

# THE SOVEREIGN-BANK NEXUS IN EMERGING MARKETS IN THE WAKE OF THE COVID-19 PANDEMIC

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# Motivation

- The sovereign-bank nexus has **intensified** in EMs during the COVID-19 pandemic
- The nexus has become more complex as **interdependencies** of the sovereign and banking sectors with the real sector have increased
- EMs are particularly vulnerable to an adverse shock amid **elevated fiscal vulnerabilities** and large external financing needs
- Raising the risk of an **adverse sovereign-bank feedback loop**



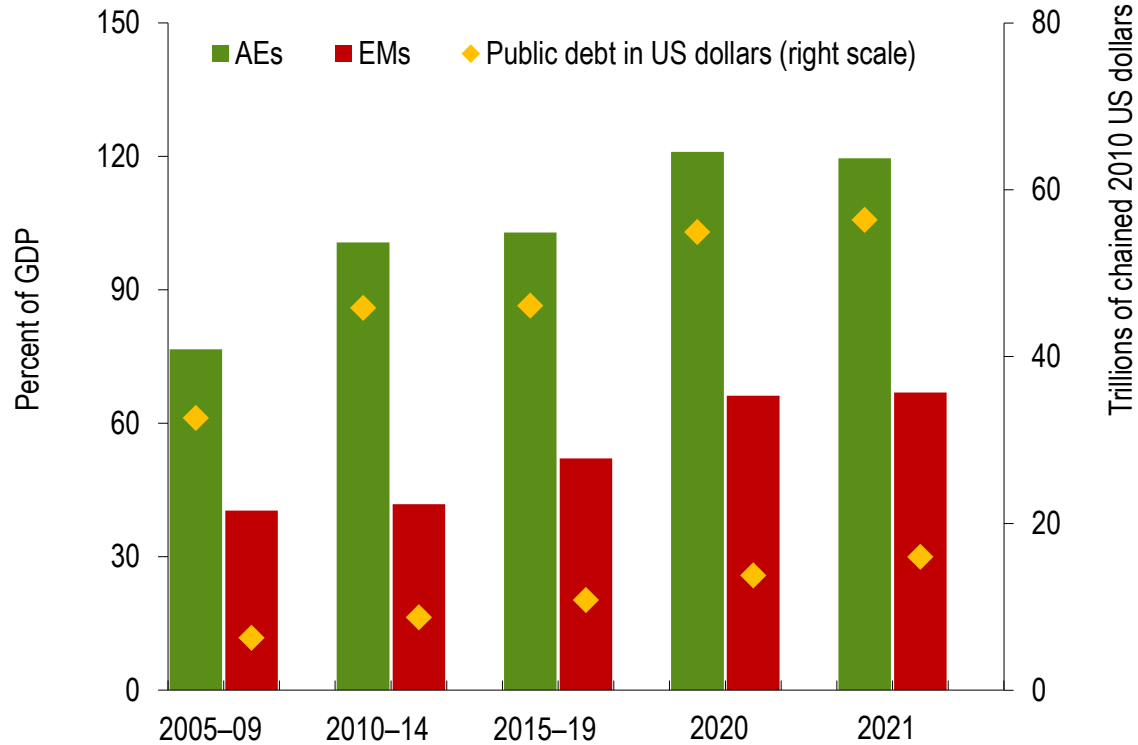
- How **relevant** is the risk? What are the key channels of transmission?
- What are the **policy options** to mitigate the risk?

# The COVID-19 crisis has brought the sovereign-bank nexus in EMs to the fore

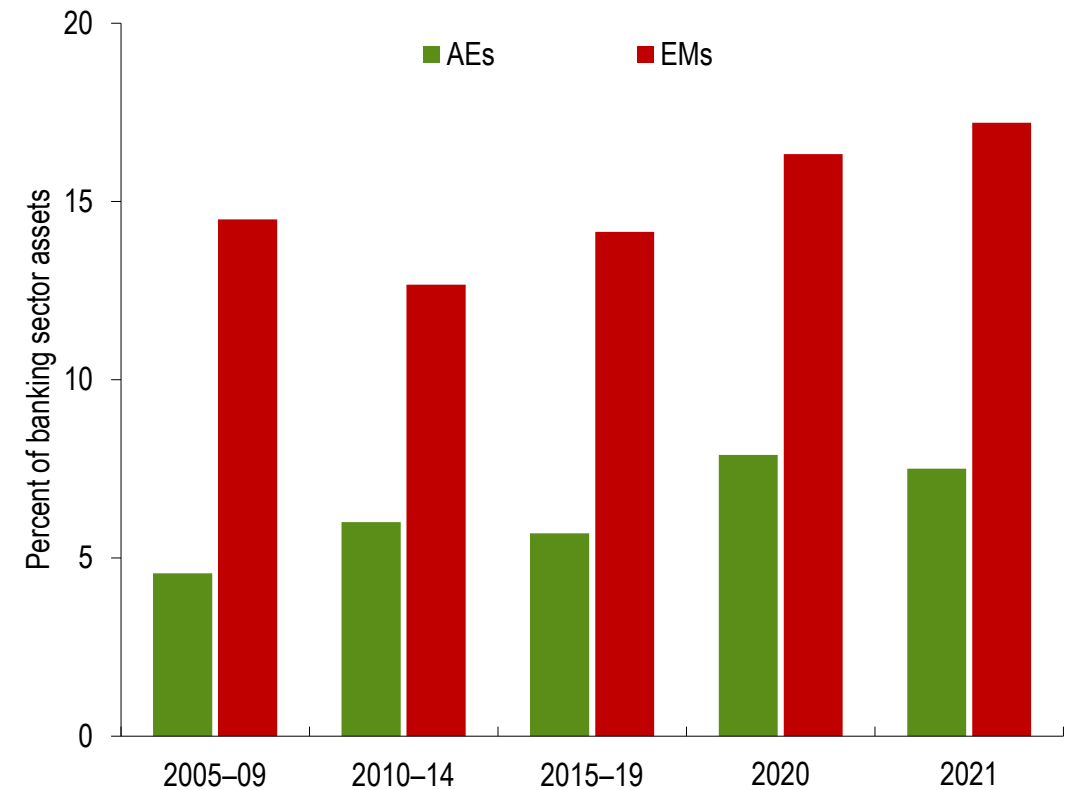
*Public debt has risen significantly globally*

*Banks' sovereign debt exposure has reached historic highs in EMs*

**1. Public Debt: Level and Ratio to GDP**  
(2005-2021)



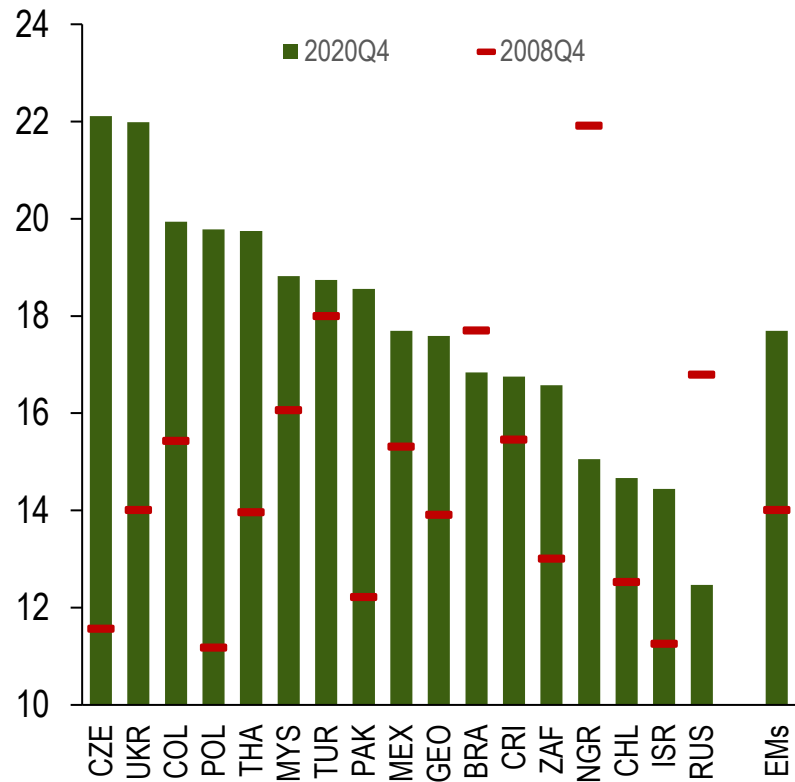
**2. Banks' Sovereign Debt Exposure, 2005-2021**  
(In percent of banking sector assets, GDP-weighted average)



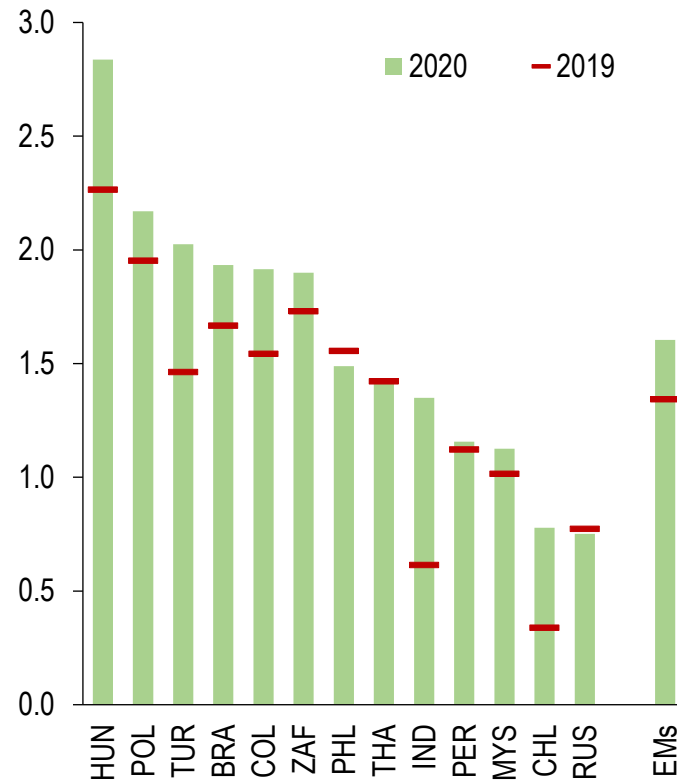
# Banks appear generally sound, but vulnerabilities are high in some EMs

*The degree of EM banks' vulnerabilities to a sovereign distress varies by region*

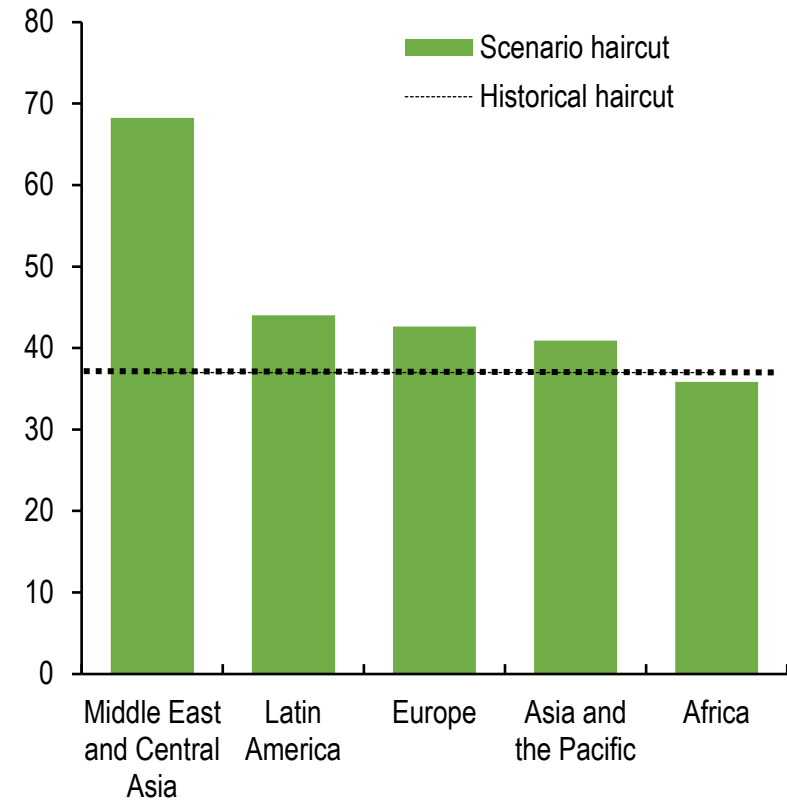
**1. Capital Adequacy Ratio**  
(Regulatory Capital/RWA, in percent)



**2. Ratio of Sovereign Bond Holdings to CET1 Capital**  
(Ratio, 2020)



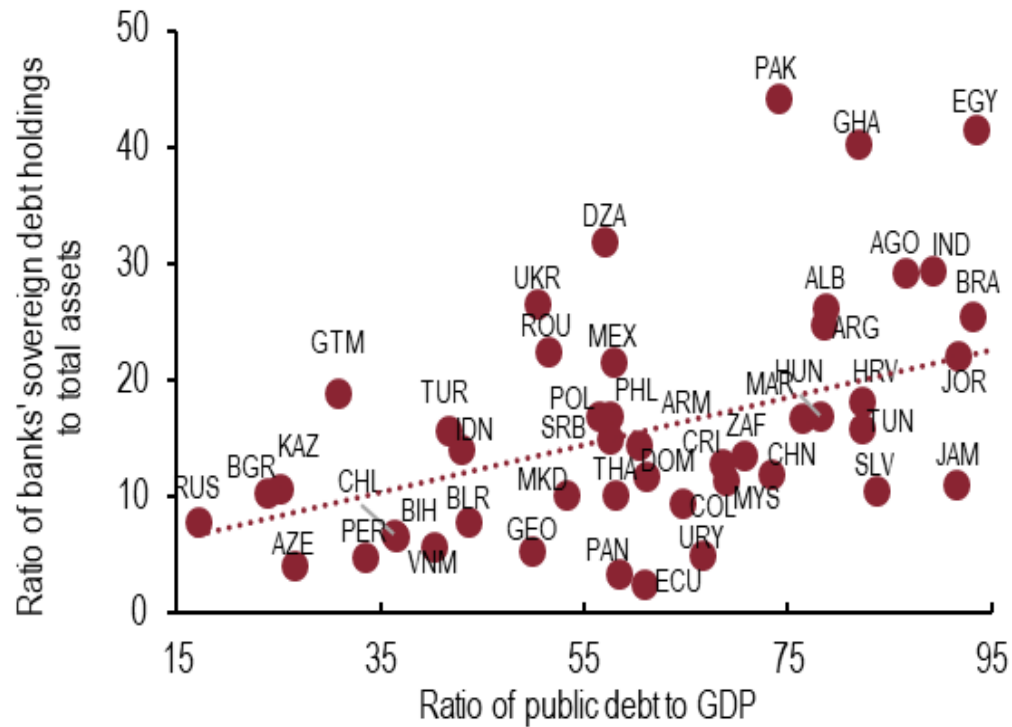
**3. Size of the haircut that would generate capital shortfall**  
(Percent of exposure to government)



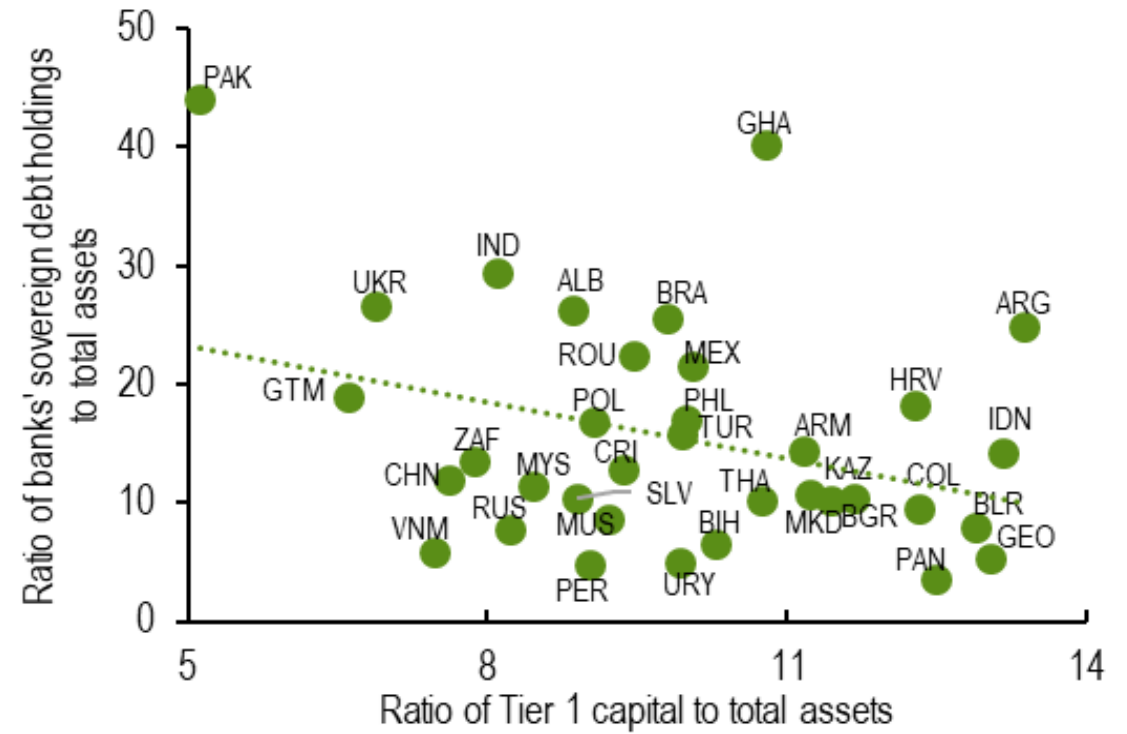
# An adverse shock could be amplified by a negative sovereign-bank feedback loop

*Banks' exposures to sovereign debt is higher in countries with higher public debt and lower bank capital*

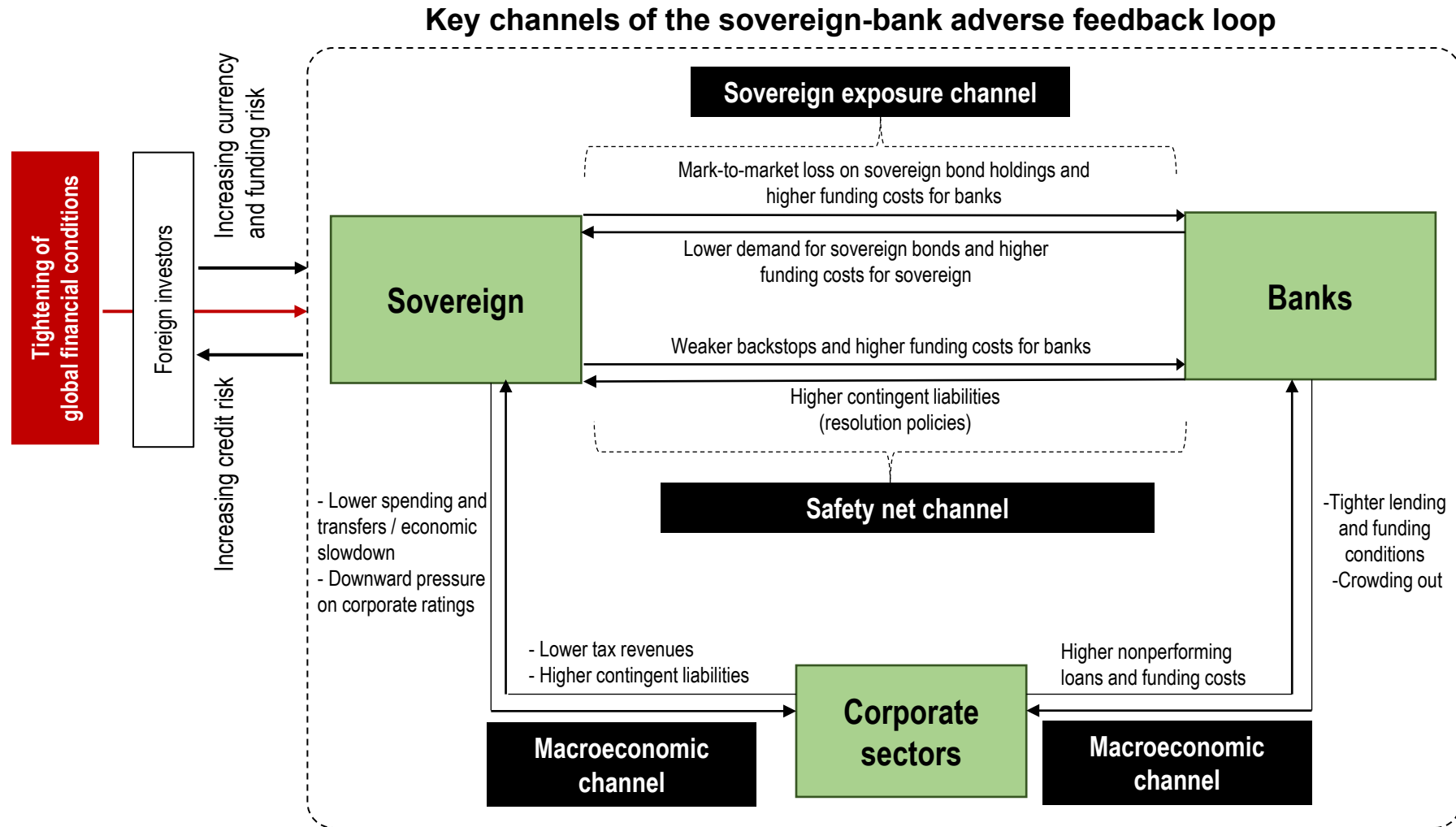
**1. EMs Sovereign Debt and Banks' Holdings of Sovereign Debt**  
(In percent, 2021)



**2. EMs Tier1 Capital and Banks' Holdings of Sovereign Debt**  
(In percent, 2021)



# ...through three key channels



# Main questions

- 1. How strong is the sovereign-bank nexus in emerging markets?**
- 2. How relevant are the key transmission channels?**



**How strong is the sovereign-bank nexus in emerging markets?**



# The sovereign-bank nexus has been relevant for EMs in the past

*Banking and sovereign debt crises have often occurred together in EMs...*

## 1. Frequency of Sovereign Default Crises and Other Economic crises in EMs and AEs (Percentage, 1971-2016)

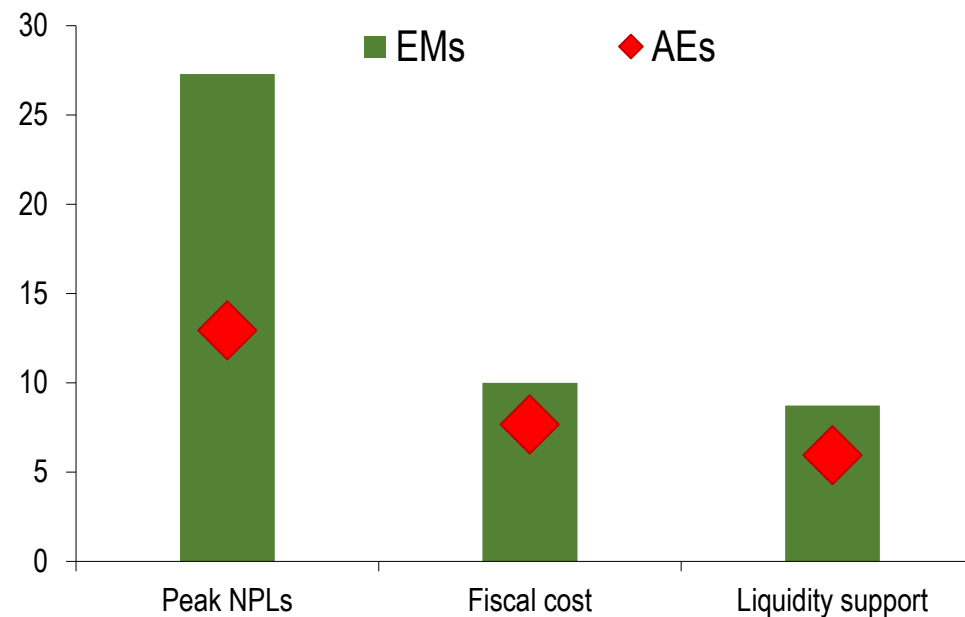
Type of crisis	EMs	AEs
Sovereign (domestic)	6.3	0.1
Sovereign (external)	18.5	0.5
Banking	15.0	16.1
Currency	25.8	10.9
Banking and sovereign	6.6	0.5
Banking, sovereign, and currency	5.1	0.0

Source: Reinhart and Rogoff (2020); IMF calculations.

Note: Crisis observations in percent of total number of country observations in specified sample.

*...and bank NPLs due to banking crises have generally been higher in EMs than in AEs, along with similar fiscal costs and liquidity support*

## 2. Financial and Fiscal Costs of Banking Crises (In percent, 1971-2016)



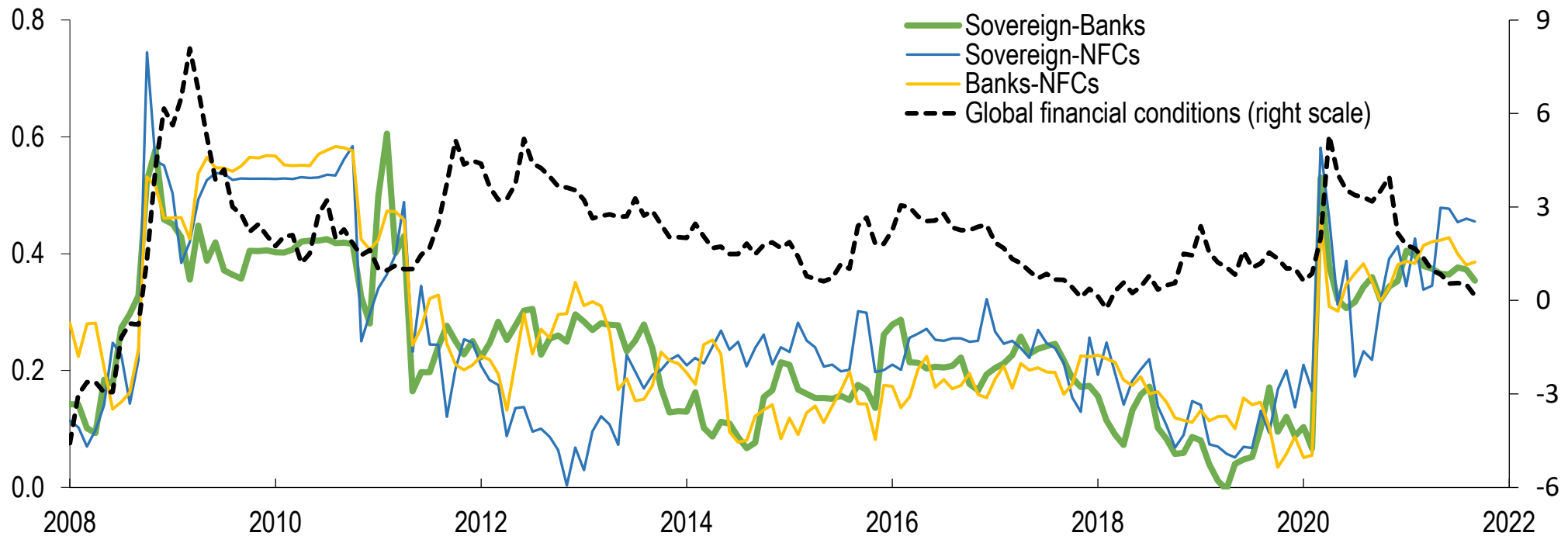
Source: Leaven and Valencia (2018); IMF staff calculations.

# Bank and sovereign spreads are highly correlated

*The correlation increases when global financial conditions are tight and at higher levels of bank stress*

## Median Correlation Between Sovereign Stress and Bank Stress, and Global Financial Conditions

(Index)



Note: The panel shows the median time-varying correlation between changes in sovereign, bank, and nonfinancial corporation' EDFs across countries using a 24-month rolling window. The median correlation is a number between -1 and 1. The global financial conditions indicator refers to the common component of monthly equity price returns estimated across advanced economies and emerging markets using a factor-augmented vector autoregressive model. NFCs = nonfinancial corporations

# Evaluating the strength of the nexus

A **structural vector autoregression model (SVAR)** is estimated at the country-level using daily data. The SVAR model takes the following form:

$$Ay_t = \tilde{a} + \tilde{A}_1 y_{t-1} + \dots + \tilde{A}_p y_{t-p} + \tilde{\Gamma}_0 x_t + \dots + \tilde{\Gamma}_q x_{t-q} + \epsilon_t$$

where  $t$  indicates time,  $y_t$  is a vector of **endogenous variables** capturing sovereign default risk, bank default risk, non-financial corporate default risk, term spread and equity indices.

- ❑ **Identification:** To identify structural shocks to the endogenous variables, the analysis exploits the heteroskedasticity in the data following Rigobon (2003).
- ❑ **Exogenous variables:** include a measure of global financial conditions (global financial condition index or VIX), USD dollar broad index and the US corporate bonds spread.
- ❑ **Sample:** daily data for 11 major EMs over 2006-2020.

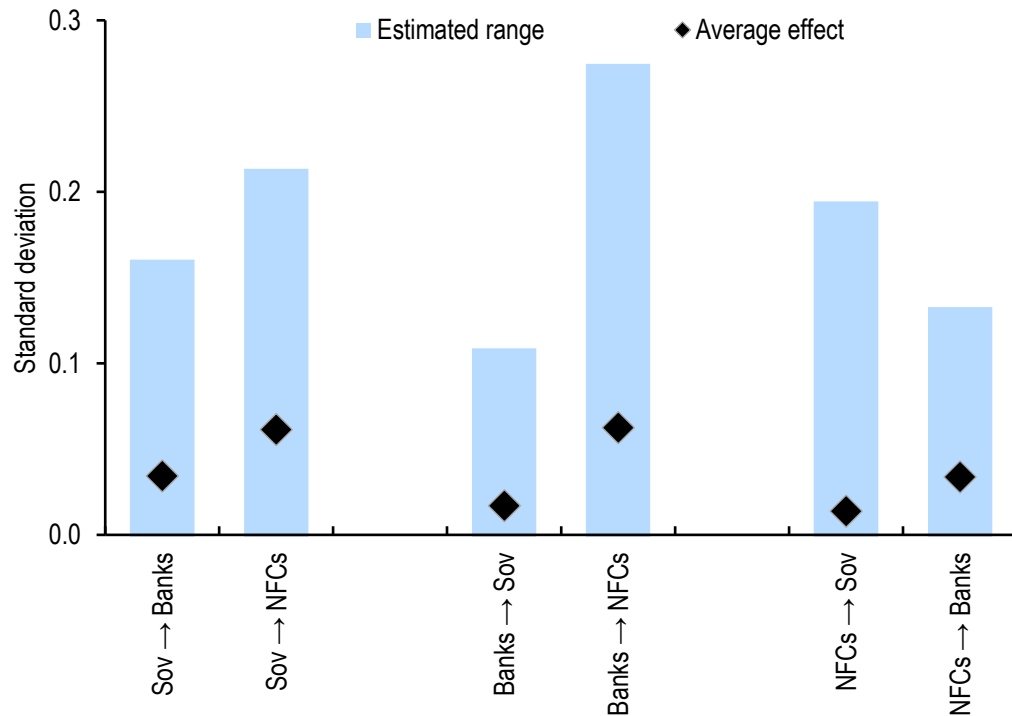
For robustness, test of a different number of volatility regimes (four instead of five) and different lag structures (from two to five lags of the endogenous variables).

# Stress transmits across sovereign, banking and corporate sectors

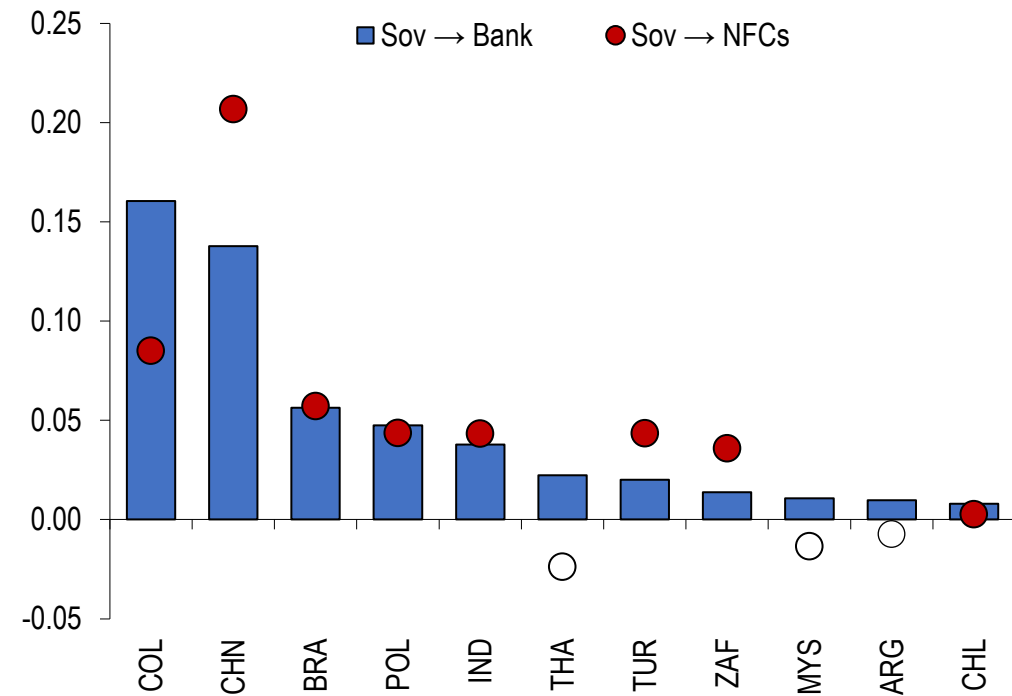
*An increase in sovereign, bank, and corporate credit risk transmits across sectors, especially from sovereign to banks and the corporate sectors*

*The relevance of the nexus differs across countries*

## 1. Effect of a One Standard Deviation Shock on Other Sectors' Default Risk (Standard deviation)



## 2. Strength of the Feedback Effects between Sovereign and Banks (Standard deviation)



Note: A full dot indicates significance at 90 percent or higher.



**How relevant are the key channels of transmission?**

# Exposure channel: shock transmission through banks' sovereign bond holdings

How do banks with higher ex-ante government bond holdings perform following a domestic sovereign stress?

Panel OLS specification (baseline)

$$Y_{i,c,t} = \beta_1 \text{Sovereign Exposure}_{i,c,t-1} + \beta_2 \text{Sovereign Exposure}_{i,c,t-1} \times \text{Sovereign Distress}_{c,t} \\ [+ \beta_3 \text{Sovereign Exposure}_{i,c,t-1} \times \text{Sovereign Distress}_{c,t} \times \text{Capital Ratio}_{i,c,t-1} + \beta_{4/5} \text{Double Interactions}] \\ + \Gamma \text{Controls}_{i,c,t-1} + \underbrace{\gamma_{c,t}}_{\text{Country-time FE}} + \underbrace{\gamma_i}_{\text{Bank FE}} + \varepsilon_{i,c,t}$$

Where:

- $Y_{i,c,t}$ : change in bank's EDF; change in equity-to-assets; change in loans-to-assets
- $\text{Sovereign Exposure}_{i,c,t-1}$ : total government bond holdings divided by total assets
- $\text{Sovereign Distress}_{c,t}$ : a dummy variable that is equal to 1 if the sovereign CDS premium exceeds 500 bps or in outright default or S&P rating of long-term foreign-currency debt of CCC- or lower; and 0 otherwise
- $\text{Controls}_{i,c,t-1}$ : banks' capital ratio, loans outstanding, non-cash assets, exposure to central bank, interbank balances, profitability, and size.

**Data:** Sample: 525 banks based in 18 emerging markets over 2000–20.

# Exposure Channel: The effect of sovereign distress on bank equity at different distress thresholds

	Dependent Variable: Log change in total equity							
	CDS Threshold: 300 bps	400 bps	500 bps	600 bps	700 bps	800 bps	900 bps	1000bps
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sovereign Exposure <sub>i,t-1</sub> * Sovereign Stress	-0.012 (0.195)	-0.342 (0.241)	-0.231 (0.227)	-0.329 (0.221)	-0.418* (0.229)	-0.518** (0.238)	-0.737*** (0.264)	-0.706*** (0.267)
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country x Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3582	3582	3582	3582	3582	3582	3582	3582
R-Squared	0.572	0.573	0.573	0.573	0.575	0.576	0.577	0.577
Number of banks	525	525	525	525	525	525	525	525
Number of Countries	18	18	18	18	18	18	18	18
Log change in total equity for a bank with 10 percent higher sovereign bond holdings (evaluated at mean capital ratio)	-0.59	-2.36	-0.87	-1.85	-2.68	-3.79	-5.68	-5.44

Note: Results based on bank-level panel regressions. Sovereign stress indicates periods when the monthly average of sovereign credit default swap spreads is higher than 500 basis points within a given year, or Standard & Poor's long-term rating for sovereign foreign exchange debt is CCC- or lower, or the government is in external or domestic default according to Harvard Business School Global Crises Data by Country.

**Robustness analysis** → alternative proxies of sovereign distress that are exogenous to domestic banking stress:  
 1) increase in fiscal debt due to an exchange rate depreciation; 2) volume of maturing debt.

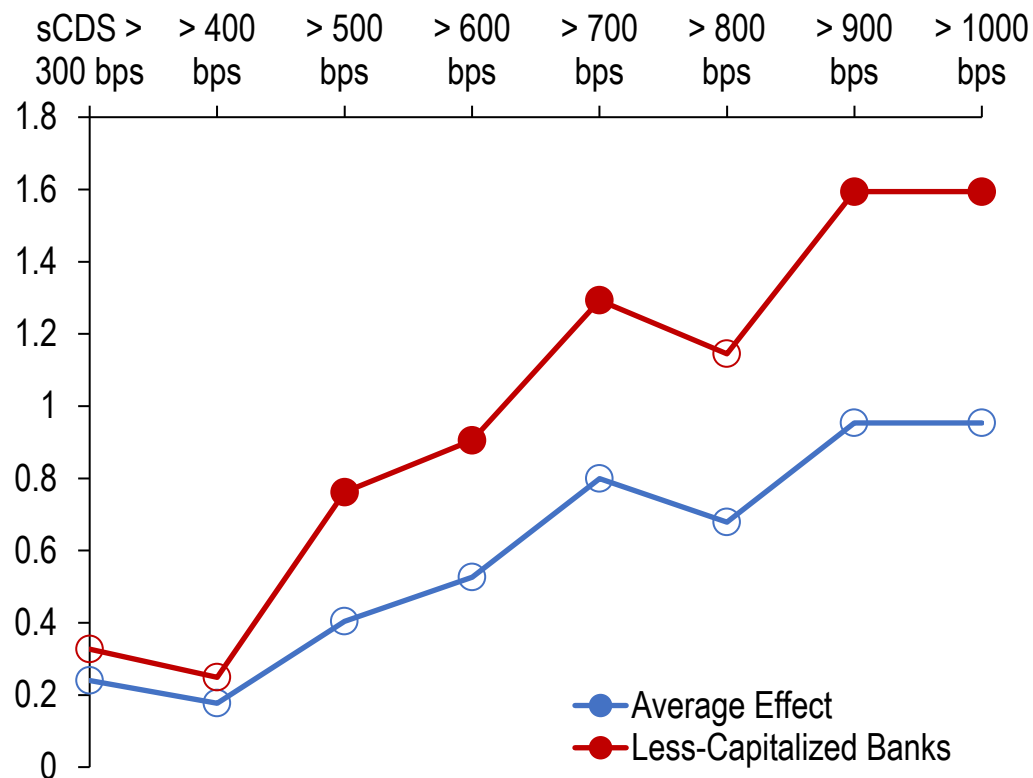


# Exposure Channel: The effect of sovereign stress on banks is large

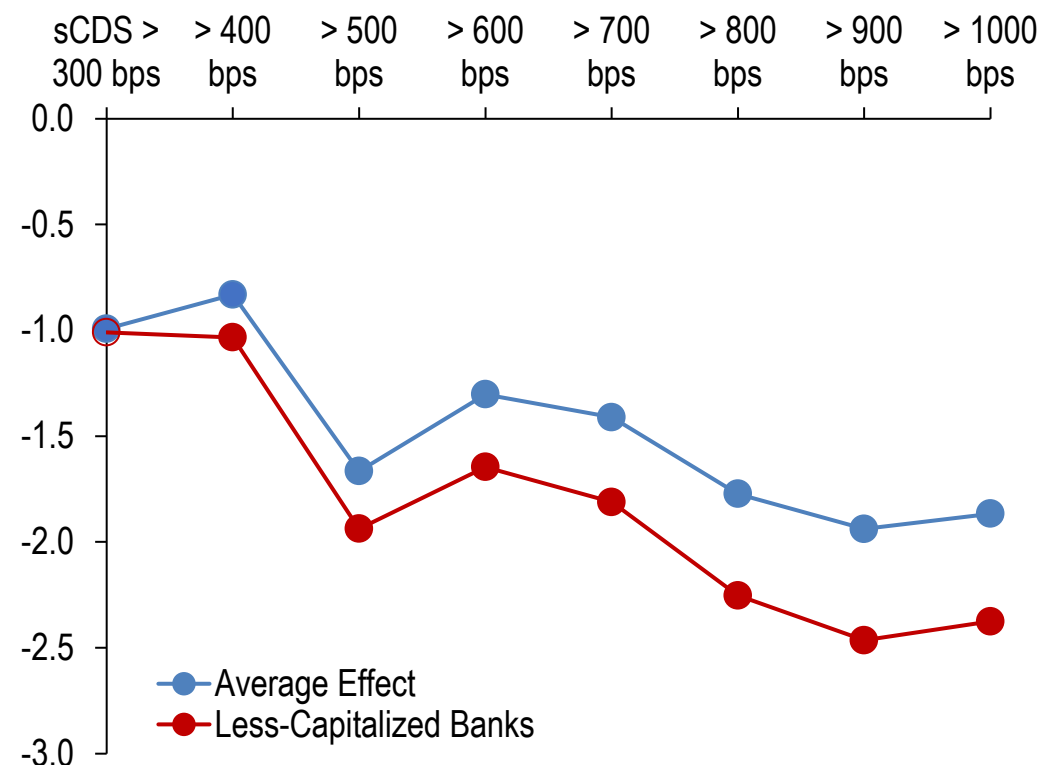
*Banks with higher sovereign debt exposure and weaker balance sheets experience a higher default risk post-sovereign distress*

*...as well as lower capital and lending to the private sector*

**1. Change in Bank EDF following Sovereign Distress with Higher Bank Sovereign Bond Holdings for Different Levels of Sovereign Distress**  
(Percentage points)



**2. Change in Bank Loans-to-Total Assets Ratio following Sovereign Distress with Higher Bank Sovereign Bond Holdings for Different Levels of Sovereign Distress**  
(Percentage points)



Note: Higher sovereign debt exposure refers to banks with ex-ante 10 ppt (1 std) higher government debt securities-to-total assets ratio. Sovereign distress in the baseline models is identified by explicit defaults and sovereign CDS premia above 500 bps. A full dot indicates significance at 90 percent or higher.



# Safety Net Channel: Shock transmission through sovereign support

**Do banks with higher government safety net coverage under-perform other banks after sovereign distress?**

**Panel local projection specification (baseline)**

$$CAR_{i,c,t-1,h} = \beta_{1,h} SRF\ purge_{i,c,t-1} + \beta_{2,h} SRF\ purge_{i,c,t-1} \times Sovereign\ Distress_{c,t} \\ + \lambda_h Controls_{i,c,t-1} + \underbrace{\theta_{c,t,h}}_{\text{Country-time FE}} + \underbrace{\lambda_{i,h}}_{\text{Bank FE}} + \epsilon_{i,c,t-1,h}$$

Where:

- ❑  $CAR_{i,c,t-1,h}$ : Cumulative abnormal returns of bank  $i$  from  $t-1$  up to  $h$ -months ahead. Abnormal returns and banks' risk exposure to the market excess returns are re-estimated based on a 24-month rolling window.
- ❑  $SRF\ purge_{i,c,t-1}$ : Fitch Support Rating Floor (SRF) purged by domestic financial conditions. The indicator evaluates government's propensity to support a bank, which is exogenous to a bank's intrinsic credit quality.
- ❑  $Sovereign\ Distress_{c,t}$ : a dummy variable that is equal to 1 if country  $c$  is in sovereign distress in month  $t$  (as in exposure channel analysis)

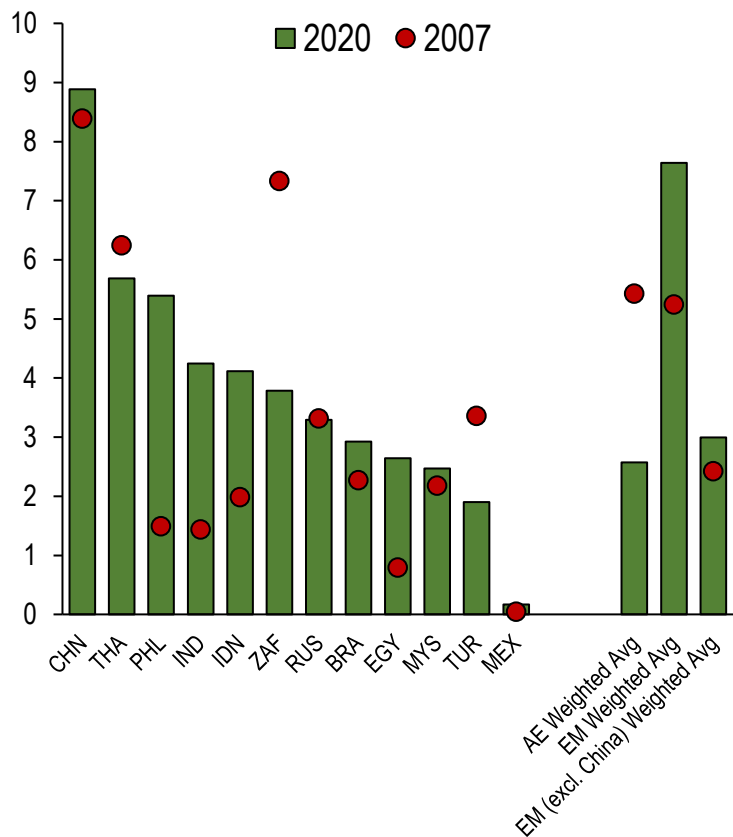
**Sample:** 54 banks from 10 EMs, with monthly frequency from Sep. 2007 to Dec. 2021.

# Safety Net Channel: An intertemporal pattern following sovereign stress

*Government implicit guarantees to EM banks have increased since the GFC...*

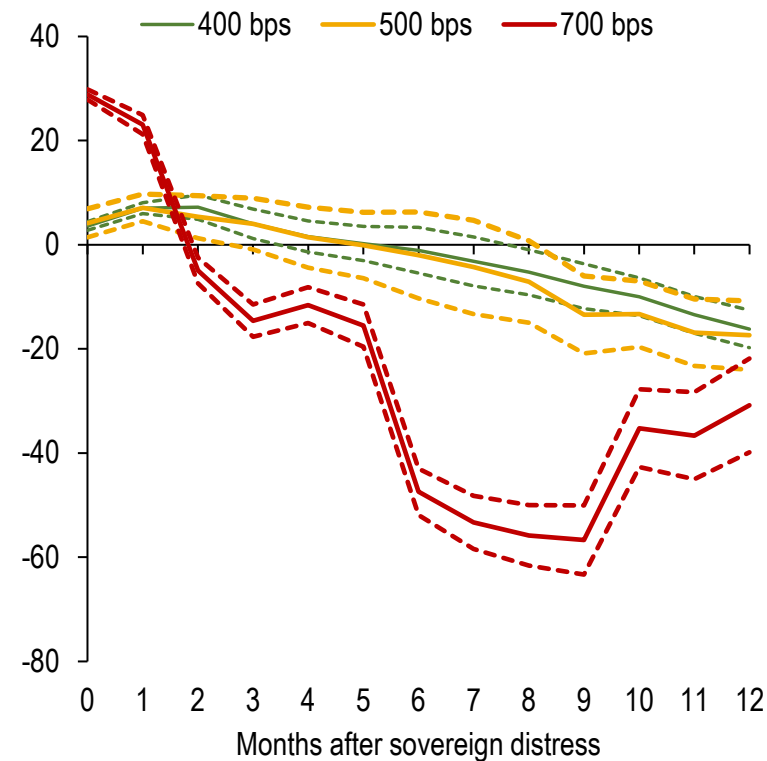
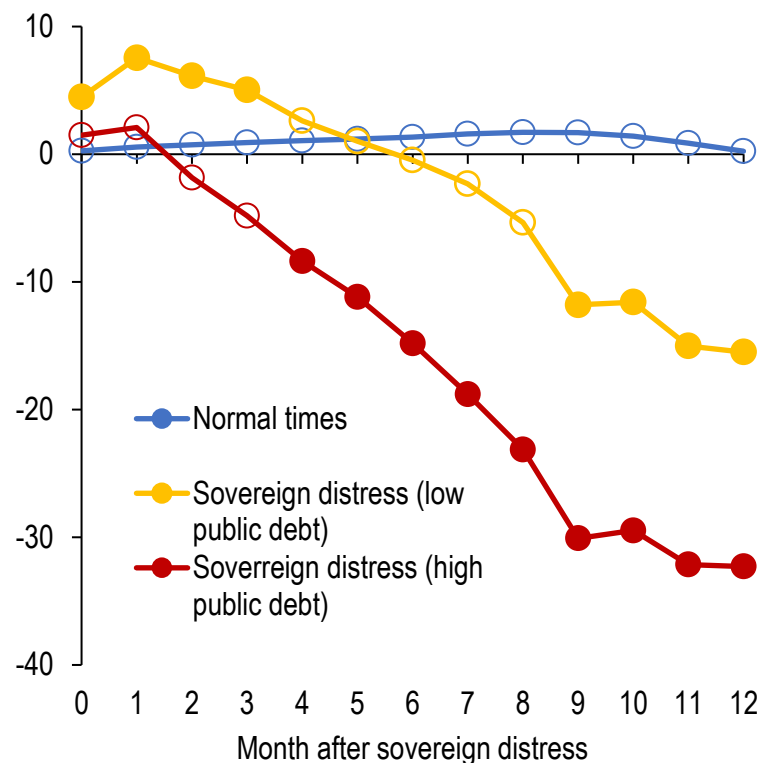
## 1. Fitch Support Rating Floor

(higher value = higher likelihood of receiving gov. support during stress)



*Government guarantees support banks after sovereign distress, but not so much in countries with high public debt*

## 2. Cumulative Abnormal Returns with one Notch Higher Government Support Rating in Countries with Different Fiscal Vulnerability and Various Sovereign CDS Spreads' Thresholds (Percentage points)



# Safety Net Channel: Risk-taking and moral hazard

Do banks with higher government safety net coverage take additional credit risks after sovereign distress? Which bank characteristics matter?

Panel local projection specification (baseline)

$$\begin{aligned} Risktaking\ Indicator_{i,c,t-1,h} = & \beta_{1,h} SRF\ purge_{i,c,t} + \beta_{2,h} Capital\ Ratio_{i,c,t-1} \\ & + \beta_{3,h} SRF\ purge_{i,c,t} \times Sovereign\ Distress_{c,t} \\ & + \beta_{4,h} SRF\ purge_{i,c,t} \times Capital\ Ratio_{i,c,t-1} \\ & + \beta_{5,h} SRF\ purge_{i,c,t} \times Capital\ Ratio_{i,c,t-1} \times Sovereign\ Distress_{c,t} \\ & + \lambda_h Controls_{i,c,t-1} + \underbrace{\theta_{c,t-1,h}}_{\text{Country-time FE}} + \underbrace{\lambda_{i,h}}_{\text{Bank FE}} + \epsilon_{i,c,t-1,h} \end{aligned}$$

Where:

- ❑ *Risktaking Indicator*<sub>*i,c,t-1,h*</sub>: Cumulative credit growth or NPL ratio change of bank *i* up to H-year ahead
- ❑ *SRF\_purge*<sub>*i,c,t*</sub>: Fitch Support Rating Floor (SRF) purged by domestic financial conditions
- ❑ *Sovereign Distress*<sub>*c,t*</sub> indicates the months with average sovereign credit default swap spreads higher than 500 basis points, or Standard & Poor's long-term rating for sovereign foreign exchange debt that is CCC– or lower, or months when external or domestic debt defaults occurred

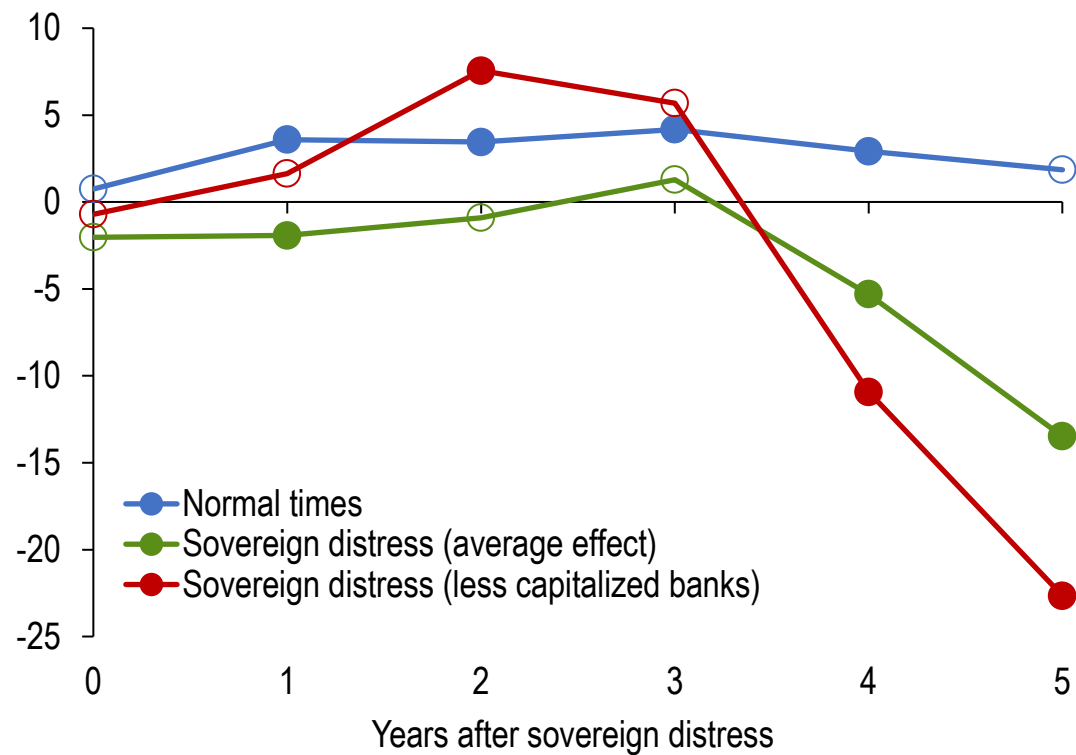
**Sample:** 54 banks from 10 EMs, with monthly frequency from Sep. 2007 to Dec. 2021.

# Safety Net Channel: More risk-taking by less capitalized banks

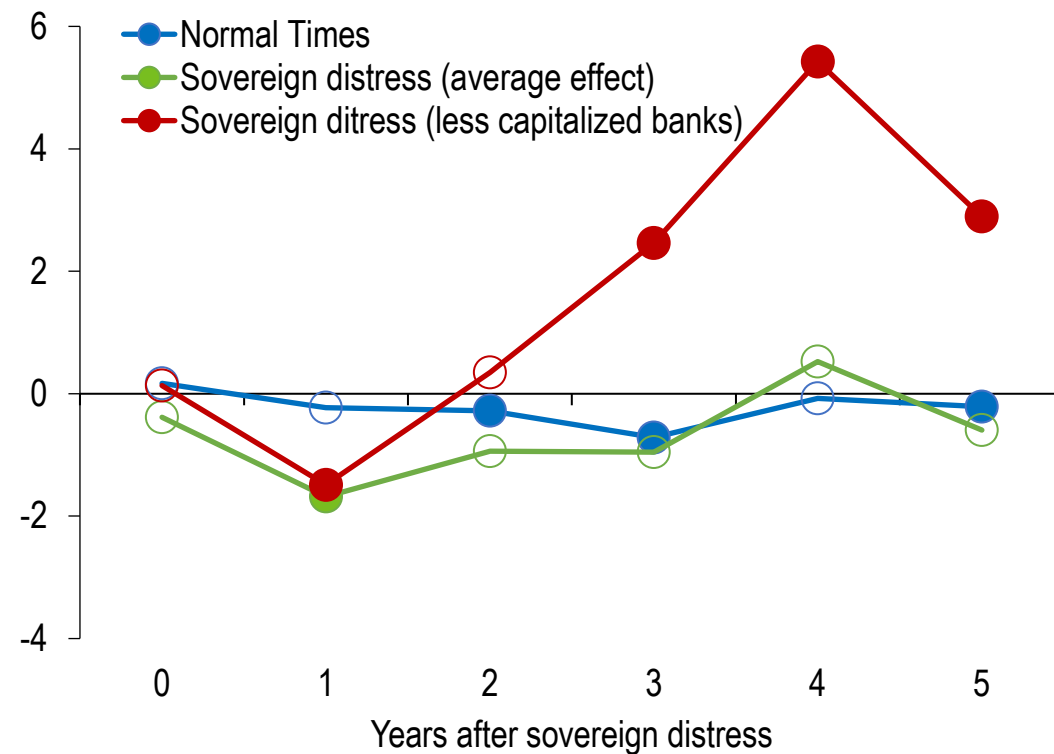
*Undercapitalized banks with implicit guarantees increase credit growth following sovereign distress...*

*...leading to higher levels of nonperforming loans, suggesting increased risk-taking.*

**1. Cumulative Bank Credit Growth with One Notch Higher Government Support Rating across Banks with Different Capital Buffers**  
(Percentage points)



**2. Cumulative Change in Bank Nonperforming Loan Ratio with a One-Notch-Higher Government Support Rating across Banks with Different Capital Buffers**  
(Percentage points)



# Macroeconomic Channel: The impact of sovereign downgrades on NFCs

Following a sovereign downgrade, do bound firms reduce their investment ratio and debt issuance more than their peer unbound firms?

Difference-in-difference approach (baseline)

$$\begin{aligned} \Delta_h y_{j,s,c,t} &= \beta_{1,h} \text{Bound}_{j,s,c,t-1} + \beta_{2,h} \text{Bound}_{j,s,c,t-1} \times \text{Sovereign Downgrade}_{c,t} \\ &+ \beta_{3,h} \text{Sovereign Downgrade}_{c,t} + \beta_{4,h} \text{Controls}_{j,s,c,t-1} \\ &+ \underbrace{\lambda_{s,h}}_{\text{Sector FE}} + \underbrace{\gamma_{c,h}}_{\text{Country FE}} + \underbrace{\eta_{t,h}}_{\text{Time FE}} + \epsilon_{j,s,c,t,h} \end{aligned}$$

Where:

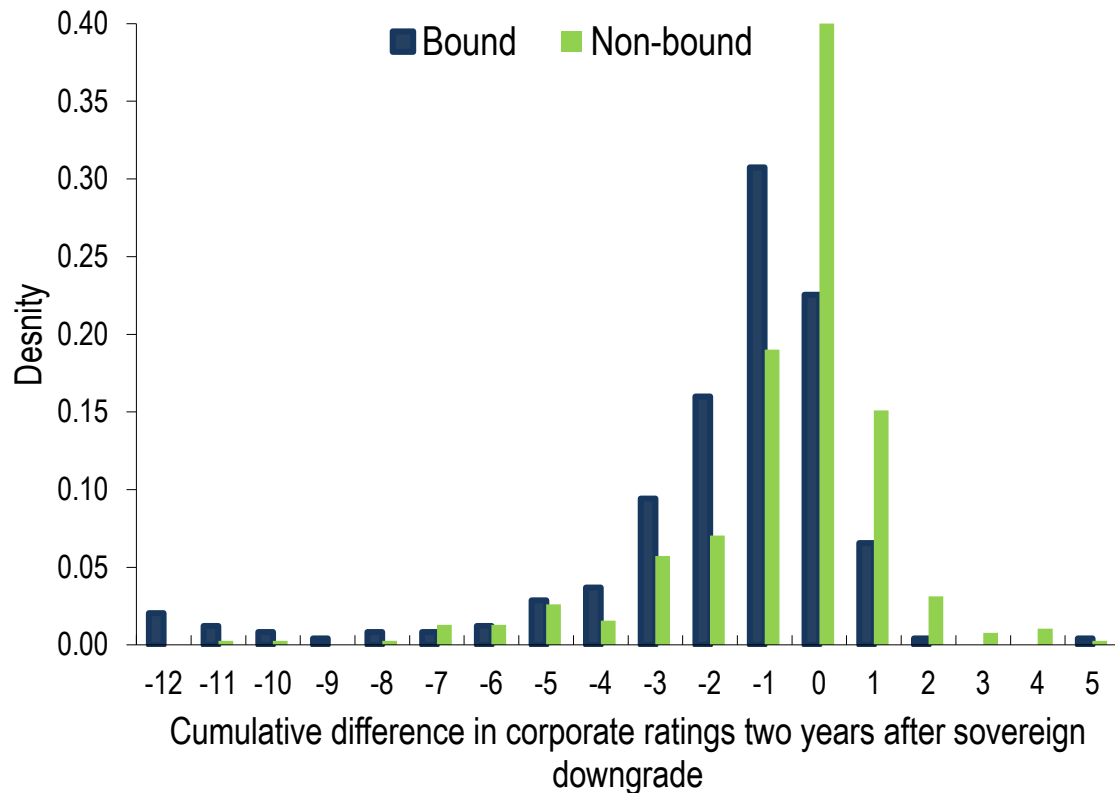
- $\Delta_h y_{j,s,c,t}$  denotes the cumulative change in firms' investment or debt issuance over the next  $h$  years relative to the pre-downgrade period
- "Bound" refers to firms with a rating at or above the sovereign rating
- $\text{Controls}_{j,s,c,t-1}$ : firm size, Tobin's Q, cash flow, cash holdings, leverage, and government ownership

**Sample:** 84 unique sovereign downgrade events in 29 EMs, , including 717 firms

# Macroeconomic channel: Sovereign downgrades hurt the corporate sector

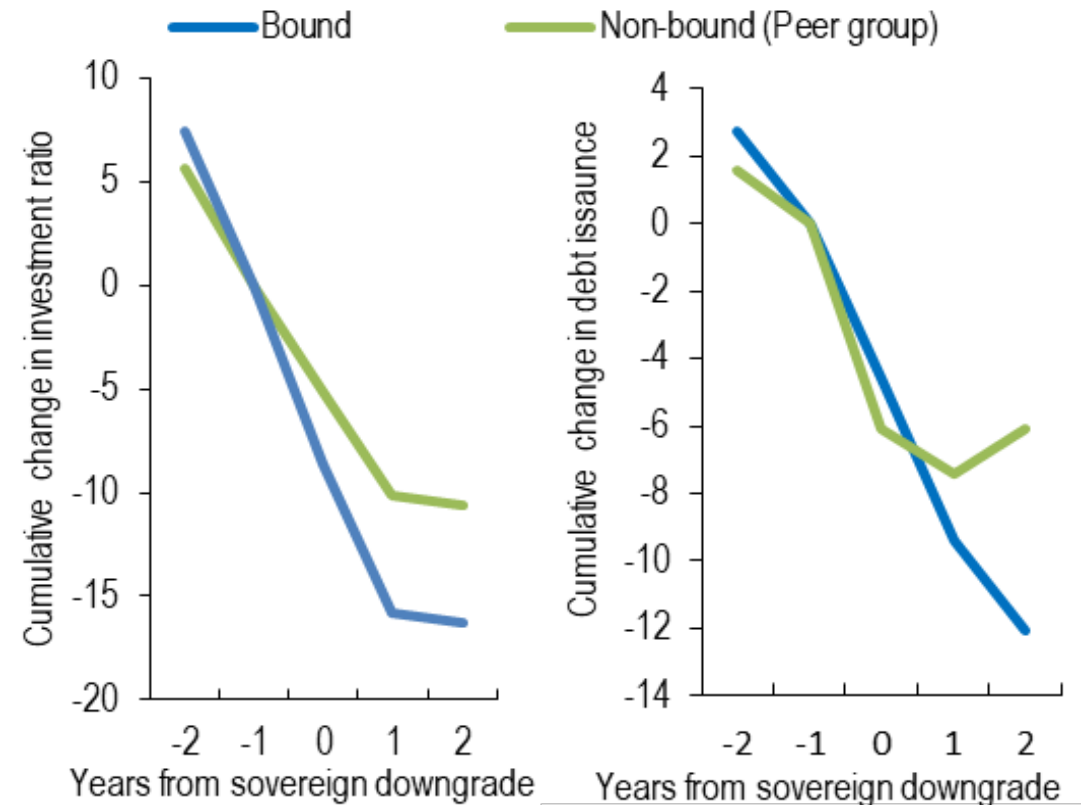
*Firms with a rating equal to or above the sovereign (“bound firms”) have a higher probability of downgrade after a sovereign downgrade*

1. Distribution of the Change in Corporate Ratings Following a Sovereign Downgrade (Density)



*... and lower their investment more than peers after a sovereign downgrade*

2. Change in Investment and Debt Issuance Following a Sovereign Downgrade (Percent)







# Conclusions

## Key takeaways

- Banks' exposure to sovereign debt has increased notably in EMs.
- EMs are particularly vulnerable to an adverse shock triggering a negative sovereign-bank feedback loop.
- The two-way transmission of risks between the sovereign, banking, and corporate sectors is significant in EMs. An increase in sovereign stress could:
  - Affect banks directly through their sovereign exposures, lowering their equity and lending—especially banks with weaker balance sheets.
  - Diminish the perceived strength of the safety net and adversely affect bank returns.
  - Hurt investment by nonfinancial corporations, hampering economic activity.



EMs face complex **policy trade-offs** amid economic uncertainty, tightening of global financial conditions, elevated fiscal vulnerabilities and large financing needs.



# Policy recommendations

- More targeted and efficient spending and **strengthening of medium-term fiscal frameworks** to mitigate the impact of an adverse shock.
- Conducting **stress testing exercises** for banks considering the multiple channels.
- Consider **measures to avoid excessive sovereign exposure** of banks, such as appropriately calibrated capital surcharges on sovereign exposure above certain thresholds, after the economic recovery has taken hold.
- Promote a **deep and diversified local investor** base to strengthen market resilience.
- Improving **data disclosure** of sovereign exposures and contingent liabilities (BCBS, '21).



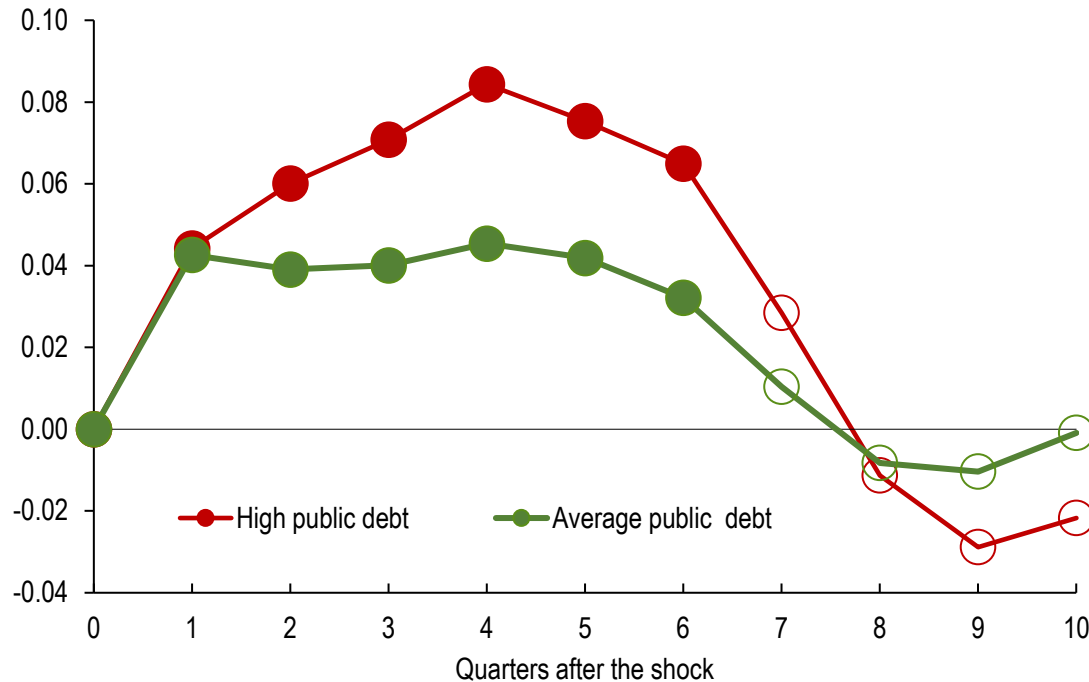
# Appendix

# Stress transmits across sovereign, banking and corporate sectors

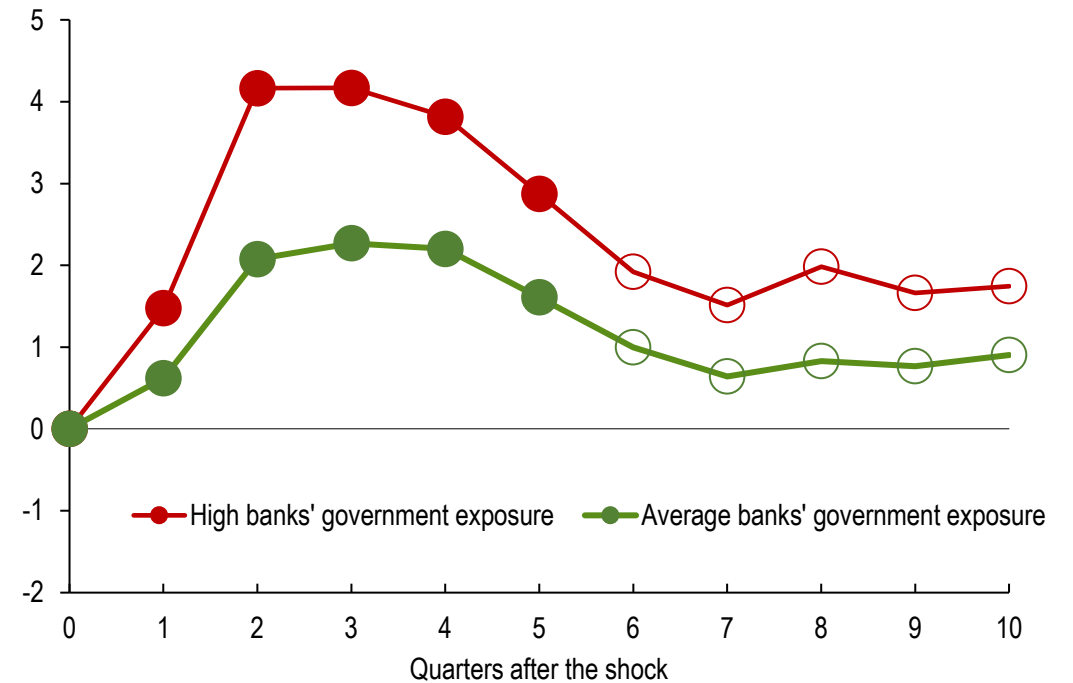
## Extension of SVAR model

$$y_{t+h} = \tilde{a} + \tilde{A}_1 y_{t-1} + \dots + \tilde{A}_p y_{t-p} + (\tilde{\Gamma}_0 x_t + \dots + \tilde{\Gamma}_q x_{t-q}) \times \text{Vulnerability}_{t-q} + \dots + \tilde{\gamma}_1 \text{Vulnerability}_{t-1} \dots + \tilde{\gamma}_p \text{Vulnerability}_{t-p} + X_{t-q} \epsilon_t$$

1. Cumulative Change in Sovereign Credit Risk Following a Global Financial Conditions Shock (Percentage point)



2. Cumulative Change in Bank Credit Risks Following a Global Financial Conditions Shock (Percentage point)



*Higher public debt and a higher sovereign exposure of banks increases the effect of global shocks on the sovereign and banking sector*

# Exposure Channel: What are the drivers in EMs?

## Examining the Presence of Moral Suasion and Risk-Shifting

The baseline empirical specification that is estimated is thus as follows:

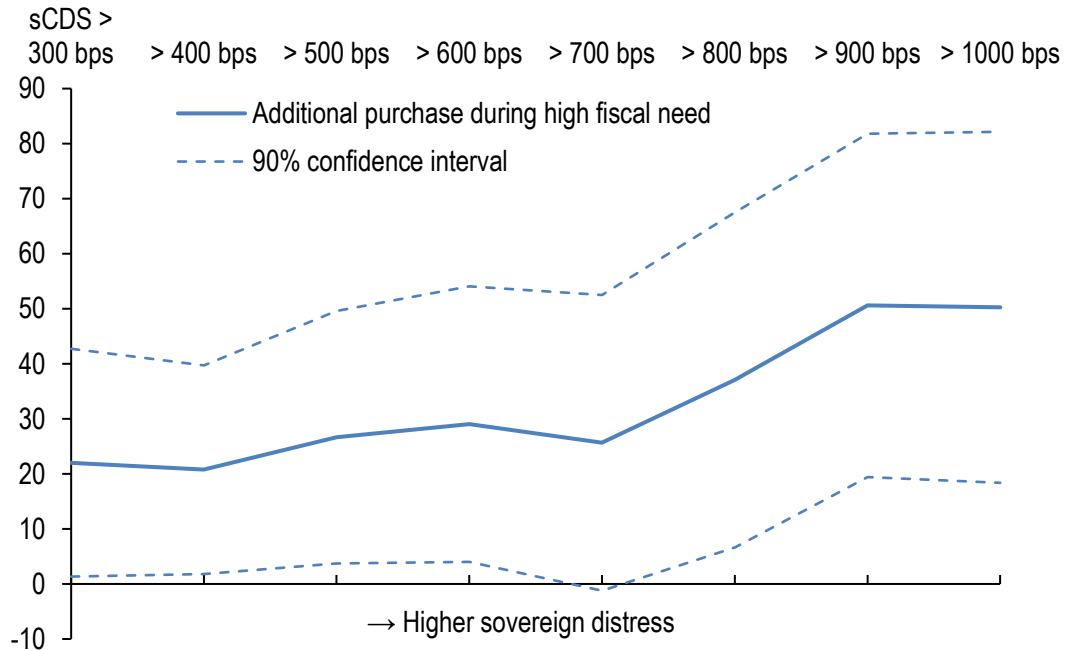
$$\begin{aligned} \text{Net Purchases}_{i,c,t} = & \beta_1 \text{High Fiscal Need}_{c,t-1} \times \text{State Owned}_{i,c,t-1} \\ & + \beta_2 \text{Capital Ratio}_{i,c,t-1} \times \text{State Owned}_{i,c,t-1} \\ & + \beta_3 \text{State Owned}_{i,c,t-1} + \beta_4 \text{Capital Ratio}_{i,c,t-1} + \Gamma X_{i,c,t-1} + \gamma_{c,t} + \gamma_i + \varepsilon_{i,c,t} \end{aligned}$$

Where:

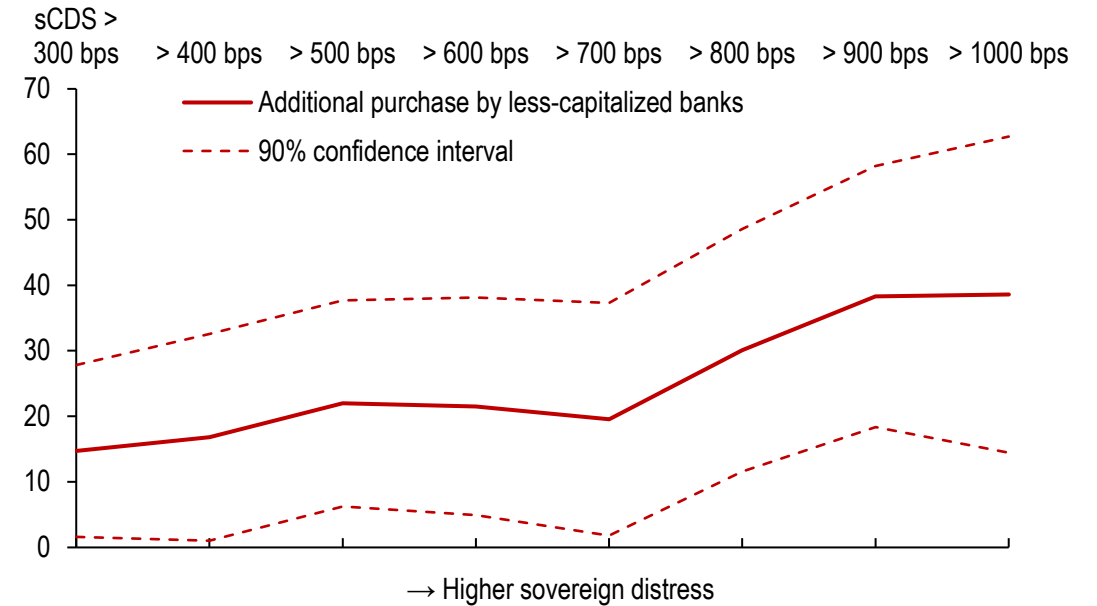
- ❑ *Net Purchases*<sub>*i,c,t*</sub> denotes the log change in total government debt holdings (normalized by total assets) of domestic bank *i* in country *c* from year *t*-1 to *t*,
- ❑ *High Fiscal Need*<sub>*c,t*</sub> is a binary variable that equals 1 if the expected maturing debt to total public debt ratio is above the country-specific 75th percentile over the sample period,
- ❑ *State Owned*<sub>*i,c,t*</sub> is a binary variable that equals 1 if a particular bank has more than 25 percent government ownership,
- ❑ *Capital Ratio*<sub>*i,c,t*</sub> is measured as the total equity-to-total assets ratio, and *X*<sub>*i,c,t*</sub> is a vector of bank controls that includes deposits-to-total assets ratio, total loans-to-deposits ratio and (log of) total assets

# Exposure Channel: What are the drivers in EMs? (cont'd)

## 1. Moral Suasion: Net Purchases of State-Owned Banks During High Need Periods (Percentage points, one-year ahead)



## 2. Risk-Shifting: Net Purchases of State-Owned Banks That are Less Capitalized (Percentage points, one-year ahead)



Note: The line for "moral suasion" corresponds to the effect for state-owned banks during episodes of high fiscal need, or when expected maturing debt as a share of total debt is above the 75th percentile for the sample period. The line for "risk shifting" corresponding to the effect for state-owned banks that have a capital ratio which is standard deviation below the mean. Sovereign distress corresponds to periods when the sovereign CDS is higher than a threshold (300 bps, 400 bps, ..., or 1000 bps), or S&P long-term rating for sovereign FX debt is CCC- or lower, or the government is in external/domestic default according to the Harvard Business School Global Crises Data by Country. All regressions include bank controls and bank and country-year fixed effects. Standard errors are clustered at the bank level. Bands indicate 90% confidence intervals.

# Exposure Channel: Valuation effect on fiscal debt and key bank outcome variables

Dependent Variable:	Change in log(Bank EDF)	Change in pre-tax profits divided by lagged total equities	Change in (log) total equity	Change in Total Loans-to- Total Assets	Change in (log) total loans
	(1)	(2)	(3)	(4)	(5)
Sovereign Exposure <sub>i,t-1</sub> * Increase in Fiscal Debt due to FX depreciation <sub>c,t-1</sub>	46.222 (25.721)	-15.699** (4.147)	-33.181* (14.063)	-7.382*** (0.877)	-8.867 (10.282)
Bank Controls	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
Country x Year FE	Yes	Yes	Yes	Yes	Yes
Observations	60	216	216	216	216
R-Squared	0.869	0.869	0.837	0.840	0.879
Number of banks	15	66	66	66	66
Number of Countries	4	4	4	4	4
Economic Impact for a bank with 10% ex-ante higher sovereign exposure	4.654	-1.821	-3.849	-0.856	-1.029

Notes: Bank controls are size (log of total assets), capital ratio (total equity-to-total assets ratio), liquidity (non-cash assets-to-total assets), profitability (return on assets), exposure to the central bank (total exposure to the central bank divided by total assets); and interbank exposure (interest-earning balances with central and other banks divided by total assets), and total loans-to-total asset ratio. All bank controls are one-year lagged. All columns include loan-to-assets ratio and net open FX position in levels and in interaction with "Increase in Fiscal Debt due to FX depreciation". Standard errors are clustered at the bank level. \*\*\*, \*\*, \* denote significance levels at 1, 5 and 10 percent respectively.

# Exposure Channel: The effect of debt rollover risks on key bank outcome variables

Dependent Variable:	Change in log(Bank EDF)	Change in pre-tax profits divided by lagged total equities	Change in (log) total equity	Change in Total Loans-to- Total Assets	Change in (log) total loans
	(1)	(2)	(3)	(4)	(5)
Sovereign Exposure <sub>i,t-1</sub> * I(Maturing Debt <sub>c,t-1</sub> <sup>e</sup> ) * Change in VIX <sub>t</sub>	11.443 (10.671)	-1.125** (0.368)	-5.192** (1.577)	-0.666** (0.190)	-0.716 (0.757)
Sovereign Exposure <sub>i,t-1</sub> * I(Maturing Debt <sub>c,t-1</sub> <sup>e</sup> )	0.922 (0.677)	-0.145 (0.144)	-0.556 (0.399)	0.043 (0.056)	0.490* (0.216)
Sovereign Exposure <sub>i,t-1</sub> * Change in VIX <sub>t</sub>	-0.232 (1.957)	0.391 (0.260)	0.507 (0.562)	0.066 (0.089)	0.648** (0.186)
Bank Controls	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
Country x Year FE	Yes	Yes	Yes	Yes	Yes
Observations	80	261	261	261	261
R-Squared	0.897	0.867	0.814	0.823	0.888
Number of banks	21	80	80	80	80
Number of Countries	5	5	5	5	5
Economic Impact for a bank with 10% ex-ante higher sovereign exposure (when VIX is higher by 1 std and sovereign has a high degree of maturing debt)	28.81	-3.036	-14.01	-1.796	-1.933

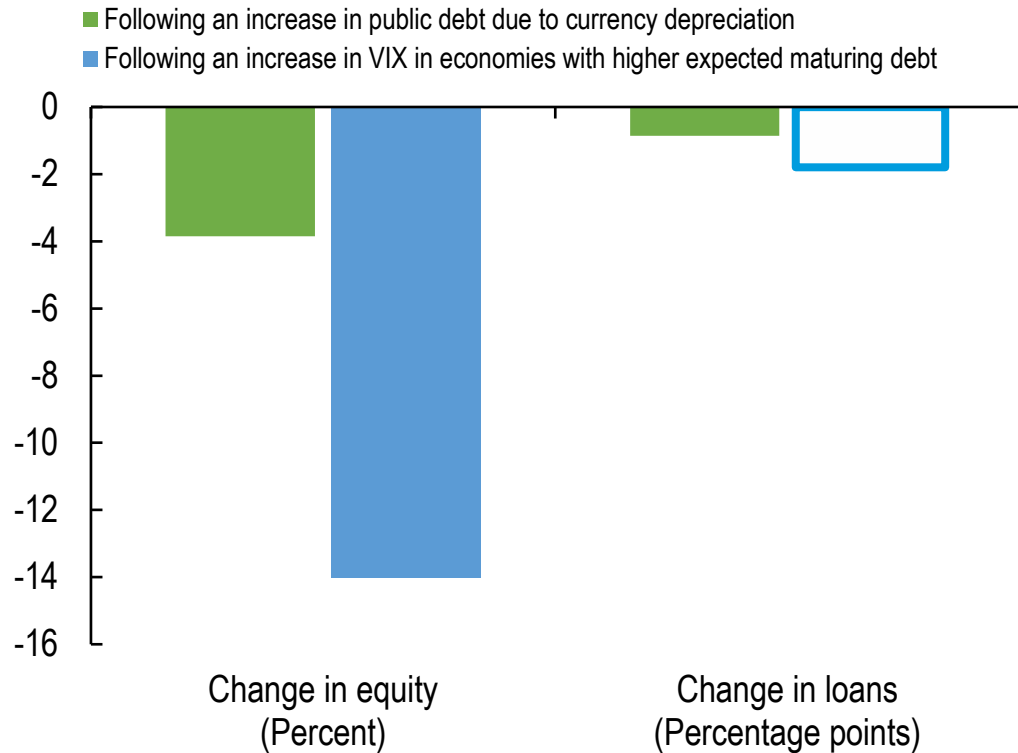
Notes: Bank controls are size (log of total assets), capital ratio (total equity-to-total assets ratio), liquidity (non-cash assets-to-total assets), profitability (return on assets), exposure to the central bank (total exposure to the central bank divided by total assets); and interbank exposure (interest-earning balances with central and other banks divided by total assets), and total loans-to-total asset ratio. All bank controls are one-year lagged. All columns include loan-to-assets ratio and net open FX position in levels, in double interaction and triple interaction with maturing debt dummy and change in VIX. Standard errors are clustered at the bank level. \*\*\*, \*\*, \* denote significance levels at 1, 5 and 10 percent respectively.



# Exposure channel: external shocks exert significant effect

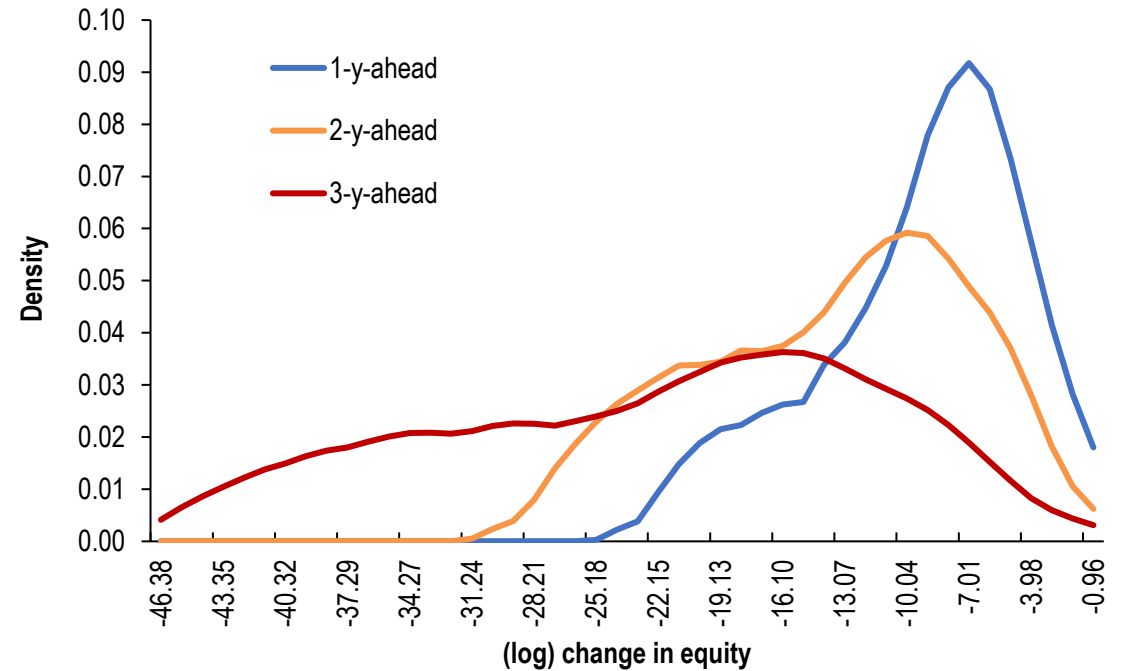
*The reduction in bank capital and lending is also significant following external shocks.*

## 1. Change in Equity and Loans following Sovereign Distress Amid External Shock



*Forward-looking scenario analysis under VIX shocks predicts substantial worsening in bank capital distribution*

## 2. Forecasted distribution of change in bank equity in distressed countries under a severely adverse VIX scenario\*



\* The evolution of the VIX follows the latest Dodd-Frank Act stress test severely adverse scenario, in which the VIX is assumed to increase by 20% in the first year, and then moderately converge to its long-run average in the following two years. The assumed evolution of VIX is mapped into change in sovereign CDS via a simple panel regression for EMs in the sample, and historical sensitivities are used to forecast log change in equity over the forecast horizons.