HONG KONG MONETARY AUTHORITY

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FOREIGN EXCHANGE RISKS AND HEDGING OF CORPORATES IN EMEAP ECONOMIES

Key points:

- *In the previous period of low interest rates, the total outstanding amount of foreign-currency (FC) corporate debts in EMEAP economies is estimated to have grown significantly, tripling to US$2 trillion at the end of 2021 from a decade earlier. Yet, the recent transition to a higher interest rate environment in major advanced economies (AEs) has put significant depreciation pressure on most of the regional currencies. The resulting increased debt burdens in terms of local currency (LC) could lead to higher liquidity and default risks for regional corporates with significant FC debts, particularly for those without hedging for foreign exchange (FX) risks.*

- *This study aims to assess the extent to which corporates in the region had tapped FC funding, and, more importantly, the prevalence of hedging for FX risks through derivatives (i.e. derivative hedge) or their overseas businesses (i.e. natural hedge). Through analysing corporates' balance-sheet information and text-based metrics, we find that, in terms of asset size, nearly 80% of the corporates had a significant share of FC debts.*

- *However, only 30% of them were found to employ FX derivatives, suggesting that the derivative hedge was uncommon. For those FC borrowers without derivative hedge, two-thirds were estimated to have a certain degree of natural hedge (by FC assets or earning). This implies that, on the whole, a quarter of the FC borrowers were without any hedging for FX risks. In addition, we observe that most of these under-hedged corporates were domiciled in emerging market economies (EMEs) and had a larger share of FC debts.*

- *We also show that derivative hedge significantly reduced corporates' FX losses by more than 75%, suggesting that the use of FX derivatives is effective in enhancing corporates' resilience to FX shocks. The mitigating effect is also*

more pronounced in absolute terms for the EME-domiciled corporates, consistent with the findings reported above.

- *However, we find evidence that corporates with FC debts are less likely to use FX derivatives if their onshore derivatives market is less developed, suggesting the importance of developing onshore derivatives markets to facilitate hedging for FX risks by domestic corporates. Nevertheless, we find that given the constraints in the onshore market, some of these corporates hedge their FX risks by accessing the offshore derivatives markets, particularly the markets that are more liquid and open to foreigners.*

- *Taken together, our findings have two policy implications for enhancing the resilience of corporates to FX shocks:*

    - *To facilitate the derivative hedge, policies may aim at, for example, (i) deepening onshore FX derivatives markets; (ii) granting more flexibility to resident corporates to access offshore derivatives markets for hedging purposes; and (iii) providing practical guidance for corporates on the use of FX derivatives as a risk management tool. However, policymakers should assess the compatibility of these measures with domestic conditions, such as the possible impacts on capital flow volatility. It is also crucial to consider potential risks to the domestic financial system when promoting the use of FX derivatives.*

    - *Policies that can foster an alternative financing source, such as continuing to develop LC funding markets, may also be considered for reducing corporates' over-reliance on FC funding markets.*

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1. INTRODUCTION

In the previous period of low interest rates, the total outstanding amount of FC corporate debts in EMEAP economies[1] is estimated to have grown significantly, tripling to US$2 trillion at the end of 2021 from a decade before (*Chart 1*). However, the recent transition to a higher interest rate environment in major AEs has put significant depreciation pressure on most of the regional currencies. Since 2022, these currencies have seen depreciation ranging from 8% to 23% against the USD up to September 2023 (*Chart 2*).[2] The resultant increased debt burdens in terms of LC could lead to higher liquidity and default risks for regional corporates with significant FC debts.

Chart 1
Total outstanding amount of FC corporate debts in EMEAP economies

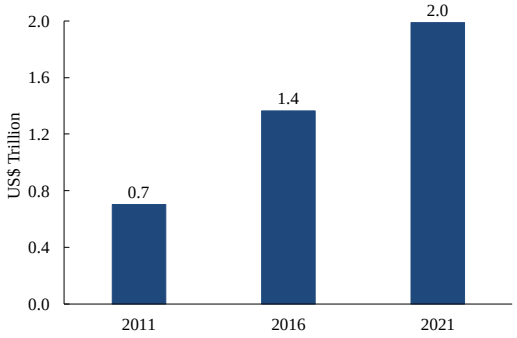
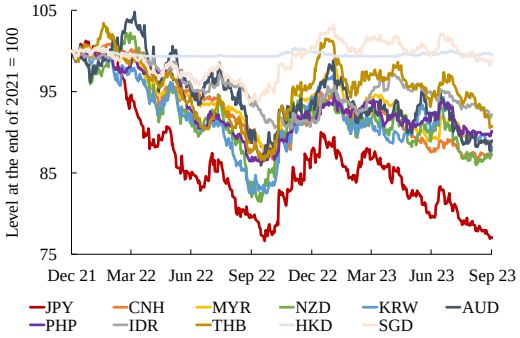


Chart 2
Exchange rate of LCs in EMEAP economies against USD



Notes:

(1) *Chart 1* depicts the total outstanding amount of FC debts issued by constituents of representative equity indices in EMEAP economies; and *Chart 2* depicts USD per LC in each EMEAP economy from the fourth quarter of 2021 to the third quarter of 2023; and

(2) JPY = Japanese Yen; CNH = Offshore Renminbi; MYR = Malaysian Ringgit; NZD = New Zealand Dollar; KRW = South Korean Won; AUD = Australian Dollar; PHP = Philippine Peso; IDR = Indonesian Rupiah; THB = Thai Baht; HKD = Hong Kong Dollar; and SGD = Singapore Dollar.

Sources: S&P Capital IQ, Bloomberg and HKMA staff estimates.

In fact, the risks associated with FC debts may hinge on (i) the prevalence of hedging for FX risks through, for example, derivatives and (ii) their effectiveness in mitigating FX risks. Even if proven to be useful in reducing FX risks, FX derivatives are not necessarily accessible to corporates in onshore or

[1] EMEAP, the Executives' Meeting of East Asia-Pacific Central Banks, is a co-operative organisation of central banks and monetary authorities in eleven economies, including Australia, Mainland China, Hong Kong, Indonesia, Japan, South Korea, Malaysia, New Zealand, the Philippines, Singapore and Thailand. The scope of corporates covers the constituents of representative equity indices in EMEAP economies. For details, please refer to *Section 2* and *Footnote 4*.

[2] HKD and SGD are the exception, which remained stable in the same period.

offshore markets for market-related or regulatory reasons. Against this backdrop, this study aims to answer the following questions:

1. Is it common for EMEAP corporates to borrow FC debts? And, for the FC borrowers, is it common to hedge FX risks through derivatives or other measures?

2. How effective are FX derivatives in reducing FX risks? If effective, are there any factors hindering corporates from accessing them?

However, it is not easy to evaluate the usage and effectiveness of FX derivatives due to the limited visibility of derivatives transactions. To address this issue, this study employs a text-mining analysis on corporates' annual reports, which typically disclose their hedging strategies against FX risks. By analysing their text-based metrics and balance-sheet information, we can identify corporates that do, or do not, use FX derivatives or other measures against FX risks, and answer the research questions.

This study is structured as follows. The next section describes our novel data and assesses FX risks and hedging strategies of the corporate borrowers. *Section 3* presents the estimated mitigation in FX losses by the use of FX derivatives. *Section 4* discusses factors that hinder corporates from accessing FX derivatives. *Section 5* concludes.

2. DID EMEAP CORPORATES HEDGE FX RISKS?

In this study, our sample covers 2,339 corporates that are constituents of representative equity indices in EMEAP economies[3] from 2011 to 2021. We retrieve the currency breakdown of the corporates' liabilities from S&P Capital IQ, and identify those having FC debts as FC borrowers. For each corporate, FC is defined as any currencies other than that of the corporate's domicile.

For the FC borrowers, we construct the text-based metric indicating their use of FX derivatives. We download their annual reports from the same data provider. Listed corporates typically disclose their analysis and management of FX risks in the annual reports. For example, corporates listed on the Hong Kong

[3] These indices include ASX 300, CSI 300, HSI, IDX Composite, Nikkei 225, KOSPI Composite, KLCI, NZX 50, PSEi, STI and SET 100. Some constituents are not included in our sample due to a lack of their balance-sheet data.

Stock Exchange furnish such disclosures in notes to the consolidated financial statements. We carry out the text-mining analysis in three steps as follows:[4]

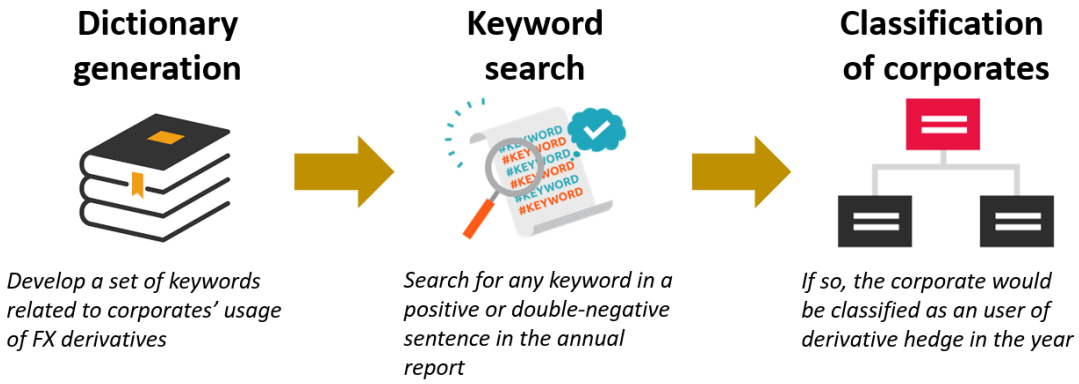
1. Create a dictionary of keywords related to FX derivatives, such as '*foreign exchange forward*', '*foreign exchange option*', '*currency swap*', '*FX forward*', '*currency future contract*' etc;[5]

2. Screen each annual report by our self-built text-mining algorithm; and

3. Classify the corporate as an FX derivative user in the year, if any of the keywords appear in a positive or double-negative sentence.[6]

As some annual reports are only published in non-English languages, the dictionary also contains synonyms in official languages of the EMEAP economies. *Chart 3* illustrates the workflow of the text-mining analysis.

Chart 3: Workflow of text-mining analysis



FC borrowers may also hedge FX risks by natural hedge, by holding assets or earning revenues denominated in FCs. We proxy their extent of natural hedge with their overseas assets, as the overseas assets are likely denominated in FCs and hence may partly offset the negative impacts due to LC depreciation. For robustness, we alternatively proxy their extent of natural hedge with their overseas revenues. Both proxies are downloaded from S&P Capital IQ. The

[4] Some academic literature also compiled text-based metrics as ours, such as Judge (2006), Ameer (2010), Compello et al. (2011), Hoberg and Moon (2017) and Wahyudi et al. (2019) etc. Our study is a departure from them since they focus on the individual economy or not on the FX derivatives. It is less common for academic literature to collect information on corporates' usage of FX derivatives by other methods, such as surveying (Nance et al., 1993) and retrieving regulatory granular data (Alfaro et al., 2022).
[5] *Table A1* provides a full list of the keywords used in the text-mining analysis.
[6] Our program reviews whether those sentences containing any keyword also contain positive, negative or double-negative words based on the frequency of negative words, such as "no", "not", "none", "cannot", "neither" etc. A sentence is classified as positive if containing none of the negative words; or negative if there is a negative word; or double-negative if there are two negative words.

results are consistent for both proxies.[7] For brevity, we only present the results based on the overseas assets in this note.

From our sample, we find that, in terms of asset size, nearly 80% of EMEAP corporates had FC debts at the end of 2021.[8] These debts appeared to be significant relative to their debt structure. Specifically, half of the corporates had over 30% of debts in FCs (median, light brown boxplot, *Chart 4*). This ratio even exceeded 80% for a quarter of them (upper quartile). Among these corporates, the EME-domiciled corporates displayed higher inclination to issue FC debts (pink boxplot) compared to their counterparts domiciled in AEs of the region (blue boxplot).

However, only 30% of the FC borrowers were found to employ FX derivatives in 2021 (LHS bar, *Chart 5*), suggesting that the derivative hedge was not commonly used. For those FC borrowers without derivative hedge, two-thirds were estimated to have a certain level of natural hedge (navy blue portion, LHS bar). This implies that, on the whole, a quarter of the FC borrowers were without any hedging for FX risks (blue-grey portion, LHS bar). Most of these under-hedged FC borrowers were EME-domiciled (blue grey portion, MID bar). Coupled with their higher tendency to issue FC debts shown above, their limited use of the derivative hedge may make them more susceptible to adverse FX shocks.

[7] Compared with the currency breakdown which is not available in S&P Capital IQ, the geographical breakdown of assets or revenues may overestimate the level of natural hedge since part of the assets or revenues overseas may actually be denominated in LC. However, this assumption has been used in academic literature, such as Kuruc et al. (2017) from BIS.

[8] This merely reflects corporates' exposure to FX risks without considering their hedging strategies, which will be discussed later in this section.

Chart 4
Share of EMEAP corporates' FC debts at end-2021

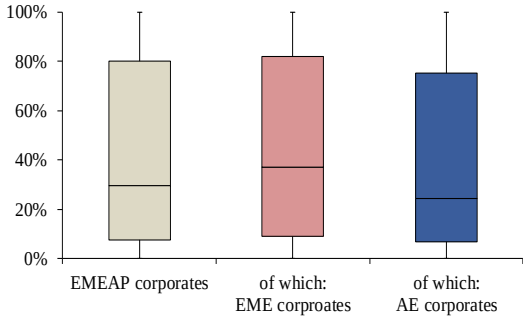
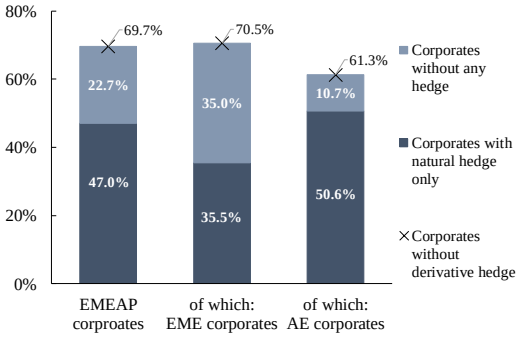


Chart 5
Share of FC borrowers without derivative hedge at end-2021



Notes:

(1) *Chart 4* depicts the distribution of EMEAP corporates' share of debts in FCs at the end of 2021 by region. The median value is represented by a horizontal line inside the box, with 50% of the values falling in the 25th and 75th percentile range shown by the box. The upper and lower end points of the thin vertical lines show the range of the entire sample;

(2) *Chart 5* depicts the share of EMEAP FC borrowers without derivative hedge at the end of 2021; and

(3) "EMEs" include Mainland China, Indonesia, Malaysia, the Philippines and Thailand. "AEs" refer to other EMEAP economies.

Sources: S&P Capital IQ and HKMA staff estimates.

Nevertheless, the under-hedged FC borrowers do not necessarily fail in the event of an adverse FX shock if they possess sufficient cash flow to meet debt repayment in the near term. However, our analysis reveals that the interest coverage ratio was below one for one-third of them at the end of 2021, reflecting that their earnings (as measured by earnings before interest and tax, or EBITs) were not sufficient to cover their interest expenses. Worse still, over one-fifth of them registered negative earnings. Even before the occurrence of adverse FX shocks, a sizable portion of the under-hedged FC borrowers had already experienced a depletion of cash flow. The increased debt burdens due to LC depreciation may further amplify their insolvency risk.

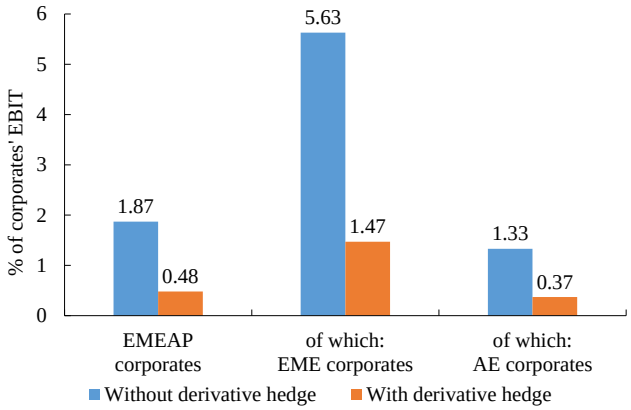
3. COULD FX DERIVATIVES HELP FC BORROWERS MITIGATE FX LOSSES?

FX derivatives do not necessarily help FC borrowers mitigate FX losses, as the derivatives may be used for speculation or arbitrage purposes. Therefore, it is necessary for us to empirically test whether they can mitigate FX losses during LC depreciation against the USD.

A comparison between the FX losses of the FC borrowers using FX derivatives (i.e. 0.48% of their EBITs) and the non-users (i.e. 1.87% of their

EBITs) reveals that the derivatives could reduce FX losses by over 75% (*Chart 6*), suggesting that the use of FX derivatives is effective in enhancing the resilience of corporates to FX shocks. Splitting the sample by region, we also find that the mitigating effect is more pronounced in absolute terms for the EME-domiciled FC borrowers (i.e. 4.16% of their EBITs, or 5.63% - 1.47%), consistent with the findings reported above that they appeared to be more susceptible to FX shocks.[9]

Chart 6
Average FX losses (as a percentage of EBITs) by usage of FX derivatives



Notes:
(1) *Chart 6* shows the estimated decline in FX loss due to the use of FX derivatives based on Equation (1). For details of the modelling approach and the full result, please refer to *Annex B*; and
(2) All the estimated coefficients are statistically significant at a 10% level.
Source: HKMA staff estimates.

Despite the finding that FX derivatives are proven to be effective in mitigating FX losses, we also find a limited use of FX derivatives by FC borrowers, especially the EMEs-domiciled corporates which appeared to have a greater tendency to issue FC debts, but under-hedge FX risks (see *Section 2*). In the next section, we analyse the reasons behind this.

4. WHY DID SOME FC BORROWERS OVERLOOK FX DERIVATIVES?

There appears to be three factors hindering FC borrowers from hedging FX risks with derivatives, including (a) limited onshore access and (b) offshore access to FX derivatives, and (c) limited financial sophistication of the FC borrowers in derivatives markets. We elaborate on these factors in the following sub-sections.

[9] For details of the estimation results, please refer to *Table B.1*.

4a. Limited onshore access to FX derivatives

In the onshore market, while the turnover of FX derivatives in the region's EMEs has increased significantly since 2010, it still represents a small proportion of the global aggregate, accounting for only 1.9% in 2022 (RHS bars, *Chart 7*). The relatively limited market depth may add to the difficulty of FC borrowers domiciled there in procuring well-suited and cost-effective FX derivatives for hedging purposes. Taking the bid-ask spreads of FX forwards across EMEAP economies as an example, the spreads in EMEs are notably wider than those in AEs in the region (*Table 1*). Such a wider spread, equivalently more expensive FX derivatives for hedging, may act as a disincentive for the EME-domiciled FC borrowers to employ the derivative hedge.

We confirm this conjecture and find evidence that the FC borrowers are less likely to use FX derivatives if their onshore FX derivatives market is less developed. Specifically, if the onshore turnover grows by 1% of the global aggregate, the probability of FC borrowers using FX derivatives is estimated to increase by 26%, and vice versa (LHS bar, *Chart 9*).[10] These findings may suggest the importance of developing onshore derivatives markets to facilitate hedging of FX risks by domestic corporates.

Apart from the limited market scale, the flexibility of entering into FX derivatives in these markets appears to be relatively constrained. In many of the region's EMEs, the onshore hedging must be backed by underlying investment. Therefore, investors have to prefund the LC account to avoid overdrafts and cannot sell their investment while the hedge is in place. In some of these EMEs, the maturity of the hedge is required to be conterminous with that of the underlying investment (BIS, 2022). In addition, the documentation required to link the hedge to the underlying investment could be cumbersome and onerous (ADB, 2015). Such rules may restrict the flexibility for the EME-domiciled FC borrowers to hedge with derivatives onshore.[11]

[10] For details of the estimation results, please refer to *Table C.1*.

[11] That said, efforts in relaxing some of the rules have been underway in some EMEs with the aim of developing onshore FX derivative markets. For instance, some have eased non-resident access to onshore hedging markets and simplified documentation requirements, thereby facilitating more flexible hedge options for foreign investors and increasing market liquidity. *Table A2* furnishes an overview of recent measures implemented by selected economies.

Chart 7
Daily average transaction of FX derivatives

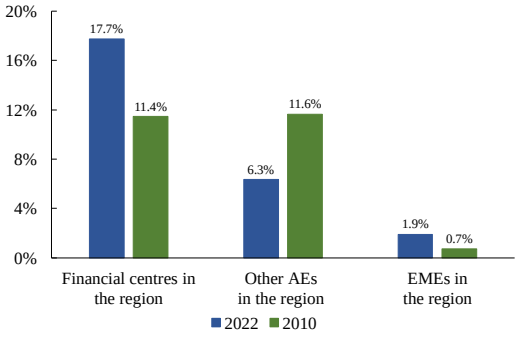


Table 1
Bid-ask spread of FX forwards

Economy	Bid-ask spread
Hong Kong	1-3 month spread: 0.5-1 pips 6-12 month spread: 1-3 pips
Singapore	1-6 month spread: 0.1-1 pip
South Korea	1-month spread: 10 pips
Mainland China	6-month spread: 5-15 pips
Indonesia	Spread: 10 pips
Malaysia	1-month spread: 30 pips
Thailand	Up to 3-month spread: 2-4 pips 6-12 month spread: 4-6 pips

Notes:

(1) *Chart 7* depicts daily average transaction of FX derivatives as a share of global transaction in 2010 (green bars) and 2022 (blue bars), by trading places. *Table 1* summarises the bid-ask spreads of FX forwards in EMEAP economies; and

(2) "Financial centres in the region" include Hong Kong and Singapore; "Other AEs in the region" cover Australia, Japan, South Korea and New Zealand; and "EMEs in the region" cover Mainland China, Indonesia, Malaysia, the Philippines and Thailand.

Sources: BIS Triennial Survey, BIS (2022) and HKMA staff estimates

4b. Limited offshore access to FX derivatives

Given the constraints in the onshore market, some FC borrowers could hedge FX risks by accessing the offshore derivatives markets, particularly for those markets that are more liquid and open to foreigners. For instance, FX derivatives markets in financial centres such as Hong Kong and Singapore have been relatively liquid in the region with market share expanding to 17.7% of the global aggregate in 2022 from 11.4% in 2010 (LHS bars, *Chart 7*). These markets are also highly open to foreigners, with 87.9% of turnover contributed by non-residents (LHS bar, *Chart 8*).

Our empirical analysis also finds that some FC borrowers may hedge their FX risks by accessing offshore derivatives. Specifically, if the turnover in both financial centres grows by 1% of the global aggregate, the probability of FC borrowers using FX derivatives is estimated to increase by 17%, and vice versa (RHS, *Chart 9*). This effect is also found to be more pronounced for the FC borrowers whose onshore market is relatively less liquid, such as those in EMEs of the region.[12]

[12] For details of the estimation results, please refer to *Table C.1*.

Chart 8
Share of FX derivatives turnover in 2022, by residency of traders

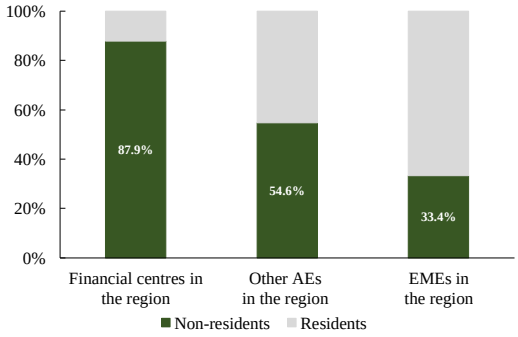
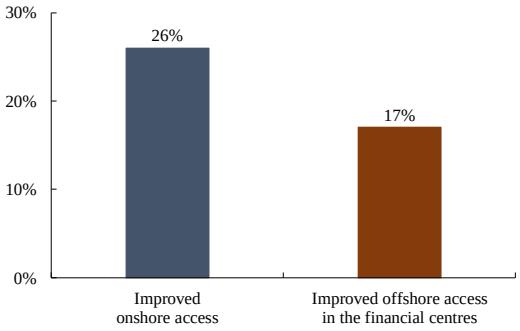


Chart 9
Estimated change in probability of FC borrowers using FX derivatives



Notes:

(1) *Chart 8* depicts the share of FX derivatives turnover by residents (grey portions) and non-residents (green portions) in 2022, by trading places; and *Chart 9* depicts the estimated changes in probability of FC borrowers using FX derivatives based on Equation (2) and (3). For details of the modelling approaches and the full results, please refer to *Annex C*;

(2) All the estimated coefficients are statistically significant at a 10% level; and

(3) "Financial centres in the region" include Hong Kong and Singapore; "Other AEs in the region" cover Australia, Japan, South Korea and New Zealand; and "EMEs in the region" cover Mainland China, Indonesia, Malaysia, the Philippines and Thailand.

Sources: BIS Triennial Survey and HKMA staff estimates

Nevertheless, some FC borrowers may still face various regulatory restrictions in accessing the offshore derivatives markets. For example, resident banks in some EMEs of the region are subject to limitations or outright bans on dealing with non-residents in the offshore non-deliverable forward markets. Offshore FX contracts delivered onshore are also not allowed in some EMEs of the region (ADB, 2015). This creates hurdles for corporates there to access FX derivatives in offshore markets through resident banks.

4c. *Financial sophistication of FC borrowers*

In addition to accessibility of FX derivatives, the limited financial knowledge and understanding of FC borrowers regarding FX derivatives could act as a deterrent to their usage in two distinct ways. First, some FC borrowers may not be fully informed of the benefits of FX derivatives in mitigating FX risk, often associating these instruments primarily with speculative activities. Consequently, the prevailing stigma surrounding derivatives may discourage some FC borrowers from using them for risk management.

Second, some FC borrowers may lack financial sophistication when it comes to negotiating with the broker-dealers of FX derivatives. In over-the-counter (OTC) market, dealers are used to price in bias against unsophisticated

clients and charge them a wider spread.[13] As a result, unsophisticated clients may face higher hedging costs, creating a disincentive for them to hedge FX risks with derivatives.

5. CONCLUSION AND IMPLICATIONS

Through the balance-sheet information and text-based metrics on EMEAP corporates, this study reveals four stylised facts pertaining to the financial stability of the region: (i) FC debts formed a significant share of total debt for most of the EMEAP corporates, particularly those domiciled in EMEs of the region; (ii) for those FC borrowers, derivatives hedging was uncommon, even if it was found effective in enhancing corporates' resilience to FX shocks; (iii) after taking their natural hedge into consideration, we still find a quarter of the FC borrowers without any hedging for FX risks, and were mostly domiciled in the region's EMEs; and (iv) some FC borrowers may have difficulty in procuring FX derivatives in onshore and offshore markets for market-related and regulatory reasons.

Taken together, our findings have two policy implications for enhancing corporates' resilience to FX shocks:

- To facilitate the derivative hedge, policies may aim at, for example, (i) deepening onshore FX derivatives markets; (ii) granting more flexibility to resident corporates to access offshore derivatives markets for hedging purposes; and (iii) providing practical guidance for corporates about using FX derivatives as a risk management tool. However, policymakers should assess the compatibility of these measures with domestic conditions, such as possible impacts on capital flow volatility. It is also crucial to consider potential risks to the domestic financial system when promoting the use of FX derivatives.

- Policies that can foster an alternative financing source, such as continuing to develop LC funding markets, may be considered for reducing corporates' over-reliance on FC funding markets.[14]

[13] Hau et al. (2021) find that the financially unsophisticated clients, who are less experienced in FX derivatives trading, are charged a higher spread for FX derivatives in the OTC market.
[14] There has been a growing call for developing LC funding markets in literature, such as Park (2016) from ADB, Hashimoto et al. (2021) from IMF and WB and FSB (2022). In our sample, the LC corporate debts reached US$13 trillion at the end of 2021, more than quadruple the level of a decade ago.

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Annex A: Tables

Table A1: Dictionary for text-mining analysis[15]

foreign exchange forward	foreign exchange future	foreign exchange option
foreign exchange swap	foreign exchange derivative	currency forward
currency future	currency option	currency swap
currency derivative	FX forward	FX future
FX option	FX swap	FX derivative
forward exchange contract	forward contracts for currency hedging	forward contracts for FX hedging
forward contracts to hedge foreign exchange risk	forward contracts to hedge FX risk	forward contracts to hedge exchange rate fluctuations
forwards for currency hedging	forwards for FX hedging	forwards to hedge foreign exchange risk
forwards to hedge FX risk	forwards to hedge exchange rate fluctuations	future exchange contract
future contracts for currency hedging	future contracts for FX hedging	future contracts to hedge foreign exchange risk
future contracts to hedge FX risk	future contracts to hedge exchange rate fluctuations	futures for currency hedging
futures for FX hedging	futures to hedge foreign exchange risk	futures to hedge FX risk
futures to hedge exchange rate fluctuations	options for currency hedging	options for FX hedging
options to hedge foreign exchange risk	options to hedge FX risk	options to hedge exchange rate fluctuations
swaps for currency hedging	swaps for FX hedging	swaps to hedge foreign exchange risk
swaps to hedge FX risk	swaps to hedge exchange rate fluctuations	contracts for currency hedging
contracts for FX hedging	contracts to hedge foreign exchange risk	contracts to hedge FX risk
contracts to hedge exchange rate fluctuations	derivatives for currency hedging	derivatives for FX hedging
derivatives to hedge foreign exchange risk	derivatives to hedge FX risk	derivatives to hedge exchange rate fluctuations

[15] The dictionary also contains synonyms in official languages of EMEAP economies, as some of the annual reports are only published in the local language.

Table A2: Recent measures in selected EMEAP economies

Economy	Measure
South Korea	Approval requirements for some capital account transactions were abolished to liberalise the onshore market. Local banks were also permitted to participate in the offshore market to conduct transactions of non-deliverable forward market.
Indonesia	A Domestic Non-Deliverable Forward instrument settled in local currency was introduced in November 2018 that evens out FX demand and eases pressure on the spot market.
Malaysia	The Dynamic Hedging Programme was introduced in 2016 that permits institutional investors to manage the FX exposure of their portfolio by entering and unwinding forward contracts without the need to submit documentation.
Thailand	Non-resident corporates were enrolled into the Non-Resident Qualified Corporate programme in January 2021, which allows them to more flexibly hedge their FX exposure in the onshore market, thereby reshoring FX activities to increase market liquidity.
Philippines	The Currency Rates Risk Protection Programme, a Non-Deliverable Froward contract between the central bank and commercial banks, was established to help bank clients hedge their eligible FX exposures.

Sources: BIS (2022) and Kumar & Rituraj (2020).

Annex B: Estimation of mitigated FX losses by FX derivatives

To estimate the mitigation of FX losses by FX derivatives, we compare the FX losses between the FC borrowers using and not using FX derivatives, and consider a fixed-effect linear regression model as follows:

$$Loss_{i,t} = \beta_1 Derivative_{i,t} \times Stress_{i,t} + \beta_2 Stress_{i,t} + Control_{i,t/t-1} + FE_i + FE_e + FE_s + \varepsilon_{i,t} \quad (1)$$

where $Loss_{i,t}$ denotes the absolute FX loss of FC borrower i as a percentage of its EBITs in year t. $Derivative_{i,t}$ is a dummy variable equal to 1 if the FC borrower uses FX derivatives in the year; otherwise zero. $Stress_{i,t}$ is another dummy variable equal to 1 if the FC borrower's LC depreciates against USD on average in the year; otherwise zero. $Control_{i,t/t-1}$ is a set of control variables in year $t-1$, including the FC borrower's (i) share of FC debts, (ii) share of assets overseas, (iii) leverage ratio and (iv) interest coverage ratio, and (v) average of CBOE Volatility Index (VIX) in year t. FE_i, FE_e and FE_s are the fixed effects of FC borrowers, their domicile economy and sector, respectively. $\varepsilon_{i,t}$ is the residual term of the regression model.

As shown in *Table B.1*, we estimate that β_2 is equal to -1.39 at a 5% level of statistical significance, suggesting that the users of FX derivatives register a lower level of FX losses than the non-users on average during LC depreciation. For the EME-domiciled FC borrowers, β_2 is even larger at -4.16 at a 5% level of statistical significance, indicating that the EME-domiciled FC borrowers could benefit more from FX derivatives in reducing FX losses in absolute terms.

Table B.1: Estimation results of Equation 1

	$Loss_{i,t}$		
	(1)	(2)	(3)
$Derivative_{i,t} \times Stress_{i,t}$ (β_1)	-1.39**	-4.16**	-0.96*
$Stress_{i,t}$ ((β_2)	1.87***	5.63***	1.33**
Fixed effects:			
Individual	Yes	Yes	Yes
Economy	Yes	Yes	Yes
Sector	Yes	Yes	Yes
Controls	Yes	Yes	Yes
Sample	FC borrowers in EMEAP economies	of which: EME-domiciled FC borrowers	of which: AE-domiciled FC borrowers
Corporates	1,037	534	503
Observations	6,328	3,326	3,002

Notes: (i) ***, ** and * denote a 1%, 5% and 10% of statistical significance; and (ii) the estimated coefficients have already been converted to the estimated changes in probability for ease of economic interpretation, by assuming other explanatory variables at their means.

Annex C: Estimation of the impact of onshore and offshore accessibility of FX derivatives on usage of FX derivatives

To test whether onshore accessibility of FX derivatives can incentivise FC borrowers' usage of FX derivatives, we proxy the onshore accessibility with the turnover of the FX derivatives market at the FC borrowers' domicile as a share of the global aggregate, and consider a fixed-effect linear regression model as follows:

$$Derivative_{i,t} = \beta_1 Onshore_{i,t-1} + \beta_2 FCs_{i,t-1} + \beta_3 Others_{i,t-1} + Control_{i,t/t-1} + FE_i + FE_e + FE_s + \varepsilon_{i,t} \quad (2)$$

where $Derivative_{i,t}$ is a dummy variable equal to 1 if FC borrower i enters into FX derivatives in year t, or zero otherwise. $Domestic_{i,t-1}$ denotes the onshore accessibility of FC borrower i in year $t-1$. As the FC borrowers may be able to access FX derivatives in offshore markets, we also control for the accessibility in major offshore markets, including financial centres in the region (e.g. Hong Kong and Singapore) and outside the region (e.g. the UK and US), denoted by $FCs_{i,t-1}$ and $Others_{i,t-1}$. Likewise, we proxy the offshore accessibility with the turnover in the offshore market as a percentage of the global aggregate.

As shown in the first column of *Table C.1*, β_1 is positive at 0.26 with 10% level of statistical significance[16], reflecting that the probability of FC borrowers using FX derivatives would increase by 26% if the onshore turnover grows by as much as 1% of the global aggregate. This provides evidence that an improvement in onshore access to FX derivatives could incentivise a wider usage of FX derivatives, and vice versa.

Offshore accessibility of FX derivatives could also create incentive to use FX derivatives, particularly for those FC borrowers whose onshore access is relatively limited. To test this conjecture, we consider a modified fixed-effect linear regression model from Equation (2) as follows:

$$Derivative_{i,t} = \beta_1 Onshore_{i,t-1} + \theta_1 FCs_{i,t-1} + \theta_2 FCs_{i,t-1} \times Onshore_{i,t-1} + \pi_1 Others_{i,t-1} + \pi_2 Others_{i,t-1} \times Domestic_{i,t-1} + Control_{i,t-1} + FE_i + FE_e + FE_s + \varepsilon_{i,t} \quad (3)$$

where two interaction terms of $Onshore_{i,t-1}$ with (i) $FCs_{i,t-1}$ and (ii) $Others_{i,t-1}$ are addition to Equation (2). If our conjecture is correct, then the interaction terms should be negative, and vice versa.

As shown in the second column of *Table C.1*, we estimate that θ_1 is equal to 0.17 at a 1% level of statistical significance, reflecting that the probability of FC

[16] Numerically, the results suggest that the probability of firms using FX derivatives would rise by 26%, following one percentage point increase in their local market's share of global FX derivative transactions.

borrowers using FX derivatives would increase by 17% if the offshore turnover in the financial centres expands by 1% of the global aggregate. In addition, the interaction term θ_2 is found to be negative at -0.07 at a 1% level of statistical significance, indicating that the improved offshore access in financial centres could create an even greater incentive to use FX derivatives for the FC borrowers with limited onshore access.

To test the robustness of the heterogeneous effect of the offshore access, we further split the sample into (i) EME-domiciled and (ii) AE-domiciled FC borrowers except those domiciled in the financial centres, and estimate Equation (3) for each sub-sample. We split the sample in such a way given that FX derivatives are less accessible for the EME-domiciled FC borrowers, and hence the effect of an improved offshore access should also be different. As shown in the last two columns of *Table C.1*, an improvement in offshore access, whether in financial centres or outside the region, can create incentives to use FX derivatives only for the EME-domiciled FC borrowers, in line with our prior expectation.

Table C.1: Estimation results of Equation 2 and 3

	$Derivative_{i,t}$			
	(1)	(2)	(3)	(4)
$Onshore_{i,t-1}$	0.26*	2.12*	3.31***	5.18*
$FCs_{i,t-1}$	0.06*	0.17***	0.23***	0.16
$FCs_{i,t-1} \times Onshore_{i,t-1}$	--	-0.07***	-0.11***	-0.08
$Others_{i,t-1}$	0.04*	0.08	0.10*	0.20
$Others_{i,t-1} \times Onshore_{i,t-1}$	--	-0.03	-0.05*	-0.10
Fixed effects:				
Individual	Yes	Yes	Yes	Yes
Economy	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Sample	FC borrowers in EMEAP economies		of which: EME-domiciled	of which: AE-domiciled (w/o financial centres)
Corporates	1,037	1,037	534	423
Observations	3,108	3,108	1,587	1,316

Notes: (i) ***, ** and * denote a 1%, 5% and 10% of statistical significance; and (ii) the estimated coefficients have already been converted to the estimated changes in probability for ease of economic interpretation, by assuming other explanatory variables at their means.