addition, risk sharing through the use of guarantees and credit enhancements should be carefully designed to effectively unlock the mobilization of private capital while ensuring the fair distribution of risks between the public and private sectors.

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Annex A. Research Process

The study team conducted a set of structured interviews, a detailed survey, and held a round-table discussion with leading experts and market participants to inform this work.

- *Survey*: A survey of 10 leading infrastructure finance banks and a select group of active derivative trading desks and providers was conducted between January and March 2018 to develop an industry perspective. The focus of the survey was on EMDEs with a track record of infrastructure investment[54] and with a certain level of maturity of their financial system.
- *Roundtable*: A roundtable with infrastructure financiers and hedge providers from top banks was held in March 2018, in which participants discussed a set of defined topics. These topics included: regulation, lending and hedging in emerging markets; impact on bankability, appetite, project and transaction structure; and new product adaptations, business models and financing patterns. The roundtable was hosted and moderated by Joaquim Levy, World Bank CFO.
- *Structured interviews*: Over 50 structured interviews with banks, industry associations, regulatory experts and infrastructure sponsors were conducted between November 2017 and March 2018. In addition, the input of almost 20 World Bank experts was gathered.

The following banks participated in the survey: Australia and New Zealand Bank, Banco Santander, BNP Paribas, Citigroup, First Gulf Bank, Mizuho Bank, Société Generale, Standard Bank of South Africa, Standard Chartered Bank, Sumitomo Mitsui Banking Corporation. In most instances, both infrastructure professionals and trading desks from these institutions provided input.

In addition, structured interviews, formal and informal discussions were held with the following: Allianz Global Investors, Bank of America, CFTC, Deutsche Bank, HSBC, International Association of Credit Portfolio Managers, ING Bank, International Finance Corporation, Institute of International Finance, JP Morgan, Mitsubishi UFJ Financial Group, Golub Center for Finance and Policy MIT, International Association of Credit Portfolio Managers, and TCX Fund.

Roundtable participants included:

- *BNP Paribas*: Global Head of FX, Local Markets and Commodities
- *Citigroup*: Managing Director, Head of Americas Strategic Risk Solutions; Managing Director, Head of Europe, the Middle East and Africa (EMEA) Project and Infrastructure Finance
- *Mizuho*: Senior Director Power & Advisory and Structured Finance
- *Santander*: Managing Director, FX and Rates Sales
- *Société Generale*: Global Head of Market Risk Advisory, Deputy Head Corporate Sales Europe
- *Standard Bank of South Africa*: Director, Mining, Energy and Infrastructure Finance
- *Standard Chartered Bank*: Global Head, Public Sector & Development Organizations
- *Sumitomo*: Managing Director, Head of Infrastructure, Transport and Islamic Finance

[54] Garcia-Kilroy and Rudolph, "Private Financing of Public Infrastructure through PPPs in Latin America and the Caribbean."

Annex B. Survey Questions

Basic information

1) Name of your firm

2) For which Emerging Market region(s) are you providing input on Infrastructure transactions? (This will filter the subset of countries investigated in the remainder of the survey)*

[ ] Asia [ ] Sub-Saharan Africa

[ ] MENA [ ] Latin America

Lending to Infrastructure

3) As a result of the Basel III reforms, what is the change in typical loan tenor for infrastructure projects in emerging markets?

	Before Basel III			After Basel III			Your firm's internal restrictions on tenor?
	>20 years	15-20 years	10-15 years	>20 years	15-20 years	10-15 years	
Asia	___	___	___	___	___	___	___
Latin America	___	___	___	___	___	___	___
Sub-Saharan Africa	___	___	___	___	___	___	___
MENA	___	___	___	___	___	___	___

4) As a result of Basel III reforms, approximately what is the regulatory cost (running basis) added to the cost of funding for a 15-20 year loan to a typical infrastructure project (rating BB-BBB)?

	Increased	Increased 25-50 bps	Increased 50-75 bps	Increased 75-100 bps	Increased >100 bps
Asia	( )	( )	( )	( )	( )
Latin America	( )	( )	( )	( )	( )
Sub-Saharan Africa	( )	( )	( )	( )	( )
MENA	( )	( )	( )	( )	( )

5) Relative impact of the Basel III reforms (capital and liquidity) on long-term lending for infrastructure in Emerging Markets

	Very low	Low	Medium	High	Very high
Capital Adequacy Ratio (CAR)	( )	( )	( )	( )	( )
Leverage Ratio (LR)	( )	( )	( )	( )	( )
Net Stable Funding Ratio (NSFR)	( )	( )	( )	( )	( )
Liquidity Cover Ratio (LCR)	( )	( )	( )	( )	( )

Hedging instruments for Infrastructure

6) Maximum tenor of hedging instruments denominated in Local Currency for approximately USD 100-200 million notional.

	Interest Rate Swap (IRS)						Cross Currency Swap (CCS)					
	1-3 years	3-7 years	7-10 years	10-15 years	15-20 years	>20 years	1-3 years	3-7 years	7-10 years	10-15 years	15-20 years	>20 years
Country	___	___	___	___	___	___	___	___	___	___	___	___
…	___	___	___	___	___	___	___	___	___	___	___	___

7) As a result of Basel III reforms, has there been a change in maturity of hedging instruments denominated in Local Currency for Infrastructure?

	Stable	Longer maturity	Shorter maturity
Country	( )	( )	( )
…	( )	( )	( )

8) As a result of Basel III reforms, has there been a change in availability (more or fewer providers) of long-dated OTC hedging instruments for Infrastructure?

	Availability of long-dated Interest Rate Swap (IRS)—denominated in Local Currency			Availability of long-dated Cross Currency Swap (CCS)—Local Currency vs USD		
	More	Stable	Less	More	Stable	Less
Country	( )	( )	( )	( )	( )	( )
…	( )	( )	( )	( )	( )	( )

9) As a result of Basel III reforms, what is the change in the price (on a running basis) of an Interest Rate Swap (IRS) denominated in Local Currency for Infrastructure?

	5-year IRS					10-15-year IRS				
	Increased	Increased 10-25 bps	Increased 25-50 bps	Increased 50-100 bps	Increased >100 bps	Increased	Increased 10-25 bps	Increased 25-50 bps	Increased 50-100 bps	Increased >100 bps
Country	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
…	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )

10) As a result of Basel III reforms, what is the change in the price (on a running basis) of a Cross Currency Swap (CCS), Local Currency vs USD, for Infrastructure?

	5-year CCS					10-15-year CCS				
	Increased	Increased 10-25 bps	Increased 25-50 bps	Increased 50-100 bps	Increased >100 bps	Increased	Increased 10-25 bps	Increased 25-50 bps	Increased 50-100 bps	Increased >100 bps
Country	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
…	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )

11) As a result of Basel III reforms, have changes in availability and cost of derivatives for hedging, materially impacted the bankability of Infrastructure transactions in Emerging Markets?

( ) Yes, materially

( ) No, negligible

( ) Somewhat, but manageable

12) When derivatives are not available at an affordable price for an Infrastructure project in Emerging Markets, what alternative products or instruments are being developed and applied to hedge Infrastructure in Emerging Markets?

Implications on Infrastructure in Emerging Markets

13) What is the relative impact of the following factors upon the bankability of Infrastructure projects in Emerging Markets?

	Negligible	Low impact	Medium impact	High impact	Critical
Political risks	( )	( )	( )	( )	( )
Macroeconomic risks	( )	( )	( )	( )	( )
Commercial risks	( )	( )	( )	( )	( )
Risk of regulatory shifts	( )	( )	( )	( )	( )
Cost of capital	( )	( )	( )	( )	( )
Loan tenor limits due to capital and liquidity requirements	( )	( )	( )	( )	( )
Availability and cost of long-dated Interest Rate hedge (in local currency)	( )	( )	( )	( )	( )
Availability and cost of long-dated Cross Currency hedge (in local currency)	( )	( )	( )	( )	( )

14) As a result of Basel III reforms, to what extent has the inability or difficulty to hedge your risk (availability and cost of IRS and CCS) impacted your firm's appetite for doing Infrastructure business in Emerging Markets?

( ) Same appetite

( ) Lower appetite

( ) Much lower appetite

15) As a result of the Basel III reforms affecting the ability to hedge effectively, what are the top 2-3 compromises you had to make in Project and Transaction Structure in Emerging Markets? (for example, sub-optimal debt structure, lower equity participation and return, raising hard currency instead of local currency, running interest rate mismatches, absorbing some market risk, posting collateral requirements, reducing hedge maturity, using corporate finance instead or project finance for some or all of the risk, and so forth.)

16) Given the existing reform environment, which market participants are best placed to provide hedging solutions at a reasonable cost for Infrastructure development in Emerging Markets?

	Limited ability to change	Support solution development	Play leading role
Commercial banks	[ ]	[ ]	[ ]
Investment banks	[ ]	[ ]	[ ]
Pension funds	[ ]	[ ]	[ ]
Hedge funds	[ ]	[ ]	[ ]
Insurance companies	[ ]	[ ]	[ ]
Infrastructure funds	[ ]	[ ]	[ ]
Asset Managers	[ ]	[ ]	[ ]
Development banks	[ ]	[ ]	[ ]
Governments	[ ]	[ ]	[ ]

Additional Questions for Dealer Desks

17) To what extent has the increase in cost of long-dated OTC derivatives for Infrastructure in Emerging Markets been passed on to the end customer and to what extent has it been absorbed by squeezing dealer margins?

( ) >80% passed through to end customers

( ) 50-80% passed through to end customers

( ) Approximately 50-50 split

( ) 50-80% absorbed by squeezing profit margins of dealer desk

( ) >80% absorbed by squeezing profit margins of dealer desk

18) As a result of Basel III reforms, what is the change in capital held (multiples) for long-dated OTC derivatives
for Infrastructure?

	10-15 year IRS, denominated in Local Currency	10-15 year CCS, Local Currency vs USD
Country	___	___
…	___	___

19) As a result of Basel III reforms, what is the approximate effect on profit margin of long-dated OTC derivatives used in Infrastructure in Emerging Markets?

( ) Stable

( ) Decreased by <10%

( ) Decreased by 10-25%

( ) Decreased by 25-50%

( ) Decreased by >50%

20) As a result of Basel III reforms, has there been a change in the number of deals, the average size of notional, the proportion hedged, the market participants, or the nature of the counterparties in long-dated OTC derivatives used for Infrastructure in Emerging Markets?

21) As a result of Basel III reforms, has there been a change in collateralization of OTC derivatives for Infrastructure in Emerging Markets? (if relevant, comment on change in nature of collateral)

	Change			Amount change in multiples
	Increase	Decrease	No significant change	
Collateralization	( )	( )	( )	___

22) As a result of Basel III reforms, how does the effect of margin requirements compare with that of CVA charge for long-dated OTC derivatives used for Infrastructure in Emerging Markets? (for example, when is one more punitive than the other, what are infrastructure clients asking for, and so on.)

23) What component of Basel III reforms is the main constraint for providing long-dated OTC hedging solutions for Infrastructure in Emerging Markets?

	Low impact	Medium impact	High impact	Very high impact
Regulatory impact of market risk	( )	( )	( )	( )
Counter-party credit risk	( )	( )	( )	( )
Collateral and margin posting requirements	( )	( )	( )	( )
Capital cost	( )	( )	( )	( )
CVA charge	( )	( )	( )	( )

24) Relative impact of the Basel III reforms (capital and liquidity) on hedging for Infrastructure in Emerging Markets

	Very low	Low	Medium	High	Very high
Capital Adequacy Ratio (CAR)	( )	( )	( )	( )	( )
Leverage Ratio (LR)	( )	( )	( )	( )	( )
Net Stable Funding Ratio (NSFR)	( )	( )	( )	( )	( )
Liquidity Cover Ratio (LCR)	( )	( )	( )	( )	( )

25) Going forward, so-called "Basel IV" will introduce tighter reforms, including capital requirements, risk-weighted asset calibration, and new accounting standards. What piece of regulation is likely to be most constraining for hedging in particular, and for the general development of Infrastructure in Emerging Markets?

Annex C. Survey Results on Lending to Infrastructure in EMDEs

Survey results, on balance, suggest that Basel III regulatory changes reduced the ability of banks to provide long-term lending to finance infrastructure projects in EMDEs by reducing the tenor of loans and increasing lending costs. To gain an understanding of the impact of regulatory reforms on lending to EMDE infrastructure projects, market participants were surveyed as to whether reforms had affected the tenor of loans, and the cost of a 15-20-year loan on a running basis (for a project rated BB-BBB). Interviews with market participants revealed changes to the business model for lending due to the impact of regulatory reforms on derivatives. These include reduced ability to lend, and increased selectivity in which loans to extend. This is in line with findings from the FSB and recent literature.[55] These effects are influenced by the uneven application of regulatory reforms by regulatory authorities across EMDE jurisdictions.

Impact on cost and tenor of loans

Survey participants reported that as a result of Basel III reforms, the cost of a 15-20 year loan to an infrastructure project with rated BB-BBB increased. The increase varied by region. In Asia, participants suggested that regulation added approximately 50-75 basis points (bps) on a running basis to a 15-20-year loan, which implies an increase in the total cost of debt of approximately 20 percent.[56] In Sub-Saharan Africa and the Middle East, reported increases were in the range of 25-50 bps (although greater in specific geographies), while in Latin America, the increased additional cost was reported to be in the range of 75-150 bps. The Capital Adequacy Ratio directly impacts a bank's funding costs and was reported to be the greatest constraint on lending.[57]

Survey responses indicated that loan tenors have decreased slightly and unevenly across regions compared to the pre-crisis period. Sub-Saharan Africa saw the largest impact, with maximum tenors decreasing from between 15 and 20 years to below 15 years. In Asia, maximum tenors decreased slightly but remain between 15-20 years, longer tenors are on an exception basis for high quality projects, while tenors are more typically around 15 years. In Latin America, strict credit lines have historically restricted loan tenors more than in other regions, and tenors remain relatively short, at around 10 years. In the Middle East, the Basel III reforms on asset risk-weighting have reportedly increased capital requirements on long tenor infrastructure assets to the extent of reportedly

[55] Ma, "Basel III and the Future of Project Finance Funding"; Greenwood, "Infrastructure Financing."
[56] Assuming a typical project finance loan cost of approximately 300 bps.
[57] The NSFR also has negative impact on lending, and the LCR poses an additional issue for infrastructure sponsors, as it treats undrawn facilities (for example, revolving loans, letters of credit) differently depending on type of borrower. An undrawn revolving loan requires 10 percent liquidity cover if made to a non-financial corporate borrower, but 100 percent cover if made to a special purpose vehicle. Finally, the impact of the LR depends on each bank's operating model.

causing difficulties for banks to meet their pricing guidelines and target returns, thus reducing typical loan tenors to below 20 years.

Figure C1. As a result of Basel III reforms, approximate regulatory cost added to the cost of funding for a 15-20 year loan to a typical infrastructure project (rating BB-BBB). Respondents = 11.

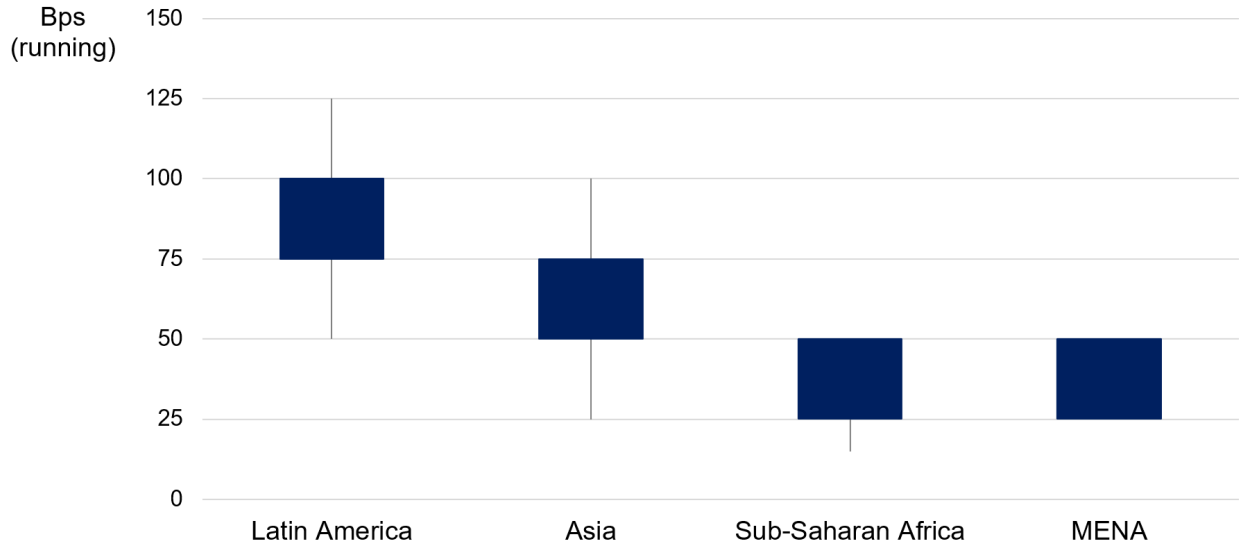
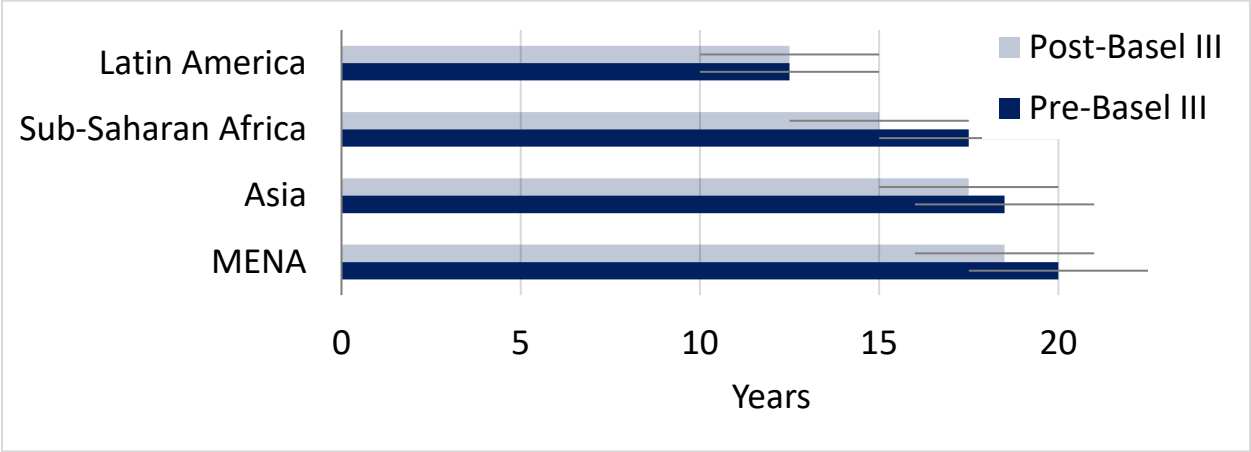


Figure C2. As a result of Basel III, change in typical loan tenor of infrastructure projects. Respondents = 11.



Annex D. Additional Survey Results on Derivatives Hedging for EMDE Infrastructure

Figure D1. Main constraints for providing long-term OTC hedging for infrastructure in EMDEs.

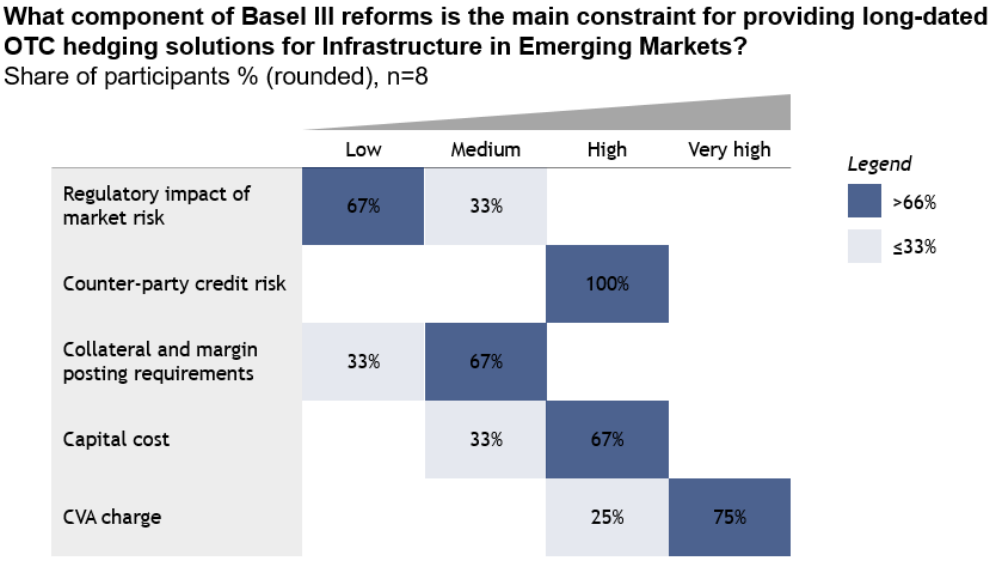


Figure D2. Change in capital held for long-dated OTC derivatives for infrastructure. Average range of respondents, n=8.

	10-year IRS	10-year CCS
Brazil		
Mexico		
Chile		
Colombia		
Peru		
Argentina		
Nigeria	-	6
Ghana	-	6
South Africa	5	5
Kenya	-	5
India	2.5	2.5
Thailand	2.5	2.5
Indonesia		
Malaysia	2.5	2.5
Philippines	2.5	2.5
Saudi Arabia	2	2
Qatar	3	4
UAE	2	2
Egypt	4	5
Turkey	2	3

Figure D3. As a result of Basel III, price change of 5-year IRS denominated in LCY for infrastructure. Average range of respondents, n=10.

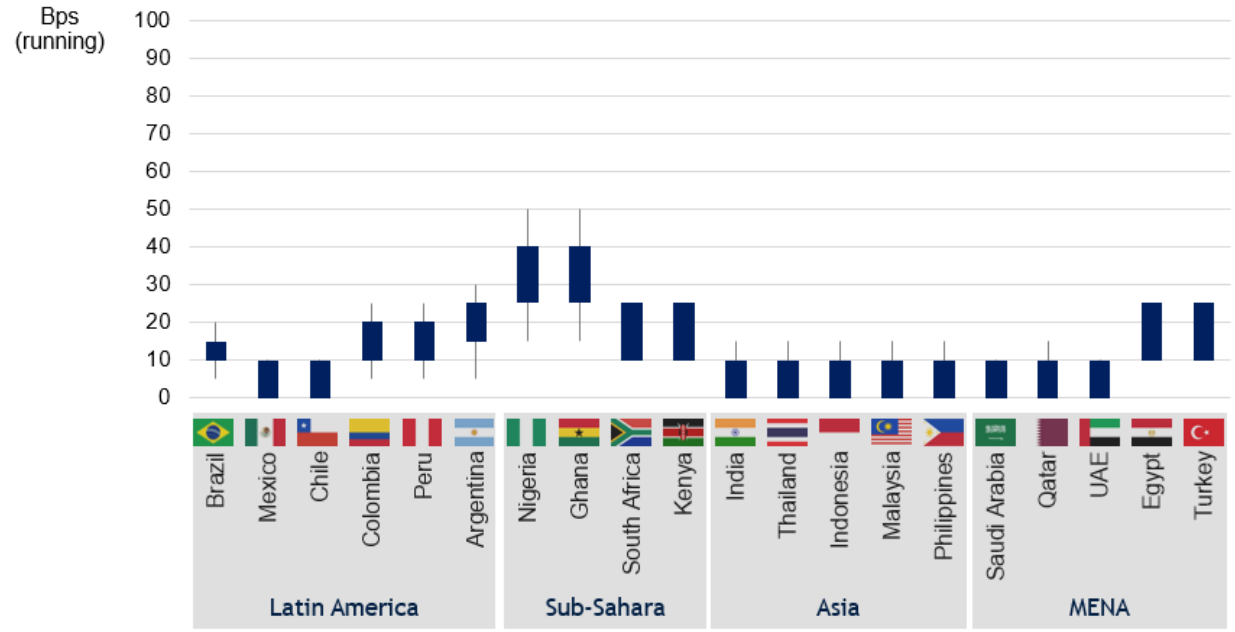


Figure D4. As a result of Basel III, price change of 10-15-year IRS denominated in LCY for infrastructure. Average range of respondents, n=10.

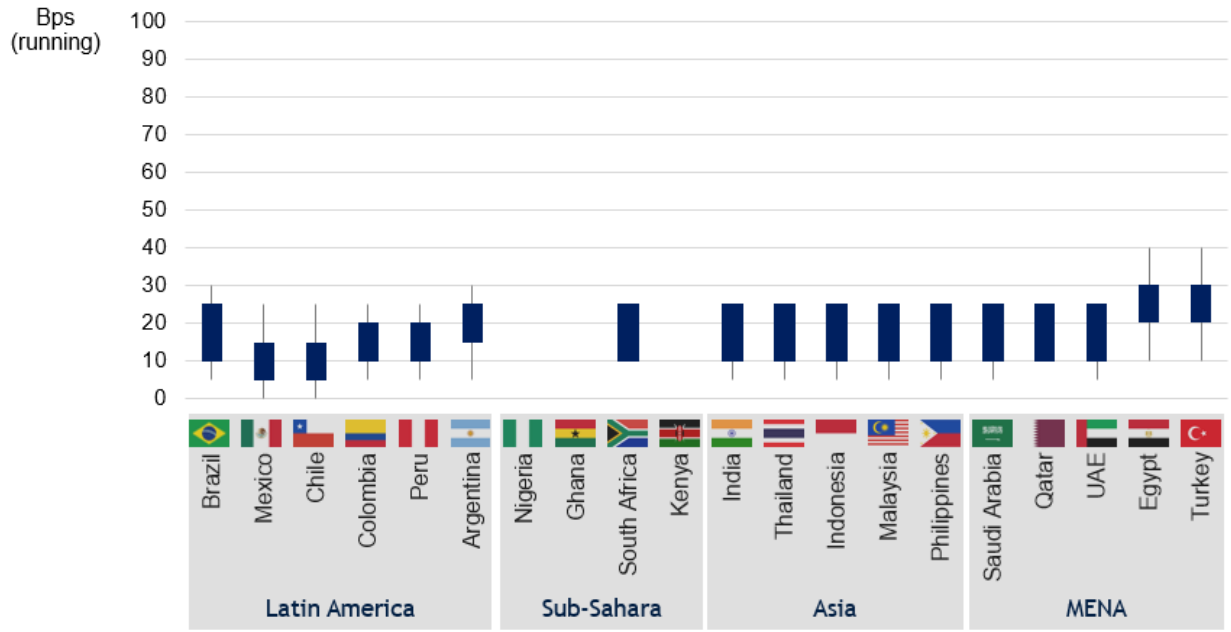


Figure D5. As a result of Basel III, price change of 5-year CCS (LCY vs USD) for infrastructure. Average range of respondents, n=10.

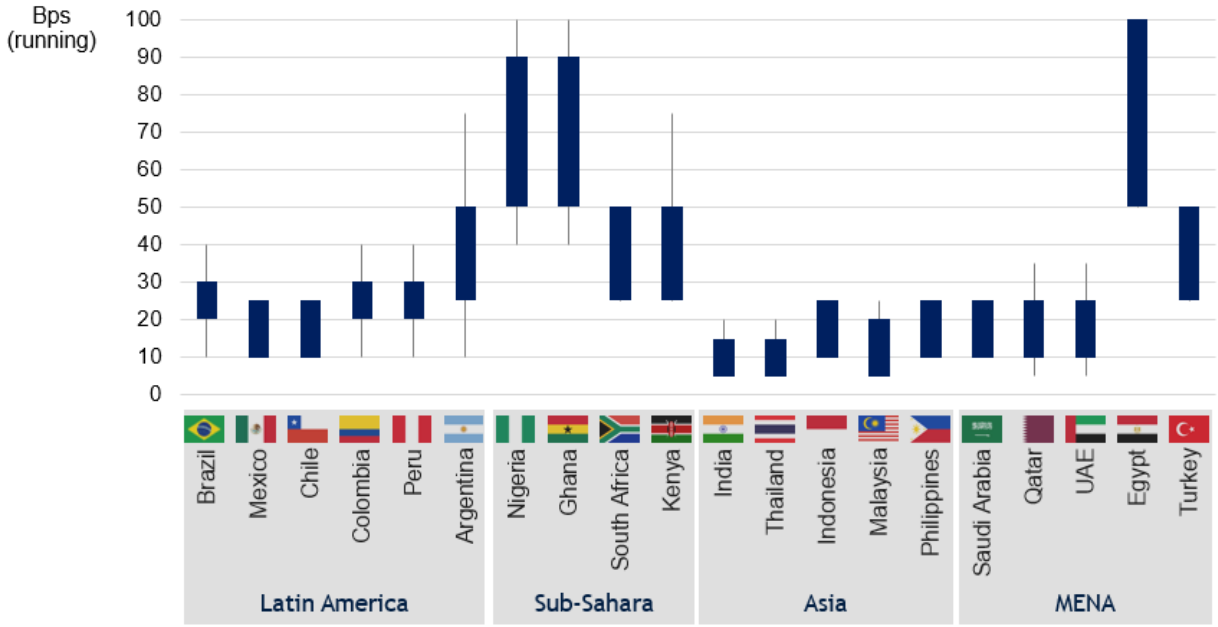


Figure D6. As a result of Basel III, price change of 10-15-year CCS (LCY vs USD) for infrastructure. Average range of respondents, n=10.

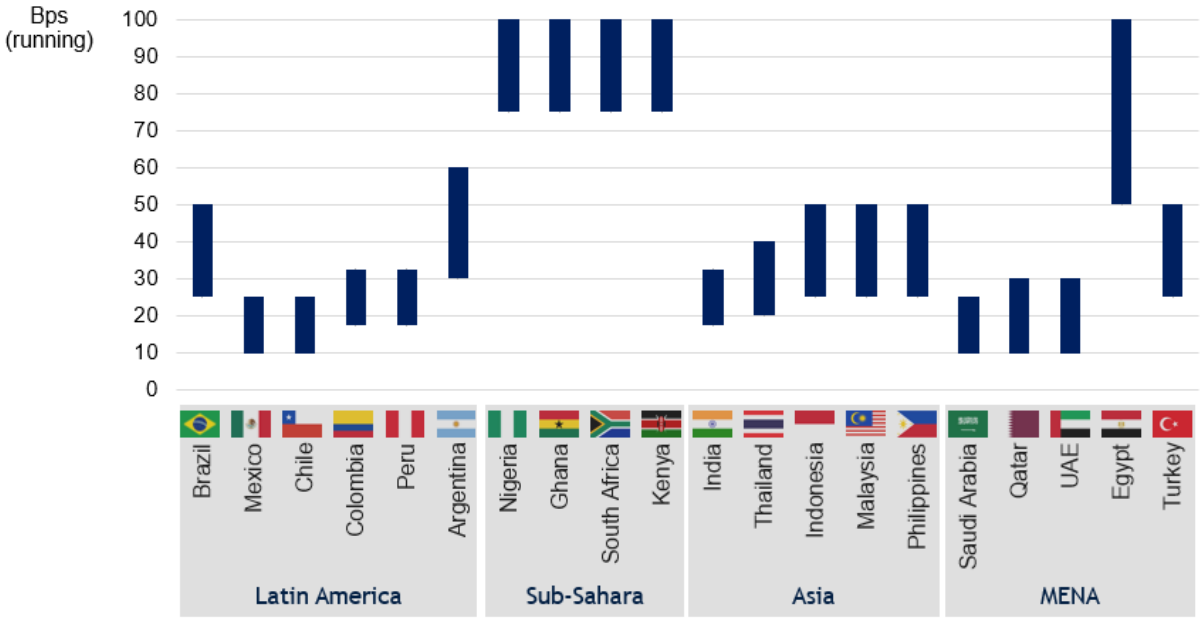


Figure D7. Approximate maximum tenor of hedging instruments denominated in LCY for USD 100-200 million notional. Note that Nigeria, Ghana and Kenya do not have meaningful local currency swap markets.

	Interest Rate Swap (IRS)	Cross-Currency Swap (CCS)
Brazil	15-20	15-20
Mexico	>20	>20
Chile	20	20
Colombia	20	20
Peru	10-15	10-15
Argentina	1-3	3-5
Nigeria	-	1-3
Ghana	-	1-3
South Africa	>20	>20
Kenya	-	1-3
India	7-10	7-10
Thailand	15-20	15-20
Indonesia	7-10	5-7
Malaysia	15	15
Philippines	3-7	3-7
Saudi Arabia	>20	10-15
Qatar	>20	10-15
UAE	>20	10-15
Egypt	5-8	3-5
Turkey	10-15	10-15

Figure D8. Decrease in dealer profit margin of long-dated OTC derivatives for infrastructure in EMDEs. As a result of Basel III reforms, what is the approximate effect on profit margin of long-dated OTC derivatives used in Infrastructure in Emerging Markets? Share of participants %, n=8