CHAPTER 2

GLOBAL FINANCIAL STABILITY REPORT

Online Annex—Capital Flows to Emerging Markets: The Role of Global Non-bank Investors

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Online Annex 2.1. Glossary of Key Non-bank financial intermediaries

NBFI type	Description
Hedge fund	A pooled investment vehicle pursuing strategies that aim to generate positive returns regardless of market conditions, reporting holdings through regulatory filings or other public disclosures.
Mutual fund	A registered collective investment vehicle that pools investor capital and reports portfolio holdings through regulatory filings, or an entity providing investment advice and managing a portfolio of securities.
Insurance company	An institutional investor responsible for managing the investment portfolio of an insurance company in-house.
Pension fund	An institutional investor that manages assets on behalf of retirement or pension schemes and reports its security holdings through regulatory filings or other public disclosures.
Sovereign wealth fund	Government-owned investment entity that manages public financial assets and discloses its holdings through regulatory filings, public reports, or other official sources.
Foundation/ endowment	Nonprofit investment entity—such as a charitable foundation, university endowment, or a similar organization—that invests financial assets and discloses its holdings publicly.
Family office	Investment entity established to manage the assets of high-net-worth individuals or families, reporting holdings through regulatory filings or other public disclosures.
Passive/ Active fund	Passive funds mechanically follow an index or rules-based methodology. The chapter classifies funds as passive if they (i) explicitly track an index, (ii) follow index-based or rules-based selection criteria, (iii) provide leveraged or inverse exposure to an index, or (iv) report an index replication method.
Exchange-traded fund	Exchange-traded funds (ETFs) are investment funds that trade on exchanges throughout the day like stocks, offering intraday liquidity and market-based pricing. Unlike mutual funds, which trade only at end-of-day NAV, ETFs allow investors to buy and sell continuously and typically use an arbitrage mechanism to keep prices aligned with underlying assets. Funds are classified as ETFs according to the Asset Universe field in Lipper.
Institutional-focused fund	Institutional-focused funds are investment vehicles whose investor base consists mainly of professional investors (such as pension funds, insurers, or endowments). The classification of institutional/retail funds is constructed using Lipper's share-class–level designation. Funds are classified as institutional if the time-series average of the share of assets under management held in institutional-oriented share classes is more than 50 percent of the fund's assets.
Distressed Debt	Private credit strategy involving the purchase or origination of debt of financially distressed or defaulted borrowers, typically at a discount, with the objective of realizing value through restructuring, recovery, or control-oriented outcomes.
Special Situations	A flexible private credit strategy targeting idiosyncratic, event-driven, or structurally complex financing needs (e.g., liquidity shortfalls, carve-outs, recapitalizations, rescue financing), where capital is provided outside standardized lending channels and priced for complexity and execution risk.
Mezzanine Financing	Subordinated or junior debt capital positioned between senior secured debt and equity in the capital structure, typically unsecured or second-lien, carrying higher yields and often including equity-linked features (e.g., warrants or PIK components).
Direct Lending	Origination and holding of privately negotiated corporate loans by non-bank investment funds, typically to middle-market or sponsor-backed firms, outside the broadly syndicated loan and public bond markets. These loans are most commonly leveraged and underwritten on a cash-flow basis.
Infrastructure Finance (Private Credit)	Provision of private debt capital to finance infrastructure assets or projects, typically backed by long-term contracted, regulated, or concession-based revenue streams, and structured with extended maturities aligned with asset cash flows.

Online Annex 2.2. Data Description and Sources

Variable	Description	Source
Fund-level Variables		
Fund cash holding percentage	More granular asset type (for example, Equity to Common Shares, DR, Warrant, REIT) allocation percentages for the latest portfolio.	LSEG Lipper
Fund domicile	The jurisdiction in which a fund is legally incorporated.	LSEG Lipper
Fund end-investor flow	The fund's estimated inflow or outflow of money for the specified period. The calculation uses total net assets and performance to derive the estimated result.	LSEG Lipper
Fund institutional share class indicator	A flag that indicates whether a fund is targeted to sell to institutional investors and is likely to require a large minimum investment.	LSEG Lipper
Fund share class size	The Total Net Assets (TNA) of the fund. TNA represents the total funds under management for net of fees and expenses for a particular date.	LSEG Lipper
Fund share class-level return	A simple percentage measurement of the increase in a fund's total value between two specific time periods with various price and income reinvestment options.	LSEG Lipper
Fund size	The Aggregated Fund Value represents a fund’s total market value less all liabilities as of any historical total net assets (TNA) date.	LSEG Lipper
Passive fund indicator	Fund whose objective is to replicate the investment performance of a publicly recognized market index. The fund must invest the majority of its assets in the index or synthetically replicate.	LSEG Lipper
Fund Holding-level Variables		
Fund holdings' ISIN	Returns the ISINs of the top constituents of the holder's portfolio, determined by the specified date range.	FactSet
Fund holdings' issuer country	Returns the countries in which the top constituents of the holder's portfolio are located, determined by the specified date range.	FactSet
Fund holdings' market value	Returns the market value of the holder's positions in the top constituents of its portfolio, determined by the specified date range.	FactSet
Fund holdings' portfolio share	Returns percentage of total portfolio values for the top constituents of the holder's portfolio, determined by the specified date range.	FactSet
Fund holdings' prices	Returns price data for the specified security.	FactSet
Fund holdings' security type	Returns the issue type name for the specified security.	FactSet
Firm-level Variables		
Capital expenditure	Amount of capital expenditure	LSEG Worldscope
Leverage ratio	Leverage ratio is computed as total liabilities divided by equity.	LSEG Worldscope
ROA	Return on assets	LSEG Worldscope
Short-term debt ratio	Short-term debt ratio is computed as the sum of short-term debt and current portion of long-term debt divided by the value of total liabilities.	LSEG Worldscope
Tobin's q	The sum of total liabilities and market capitalization divided by total assets.	LSEG Worldscope
Total assets	Amount of total asset	LSEG Worldscope
Total cash holdings	Amount of cash and short-term investment	LSEG Worldscope
Total debt	Amount of total debt	LSEG Worldscope
Institutional Investor Variables		
Lack of US-Linked MMF access	Dummy variable = 1 if there is no money market fund linked to US investment schemes (“Money Market USD” and “Bond USD Government Short Term”) domiciled in that country, based on countries whose MMF data are available as of 2025, 0 otherwise.	LSEG Lipper
Ownership share	Market value of an institutional investor's holdings of a security as a percentage of its market value.	FactSet

Portfolio share	Market value of an institutional investor's holdings of a security as a percentage of the market value of the institution's total reported holdings.	FactSet
Global Macro-Financial Variables		
Adjusted Fed funds rate	Fed funds rate replaced by the shadow rate between 2009:Q1 and 2015:Q4	IMF staff calculations
Dollar index returns	Month-on-month percentage change in dollar index	LSEG Datastream
Federal funds rate	The federal funds rate is the interest rate at which depository institutions trade federal funds (balances held at Federal Reserve Banks) with each other overnight.	Federal Reserve Bank of St.Louis
RORO	The Risk-On Risk-Off (RORO) Index, using daily data from asset markets in the United States and Euro area to measure the variation in global investors' risk appetites.	Federal Reserve Bank of Kansas City
Shadow Fed funds rate	Wu–Xia Shadow Federal Funds Rate	Federal Reserve Bank of Atlanta
Ten-year treasury yield	Market Yield on U.S. Treasury Securities at 10-Year Constant Maturity, Quoted on an Investment Basis	Federal Reserve Bank of St.Louis
VIX	VIX measures market expectation of near term volatility conveyed by stock index option prices.	Federal Reserve Bank of St.Louis
World GDP growth	Annual percentage change in world real GDP	IMF, World Economic Outlook database
MOVE	1-month implied volatility of U.S. Treasury yields.	LSEG Datastream
Country-level Macro-financial Variables		
Banking inflows	Inflows = cross-border liabilities; or claims of the source country banking system on the recipient country (all sectors)	BIS, Locational Banking Statistics
Bond issuance volume	Log of volume of bond issuance	Dealogic
Bond spreads at issuance	The unit is basis points. If the spread value is missing in Dealogic, the spread is supplemented by the difference between the coupon rate and the corresponding U.S. Treasury yield for the same maturity.	Dealogic
Callability	Indicator of whether the issue is callable	Dealogic
Capital account openness	Normalized Chinn–Ito index	Chinn, M. and H. Ito (2006)
Coupon rate	Coupon rate of the security	Dealogic
Duration	The difference between pricing date and maturity date	Dealogic
Ex ante real policy rate	Policy rate minus inflation forecast	IMF staff calculations
Exchange rate volatility	Coefficient of variation of daily bilateral exchange rate vis-à-vis the US dollar	IMF, World Economic Outlook database; and IMF staff calculations.
Export flows/GDP	Ratio of exports to GDP by country	IMF, World Economic Outlook database
Financial flows/GDP	Ratio of sum of portfolio flows and foreign direct investment flows to GDP by country	IMF, Balance of Payments Statistics
Floating/fixed rate	Indicator of whether the coupon is floating rate of fixed rate	Dealogic
GDP, nominal	Nominal gross domestic product, US dollars.	IMF, World Economic Outlook database
GDP, real	Real gross domestic product, US dollars	Haver Analytics
Gross portfolio inflows	Gross inflows = gross liability flows, net of payment (i.e., net inflows from nonresidents).	IMF, Balance of Payments Statistics
Imports	Total imports of goods and services, US dollars	IMF, World Economic Outlook database
Inflation	Year-on-year percentage change in CPI inflation, with outliers (above 100%) dropped	IMF, World Economic Outlook database
Inflation forecast	One-year-ahead inflation forecast from WEO vintages	IMF, World Economic Outlook database
Institutional, political stability	Average of the 12 components of the ICRG rating.	PRS Group
Institutional quality	Average of the following components of the ICRG rating: bureaucracy quality, corruption, democratic accountability, government stability, socioeconomic conditions, investment profile, law and order.	PRS Group
International debt	Total international debt outstanding by residence and nationality basis	BIS, International Debt Statistics

Investment fund flows	Sum of flows by nonresident open- and closed-end funds to emerging market assets	Emerging Portfolio Fund Research
Long-term real interest rate differential	The difference between the World Economic Outlook (WEO) forecast for a given country and the U.S. real long-term bond yield.	IMF, World Economic Outlook database
Nominal effective exchange rate	Nominal effective exchange rate index (2010 = 100), weighted	IMF, Effective Exchange Rate dataset
Official reserve	Official reserve assets	IMF, International Financial Statistics
One-year ahead inflation (standard deviation)	Mean (standard deviation) one-year-ahead inflation forecast (consumer prices, percent change)	Consensus Economics
Policy rate	Monetary policy rate, in percent	Haver Analytics and Global Data Source
Portfolio debt	The net incurrence of liabilities from nonresidents' portfolio investment in debt securities, as recorded in the balance of payments	IMF, Balance of Payments Statistics
Portfolio equity	The net incurrence of liabilities from nonresidents' portfolio investment in equity and investment fund shares, as recorded in the balance of payments	IMF, Balance of Payments Statistics
Portfolio investment by nonresident NBFI sectors	NBFI sector as 'Other financial corporations' in PIP	IMF Portfolio Investment Positions by Counterpart Economy Statistics
Private sector debt to GDP ratio	Banks' claims on private sector relative to GDP	IMF, International Financial Statistics
Public consumption expenditure	Public consumption expenditure, constant prices (national currency, billions)	IMF, World Economic Outlook database
Public sector debt	General government gross debt	IMF, World Economic Outlook database
Rating	Effective rating at issuance	Dealogic
Real effective exchange rate gap	Deviation of REER from its HP-filtered trend	IMF, Effective Exchange Rate dataset
Real GDP growth	Annual percentage change in country real GDP	IMF, World Economic Outlook database
Remittance flows/GDP	Ratio of remittance payment flows to GDP by country	World Bank
Share of flighty investors	Constructed by estimating each investor's sensitivity to the VIX and then computing, for each emerging market sovereign and corporate bond, the share accounted for by the top quintile of non-resident investors with highest sensitivity.	FactSet
Short-term external debt	Total external debt, short-term, US dollars	IMF, World Economic Outlook database
Short-term real interest rate differential	The difference between the World Economic Outlook forecast for a given country and the U.S. real short-term bond yield.	IMF, World Economic Outlook database
Subordination	Indicator of whether the transaction is subordinated debt	Dealogic
Syndicated loans volume	Log of volume of syndicated loans	Dealogic
World uncertainty index	Frequency-based measures of economic uncertainty for each country, scaled by 1000.	Ahir, H, N Bloom, and D Furceri (2022)
Crypto-currency Variables		
Bitcoin price volatility	Coefficient of variation of daily Bitcoin price in USD	Chainalysis
Bitcoin returns	Month-on-month percentage change in Bitcoin USD price	Chainalysis
Bitcoin supply	Month-on-month percentage change in BTC supply	Chainalysis
Crypto flows/GDP	Ratio of sum of gross inflows of Bitcoin and Ethereum	Chainalysis
Stablecoin flows/GDP	Ratio of sum of gross inflows of Tether (USDT) and USD Coin (USDC) to GDP by country	Chainalysis

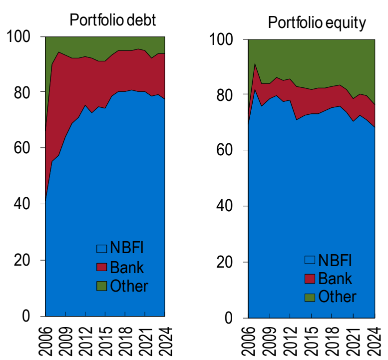
Online Annex Table 2.2.1 Advanced Economies and Emerging Markets Included in the Descriptive or Empirical Analyses

Advanced Economies	*Emerging Markets*
Andorra, Australia, Austria, Belgium, Canada, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong SAR, Iceland, Ireland, Italy, Israel, Japan, Korea (South Korea), Latvia, Lithuania, Liechtenstein, Luxembourg, Macau, Malta, Netherlands, New Zealand, Norway, Portugal, Puerto Rico, San Marino, Singapore, Slovakia, Slovenia, Spain, Sweden, Switzerland, Taiwan Province of China, United Kingdom, United States.	Albania, Algeria, Angola, Argentina, Armenia, Azerbaijan, Barbados, Belarus, Bolivia, Bosnia and Herzegovina, Brazil, Bulgaria, Chile, China, Colombia, Costa Rica, Dominican Republic, Ecuador, Egypt, El Salvador, Georgia, Ghana, Guatemala, Hungary, India, Indonesia, Jamaica, Jordan, Kazakhstan, Lebanon, Malaysia, Mexico, Morocco, North Macedonia, Pakistan, Panama, Peru, Philippines, Poland, Romania, Russia, Serbia, South Africa, Sri Lanka, Thailand, Tunisia, Türkiye, Ukraine, Uruguay, Venezuela, Vietnam.

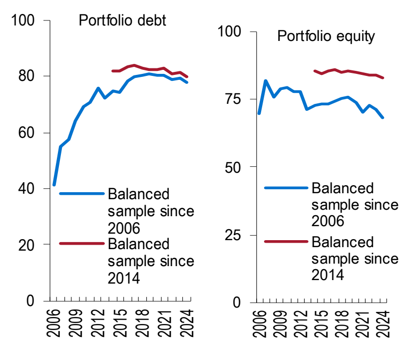
Source: IMF staff.
Note: The emerging market sample are countries included in the IMF's Vulnerability Exercise as of February 2026. The exact sample composition varies across empirical analyses based on data availability. Macro analyses exclude US, Japan, and Switzerland, traditionally considered safe havens, from the list of recipient advanced economies. Figure 2.4 panel 3 additionally includes Saudi Arabia, Kuwait, Qatar, and the United Arab Emirates.

Figure 2.2.1 Additional Stylized Facts on External Debt and Equity Liabilities

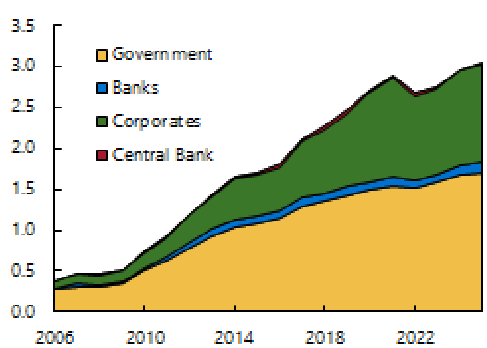
1. External Portfolio Debt and Equity Liabilities, by Investor Types Over Time with a Fixed Country-Pair Sample Starting from 2006
(percent)



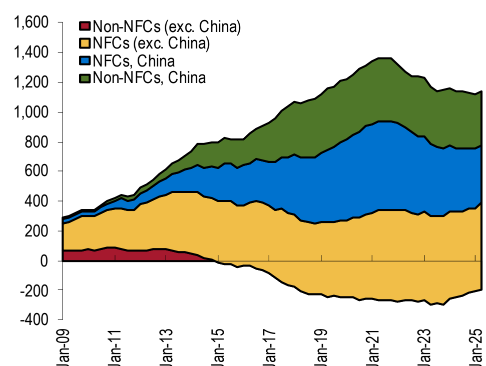
2. External Portfolio Debt and Equity Liabilities, Share of NBFI
(percent)



3. External Portfolio Debt Liabilities, by Recipients
(percent)



4. Off-Shore Debt
(billion US dollars, outstanding volume)



Sources: Bank for International Settlements, International Debt Statistics; IMF Balance of Payments Statistics (BOP), Portfolio Investment Positions by Counterpart Economy (PIP, formerly Coordinated Portfolio Investment Survey, or CPIS); and IMF staff calculations.

Note: The panels pertain to emerging markets listed in Online Annex Table 2.1. Panel 5 follows Avdjiev and others (2022) in decomposing external portfolio debt liabilities. In Panel 6, "Off-shore debt" is defined as the difference between nationality-based and residence-based international debt security issuances, based on Bank for International Settlements, International Debt Statistics. NBFI=non-bank financial intermediation. NFCs=Non-financial corporations.

Online Annex 2.3. How strongly do non-bank investors transmit global shocks to Emerging Markets?

This subsection quantifies how portfolio debt and equity liability flows to emerging markets respond to global risk factors. To provide broader context, the analysis compares these sensitivities before and after the global financial crisis (GFC) and contrasts the behavior of NBFI flows with that of banking flows and flows to advanced economies.

Data on portfolio liability flows are sourced from the IMF Balance of Payments (BOP) statistics. Banking flows are measured using FX- and break-adjusted cross-border claims reported by international banks in the BIS Locational Banking Statistics (LBS). The results are estimated based on a sample of 20 major emerging markets and 31 major advanced economies, excluding traditional safe-haven countries (i.e., Japan, Switzerland, and the United States). To compare the estimated impacts for major emerging markets with those of smaller emerging markets additional results based on a larger sample are reported below.[1] The sample period is 2003Q2-2025Q1.

Portfolio debt liability flows, expressed in percent of GDP, average 1 percent across the sample of major emerging markets, but exceed 2 percent at the upper quartile and can reach up to 20 percent. Portfolio equity liability flows are more modest, averaging around 0.2 percent of GDP, rising to about 0.5 percent at the upper quartile, and reaching up to 10 percent. Banking flows are moderate compared to portfolio debt flows, averaging 0.6 percent of GDP, but reaching up to 30 percent of GDP. Portfolio equity liability flows are somewhat less pronounced in the expanded emerging market sample, reflecting weaker institutional or absorption capacity in smaller emerging markets. Portfolio and banking flows also exhibit sizeable variation across countries and time, with standard deviations of 4.0, 3.0, and 1.4 for banking, portfolio debt and portfolio equity, respectively.

Online Annex Table 2.3.1. Summary Statistics of Key Variables

(Percent of lagged GDP)	count	mean	sd	min	p25	p50	p75	max
Banking inflows	1740	0.614	3.982	-41.583	-1.140	0.352	2.009	29.838
Overall portfolio debt liability flows	1740	0.992	3.048	-19.212	-0.499	0.464	2.152	19.792
Overall portfolio equity liability flows	1740	0.231	1.351	-21.728	-0.202	0.064	0.558	10.323
Investment fund debt inflows	1664	0.233	1.385	-7.151	-0.283	0.084	0.724	8.840
Investment fund equity inflows	1740	0.082	0.375	-1.635	-0.080	0.010	0.197	2.552

Note: The summary statistics are based on the sample from 2003Q2 to 2025Q1. “p” denotes percentiles. sd= standard deviation.

Overall BOP and banking flows: The section begins by estimating the sensitivity of overall portfolio liability flows and cross-border banking flows to major emerging markets in response to changes in global risk factors, using the following baseline specification:

$$Y_{c,t}^{k} \;=\; \beta^{k}\, Global\, risk\, factor_t \;+\; \gamma^{k} D^{post}\, Global\, risk\, factor_t + \eta_{c,t(y)} + \varepsilon_{c,t}^{k} \qquad (2.3.1)$$

where $Y_{c,t}^{k}$ denotes *overall portfolio liability flows (debt or equity)* or *banking inflows* to country *c* in quarter *t,* normalized by country *c* ’s (seasonally-adjusted) quarterly GDP at *t-1*.[2] Each $Y_{c,t}^{k}$ series is standardized to facilitate a comparison of sensitivities across categories of flows. The global risk factor is measured by the VIX (Rey, 2013) in the baseline specification (and the Risk-on/Risk-off (RORO) index (Chari and others, 2024) as robustness), and D^{post} is a dummy equal to one from 2009Q2 onward, and 0 otherwise. The regression includes country-year fixed effects ($\eta_{c,t(y)}$) to absorb potential confounding factors. The country-year fixed effects absorb global and country-specific factors driving capital inflows at annual frequency. Identification of sensitivity to

[1] The list of emerging markets includes ARG, BGR, BRA, CHL, CHN, COL, HUN, IDN, IND, MEX, MYS, PER, PHL, POL, ROU, RUS, THA, TUR, UKR, and ZAF. The list of advanced economies are AUS, AUT, BEL, CAN, CZE, DEU, DNK, ESP, EST, FIN, FRA, GRB, GRC, HKG, HRV, IRL, ISL, ISR, ITA, KOR, LTU, LUX, LVA, MLT, NLD, NOR, NZL, PRT, SVK, SVN, and SWE. The additional emerging markets included in the expanded emerging market sample are AGO, ALB, BLR, BOL, CRI, DOM, ECU, EGY, GHA, GTM, JAM, JOR, KAZ, LBN, LKA, MAR, MKD, PAK, TUN, URY and VNM.

[2] Seasonally adjusted quarterly nominal GDP is constructed using seasonally adjusted quarterly data when available; otherwise, it is proxied as a quarter of the corresponding annual nominal GDP.

global risk shocks therefore comes from quarterly variation in the global risk factor. Driscoll-Kraay standard errors are used to account for potential cross-sectional dependence and serial correlation in the error term.

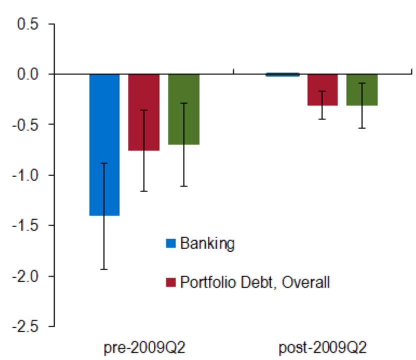
Figure 2.7, Panel 1 in the main text presents the baseline estimates based on the sample of 20 major emerging markets. Additional analysis confirms that the findings are not driven by a small number of large emerging markets or individual regions. The result—that the sensitivity of portfolio debt inflows to emerging markets has increased relative to that of banking flows post-2009Q2 period—remains robust when excluding selected large emerging markets (e.g., China, India), a group of large emerging markets (including Brazil, China, India, and Mexico), and individual regions (Asia Pacific, Emerging Europe, and Latin America) from the sample. The result is also broadly robust to region-specific samples.

Further Robustness Tests and Additional Discussion

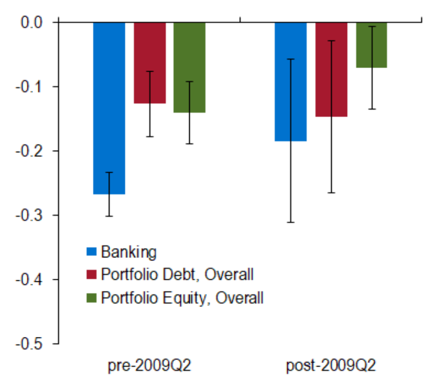
Alternative risk factor. In the post-GFC period, a one-standard-deviation increase in the RORO is associated with a decline of about 0.3 standard deviations in portfolio debt flows, comparable in magnitude to the effect of a one-standard-deviation increase in the VIX reported in the main text (Online Annex Figure 2.3.1, panel 1). The corresponding response of portfolio equity inflows is about 0.3 standard deviations, exceeding the sensitivity to the VIX. The sensitivity of both banking flows and portfolio debt flows to the RORO declines significantly in the post-GFC period, with the response of banking flows becoming statistically indistinguishable from zero, consistent with Avdjiev and others (2025), who document that the sensitivity of emerging market banking flows to global risk falls to near zero after the GFC. While not shown here, the results are qualitatively similar when using alternative global risk measures, including the World Uncertainty index, the MOVE index for portfolio liability debt flows, and the US dollar index (DXY).

Online Annex Figure 2.3.1. Risk Sensitivity of NBFI Flows to emerging markets—Robustness Tests

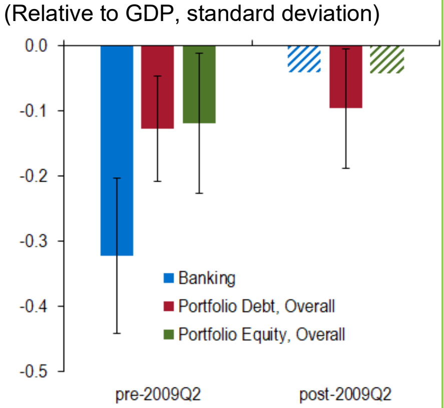
1. Portfolio and Bank Liability Flows to Emerging Markets following an Increase in the RORO
(Relative to GDP, standard deviation)



2. Portfolio and Bank Liability Flows to emerging markets following an Increase in the VIX, expanded sample
(Relative to GDP, standard deviation)



3. Portfolio and Bank Liability Flows to emerging markets following an Increase in the VIX, global and country controls
(Relative to GDP, standard deviation)



Sources: IMF BOP, BIS LBS, EPFR, and IMF staff calculations.
Notes: Bars show the sensitivity of portfolio or banking liability flows relative to GDP, expressed in standard deviations, in response to a one-standard deviation increase in the VIX or RORO. The charts report robustness checks to the baseline results shown in the main text (Figure 2.7, Panel 1). The first chart is estimated using the baseline specification (Equation 2.3.1) and the baseline sample of 20 emerging market economies. The second chart uses the same specification but an expanded sample of 41 emerging markets. The third chart is estimated using an alternative specification (Equation 2.3.2) based on a large set of global and domestic controls, based on the baseline sample of 20 emerging market economies. The ranges correspond to 90 percent confidence intervals around the mean estimates.

Expanded sample coverage. In an expanded sample of 41 emerging markets, portfolio liability flows remain sensitive to global risk conditions (Online Annex Figure 2.3.1 panel 2). Relative to the baseline results reported in the main text (Figure 2.7, Panel 1), the sensitivity of portfolio debt liability flows to a one-standard-deviation increase in the VIX is smaller—at around 1¼ standard deviations—while the sensitivities of portfolio equity liability and banking flows are broadly similar.

Global and country controls. We re-estimate equation (2.3.1) using country fixed effects and a large set of global and domestic controls as follows:

$$Y_{c,t}^{k} = \beta^{k}\, Global\, risk\, factor_{t} + \gamma^{k} D^{post}\, Global\, risk\, factor_{t} + \tau^{k} Z_{c,t} + \theta^{k} D^{post} Z_{c,t} + \eta_{c} + \varepsilon_{c,t}^{k} \qquad (2.3.2)$$

where $Z_{c,t}$ captures push and pull factors, including global variables—the change in U.S. monetary policy (measured by the change in the actual/shadow federal funds rate[3]) and world GDP growth—and domestic variables, including real GDP growth, the private credit-to-GDP ratio, the ex-ante real policy rate, capital account openness, institutional quality, official international reserves, the real effective exchange rate gap, and a linear annual time trend. All domestic variables are lagged by one quarter to mitigate endogeneity concerns.

Under this alternative specification portfolio debt liability flows remain sensitive to increases in the VIX, albeit moderate compared to the baseline results (Online Annex Figure 2.3.1 panel 3). By contrast, the sensitivity of banking flows to the VIX declines in the post GFC period and becomes statistically insignificant.

Comparing the sensitivity of portfolio flows with banking flows. To formally compare the sensitivity of portfolio liability flows with banking flows, both in terms of levels and sensitivities to global risk factors, we estimate

$$Y_{c,k,t} = \sum_{k \in K} \beta^k D^k + \sum_{k \in K} \gamma^k D^k D^{post} + \sum_{k \in K} \theta^k \, Global\ risk\ factor_t D^k + \sum_{k \in K} \rho^k Global\ risk\ factor D^k D^{post} + \eta_{c,t} + \varepsilon_{c,t} \quad (2.3.3)$$

where $Y_{c,k,t}$ denotes overall portfolio liability flows of type k or banking flows to country *c* at quarter *t,* where $k \in \{portfolio\ debt, portfolio\ equity, banking\}$. Flows are normalized by country c 's (seasonally-adjusted) quarterly GDP at *t-1* and standardized by flow type to facilitate comparison of sensitivities across categories of flows. D^k is a dummy variable equal to one for flow type k and zero otherwise. Banking flows are treated as the base category, so that all coefficients on D^k and their interaction terms can be interpreted relative to banking flows. $\eta_{c,t}$ denotes country-quarter fixed effects, i.e. identification comes from within-country-quarter differences across the three flow types (bank vs portfolio debt vs portfolio equity).

Online Annex Figure 2.3.2 panel 1 reports the results from estimating equation (2.3.3) using the VIX as the global risk factor and the baseline sample of 20 emerging markets. The estimates confirm that, in the post-GFC period, portfolio debt liability flows to emerging markets increased relative to banking flows. Portfolio equity liability flows show a similar pattern, although the difference is not statistically significant. While portfolio debt liability flows appear less sensitive to the VIX than banking inflows prior to the GFC their sensitivity increased relative to banking inflows post-GFC, becoming statistically similar. Using the RORO as the global risk factor, both portfolio debt and equity liability flows appear to be significantly more sensitive to global risk than banking flows (Online Annex Figure 2.3.2 panel 2). The corresponding estimates using the expanded sample of 41 emerging markets are broadly similar (Online Annex Figure 2.3.2 panels 3 and 4).

Advanced economies vs emerging markets. This section studies whether the sensitivity of portfolio or banking liability flows to global risk factors differs between emerging markets and advanced economies by estimating

$$Y^k_{c,t} \ = \ \beta^k \, Global\ risk\ factor_t \ + \ \gamma^k D^{EM} \, Global\ risk\ factor_t + \eta_{c,t(y)} + \ \varepsilon^k_{c,t} \quad (2.3.4)$$

where D^{EM} is an indicator variable equal to one for emerging markets and zero otherwise, and $\eta_{c,t(y)}$ denotes country-year fixed effects. The results are estimated using a sample of 31 advanced economies and the same baseline 20 emerging markets over the period 2009Q2-2025Q1.

Figure 2.7, Panel 2 in the main text presents the baseline estimates based on the sample of 20 major emerging markets. Additional analysis confirms that the findings are not driven by a small number of large emerging markets or individual regions. The result remains unchanged when excluding selected large emerging markets (e.g., China, India), a group of large emerging markets (including Brazil, China, India, and Mexico), and individual regions (Asia Pacific, Emerging Europe, and Latin America) from the sample. The result is also broadly robust to using region-specific samples.

Estimating the baseline specification (Equation 2.3.4) using the RORO index as the global risk factor suggests that portfolio debt liability flows to emerging markets are more sensitive to the RORO than those to advanced economies, although the difference is not statistically significant (Online Annex Figure 2.3.3 panel 1). The results are robust to using alternative global risk measures, including the MOVE index, the World Uncertainty index, and the dollar index.

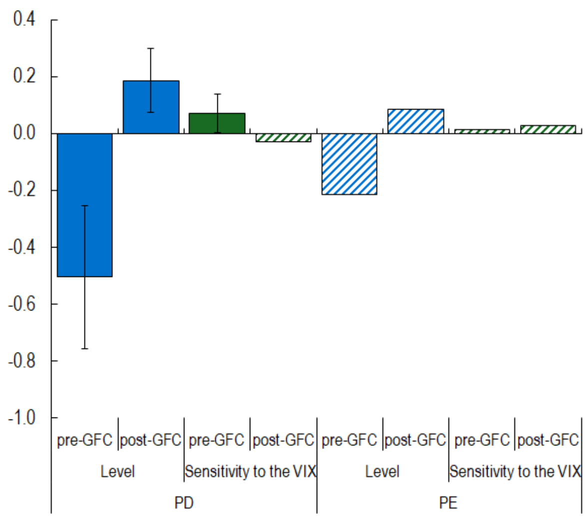
[3] The actual/shadow federal funds rate is taken as the effective federal funds rate when non-zero and the Wu-Xia shadow rate during the zero lower bound period (2009Q1-2015Q4) to capture the effects of quantitative easing on monetary conditions.

When examining the differential sensitivity to the VIX of portfolio flows to advanced economies and emerging markets based on equation (2.3.4) and the expanded sample of 41 emerging markets, the results are largely consistent with those reported in the main text (Annex Figure 2.3.3, Panel 2).

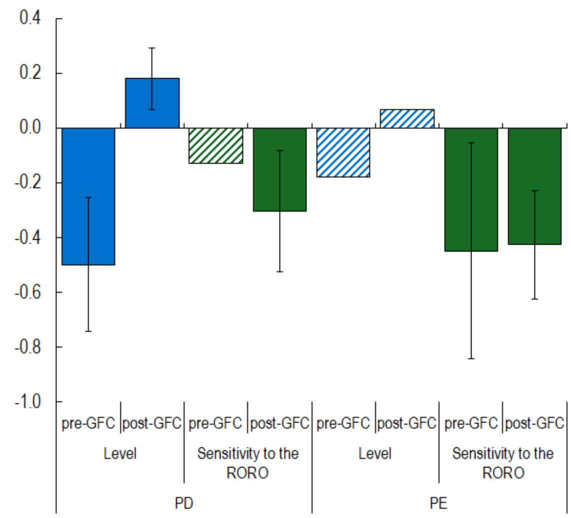
The main findings remain robust to an alternative specification that includes country fixed effects and the set of domestic and global controls, with portfolio debt inflows to emerging markets exhibiting greater sensitivity than those to advanced economies (Annex Figure 2.3.3 Panel 3).

Online Annex Figure 2.3.2. Sensitivity of Portfolio Liability and Bank Flows to Emerging Markets

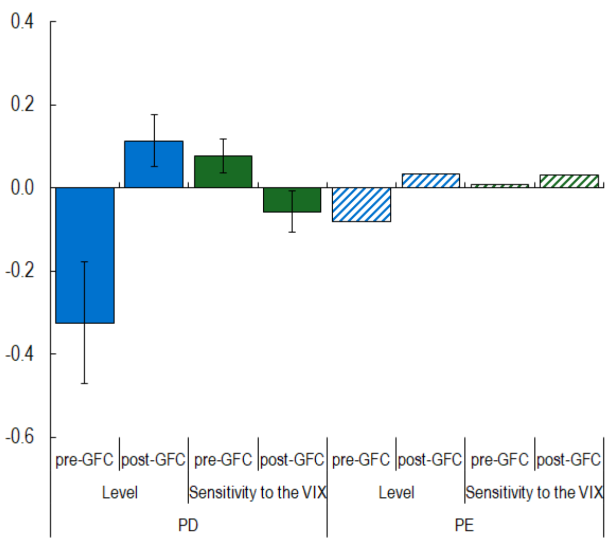
1. Portfolio Liability Flows Relative to Bank Liability Flows to Emerging Markets in Response to an Increase in the VIX, Baseline Sample
(Standard deviations)



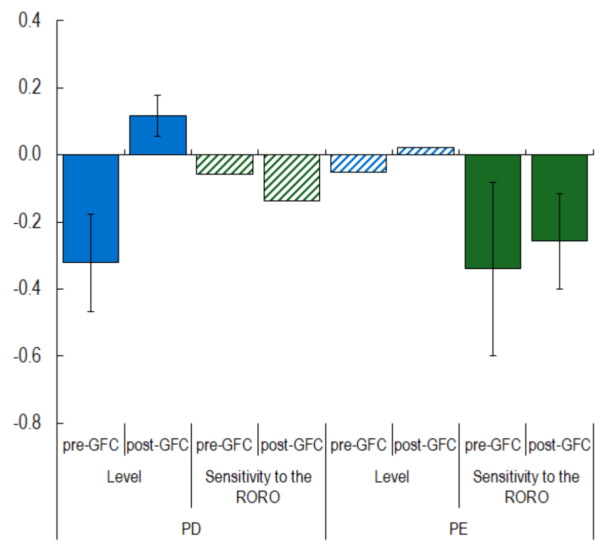
2. Portfolio Liability Flows relative to Bank Liability Flows to Emerging Markets in Response to an Increase in the RORO, Baseline Sample
(Standard deviations)



3. Portfolio Liability Flows Relative to Bank Liability Flows to Emerging markets in Response to an Increase in the VIX, Expanded Sample
(Standard deviations)



4. Portfolio Liability Flows Relative to Bank Liability Flows to Emerging Markets in Response to an Increase in the RORO, Expanded Sample
(Standard deviations)



Sources: IMF BOP, BIS LBS, EPFR, and IMF staff calculations.
Notes: Blue bars show the estimated level of portfolio liability flows relative to banking liability flows, while green bars show the sensitivities of portfolio liability flows, relative to that of bank liability flows, to a one-standard-deviation increase in the VIX or the RORO, expressed in standard deviations and estimated using Equation (2.3.3). Panels 1 and 2 use the baseline sample of 20 emerging markets, while panels 3 and 4 use the expanded sample of 41 emerging markets. The ranges correspond to 90 percent confidence intervals around the mean estimates.

Investment-fund flows. This section estimates the sensitivity of portfolio debt and equity flows by investment funds to global risk, based on equations (2.3.1) and (2.3.2). As a proxy for investment fund flows, we use data from Emerging Portfolio Funds Research (EPFR), which track country-level portfolio flows reported by mutual funds and exchange-traded funds.[4] The results are estimated using the same sample of 20 emerging market economies over the period 2003Q2-2025Q1.

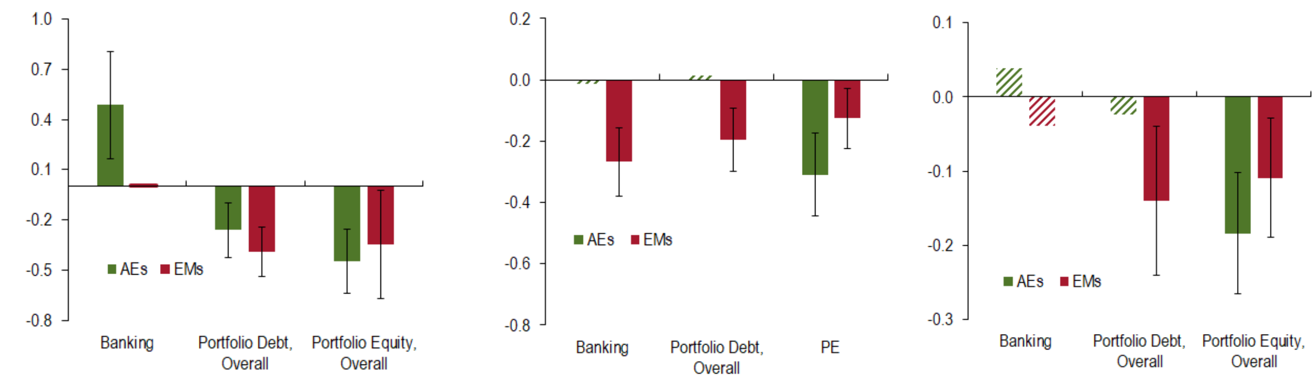
Figure 2.7, Panel 3 in the main text presents the baseline estimates based on the sample of 20 major emerging markets. Additional analysis confirms that the findings are not driven by a small number of large emerging markets or individual regions. The result—that portfolio debt liability flows intermediated by investment funds are more sensitive to global risk than overall portfolio debt liability flows in the post-2009Q2 period—remains unchanged when excluding selected large emerging markets (e.g., China, India), a group of large emerging markets (including Brazil, China, India, and Mexico), and individual regions (Asia Pacific, Emerging Europe, and Latin America) from the sample. The result is also broadly robust to region-specific samples.

Online Annex Figure 2.3.3. Risk Sensitivity of NBFI flows to Advanced Economies and Emerging Markets

1. Portfolio and Bank Liability Flows to Emerging Markets Following an Increase in the RORO, Post 2009Q2
(Relative to GDP, standard deviation)

2. Portfolio and Bank Liability Flows to Emerging Markets Following an Increase in the VIX, Post 2009Q2, expanded sample
(Relative to GDP, standard deviation)

3. Portfolio and Bank Liability Flows to Emerging Markets Following an Increase in the VIX, Post 2009Q2
(Relative to GDP, standard deviation)



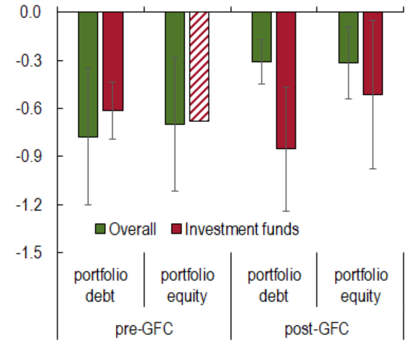
Sources: IMF BOP, BIS LBS, EPFR, and IMF staff calculations.
Notes: The bars indicate the sensitivity of portfolio or bank liability flows relative to GDP, expressed in standard deviations, in response to a one-standard deviation increase in the VIX or RORO. The charts report robustness checks to the baseline results shown in the main text (Figure 2.7, Panel 2). The first chart is estimated using the baseline specification (Equation 2.3.4) and the baseline sample of 20 emerging markets. The second chart uses the same specification but an expanded sample of 41 emerging markets. The third chart is estimated using an alternative specification (Equation 2.3.5) based on a large set of global and domestic controls, based on the baseline sample of 20 emerging markets. The ranges correspond to 90 percent confidence intervals around the mean estimates. Advanced economies included in the sample excluding the traditional safe-haven countries, Japan, Switzerland, and the United States.

Online Annex Figure 2.3.4 panel 1 shows that the sensitivity of investment funds flows to an increase in the RORO is larger than their sensitivity to the VIX under the baseline specification (Equation (2.3.1)). A one-standard-deviation increase in the RORO is associated with a decline of about 0.9 and 0.5 standard deviation in portfolio debt and equity flows by investment funds, respectively, in the post-GFC period. The results are qualitatively the same when using alternative global risk measures, including the MOVE index, the World Uncertainty index, and the dollar index.

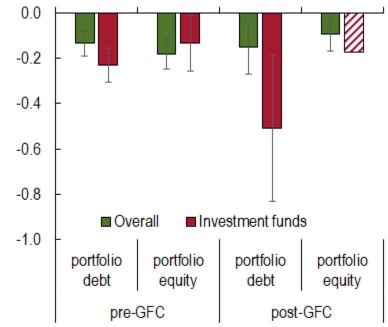
[4] While EPFR fund-flow data provide timely and granular information on cross-border portfolio investment, they have some limitations (Koepke and Paezold, 2022). First, the data primarily captures investments by mutual funds and ETFs and therefore excludes important investors groups such as sovereign wealth funds, pension funds investing outside mutual fund vehicles, insurance companies, and banks' trading books. Second, fund domicile does not necessarily correspond to the residence of the ultimate investor. As a result, some of the flows to a given country may reflect investments by domestic investors through foreign-domiciled mutual fund vehicles.

Online Annex Figure 2.3.4. Risk Sensitivity of Investment Funds NBFI flows to Emerging Markets

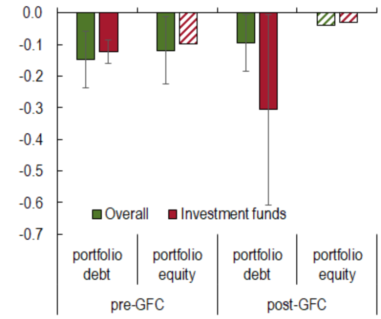
1. Portfolio Liability Flows to Emerging Markets Following an Increase in the RORO
(Relative to GDP, standard deviation)



2. Portfolio Liability Flows to Emerging Markets Following an Increase in the VIX, expanded sample
(Relative to GDP, standard deviation)



3. Portfolio Liability Flows to Emerging Markets Following an Increase in the VIX
(Relative to GDP, standard deviation)



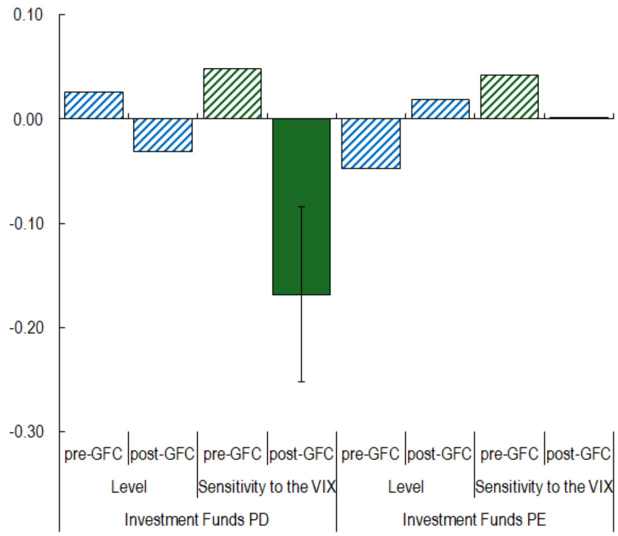
Sources: IMF BOP, BIS LBS, EPFR, and IMF staff calculations.
Notes: The bars indicate the sensitivity of portfolio liability flows relative to GDP, expressed in standard deviations, in response to a one-standard deviation increase in the VIX or RORO. The charts report robustness checks to the baseline results shown in the main text (Figure 2.7, Panel 3). The first chart is estimated using the baseline specification (Equation 2.3.1) and the baseline sample of 20 emerging markets. The second chart uses the same specification but an expanded sample of 41 emerging markets. The third chart is estimated using an alternative specification (Equation 2.3.2) based on a large set of global and domestic controls, based on the baseline sample of 20 emerging markets. The ranges correspond to 90 percent confidence intervals around the mean estimates.

Based on the expanded sample of 41 emerging market economies and the baseline specification (Equation (2.3.1)), Online Annex Figure 2.3.4 shows that the sensitivity of investment-fund flows to a one-standard-deviation increase in the VIX is broadly the same as the results reported in the main text (Figure 2.7, Panel 3).

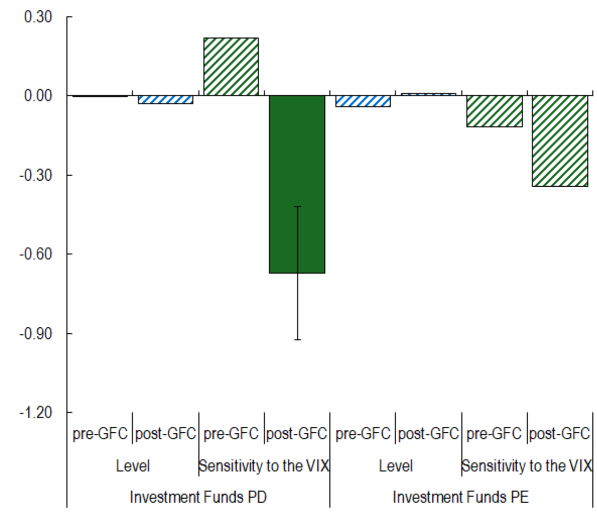
Online Annex Figure 2.3.4 Panel 3 shows that, under the alternative specification (Equation 2.3.2)–which instead includes quarterly global and domestic controls, a one-standard-deviation increase in the VIX is associated with a decline of about 0.3 standard deviations in portfolio debt inflows. The response of investment fund portfolio equity inflows appears mild and not statistically significant at conventional values.

Online Annex Figure 2.3.5. Risk Sensitivity of NBFI Flows to Emerging Markets

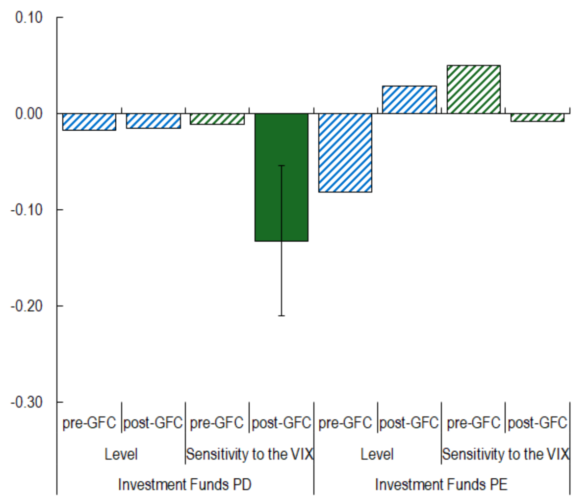
1. Portfolio Liability Flows vs. Investment Funds Flows to Emerging Markets
(Standard deviations)



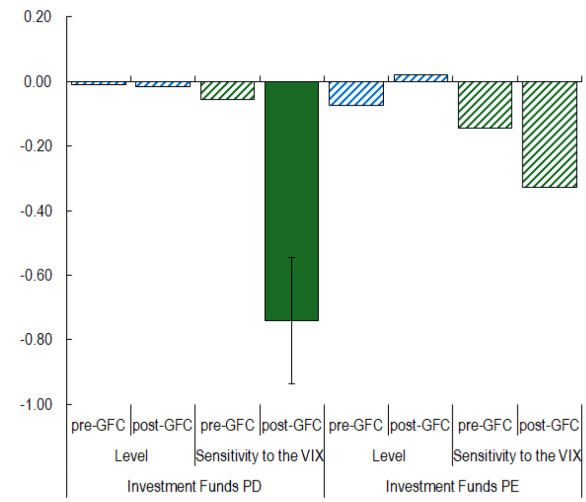
2. Portfolio Liability Flows vs. Investment Funds Flows to Emerging Markets
(Standard deviations)



3. Portfolio Liability Flows vs. Investment Funds Flows to Emerging Markets, expanded sample
(Standard deviations)



4. Portfolio Liability Flows vs. Investment Funds Flows to Emerging Markets, expanded sample
(Standard deviations)



Sources: IMF BOP, BIS LBS, EPFR, and IMF staff calculations.
Notes: Blue bars show the estimated level of overall portfolio liability flows relative to investment funds inflows, while green bars show the sensitivities of overall portfolio inflows relative to investment funds inflows to a one-standard-deviation increase in the VIX or the RORO, expressed in standard deviations and estimated using Equation (2.3.3). Panels 1 and 2 use the baseline sample of 20 Es, while Panels 3 and 4 use the expanded sample of 40 emerging markets for debt liability flows and 38 for equity liability flows. The ranges correspond to 90 percent confidence intervals around the mean estimates.

To formally compare overall portfolio liability flows with portfolio liability flows by investment funds, this section also estimates specification (2.3.3) using these two types of flows. Online Annex Figure 2.3.5 reports the results from using the VIX as the global risk factor and the baseline sample of 20 emerging markets. The estimates indicate that, in the post-GFC period, investment funds portfolio debt inflows are more sensitive to the VIX than overall portfolio debt inflows (panel 1, fourth bar). In contrast, the difference is statistically insignificant for equity flows. Panel 2 presents the results using the RORO index as the global risk factor. The results similarly show that both investment funds debt and equity inflows exhibit greater sensitivity to global risk than overall portfolio debt and equity liability flows, respectively. Panels 3 and 4 present the corresponding estimates using the expanded sample of 41 emerging markets and the results are broadly similar.

Nonlinear effects. This section examines whether the response of portfolio liability flows to global risk varies nonlinearly with the level of global risk, by extending the baseline specification with a quadratic relationship between flows and the global risk factor:

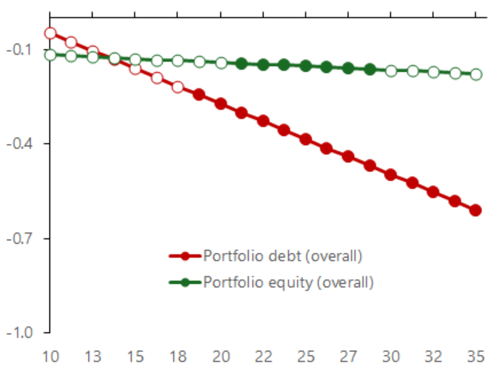
$$Y_{c,t}^{k} = \beta^{k}\, Global\ risk\ factor_{t} + \theta^{k}\, Global\ risk\ factor_{t}^{2} + \eta_{c,t(y)} + \varepsilon_{c,t}^{k} \tag{2.3.5}$$

where $Y_{c,t}^{k}$ and $\eta_{c,t(y)}$ are defined as above, with $k \in K = \{\text{Portfolio debt or equity inflows (overall)}\}$. Marginal effect of the VIX is thus given by β^{k}+2 $\theta^{k} VIX$ and evaluated across the empirical distribution of the VIX. The results are estimated using the baseline sample of 20 emerging markets over the period 2009Q2-2025Q1.The results show that the effect of global risk shocks on NBFI behavior may depend on the size of the shock (Online Annex Figure 2.3.6). For example, portfolio debt liability flows become increasingly sensitive as the VIX rises, remaining relatively unresponsive at low levels of global risk—when the VIX is below its historical mean of about 20—but reacting strongly at higher levels. Portfolio debt liability flows also exhibit a non-linear response to global risk, as measured by the RORO index.

Online Annex Figure 2.3.6. Non-Linear Effects of Global Risk on NBFI Flows

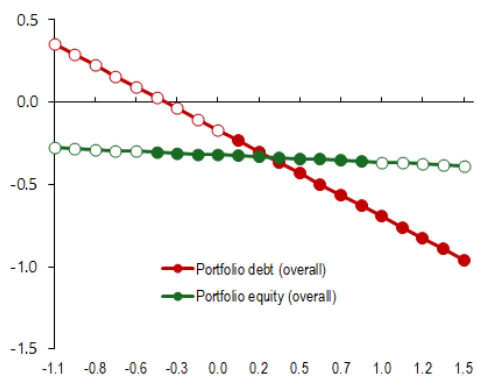
1. Sensitivity of Portfolio Liability Flows to Emerging Markets Following an Increase in the VIX, at Different Levels of the VIX, Post-2009Q2

(Standard deviation)



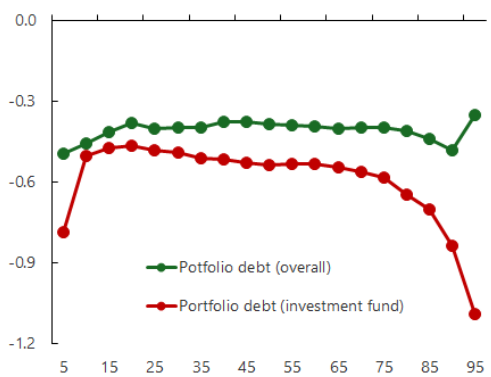
2. Sensitivity of Portfolio Liability Flows to Emerging Markets Following an Increase in the RORO, at Different Levels of the RORO, Post-2009Q2

(Standard deviation)



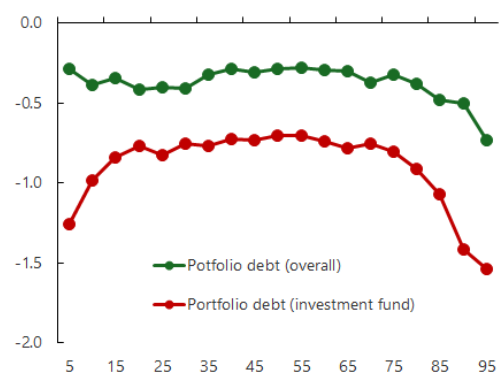
3. Effect of a one-standard-deviation increase in the VIX on portfolio debt liability flows, at different percentiles of the flows, Post-2009Q2

(Standard deviation)



4. Effect of a one-standard-deviation increase in the RORO on portfolio debt liability flows, at different percentiles of the flows, Post-2009Q2

(Standard deviation)



Sources: IMF BOP, EPFR, and IMF staff calculations.
Notes: In Panels 1 and 2, The markers indicate the degree of sensitivity of portfolio inflows (overall) relative to GDP, expressed in standard deviations, in response to a one-standard deviation increase in the VIX or the RORO, evaluated at different levels of the VIX (original scale) or the RORO, respectively. The quarterly VIX series entering the regression is standardized using data from 2000 onward. Panels 3 and 4 show the effects of a one-standard-deviation increase in the VIX or RORO at different percentiles of gross portfolio inflows. Solid markers indicate statistical significance at 10 percent or lower, and hollow markers indicate that the estimated effect is not statistically significant. The ranges correspond to 90 percent confidence intervals around the mean estimates.

An alternative approach to studying nonlinearity is to estimate a "capital-flows-at-risk" model—estimate the impact of the VIX across different parts of the distribution of capital flows using quantile regressions. This approach addresses a related question: whether the effect of global risk is stronger during periods of large outflows/inflows vs normal times. Specifically, we estimate

$$Y_{c,t}^{k,(\tau)} = \beta^{k,(\tau)}\, Global\ risk\ factor_t + \eta_{c,t(y)}^{(\tau)} + \varepsilon_{c,t}^{k,(\tau)} \quad (2.3.6)$$

where $Y_{c,t}^{k,(\tau)}$ defined similarly as above, with τ denoting the τth percentile of capital flows.
The results suggest that, in the post-GFC period, portfolio debt liability flows intermediated by investment funds exhibit the most pronounced non-linear effects (Online Annex Figure 2.3.6). Increases in global risk have stronger effects during large outflows and the strongest effects during periods of large inflows.

The role of policies and vulnerabilities. The chapter also explores whether country-specific vulnerabilities and policy frameworks influence the sensitivity of portfolio liability flows to global risk conditions in the post-GFC period. Specifically, we estimate

$$Y_{c,t}^{k} = \beta^{k}\, Global\ risk\ factor_t + \sum_{f\in F}\gamma^{f,k} 1\{X_{i,t(y)-1}^{f} > median\}\, Global\ risk\ factor_t + \eta_{c,t(y)} + \varepsilon_{c,t}^{k} \quad (2.3.7)$$

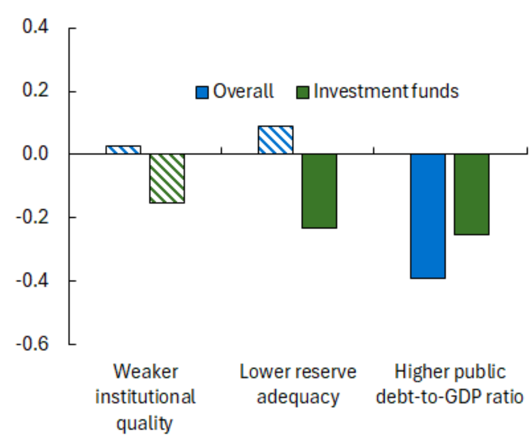
where $Y_{c,t}^{k}$ and $\eta_{c,t(y)}$ are defined as above, with $\mathrm{k} \in \mathrm{K} = \{\text{Portfolio debt or equity inflows (overall or investment funds)}\}$. $X_{i,t(y)}^{f}$ represents annual indicators of country characteristics for $f \in F$, where F includes institutional quality, reserve-to-import ratio, debt-to-GDP ratio, capital account openness, and exchange rate regime.[5] The global risk factor is interacted with these variables. Each characteristic is transformed into a binary indicator equal to one if the country's value is above the cross-country median. All interactions use four-quarter lags to mitigate endogeneity concerns. The results are estimated using the same sample of 20 emerging market economies over the period 2009Q2-2025Q1.

The main text reports the additional sensitivity of portfolio debt inflows (overall or investment funds) to a one-standard-deviation increase in the VIX in countries with weaker fundamentals relative to those with stronger fundamentals. Further analysis shows that, among the seven components of the institutional quality measure, government stability is the primary driver of this result. Finally, beyond the incremental effects estimated for countries with weaker fundamentals, an increase in the VIX may still be associated with lower inflows in countries with stronger fundamentals in some cases. Specifically, a one-standard-deviation increase in the VIX is associated with a one-standard-deviation decline in investment-fund portfolio debt flows, while its effects on overall debt flows and on portfolio equity flows (both overall and investment-fund flows) are not statistically significant at conventional levels.[6]

Online Annex Figure 2.3.7 shows that replacing the VIX with the RORO index yields similar qualitative patterns shown in the main text. The interaction terms continue to suggest that stronger institutions and external buffers are associated with a more muted response of portfolio debt inflows to global risk, while higher public debt is associated with greater sensitivity.

Online Annex Figure 2.3.7. Risk Sensitivity of NBFI Flows and Country Fundamentals

Portfolio Debt Liability Flows to Emerging Markets Following an Increase in the RORO, Post-2009Q2



Sources: IMF BOP, EPFR, and IMF staff calculations.
Note: The bars indicate the additional sensitivity of portfolio debt liability flows (overall or investment funds) relative to GDP, expressed in standard deviations, in response to a one-standard-deviation increase in the RORO, for countries with weaker fundamentals—below-median institutional quality and reserve-to-import ratios, or above-median debt-to-GDP ratios—relative to countries with stronger fundamentals, based on the period after the second quarter of 2009. Solid bars indicate statistical significance at 10 percent or lower.

[5] The classification of exchange rate regimes is based on Ilzetzki, Reinhart and Rogoff (2021), *Rethinking Exchange Rate Regimes*.

[6] For overall portfolio equity inflows, there is evidence that building reserves are more critical for countries with shallower FX markets (proxied by higher FX market spot bid-ask spreads). But no similar results are found for debt flows. The results are available upon request.

Online Annex 2.4. Which type of NBFI investors in Emerging Markets are most sensitive to global shocks?

A. Institutional investors

Sample coverage

This section estimates how nonresident institutional investors adjust their securities holdings in response to changes in global risk factors using FactSet Ownership, security-level holdings data. FactSet gathers ownership data from periodic company reports, disclosed lists of the largest holders, transactional announcements, and other public filings. The coverage of the securities held by individual investors is relatively high for mutual fund managers (over 70 percent of assets under management), but lower for pension fund managers and insurance companies (around 20 percent of assets under management).

Online Annex Table 2.4.1. Composition of Nonbank Investors in the Sample

Security holdings of mutual funds are significantly larger than those of the other investor groups in the sample.

	Advanced economies				Emerging markets			
	Number		Holdings in 2024:Q4		Number		Holdings in 2024:Q4	
	Nonresident	Resident	Nonresident	Resident	Nonresident	Resident	Nonresident	Resident
Mutual fund	7,703	7,482	17.11	37.57	4,357	1,258	2.02	1.91
Hedge fund	2,893	2,889	0.84	1.79	1,523	74	0.06	0.01
Pension fund	208	162	0.90	1.12	135	49	0.08	0.11
Insurance company	167	158	0.05	0.10	96	78	0.01	0.24
Other nonbanks	140	153	1.38	0.08	70	21	0.14	0.05

Source: FactSet; and IMF staff calculations.
Note: Advanced and emerging market securities holdings of the nonbank financial institutions in the sample, in trillions of US dollars. For each security-investor pair, an investor not residing in the same country as the issuer of the security is defined as a nonresident investor. Other nonbanks are family offices, foundations, endowments, and sovereign wealth funds.

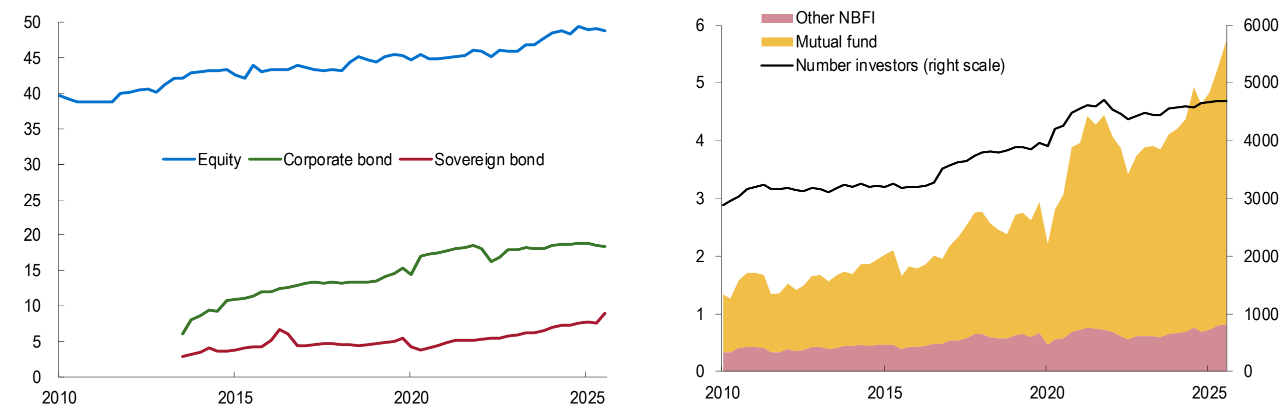
Online Annex Figure 2.4.1. Securities Holdings of Nonbank Financial Institutions

Reported nonbank holdings account for a larger share of the market value of equity than that of debt securities

1. Securities Ownership of the Nonbanks Covered by FactSet Across Asset Classes
(Percent, relative to market value)

Emerging markets securities holdings of nonbanks have increased substantially over the sample period

2. Emerging Market Security Holdings of the Nonbanks Covered by FactSet
(Trillions of dollars; number of investors)



Source: FactSet; and IMF staff calculations.
Note: Panel 1 shows the market value of advanced economy and emerging market securities holdings of NBFIs as a percentage of the market value of the securities they hold. Panel 2 illustrates the holdings of emerging market debt and equity securities, at market values, for nonbank financial investors reporting holdings of such securities.

The data contains the holdings of a range of nonbank institutional investors, covering hedge funds, insurance companies, mutual funds, and pension funds, along with sovereign wealth funds, family offices, foundations, and endowments (Online Annex Table 2.4.1). Collectively, the NBFI holdings assembled by FactSet account for close to 50 percent of the market value of equities, but below 20 percent of that of debt securities (Online Annex Figure 2.4.1). Compared with the PIP (formerly CPIS), FactSet Ownership provides reasonable coverage, capturing roughly 65 percent of the total portfolio equity positions intermediated by non-bank financial institutions in the PIP. For debt securities, coverage has gradually increased over time, reaching close to 25 percent in 2024. For investment funds, the coverage appears higher, up to 70 and more than 30 percent for equity and debt holdings, respectively.

Methodology

The main outcome variable is the change in the share of a security held by an investor, which equals the change in the holdings of the investor not attributable to valuation changes:

$$\frac{Ownership\ share_{i,j,t} - Ownership\ share_{i,j,t-1}}{Ownership\ share_{i,j,t-1}} = \frac{\frac{Security\ value_{i,t-1}}{Security\ value_{i,t}}\ Holdings_{i,j,t} - Holdings_{i,j,t-1}}{Holdings_{i,j,t-1}} \quad (2.4.1)$$

For security *i*, investor *j*, and quarter *t*, $Holdings_{i,j,t}$ denotes the market value of holdings and $Security\ value_{i,t}$ the market value of a security. Note that this change is defined only when the investor held the security in the previous period, that is $Holdings_{i,j,t-1} > 0$, and the security has not been redeemed, implying that $Security\ value_{i,t} > 0$. These restrictions exclude changes in holdings attributable to issuance and redemptions. The analysis on portfolio rebalancing relies on the weight of an individual security in the portfolio of an investor, given by:

$$Portfolio\ share_{i,j,t} = \frac{Holdings_{i,j,t}}{\sum_i Holdings_{i,j,t}} \quad (2.4.2)$$

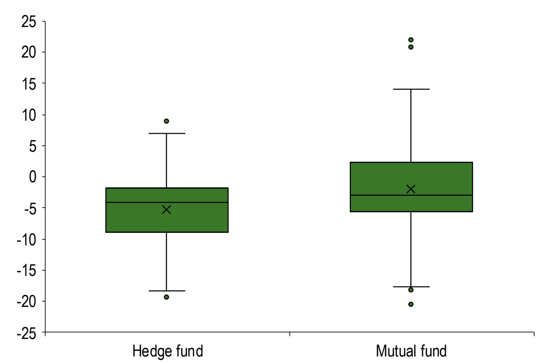
The empirical specification used to estimate the sensitivity of nonresident relative to resident holdings to global risk factor (GRF) is:

$$\frac{Ownership\ share_{i,j,t} - Ownership\ share_{i,j,t-1}}{Ownership\ share_{i,j,t-1}} = \gamma_{f,s,t} + \delta_{f,j,s} + \beta\ GRF_t\ Nonresident_{i,j} + \eta_{i,j,t} \quad (2.4.3)$$

where *f* denotes the issuer of the security *i*, *s* the type of the security (bond/equity), GRF_t the global risk factor, $Nonresident_{i,j}$ is an indicator equal to 1 when investor *j* is a nonresident investor for security *i*, and 0 otherwise. The issuer-security type-time fixed effect ($\gamma_{f,s,t}$) captures the average period-*t* change in the holdings of the debt, and separately of the equity, securities of the issuer, absorbing common factors affecting changes in the holdings of all institutional investors in the sample. The inclusion of this fixed effect implies that β measures the sensitivity of the nonresident relative to the resident investors. The issuer-investor-security type fixed effects ($\delta_{f,j,s}$) capture, for each investor *j*, the average change in their holdings of the debt, and separately of the equity, securities issued by entity *f* over the sample. This fixed effect captures the time-invariant issuer and security type characteristics that affect the demand of investor *j* for the securities of issuer *i*. Further analysis investigates heterogeneity in the sensitivities by allowing the β coefficient to vary across different types of investors and issuers. For example, differences in the sensitivities are examined across countries ranked by institutional quality, international reserves adequacy, and fiscal vulnerabilities. The specification is otherwise the same in these exercises.

Online Annex Figure 2.4.2. Sensitivity to the VIX of Nonresident's Investment in Emerging Market Securities, Across Investors

(Percentage points)



Sources: Chicago Board Options Exchange; FactSet; and IMF staff calculations.
Note: Estimates of the changes in the growth of valuation-adjusted emerging market securities holdings of individual nonresident investors for a one-standard-deviation increase in the VIX, obtained using a specification that includes security fixed effects. The boxes represent the interquartile ranges, "×" and "–" denote the average and the median sensitivity, respectively, and the whiskers illustrate the range of the estimates, excluding outliers, which are shown by the dots outside the whiskers.

For individual investors, the sensitivity of their emerging market holdings to the global risk factor is estimated using:

$$\frac{Ownership\ share_{i,j,t} - Ownership\ share_{i,j,t-1}}{Ownership\ share_{i,j,t-1}} = \mu_{i,j} + \beta_j\ GRF_t + \nu_{i,j,t} \tag{2.4.4}$$

where $\mu_{i,j}$ captures the time-invariant determinants of the demand for the security *i* by investor *j*. The specification is estimated separately for each investor, and only the coefficients that are statistically significant at the 5 percent level are retained for further analysis of investor heterogeneity.

The statistically significant sensitivities β_j are used to measure the share of flighty investors in the investor base of emerging market securities as follows:

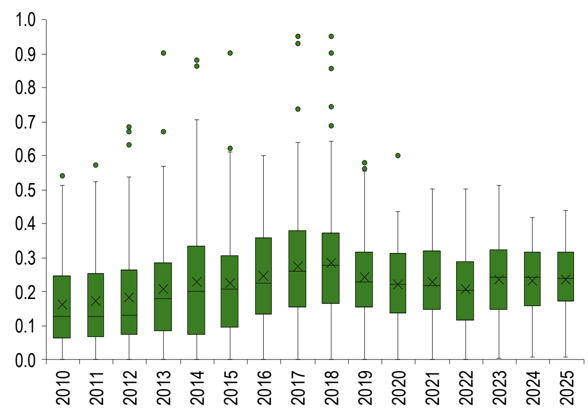
$$Share\ flighty_{d,t} = \frac{\sum_{j:\beta_j<\tilde{\beta}} Holdings_{d,j,t}}{\sum_j Holdings_{d,j,t}} \tag{2.4.5}$$

where $\tilde{\beta}$ is a threshold value equal to 0 when the measure is calculated for individual securities ($d = i$), and the 20th percentile of the β_j distribution for the share at the level of recipient countries ($d = c$, with $Holdings_{c,j,t}$ denoting the securities issued by entities residing in country *c* held by investor *j* in quarter *t*). These thresholds ensure that both measures exhibit sufficient variability across the sample, and at the same time capture the flightiness of the investor base.

There are 167 nonresident NBFIs in the sample for which β_j is statistically significantly different from 0 and negative, of which 120 are mutual funds and 32 hedge funds (Online Annex Figure 2.4.2). Collectively, these flighty nonresident investors account for 23 percent of the emerging market bond holdings and 12 percent of the equity holdings of the NBFIs in the sample, but there is substantial heterogeneity in their share across countries and over time (Online Annex Figure 2.4.3).

Online Annex Figure 2.4.3. Securities Holdings of Flighty Nonresident Investors Across Emerging Markets

(Share, relative to total NBFI holdings)



Sources: Chicago Board Options Exchange; FactSet; and IMF staff calculations.
Note: Market value of the securities held by flighty nonresident investors relative to the market value of the securities held by all NBFIs, for individual emerging markets. Flighty nonresident investors are defined as nonresident NBFIs for which the sensitivity of their emerging market investments to the VIX is statistically significantly different from 0 at the 5 percent level and negative. The boxes represent the interquartile ranges, "×" and "–" denote the average and the median ratio, respectively, and the whiskers illustrate the range of the ratios, excluding outliers, which are shown by the dots outside the whiskers.

The specification employed to evaluate how nonresident investors rebalance their portfolios when global volatility rises is:

$$\frac{Portfolio\ share_{i,j,t} - Portfolio\ share_{i,j,t-1}}{Portfolio\ share_{i,j,t-1}} = \lambda_{d,j,t} + \delta_{f,j,s} + \varphi\ GRF_t\ Asset\ class_i + \varepsilon_{i,j,t} \tag{2.4.6}$$

where $Asset\ class_i$ denotes the asset class of security *i* (corporate/sovereign bond/equity), $d \in \{c, f\}$, and *c* is the country in which issuer *f* resides. In the specification employed to estimate the rotation from corporate bonds to equities, $d = f$ to control for the average change in the holdings of the securities of issuer *f* at the level of each investor. In this way, the coefficient φ captures how an individual investor alters their holdings of the debt securities of a given issuer relative to the equity securities of the same issuer. Rotation from corporate to sovereign bonds is instead estimated by setting $d = c$, implying that portfolio rebalancing is estimated within a country. In this case, the coefficient φ quantifies the rotation from sovereign to corporate bonds whose issuers reside in the same country, and the fixed effect $\lambda_{c,j,t}$ controls for determinants of portfolio shares that vary at the level of country.

All the specifications are estimated using the holdings data for each security aggregated to the investor parent level as the focus of the section is the heterogeneity among different types of NBFIs.[7] Each investor is required to have held the securities (debt or equity) of an issuer in at least 25 quarters for the issuer-investor pair to be

[7] A more granular analysis of the legal entities of the investor parents would also introduce noise to the estimates due to the smaller magnitude of the holdings at the more granular level.

included in the estimation sample. Moreover, only investors whose emerging market security holdings exceed 10 million US dollars are included in the analysis.[8] These restrictions ensure that the estimates are not driven by the smallest investors, whose behavior is less material to aggregate outcomes, and that there is sufficient variation over time to estimate the sensitivities.

Additional results

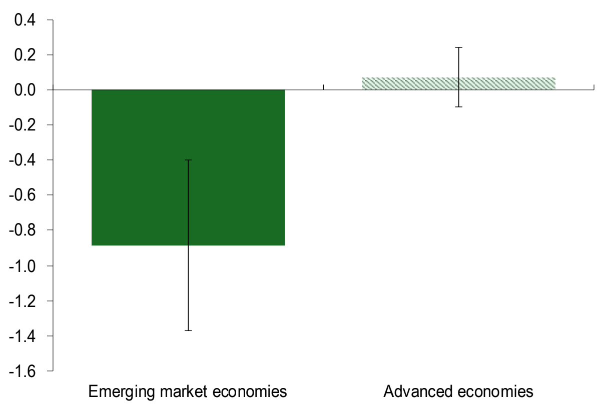
Nonresident NBFI reduce their emerging market investments more than resident NBFI when the Risk-On Risk-Off (RORO) Index, measuring the risk aversion of global investors, rises and during market stress episodes, captured by elevated values of the VIX (Online Annex Figure 2.4.4). The investments of nonresident investors in advanced economies, on the contrary, do not respond differently to these alternative risk indicators than those of resident NBFIs. Nonresident investors are more reactive to increases in global political and economic uncertainty, as measured by the World Uncertainty Index (WUI), than resident NBFIs not only in terms of their emerging market but also advanced economy investments (Online Annex Figure 2.4.5, panel 1). The securities holdings of nonresident NBFIs are also strongly responsive to the strength of the US dollar: a one-standard-deviation appreciation of the dollar against other major currencies is followed by a decrease of 1.4 percentage points in their emerging market investments, which is a substantially larger effect than that induced by an analogous increase in the VIX (Online Annex Figure 2.4.5, panel 2).

Online Annex Figure 2.4.4. Sensitivity of Nonresident Investments to Global Risk

Nonresident NBFIs cut their emerging market investments more than resident investors when global risk aversion rises …

1. Change in the Growth of Nonresident Securities Holdings for an Increase in the RORO

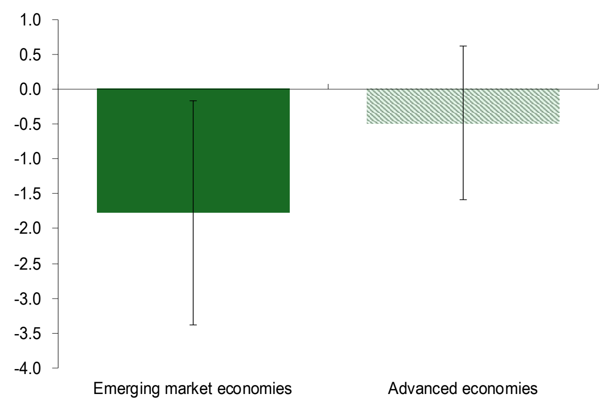
(Percentage points)



.. with such differential responses being particularly significant in episodes of market stress

2. Change in the Growth of Nonresident Securities Holdings When the VIX is Elevated

(Percentage points)



Source: Chicago Board Options Exchange; FactSet; Federal Reserve Bank of Kansas City; and IMF staff calculations.

Note: Regression estimates of the changes in the growth of valuation-adjusted securities holdings of nonresident NBFIs, relative to those of resident NBFIs, for a one-standard-deviation increase in the RORO (panel 1), and when the VIX takes a value in its top decile. The advanced economy sample excludes the traditional safe-haven countries, Japan, Switzerland and the United States. The specifications include time–issuer–security type (bond/equity) and investor–issuer–security type fixed effects. The error bars show 90 percent confidence intervals of the estimates, obtained using Driscoll-Kraay standard errors, with the number of lags equal to 4.

[8] The emerging market securities holdings of the NBFIs satisfying these restrictions account for 74 percent of the total in the data.

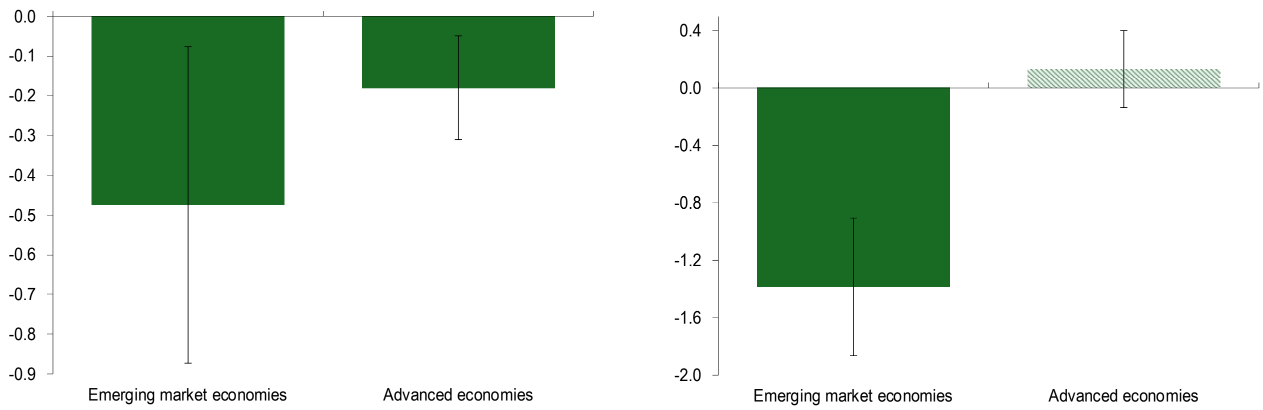
Online Annex Figure 2.4.5. Sensitivity of Nonresident Investments to Global Uncertainty and the Dollar

Nonresident NBFIs cut their emerging market investments more than resident investors when global uncertainty rises

1. Change in the Growth of Nonresident Securities Holdings for an Increase in the WUI
(Percentage points)

… and when the US dollar appreciates against other major currencies

2. Change in the Growth of Nonresident Securities Holdings for an Increase in the DXY
(Percentage points)



Source: Ahir, Bloom, and Furceri (2022); FactSet; LSEG; and IMF staff calculations.
Note: Regression estimates of the changes in the growth of valuation-adjusted securities holdings of nonresident NBFIs, relative to those of resident NBFIs, for a one-standard-deviation increase in the World Uncertainty Index (WUI, panel 1), and the US dollar index (DXY, panel 2). The advanced economy sample excludes the traditional safe-haven countries, Japan, Switzerland and the United States. The specifications include time–issuer–security type (bond/equity) and investor–issuer–security type fixed effects. The error bars show 90 percent confidence intervals of the estimates, obtained using Driscoll-Kraay standard errors, with the number of lags equal to 4.

The baseline specification in (2.4.3) controls for the effects of the global risk shocks on the issuers, which may in turn affect the asset allocation decisions of the investors, by time–issuer–security type fixed effects. These fixed effects can fail to capture all the time variation in the recipient determinants of the investor holdings if different securities of a given issuer are affected heterogeneously by the shocks. Such heterogeneity could arise, for example, due to the shocks affecting local and foreign currency debt securities differently. The potential bias induced by such effects can be assessed by including in the specification time–security fixed effects. In this way, the β coefficient captures how the changes in the holdings of nonresident NBFIs of a given security differ from those of resident investors when global risk rises. The results indicate that the coefficients estimated with the specification in (2.4.3) are not significantly biased: the more saturated specification with time–security fixed effects yields similar estimates, with only the advanced economy coefficient slightly larger in absolute value and more statistically significant (Online Annex Figure 2.4.6, panel 1).

The results are also not driven by any of the emerging market countries in the sample: when the baseline specification is estimated by excluding, one at a time, each of the countries in the sample, the resulting coefficient estimates are tightly concentrated around the baseline estimate (Online Annex Figure 2.4.6, panel 2). Even the largest and the smallest estimate in absolute value (obtained by excluding China and India, respectively) are not economically significantly different from the baseline estimate.

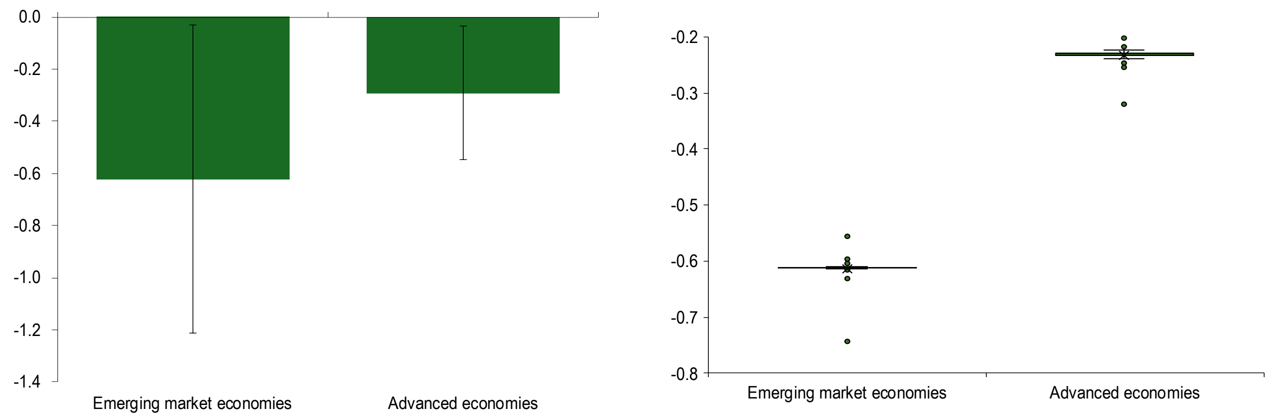
Online Annex Figure 2.4.6. Sensitivity of Nonresident Investments to the VIX

Estimates of the sensitivities are robust to controlling for time-varying recipient factors at the security level …

1. Change in the Growth of Nonresident Securities Holdings for an Increase in the VIX
(Percentage points)

… and are not substantially affected by excluding each of the emerging market countries from the sample

2. Change in the Growth of Nonresident Securities Holdings for an Increase in the VIX, Across Samples
(Percentage points)



Source: Chicago Board Options Exchange; FactSet; and IMF staff calculations.
Note: Regression estimates of the changes in the growth of valuation-adjusted securities holdings of nonresident NBFIs, relative to those of resident NBFIs, for a one-standard-deviation increase in the VIX. Panel 1 illustrates the estimated obtained with specifications that include time–security and investor–security fixed effects. The error bars show 90 percent confidence intervals of the estimates, obtained using Driscoll-Kraay standard errors, with the number of lags equal to 4. The advanced economy sample excludes the traditional safe-haven countries, Japan, Switzerland and the United States. Panel 2 shows the sensitivities estimated by excluding, one at a time, each of the countries from the sample employing a specification that includes time–issuer–security type (bond/equity) and investor–issuer–security type fixed effects. The boxes represent the interquartile ranges, "×" and "–" denote the average and the median estimate, respectively, and the whiskers illustrate the range of the estimates, excluding outliers, which are shown by the dots outside the whiskers.

There is some evidence of state dependence in the response of nonresident investors to the VIX. Specifically, the emerging market investments of nonresident NBFIs are more sensitive to the VIX when it increases from a low level than when it decreases from a high level (Online Annex Figure 2.4.7, panel 1). However, the two responses are not statistically significantly different from each other. There are also significant differences in nonresident behavior across emerging markets grouped by the depth of their financial markets: nonresident investors reduce their investments more substantially in countries with shallower financial markets, as proxied by the ratio of private debt securities to GDP (Online Annex Figure 2.4.7, panel 2).[9]

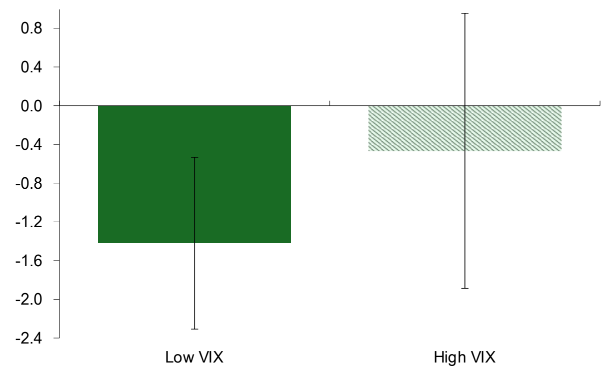
For the flightier nonresident investors, identified using specification (2.4.4), the recipient vulnerabilities discussed in the previous section substantially alter their behavior. Specifically, flightier nonresident investors cut their emerging market investments more substantially following increases in the VIX in countries with lower international reserves, weaker institutions, and higher sovereign credit risk (Online Annex Figure 2.4.7, panel 3). Higher foreign exchange reserves substantially moderate the fall in nonresident emerging market investments particularly in countries with managed exchange rates (Online Annex Figure 2.4.7, panel 4). The difference between high and low level of vulnerabilities is statistically significant for institutional quality, and for reserve adequacy in countries with managed exchange rates but not for the other variables.

[9] The sensitivities for the two country groups are statistically significantly different only when focusing on the flightier nonresident NBFIs.

Online Annex Figure 2.4.7. Sensitivity of Nonresident emerging market Investments to the VIX

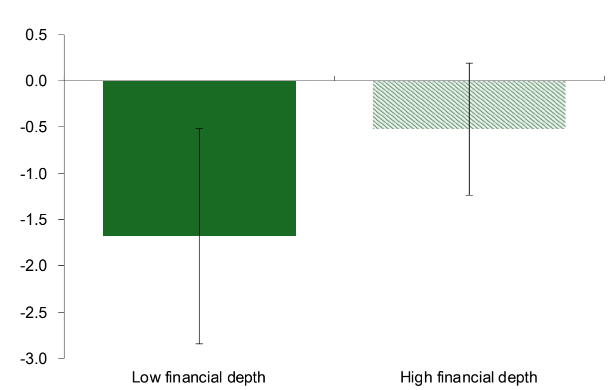
Nonresident NBFIs adjust their emerging market investments more when the VIX is low and rises than when it is high and falls

1. Change in the Growth of Nonresident Securities Holdings for an Increase in the VIX, by Its Initial Level
(Percentage points)



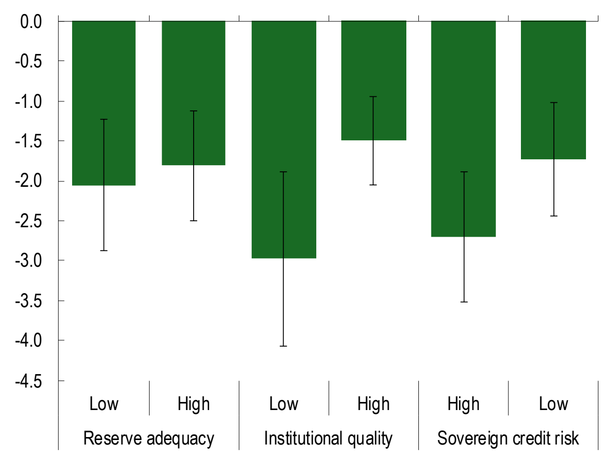
Sensitivities of nonresident NBFIs to the VIX are higher in jurisdictions with shallower financial markets

2. Change in the Growth of Nonresident Securities Holdings for an Increase in the VIX, by Financial Depth
(Percentage points)



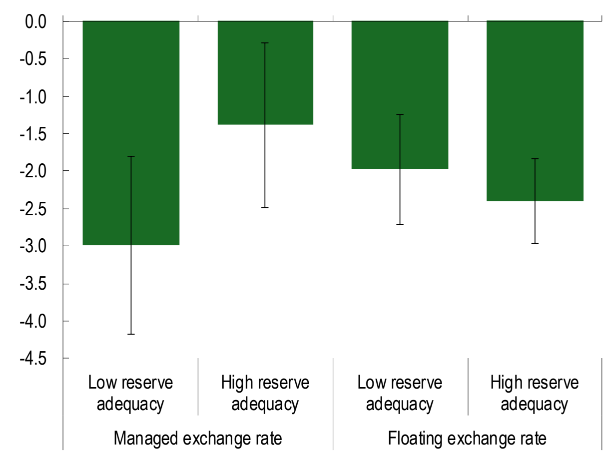
Flighty nonresident NBFIs reduce their emerging market investments more in jurisdictions with elevated vulnerabilities

3. Change in the Growth of Flighty Nonresident Securities Holdings for an Increase in the VIX
(Percentage points)



Higher international reserves moderate nonresident outflows jurisdictions with shallower financial markets

4. Change in the Growth of Flighty Nonresident Securities Holdings for an Increase in the VIX
(Percentage points)



Source: BIS; Chicago Board Options Exchange; CMA; FactSet; PRS Group; and IMF staff calculations.
Note: Regression estimates of the changes in the growth of valuation-adjusted emerging market securities holdings of nonresident NBFIs, relative to those of resident NBFIs, for a one-standard-deviation increase in the VIX. Panel 1 illustrates the sensitivity as a function of the value of the VIX in the previous quarter, with low (high) VIX denoting values below (above) its mean over the sample period. Panel 2 shows the sensitivity by financial depth, defined to be low (high) when the ratio of private debt securities to GDP is below (above) the sample median in the previous year. In panels 3 and 4, flighty nonresident investors are defined as nonresident NBFIs for which the sensitivity of their emerging market investments to the VIX is statistically significantly different from 0 at the 5 percent level and negative. Foreign exchange adequacy (FX reserves relative to imports) is defined to be low (high) when it is below (above) the sample median for the previous year, institutional quality is defined to be low (high) when the sum of relevant ICRG political risk components (bureaucracy quality, corruption, democratic accountability, government stability, investment profile, law and order, socioeconomic conditions) is below (above) the sample median for the previous year, and sovereign risk is defined to be low (high) when the average of the daily values of the sovereign credit default swap spread in the previous quarter is below (above) the sample median. The specifications include time–issuer–security type (bond/equity) and investor–issuer–security type fixed effects. The error bars show 90 percent confidence intervals of the estimates, obtained using Driscoll-Kraay standard errors, with the number of lags equal to 4.

Nonresident NBFIs also appear to adjust their equity and bond holdings differently when global risk rises: investors holding both the equity and debt securities of a given emerging market issuer tend to rebalance their portfolios from the latter to the former (Online Annex Figure 2.4.8, panel 1). Across emerging markets, nonresident investors instead rotate from corporate to sovereign bonds. Issuers that have both local and foreign currency bonds outstanding witness nonresident investors decreasing the portfolio share of their foreign currency bonds more than that of their local currency bonds (Online Annex Figure 2.4.8, panel 2). Taken together, these findings suggest that among emerging market securities corporate bonds are the most prone to being sold by nonresident NBFIs in periods of elevated volatility, and the choice between issuing in local or foreign currency can influence the investor base of emerging market issuers, and thereby the market pricing of their securities, especially during market stress episodes.

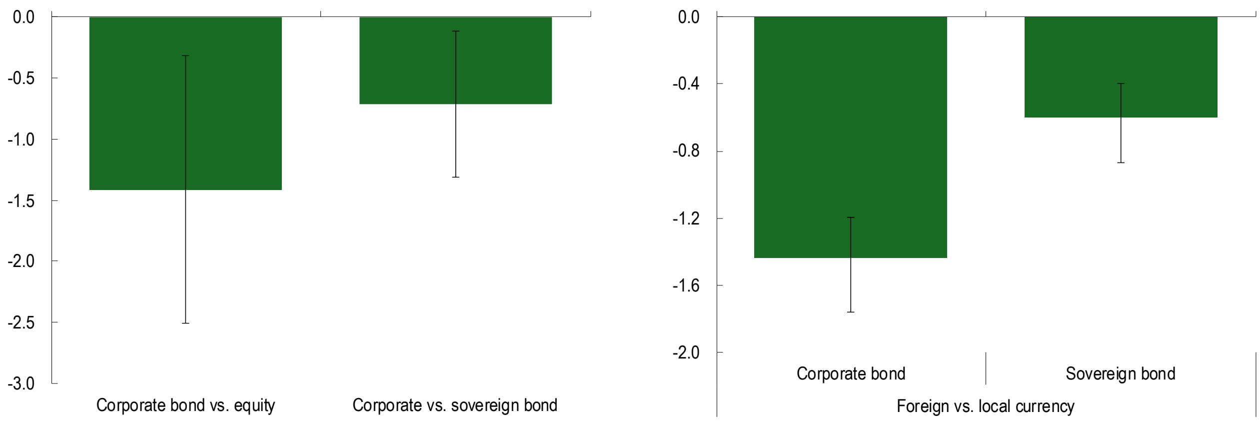
Online Annex Figure 2.4.8. Sensitivity of the portfolio allocation of nonresident NBFIs to the VIX

When volatility rises, nonresident NBFIs rotate from corporate bonds to equities and sovereign bonds …

1. Sensitivity of relative portfolio shares of nonresident NBFIs to the VIX
(Percentage points)

… and from foreign to local currency corporate and sovereign bonds.

2. Sensitivity of the changes in relative portfolio shares of nonresident NBFIs to the VIX
(Percentage points)



Source: Chicago Board Options Exchange; FactSet; and IMF staff calculations.
Note: Regression estimates of the changes in the growth of the share of emerging market securities in the portfolios of nonresident NBFIs for a one-standard-deviation increase in the VIX. In panel 1, the rotation from equities to corporate bonds is estimated within an issuer, by including time–investor–issuer and investor–issuer–security type fixed effects, while the rotation from corporate to sovereign bonds is quantified within a country, employing a specification with time–investor–country and investor–issuer–security type fixed effects. In panel 2, the rotation from foreign to local currency bonds is estimated with a specification that includes time–investor–issuer and investor–issuer–currency type fixed effects. The error bars show 90 percent confidence intervals of the estimates, obtained using bootstrapped standard errors, resampling at investor-security level.

B. Mutual Funds/ETFs

Data, Sample, and Variable Construction

<u>Data coverage.</u> The analysis combines (i) security-level portfolio holdings that report each fund's positions in individual securities, (ii) fund-level characteristics and returns used to construct investor flows and fund classifications, and (iii) global financial conditions indicators. These datasets are merged at the fund and reporting-date level to form a quarterly panel of fund–security observations spanning 2013q2-2025q2 and covering around 4k funds, 12k securities from 52 emerging countries, and 5 million fund–security–time observations. Securities are roughly equally split between equities, corporate bonds, and sovereign bonds. Global risk is measured using the CBOE VIX index, aggregated to quarterly frequency by taking the within-quarter average and standardized by its sample standard deviation.[10] Detailed definitions and original data sources for all variables are provided in the chapter variable list.

<u>Sample construction and filters</u>. The sample is restricted to funds that invest in at least one security over the sample period that is issued in a country that belongs to emerging markets included in the IMF's Vulnerability Exercise. To capture persistent portfolio relationships rather than sporadic entry and exit, only fund–issuer pairs observed for at least 25 quarters are retained and the analysis focuses on intensive-margin portfolio adjustments. [11] Finally, we restrict the sample to mutual funds and exchange-traded funds (ETFs).

<u>Construction of flow variables</u>. Security-level flows are computed by adjusting changes in holdings for contemporaneous price movements to isolate net trading. This value-adjustment ensures that changes in portfolio weights reflect purchases and sales rather than asset price fluctuations. Flows are defined on the intensive margin (continuing positions only) to isolate within-position rebalancing. Including entry and exit would

[10] One standard deviation of VIX in our quarterly sample is around 5.22.

[11] The 25-quarter requirement is imposed at the fund–issuer level. Because estimation occurs at the fund–security level and individual securities enter and exit over time (issuance, maturity, turnover), fund–security pairs typically have shorter effective histories, leaving the panel unbalanced with an interquartile range of 4–27 quarters.

mix scaling decisions with discrete initiation or liquidation and change the interpretation of the estimated sensitivities. Investor flows are constructed analogously using changes in fund size net of returns, capturing net subscriptions and redemptions. Fund j's flow into security i at quarter t is then defined as

$$FLOW_{ijt} = 100 * \frac{\Delta_{it}\, Holding\ value_{ijt} - Holding\ value_{ijt-1}}{Holding\ value_{ijt-1}},$$

with $\Delta_{it} = \frac{P_{it-1}}{P_{it}}$ and P_{it} being the average price of the security at quarter t). Investor flows are constructed analogously using changes in fund size net of returns, capturing net subscriptions and redemptions. Fund j's investor flow at quarter t is defined as

$$Investor\ Flow_{jt} = 100 * \frac{Fund\ size_{jt} - Fund\ size_{jt-1}(1 + R_{j,t})}{Fund\ size_{jt-1}},$$

with $R_{j,t}$ being the return of the fund for the period of quarter t-1 to t.

Synthetic Leverage/Hedging. To measure funds' effective use of leverage or hedging instruments, we follow the methodology in Fricke (2025) and compare realized fund returns with the return implied by reported security holdings. Let $R_{jt}^H = w_{j,t-1}^{b\prime} r_t$ denote the return on a buy-and-hold portfolio constructed using beginning-of-period holdings weights. The return gap $\Delta_{jt} = R_{jt} - R_{jt}^H$ is then decomposed into three components. First, a 'passive' component captures the return that arises mechanically from price movements is computed by valuing lagged holdings at current prices and recomputing their weights, yielding value-adjusted weights $\mathrm{w}_{j,t-1}$. Second, an 'active' component measures the effect of changes in portfolio weights between the value-adjusted lagged portfolio $\mathrm{w}_{j,t-1}$and the observed current holdings $\mathrm{w}_{j,t}$, and therefore reflects discretionary trading or rebalancing. The remaining contemporaneous component, defined as the difference between realized fund returns and the return implied by current holdings, captures exposures not recorded in the holdings data, including derivatives, borrowing, and other off-balance-sheet instruments. The decomposition is as follows:

$$\begin{aligned}
\Delta_{j,t} &= R_{j,t} - R_{j,t}^H \\
&= R_{j,t} - w_{j,t-1}^{b\prime} r_t \\
&= (R_{j,t} - w_{j,t}' r_t) + (w_{j,t}' r_t - w_{j,t-1}' r_t) + (w_{j,t-1}' r_t - w_{j,t-1}^{b\prime} r_t) \\
&= \Delta_{j,t}^{Contemp} + \Delta_{j,t}^{Active} + \Delta_{j,t}^{Passive}.
\end{aligned}$$

To isolate these synthetic exposures, we remove the active component and regress the residual return gap on the holdings-implied return and fund controls. A significantly positive (negative) $\bar{\bar{\beta}}_j$ indicates amplified (dampened) exposure relative to underlying holdings and is interpreted as synthetic leverage (hedging):

$$(\Delta_{j,t} - \Delta_{j,t}^{Active}) = \bar{\bar{\alpha}}_j + \bar{\bar{\beta}}_j \cdot R_{j,t}^H + Controls_{j,t} + \varsigma_{j,t}.$$

We classify funds as Leveraged (Hedged) when $\bar{\bar{\beta}}_j$ is significantly positive (negative) at the 10 percent level. The control variables include a fund's end-investor flows (scaled by lagged AUM), flows squared, turnover[12], lagged portfolio concentration (HHI), lagged fund size, VIX and its lag, and the lagged return gap $\Delta_{j,t-1}$. Synthetically hedged funds allocate the largest share of their portfolios to emerging market sovereign bonds, while still holding a sizable equity component (Online Annex Figure 2.4.11). In contrast, synthetically leveraged funds invest mostly in emerging market equities.

[12] A fund's turnover is defined as the minimum of asset sales (value-adjusted) and asset purchases (value-adjusted) by the fund, normalized by the current period AUM of the fund.

Descriptive Statistics and Sample Composition

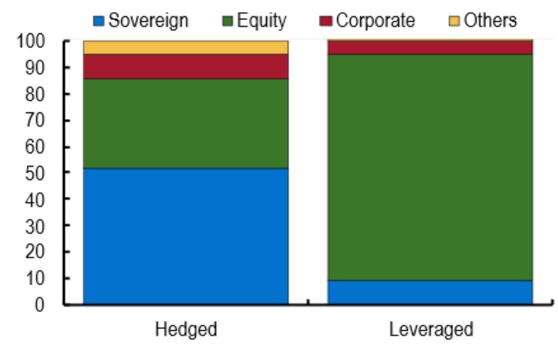
Key variables' summary statistics (Online Annex Table 2.4.2). The quarterly fund–security flows are centered around a median change of only 0.2% of holdings but exhibit substantial dispersion and fat tails: the interdecile range spans roughly −19% to +27%, indicating episodic rebalancing rather than gradual adjustments. Position sizes are highly heterogeneous, with median holdings of USD 0.7 million but a pronounced right tail exceeding USD 8 million. Most securities account for small portfolio shares, suggesting broadly diversified portfolios. The panel structure indicates moderate turnover at the security level (median 12 quarters) but longer relationships at the issuer level (33 quarters), consistent with within-issuer rotation. Funds typically hold a handful of emerging market securities, though some are highly diversified, and many emerging market securities are widely held, implying potential for correlated trading. At the monthly frequency, funds range widely in size (median USD 312 million; top decile above USD 3.3 billion), while end-investor flows are usually small but occasionally large (±3–4%), suggesting that tail events can generate meaningful trading pressure.

Online Annex Figure 2.4.11. Emerging Market Holdings by Asset Types, Synthetically Hedged vs Leveraged Funds

Synthetically hedged funds invest primarily in emerging market sovereign bonds with smaller positions in other emerging market asset classes, whereas synthetically leveraged funds allocate overwhelmingly to emerging market equities.

Emerging Market Holdings Within Synthetically Hedged or Leveraged Funds, 2025:Q3

(estimate, percent)



Source: FactSet, and IMF staff calculations.
Note: The figure shows the composition of emerging market holdings by asset type for synthetically hedged and leveraged funds. Shares are calculated as the value of holdings in each emerging market asset class divided by total emerging market security holdings in the most recent sample period (2025 Q3).

Online Annex Table 2.4.2. Descriptive statistics of key variables

Fund–security flows are typically small but highly dispersed with fat tails; portfolios are heterogeneous, broadly diversified, and characterized by episodic rebalancing and potential for correlated trading.

Sample	Variable	p10	p25	p50	p75	p90
Main specification (Quarterly)	Flow (thousand USD, thousands)	-346.6	-43.55	56.09	53.17	357.51
Main specification (Quarterly)	Flow (% of previous holding)	-18.59	-6.4	0.22	8.52	26.84
Main specification (Quarterly)	Holding value (USD, thousands)	72	215.43	730	2611.6	8356
Main specification (Quarterly)	Holding's portfolio share (%)	0.01	0.02	0.09	0.34	1
Main specification (Quarterly)	Number of observations for fund-security pairs	2	4	12	27	39
Main specification (Quarterly)	Number of observations for fund-issuer pairs	26	28	33	42	48
Main specification (Quarterly)	Number of securities a given fund hold	1	2	7	20	74
Main specification (Quarterly)	Number of funds that hold a given security	1	3	7	21	57
End-investor flow specification (Monthly)	Fund size (Million USD)	30.7	87.9	312.65	1079.37	3339.37
End-investor flow specification (Monthly)	End-investor flow (% of lagged AUM)	-3.61	-1.34	-0.08	1.13	4.09

Source: FactSet, and IMF staff calculations.

Note: The table reports distributional statistics (p10–p90) for fund–security flows, holdings, and panel structure in the quarterly main specification, and for fund size and end-investor flows in the monthly specification.

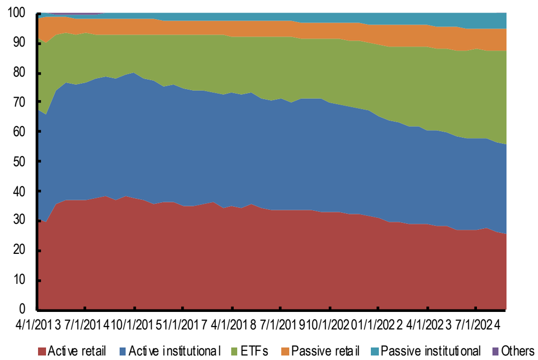
Actively managed mutual funds are the dominant investors throughout the sample period, accounting for the majority of both assets and fund counts (Online Annex Figure 2.4.12). At the same time, passive vehicles (including ETFs and passive mutual funds) have steadily gained share over time. The increase is more pronounced in holdings than in counts, particularly for ETFs, suggesting larger average fund sizes.

Online Annex Figure 2.4.12. Sample Composition of Different Fund Types

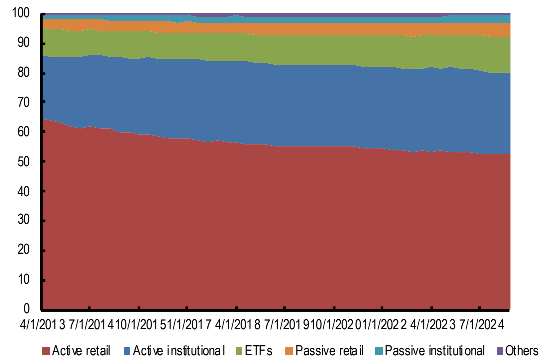
Nonresident emerging market holdings are dominated by active mutual funds, but passive vehicles—especially ETFs—have steadily increased their share of total assets over time.

By fund count, active mutual funds remain the majority, while the number of passive and ETF funds has grown gradually, though less sharply than their asset share.

1.Share of Total Emerging Market Holdings
(Percentage point, relative to total emerging market holdings)



2.Share of Funds
(Percentage point, relative to total number of funds)



Source: FactSet, Lipper and IMF staff calculations.
Note: The left panel reports each fund type's share of total nonresident holdings of emerging market securities, calculated as the sum of holding values for funds of a given type divided by the total holding value across all fund types. The right panel reports each fund type's share of funds, measured as the number of funds in each category relative to the total number of funds in the sample. The sample is restricted to nonresident fund–issuer pairs observed for at least 25 periods.

Empirical Specification

The response of funds' emerging market security holdings in response to global financial shocks is estimated as follows:

$$FLOW_{ijt} = \tau_1\, GRF_t \times Type_j + \mu_{f,s,t} + \xi_{f,s,j} + \varepsilon_{ijt},$$

where the dependent variable measures valuation-adjusted flows into security i by fund j at time t. GRF_t denotes the global risk measure (standardized quarterly VIX), and $Type_j$ is an indicator for fund characteristics such as foreign vs domestic domicile, passive vs active strategy, ETF vs mutual fund structure, or institutional vs retail investor base. The fixed effects $\mu_{f,s,t}$ absorb issuer–security type (debt/equity)–time shocks common across funds, while $\xi_{f,s,j}$ absorb time-invariant fund–issuer- security type (debt/equity) relationships. Identification therefore comes from within-fund–issuer variation in responses to changes in global risk. We use two-way cluster-robust standard errors that allow for arbitrary dependence within funds over time and within securities across funds.[13]

Additional results

<u>*Decomposition of funds' sensitivity to global risk factors*</u>. To understand the mechanisms underlying the heterogeneity observed in Figure 2.8, panel 3 of the chapter, the sensitivities of fund holdings to global risk can be decomposed into their key components, distinguishing between vulnerabilities driven by end-investor behavior (end-investor redemptions), fund structure and liquidity management (the degree to which these

[13] To determine the appropriate clustered standard errors the residual dependence along the three panel dimensions of the data—fund portfolio, security holding, and time—are directly assessed by computing, for each model, the regression residuals on the estimation sample and, within each group, the average of all pairwise products of residuals among observations belonging to the same group. This statistic provides an empirical measure of within-group covariance: it is close to zero under independence, becomes positive when observations co-move because of shared shocks or exposures, and can be negative when substitution or rebalancing effects dominate. It shows economically meaningful dependence within funds and within securities, consistent with persistent portfolio decisions and issuer-level shocks. The within-time covariances are several orders of magnitude smaller, indicating relatively weak cross-sectional co-movement within a given quarter. Combined with the highly unbalanced structure of the panel—short time series per fund–security pair but a very large cross section—clustering by time would rely on few effective clusters while addressing only a minor source of dependence, leading to noisy variance estimates. Therefore, standard errors are clustered along the cross-sectional dimensions, which capture the dominant sources of residual correlation and provide more reliable inference. Similar residual-dependence diagnostics for specifications that additionally control for end-investor flows yield comparable conclusions and are available upon request.

redemptions are passed through into asset sales), and by portfolio rebalancing independent of end-investor flows.

First, we estimate heterogeneity in end-investor flow sensitivity to global risk using:

$$InvestorFlow_{jt_m} = \gamma_1 GRF_{t_m} \times Type_j + Controls_{jt_m} + \lambda_t + \nu_j + u_{jt_m},$$

where ν_j are fund fixed effects and λ_t are time fixed effects, and $Controls_{jt_m}$ include lagged fund size, lagged fund returns, and portfolio-weighted country macro pull factors (constructed from lagged country fundamentals[14] using the fund's portfolio weights). Standard errors are two-way clustered by funds and time, allowing for arbitrary serial correlation within funds and common shocks across funds within each period. With fund and time fixed effects, the baseline sensitivity of flows to global risk is absorbed, and the regression estimates only the differential slope γ_1, which captures how the global-risk sensitivity of $Type_j = 1$ funds differs from that of the baseline group:

$$\gamma_1 = \frac{\partial InvestorFlow_{jt_m}}{\partial GRF_{t_m}} |_{Type_j=1} - \frac{\partial InvestorFlow_{jt_m}}{\partial GRF_{t_m}} |_{Type_j=0}.$$

For the decomposition, we nevertheless parameterize the baseline group's end-investor-flow sensitivity as γ_0. This parameter is not identified in the above specification; it is introduced to separate (i) the baseline group's total holdings response (which is normalized to zero in the relative-effect presentation of the holdings-sensitivity regression) from (ii) the baseline group's end-investor-flow channel, which must be accounted for when mapping estimated flow sensitivities into holdings responses.

Second, we incorporate realized investor flows directly into the security-level holdings regression (with $InvestorFlow_{jt} = \frac{1}{3}\sum_{t_m \in t} InvestorFlow_{jt_m}$ and $GRF_t = \frac{1}{3}\sum_{t_m \in t} GRF_{t_m}$) by estimating

$$FLOW_{ijt} = \beta_1 GRF_t \times Type_j + \beta_2 InvestorFlow_{jt} + \beta_3 InvestorFlow_{jt} \times Type_j + \mu_{f,s,t} + \xi_{f,s,j} + \omega_{ijt}.$$

The fixed effects and inference structure mirror those used in the baseline holdings-sensitivity specification. This regression separates three distinct channels through which global risk affects security-level trades. β_2 measures the pass-through of end-investor flows into asset sales, that is, how investor redemptions translate mechanically into reductions in holdings; β_3 captures the incremental pass-through for funds of type j, indicating whether certain fund structures transmit flows more (or less) aggressively into trades; β_1 identifies stress-induced portfolio rebalancing independent of contemporaneous investor flows, reflecting discretionary or rule-based adjustments in portfolio composition that occur even absent redemptions.

Third, taking the derivative of holdings with respect to global risk as

$$\frac{\partial FLOW_{ijt}}{\partial GRF_t} = \beta_1 Type_j + \beta_2 \frac{\partial InvestorFlow_{jt}}{\partial GRF_t} + \beta_3 \frac{\partial InvestorFlow_{jt}}{\partial GRF_t} Type_j$$

And substituting the estimate from the baseline fund security holding regression yields:

$$\tau_1 = \beta_1 + \beta_2\gamma_1 + \beta_3\gamma_0 + \beta_3\gamma_1,$$

Given these coefficient definitions, each product on the RHS isolates a distinct margin of adjustment by holding one mechanism fixed while varying the other. The term $\beta_2\gamma_1$ fixes the pass-through at the baseline level (β_2) and captures the additional asset sales that arise solely because Type j funds experience larger investor redemptions in response to global risk. Conversely, $\beta_3\gamma_0$ fixes investor-flow sensitivity at the baseline level (γ_0) and measures the incremental sales that occur because Type j funds translate a given redemption into trades more aggressively, reflecting structural differences in liquidity management or trading technology. The interaction $\beta_3\gamma_1$ allows both margins to vary simultaneously and captures the compounding effect when funds face larger outflows and pass those flows through more strongly. Together with β_1, which captures rebalancing independent of flows, these terms separate investor-driven, structural, and discretionary channels of adjustment.

[14] The country fundamentals include vintages of WEO forecasts of the following year's real GDP growth, and inflation, real ex-ante policy rate calculated from subtracting inflation forecasts from a country's policy rate, long-term yield differential between domestic and US, short-term deposit rate differential between domestic and US, an equally weighted composite of ICRG institutional and political risk sub-indices, foreign exchange reserves to GDP, private sector credit to GDP, Chinn-Ito financial openness index, real effective exchange rate gap.

The results of the decomposition are summarized in Online Annex Figure 2.4.13 panels 1 and 2. Passive funds retrench more sharply from emerging market assets than active funds because investor outflows translate more directly into asset sales, reflecting limited use of internal liquidity buffers, and because passive funds engage in more pronounced stress-induced portfolio rebalancing. This rebalancing does not reflect changes in benchmark composition but rather liquidity management. ETFs, mostly passive, demonstrate strong passthrough from investor flows to asset sales and have a somewhat more stress-sensitive investor base than mutual funds. Institutional funds experience larger investor redemptions during periods of global stress, consistent with more procyclical portfolio adjustments by professional investors, while retail-oriented funds, on aggregate, exhibit higher passthrough from investor flows to asset sales. These findings suggest that vulnerability depends not only on who redeems, but also on how fund structures translate redemptions into security-level selling pressure.[15] Among passive funds, institutional mandates seem to be able to smooth adjustments while active institutional funds seem serve performance-sensitive investors whose withdrawals are larger, leading to greater passthrough and higher sensitivity[16]. Overall, these decompositions indicate that the observed heterogeneity arises not from any single attribute, but from specific combinations of vehicle design, investor base, and portfolio management constraints.

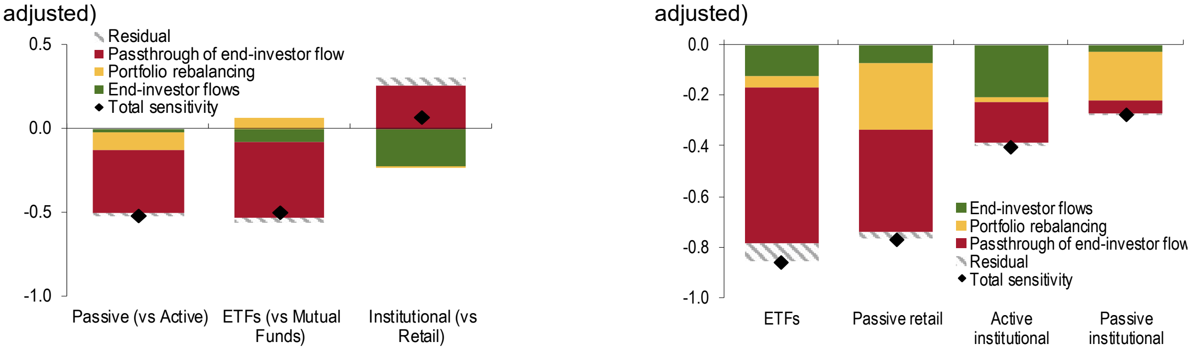
Online Annex Figure 2.4.13. Decomposition of Emerging Market Flow Sensitivity to VIX across Fund Characteristics

End-investor flows, their passthrough, and portfolio rebalancing are drivers of changes in nonresident holdings.

Differences in flow sensitivity across fund types reflect distinct combinations of investor behavior and fund structures.

1. Decomposition of Non-Residents' Emerging Market Flow Sensitivity to VIX Across Fund Characteristics
(Percentage point, relative to initial holdings, valuation-adjusted)

2. Decomposition of Non-Residents' Emerging Market Flow Sensitivity to VIX by Fund Type Combinations
(Percentage point, relative to initial holdings, valuation-adjusted)



Sources: FactSet; Lipper, MSCI, and IMF staff calculations.
Note: The panels decomposes funds' emerging market holdings sensitivity to a one–standard deviation increase in the CBOE Volatility Index (VIX) reported in Figure 2.8 panel 3 and 4 of the chapter into (i) the sensitivity of end-investor flows to VIX, (ii) the passthrough of those flows to emerging market asset sales, and (iii) portfolio rebalancing independent of flows; the decomposition is obtained using two auxiliary regressions in addition to the baseline regression for total sensitivity. Each column in panel 1 decomposes the VIX sensitivity of a given fund type, measured relative to its baseline (shown by the black diamond), into the three components and a residual, displayed as colored segments in the stacked bars. Panel 2 applies the same decomposition at a more granular level, estimating the incremental VIX sensitivity for mutually exclusive fund groups relative to a common baseline (Retail, Active Mutual Funds), the largest category in the sample.

Emerging Market-Targeted vs Emerging Market-Invested Funds. Emerging market-targeted funds are significantly more sensitive to global risk than emerging market-invested funds (Online Annex Figure 2.4.14, panel 1). This heightened sensitivity is associated in part with a more risk-responsive end-investor base (larger ETF presence seen in Online Annex Figure 2.4.14, panel 3). Emerging market-targeted funds also exhibit stronger stress-induced portfolio rebalancing, consistent with active precautionary liquidity management in the presence of higher liquidity mismatch between redeemable liabilities and relatively illiquid emerging market assets. Finally, exposure to emerging market-targeted funds is more concentrated in equities (Online Annex Figure 2.4.14, panel 2), implying that global risk shocks are more likely to be transmitted through emerging market-Targeted funds to emerging market equity markets.

[15] More granular investment fund breakdowns show that the sensitivities of ETFs and passive retail funds are driven by high passthrough and rebalancing while the sensitivities of institutional active mutual funds reflect more procyclical redemptions and limited ability to smooth adjustments. See Figure 2.4.13, panel 2.

[16] Salganik-Shoshan (2016) shows that institutional mutual fund investors exhibit more performance-sensitive and correlated flow behavior, implying larger and more synchronized withdrawals and higher passthrough to portfolio adjustments in institutional active funds.

Online Annex Figure 2.4.14. Emerging Market-Targeted vs Emerging Market-Invested Funds

Emerging market-targeted funds are significantly more sensitive to the VIX than emerging market-invested funds, mostly due to portfolio rebalancing and a more sensitive end-investor base.

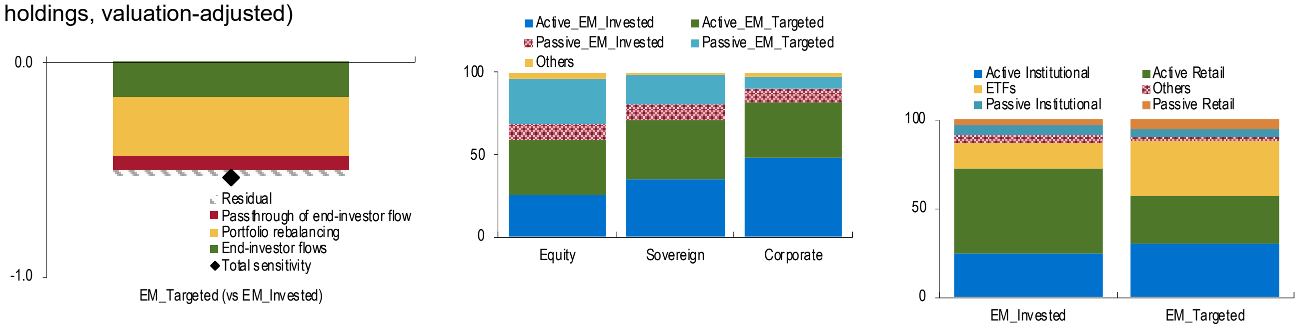
The higher presence of passive emerging market-targeted vehicles in emerging market equities increases the sensitivity of flows to rebalancing.

Emerging market-invested funds are predominantly active retail vehicles, whereas emerging market-targeted funds have a larger ETF presence.

1. Decomposition of Non-Residents' Flow Sensitivity to VIX for Emerging Market-Targeted funds relative to Emerging Market-Invested Funds
(Percentage point, relative to initial holdings, valuation-adjusted)

2. Share of Nonresident Emerging Market Holdings in Emerging Market-Targeted/Invested Funds Across Passive/Active strategies, 2025:Q3
(Percent)

3. Composition of fund types within Emerging Market-Targeted/Invested Funds, 2025:Q3
(Percent)



Sources: FactSet; Lipper, MSCI, and IMF staff calculations.
Note: Panel 1 decomposes emerging market-targeted funds' emerging market holdings sensitivity (relative to emerging market-invested funds) to a one–standard deviation increase in the CBOE Volatility Index (VIX) into (i) the sensitivity of end-investor flows to VIX, (ii) the passthrough of those flows to emerging market asset sales, and (iii) portfolio rebalancing independent of flows; the decomposition is obtained using two auxiliary regressions in addition to the baseline regression for total sensitivity. For detailed methodology, see Online Annex 3.2. Panel 2 shows the share of each nonresident fund type in total nonresident emerging market holdings by asset class, highlighting exposure across investor categories. Panel 3 presents the composition (in terms of nonresident emerging market holdings) of emerging market-targeted and emerging market-invested funds along three dimensions: investment style (active versus passive), investor type (institutional versus retail), and ETFs as a distinct category. EM=Emerging Market.

<u>*Alternative fixed effect structures.*</u> To disentangle fund-type effects from security-composition effects, we replace the baseline fund × issuer × security-type and issuer × security-type × time fixed effects with fund × security and security × time fixed effects. This specification absorbs all time-varying heterogeneity at the individual security level, including differences in ratings, currency denomination, maturity, and liquidity. The results (See Online Annex Figure 2.4.15) remain robust under this more stringent control structure, indicating that the estimated sensitivities are not driven by security composition but reflect differential behavior across fund types holding the same securities.

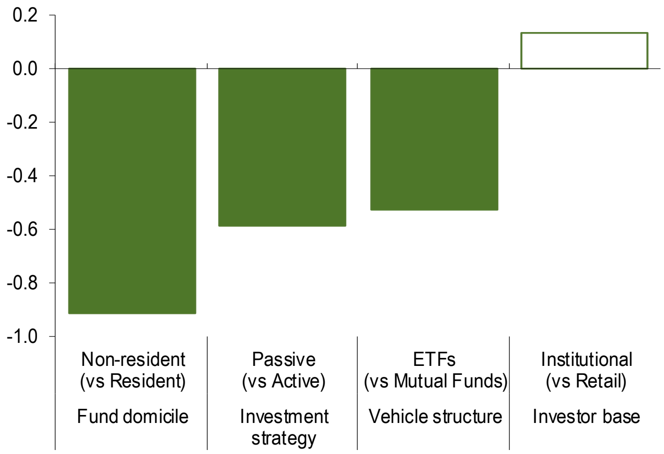
Online Annex Figure 2.4.15. Sensitivity of Nonresident Investment Funds' Emerging Market Holdings to the VIX (Alternative Fixed Effect structure)

Nonresident nonbank financial investors decrease their emerging market investments more than resident investors when global risk rises.

Sensitivity to global risk shock varies across types of nonbank financial intermediaries.

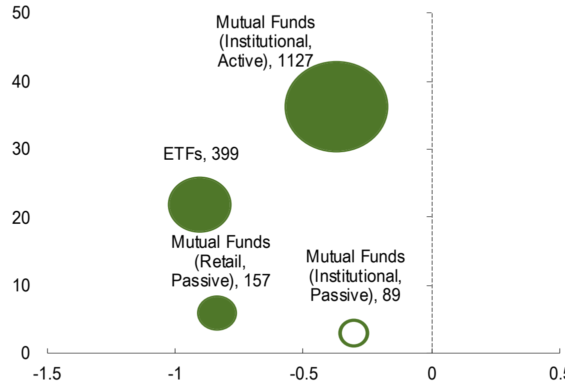
1. Change in Nonresident Investments of Different Types of Investment Funds for an increase in the VIX

(Percentage points, relative to initial holdings, valuation-adjusted)



2. Change in Nonresident Investments, by Investment Fund Type and Characteristic for an increase in the VIX

(Percentage points, relative to initial holdings, valuation-adjusted)



Sources: FactSet; Lipper; and IMF staff calculations

Note: Panel 1 reports emerging market holding sensitivities from separate regressions, with coefficients interpreted relative to each column's omitted group(columns 2-4 are restricted to nonresident emerging market holdings). Panel 2 reports sensitivities from a single regression across mutually exclusive fund groups relative to a common base category (Mutual Funds: Retail, Active); the marker position shows the estimate, the marker size and height indicate the number of funds and the group's share of holdings in the data, respectively. Regressions include fund – issuer–security type and issuer–security type–time fixed effects. Solid bars (or circles) indicate statistical significance at 10 percent or lower. See Online Annex 2.4 for details. VIX = Chicago Board Options Exchange Volatility Index.

Online Annex 2.5. What are the macro-financial implications?

*<u>Impacts on volumes and spreads of international bond issuance</u>***.** To examine whether sovereigns or corporates with an ex-ante 'flighty' investor base tend to experience a decline in debt issuances or higher spreads in international markets during periods of global stress, we estimate

$$Y_{i,t_d} = \alpha + \beta_1 \cdot Flighty_{c,t_q-1} + \beta_2 \cdot GRF^D_{t_w-1} + \beta_3 \cdot \left(Flighty_{c,t_q-1} \cdot GRF^D_{t_w-1}\right) + Control + F.E. + \varepsilon_{i,t_d}. \qquad (2.5.1)$$

where, Y_{i,t_d} denotes (i) the logarithm of the volume issued of international bond i on day t_d ; or (ii) the bond's spread (in basis points). $Flighty_{c,t_q-1}$ represents the share of flighty investors in each emerging market sovereign and corporate bond market, measured as average over the preceding four quarters from.[17] $GRF^D_{t_w-1}$ is a dummy variable equal to one if the average VIX over the preceding week, from $t_d - 7$ to $t_d - 1$, exceeds the 90th percentile, and zero otherwise.[18] Control variables include rating, duration, subordination, callability, floating-rate and fixed-rate indicators, the coupon rate (for the volume regression), and the logarithm of issuance volume (for the spread regression). For corporate bond issuance, additional firm-level controls—log total assets, log total cash holdings, Tobin's q, leverage ratio, and ROA at $t_q - 1$—are included.[19] Fixed effects for country, currency, and time are incorporated, and sector fixed effects are added for corporate bonds. The set of controls broadly follows Coppola (2025). The dependent variable Y_{i,t_d} is winsorized at the one-percent level on both tails. The effect of a one-percentage-point increase in the share of flighty investors is captured by $\hat{\beta}_1$ in normal times

[17] Flighty investors are defined, separately for sovereign and corporate bond markets, as the top quintile of nonresident investors with the highest sensitivity to the VIX. The share of flighty investors is around 1 percent on average across emerging market sovereign and corporate bond markets, and up to 14 percent in some countries. While the analysis seeks to identify the impact of investor composition on bond issuance, issuance itself may attract particular investors. To address this, investor composition is lagged by one quarter.

[18] While the analysis examines the effect of the VIX on bond issuance, issuance activity may in turn influence the VIX. Accordingly, the VIX is measured using information lagged by one day.

[19] In this section, the analysis is conducted using data up to 2024.

and by $\hat{\beta}_1 + \hat{\beta}_3$ during stress periods. The results during stress periods are reported in panel 1 of Figure 2.11, while those in normal times are presented in panel 1 of Online Annex Figure 2.5.1.[20]

Impacts on domestic bond issuances and syndicated loan markets. Whether tightening financial conditions in international bond markets spill over to domestic bond issuance and syndicated loan markets is examined by estimating:

$$X_{i,t_d} = \alpha + \beta_1 \cdot Flighty_{c,t_q-1} + \beta_2 \cdot GRF^D_{t_w-1} + \beta_3 \cdot \left(Flighty_{c,t_q-1} \cdot GRF^D_{t_w-1}\right) + Control + F.E. + \varepsilon_{i,t_d}. \quad (2.5.2)$$

where, X_{i,t_d} is (i) the logarithm of the volume of domestic bond issuance i on day t_d; or (ii) the logarithm of the volume of syndicated loan i on day t_d.[21] For the domestic bond market analysis, all other specifications mirror those in equation (2.5.1).[22] For syndicated loans, firm-level controls—log total assets, log cash holdings, Tobin's q, leverage ratio, and ROA at $t_q - 1$—are included, along with country, currency, time, and sector fixed effects. The dependent variable X_{i,t_d} is winsorized at the one-percent level on both tails. Then, the impact of a one-percentage-point increase in the share of flighty investors during stress periods is given by $\hat{\beta}_1 + \hat{\beta}_3$. The results are shown in panel 2 of Figure 2.11.

*Impacts on emerging market firms' deleveraging and investments***.** For firms with greater reliance on flighty investors, access to international bond markets becomes constrained during stress periods. As no substitution toward domestic bond markets or syndicated loan markets is observed, we further examine the implications for firms' balance sheets and investment decisions. Specifically, we estimate:

$$Z_{j,t_q} = \alpha + \beta_1 \cdot Flighty_{c,t_q-1} + \beta_2 \cdot GRF^D_{t_q-1} + \beta_3 \cdot \left(Flighty_{c,t_q-1} \cdot GRF^D_{t_q-1}\right) + Control + F.E. + \varepsilon_{j,t_q}, \quad (2.5.3)$$

where the dependent variable Z_{j,t_q} denotes either firm j's total debt or capital expenditure in quarter t_q, each scaled by total assets in the previous year. $GRF^D_{t_q-1}$ equals one if the VIX in quarter $t_q - 1$ exceeds the 80th percentile. Control variables include log total assets, log cash holdings, Tobin's q, leverage ratio, and ROA at $t_q - 1$. Firm and time fixed effects are included, and both dependent variable Z_{j,t_q} and control variables are winsorized at the one-percent level on both tails. The effect during stress periods is given by $\hat{\beta}_1 + \hat{\beta}_3$. The results are presented in panel 2 of Figure 2.11.

[20] Chinese issuers account for about 10 percent of the observations in the sovereign bond sample and roughly 60 percent in the corporate bond sample. Excluding China does not materially affect the baseline results.

[21] The distinction between international and domestic bond markets is based on whether bonds are marketed internationally or not

[22] Since ultra-long-term bond issuance is expected to be less affected by firms' and sovereigns' short-term decision to issue in international or domestic bond markets during stress episodes, the sample is restricted to bonds with a duration of up to ten years. Including bonds with maturity above ten years yields qualitatively similar but statistically insignificant results.

Online Annex Figure 2.5.1 Impact of Greater Reliance on Flighty Investors

In normal times, emerging market issuers with ex-ante greater reliance on flighty investors do not issue less debt or experience higher spreads.

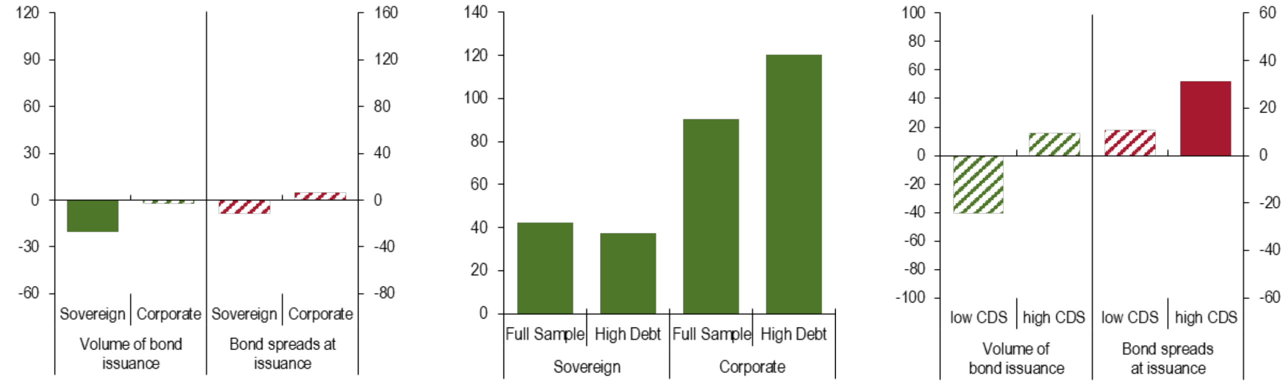
The impact of greater reliance on flighty investors on bond spreads appears more pronounced for emerging market firms with preexisting vulnerabilities.

During stress episodes, issuers with higher CDS spreads tend to face higher bond spreads at issuance.

1. Volume and Spreads of Bond Issuance by Issuers with Higher Ex-ante Reliance on Flighty Investors
(LHS: Percentage points, RHS: Basis points)

2. Bond Spreads at Issuance of Issuers with Preexisting Vulnerabilities
(Basis points)

3. Volume and Spreads of Sovereign Bond Issuance and CDS Spreads
(LHS: Percentage points, RHS: Basis points)



Sources: Dealogic; FactSet; WorldScope; FRED; and IMF staff calculations.
Notes: Impact of a one-percentage-point increase in the share of flighty investors, from a regression of (log) issuance volume or bond spreads on bond, firm, and country-level controls. Stress episodes correspond to the top decile of the Chicago Board Options Exchange Volatility Index. Solid bars indicate a 10 percent significant level. "High Debt" in panel 2 corresponds to the estimates based on the sample of sovereigns with an above median public debt-to-GDP ratio, or firms with above sector-specific-median leverage ratio. Panel 3 presents the results for sovereign bond issuance during stress episodes using the level of sovereign CDS spreads instead of public debt-to-GDP ratio. Based on the distribution of sovereign CDS spreads in the sample low (high) CDS issuers are defined as those below (above) the 45th percentile.

Amplified effects for emerging market issuers with preexisting vulnerabilities. Returning to equation (2.5.1), we next examine whether the effects of reliance on flighty investors vary with issuers' preexisting vulnerabilities. Vulnerabilities are proxied by debt levels: sovereign issuers are classified as vulnerable if their public debt-to-GDP ratio exceeds the sample median, while corporate issuers are classified as vulnerable if their leverage ratio exceeds the industry-specific median. The corresponding specification is:

$$Y_{i,t_d} = \alpha + \gamma_1 \cdot w_j^D \cdot \left(\beta_1 \cdot Flighty_{c,t_q-1} + \beta_2 \cdot GRF_{t_w-h}^D + \beta_3 \cdot \left(Flighty_{c,t_q-1} \cdot GRF_{t_w-h}^D\right)\right) + Control + F.E. + \varepsilon_{i,t_d}. \quad (2.5.4)$$

Here, w_j^D is a dummy equal to one if the issuer j is classified as vulnerable and zero otherwise. To allow for persistent responses to stress, $GRF_{t_w-h}^D$ is constructed using lags $h = 4$ (approximately one month). All other specifications follow equation (2.5.1). The effect of a one-percentage-point increase in the share of flighty investors for vulnerable issuers during stress periods is given by $\hat{\gamma}_1 \cdot (\hat{\beta}_1 + \hat{\beta}_3)$. Volume results are reported in panel 3 of Figure 2.11, while spread results are presented in panel 2 of Online Annex Figure 2.5.1. Furthermore, while debt-to-GDP ratio remains a parsimonious and widely used summary indicator of accumulated vulnerabilities, governments' debt carrying capacity depends on broader macroeconomic and institutional fundamentals—including growth prospects, fiscal space and policy credibility. To this end, as a robustness check, spreads of sovereign credit default swap are used instead of public debt-to-GDP ratio, but the key empirical results are largely unchanged (Online Annex Figure 2.5.1, panel 3).

Growth-at-Risk. The growth-at-risk (GaR) for a panel of countries is defined as

$$y_{i,t+h}^{(\tau)} = \beta_{h,i}^{(\tau)} + \beta_{h,t}^{(\tau)} + \beta_{h,y}^{(\tau)} y_{i,t} + \beta_{h,FCI}^{(\tau)} FCI_{i,t} + \beta_{h,flighty}^{(\tau)} FLIGHTY_{i,t} + \beta_{h,inter}^{(\tau)} VIX_t FLIGHTY_{i,t} + \epsilon_{i,t+h}^{(\tau)}$$

where $y_{i,t+h}^{(\tau)}$ represents h-quarter ahead GDP growth for country i realized at $t + h$ (annualized), $\beta_{h,i}^{(\tau)}$ and $\beta_{h,t}^{(\tau)}$ indicate country-specific and time-specific constant terms, respectively. $y_{i,t}$ is realized GDP growth at t and $FCI_{i,t}$ is country i's financial conditions index. τ denotes the quantile level ($\tau = 0.05, 0.10, \ldots, 0.95$) and h is the forecasting horizon in quarters (e.g., h=1,…,12). The model is extended to include a measure of the degree of the flighty investor base ($FLIGHTY_{i,t}$) and its interaction with the VIX, as follows:

$$y_{i,t+h}^{(\tau)} = \beta_{h,i}^{(\tau)} + \beta_{h,t}^{(\tau)} + \beta_{h,y}^{(\tau)} y_{i,t} + \beta_{h,FCI}^{(\tau)} \overline{FCI}_{i,t} + \beta_{h,flighty}^{(\tau)} FLIGHTY_{i,t} + \beta_{h,inter}^{(\tau)} VIX_t FLIGHTY_{i,t} + \epsilon_{i,t+h}^{(\tau)}$$

where $\overline{FCI}_{i,t}$ is the residuals from regressing the original financial conditions index on the VIX, country fixed effects and time fixed effects, and therefore is orthogonal to the VIX. The model is estimated for the panel of 18 emerging markets with available data from 2013q4 to 2024q1. Standard errors are bootstrapped. Figure 13 in the main text shows the estimated results.

Online Annex 2.6. Cross-Border Stablecoin Flows to Emerging Markets: An Overview

This section summarizes the underlying cross-border crypto-asset dataset, methodology, and additional results supporting the analysis in Box 2.2, which examines the trends and drivers of cross-border stablecoin flows to emerging markets.

Measuring cross-border stablecoin flows

Measuring cross-border stablecoin flows is challenging as the residency of transacting parties is not directly observable, as with unbacked crypto assets. Accordingly, existing estimates rely on allocation assumptions that differ across methodologies (Cerutti and others 2025; Cardozo and others 2024; and Reuter 2025). Similar to Auer and others (2025) and Cerutti and others (2025), the analysis in this box utilizes data from Chainalysis, which observes on-chain transfers between crypto wallets and allocates these wallets to exchanges using a proprietary algorithm. The exchanges are then allocated to countries based on country-specific web-traffic patterns. The resulting dataset, available at daily frequency for bilateral gross and net flows between countries, covers the two largest unbacked crypto-assets, BTC and ETH, and the two largest stablecoins, Tether (USDT) and USD Coin (USDC), in addition to other assets, from January 2019 to February 2025.

The dataset is further prepared for analysis as follows. First, Chainalysis classifies exchange-to-exchange transfers as “direct” and flows that pass through non-exchange wallets or extra transactions as “indirect”; these two series are summed to obtain gross and net flows for each asset (BTC, ETH, USDT and USDC). Second, to mitigate potential measurement error from web-traffic–based country assignments, all bilateral flows are aggregated by destination country to derive country-level gross and net inflows. Third, to focus on longer-term dynamics, daily flows are aggregated to monthly frequency for the regression analysis (and to lower frequencies as needed). Finally, residual observations not allocated to a specific country (classified as “defi” by Chainalysis) and domestic (within-country) flows are excluded.

Additional stylized facts

In addition to the stylized facts presented in the box, three observations are noteworthy. First, the large share of emerging market-related cross-border stablecoin activity reflects both within-group and across-group flows—the latter primarily with advanced economies—while low-income countries (LICs) account for only a very small fraction of overall gross volume (Online Annex Figure 2.6.1, panel a). Second, in terms of the geographical distribution, Asia accounts for the largest share of cross-border stablecoin activity, followed by Europe and the Americas, whereas activity in Oceania and Africa remains limited (Online Annex Figure 2.6, panel b). Third, unlike the patterns observed when inflows are scaled by GDP, in nominal terms several large emerging markets—such as Russia, India, Türkiye, and Brazil—rank among the largest recipients of gross stablecoin inflows, with volumes comparable in magnitude to those observed in the largest advanced economy recipients (Online Annex Figure 2.6, panel c).[23]

Panel regression

To examine the drivers of gross stablecoin inflows into emerging markets, the following panel-regression specification is considered:

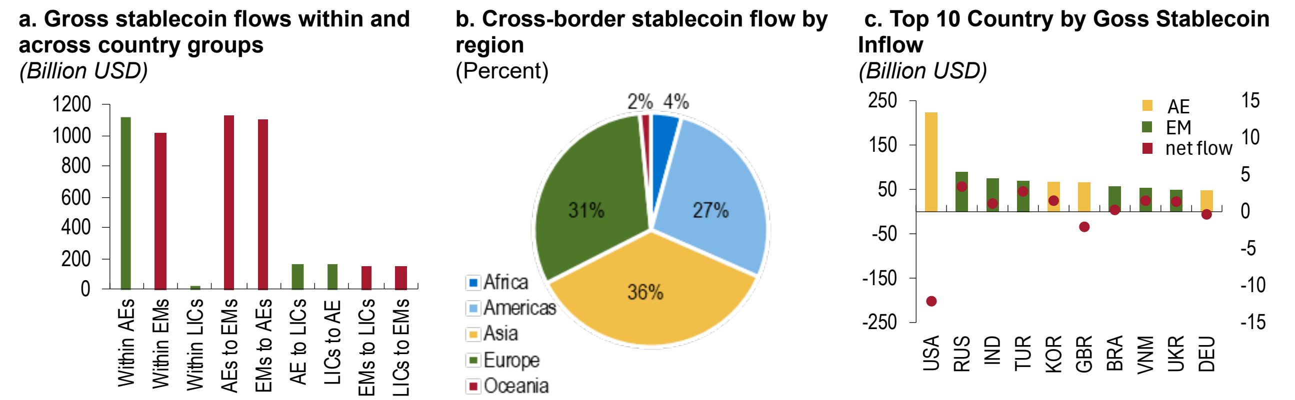
$$SCgrossinflowGDP_{i,t} = \alpha + \boldsymbol{\beta Domestic_{i,t-1}} + \boldsymbol{\gamma Global_t} + \boldsymbol{\lambda Crypto_t} + trend_t + \epsilon_{i,t},$$

where $SCgrossinflowGDP_{i,t}$ denotes the sum of USDC and USDT gross inflows into country i in month t, scaled by GDP; $\boldsymbol{Domestic_{i,t-1}}$, $\boldsymbol{Global_t}$, and $\boldsymbol{Crypto_t}$ are vectors of country-specific, global, and crypto-market-specific factors, respectively; and $trend_t$ captures a linear time trend. Country-specific factors include inflation, volatility of the bilateral exchange rate relative to the U.S. dollar, a measure of institutional and policy stability, and an indicator of access to short-term dollar assets, proxied by the presence of U.S.-dollar-asset money market funds domiciled in the country.[24] To examine the relevance of economic flows that may drive stablecoin transactions, the specification also includes exports-to-GDP, financial-flows-to-GDP, remittance-flows-to-GDP,

[23] In net terms, Russia, Türkiye, Vietnam, Korea, and Ukraine are the largest recipients in 2024.
[24] Except in one EM, where access to short-term U.S.-dollar assets is via an exchange-traded fund (ETF)

and (unbacked) crypto-flows-to-GDP (the sum of BTC and ETH). All time-varying domestic factors are lagged to reduce endogeneity concerns arising from reverse causality. Global factors attempt to capture global financial conditions, including global funding costs (proxied by the effective federal funds rate), global risk aversion (the VIX), and the value of the U.S. dollar (the dollar index: DXY). Finally, crypto specific factors include the growth rate of Bitcoin supply, the volatility of Bitcoin price, and BTC returns in U.S. dollar terms. With more detail on the variable construction provided in Online Annex Table 2.2, the resulting monthly dataset comprises 18 emerging markets between January 2019 to February 2025. The baseline regression is estimated through pooled ordinary least squares, with standard errors clustered at the country level, while fixed effects are included in robustness exercises. All continuous variables are standardized.

Online Annex Figure 2.6.1. Cross-Border Stablecoin Flows by Country Group, Region and Top 10 Recipient



Source: Chainalysis and IMF staff calculations.
Note: Stablecoin flows are computed from the sum of gross USDC and USDT flows. Panels a and b are based on 2019-2024 data, while Panel c is based on 2024. AEs: Advanced Economies, EMs: Emerging Markets, and LICs: Low-Income Countries.

Results from baseline regression and robustness exercises

Online Annex Table 2.6.1 reports the regression coefficients for the baseline specification—as shown in Box Figure 2.2.1.d—in Column 1, while the additional columns present results from robustness exercises. Columns 2 and 3 show estimates from augmenting the baseline specification with time- and country-fixed effects, respectively. Comparing coefficients across the three columns indicates that the baseline results are robust to the inclusion of time fixed effects. Baseline results for country-specific factors are weaker once country fixed effects are included, suggesting that much of the variation underlying the baseline estimates reflects cross-country differences—an expected outcome given the relatively short sample period and the persistence of country-specific fundamentals. Notably, inflation remains statistically significant even after controlling for country fixed effects, which may reflect the strength of the relationship through sizable shifts in inflation through the sample period.[25]

Column 4 reports results from an additional specification in which unbacked-crypto gross inflows (the sum of BTC+ETH) as a percent of GDP are instead used as the dependent variable, controlling for the same set of variables as well as stablecoin flows as a percent of GDP. This exercise serves as a falsification check to assess whether the significance of domestic macroeconomic and institutional variables in the stablecoin specification reflects a stablecoin-specific channel or broader crypto-market behavior. Comparing Columns 1 and 4, the contrast in results points to distinct underlying use cases. The significance of inflation, exchange-rate volatility, institutional and political stability, and limited access to on-shore cash-like U.S.-dollar instruments (proxied by MMF access) in the baseline regression is consistent with stablecoins functioning as "digital dollars" used to manage macroeconomic risk and navigate domestic financial frictions. By contrast, in the unbacked crypto specification, these domestic variables are no longer statistically significant, indicating that unbacked crypto behaves more like a risk asset driven primarily by crypto-market dynamics and global risk factors rather than domestic "dollar-access" constraints. Finally, the differential responses to global risk aversion (negative versus positive coefficient) are also consistent with their respective roles as speculative versus safe assets.

[25] The regression results remain robust to correcting for unusual spikes in USDT flows in April 2024, which appear to reflect a data anomaly.

Online Annex Table 2.6.1. Regression Analysis of Cross-Border Stablecoin Flows to Emerging Markets

	(1) Stablecoin flow / GDP	(2) Stablecoin flow / GDP	(3) Stablecoin flow / GDP	(4) Crypto flow / GDP
Inflation	0.072***	0.064***	0.042**	-0.006
	(0.020)	(0.018)	(0.015)	(0.015)
FX volatility	0.023*	0.009	0.019	0.005
	(0.013)	(0.014)	(0.013)	(0.015)
Institutional and political stability	-0.067*	-0.058*	-0.089	-0.030
	(0.037)	(0.033)	(0.062)	(0.028)
Export/GDP	0.072**	0.057*	-0.034	0.055**
	(0.033)	(0.030)	(0.117)	(0.020)
Financial flow/GDP	-0.015	-0.011	0.001	0.011
	(0.011)	(0.011)	(0.010)	(0.011)
Remittance flow/GDP	0.190***	0.166***	0.285	0.045
	(0.044)	(0.039)	(0.170)	(0.065)
Crypto flow/GDP	0.620***	0.716***	0.490***	
	(0.071)	(0.066)	(0.085)	
Stablecoin flow/GDP				0.493***
				(0.105)
No US-linked MMF Access	0.107**	0.100**		0.023
	(0.047)	(0.040)		(0.060)

	(1) Stablecoin flow / GDP	(2) Stablecoin flow / GDP	(3) Stablecoin flow / GDP	(4) Crypto flow / GDP
Dollar returns	-0.022**		-0.018	-0.019***
	(0.010)		(0.010)	(0.005)
Federal funds rate	-0.084*		-0.142***	-0.427***
	(0.045)		(0.036)	(0.088)
VIX	0.019*		0.002	-0.183***
	(0.010)		(0.008)	(0.025)
Bitcoin supply	0.074***		0.086***	0.160***
	(0.025)		(0.021)	(0.027)
Bitcoin price volatility	0.023**		0.029***	0.092***
	(0.010)		(0.010)	(0.015)
Bitcoin returns	-0.006		-0.018***	-0.017
	(0.007)		(0.006)	(0.011)
Trend	0.018***		0.021***	0.017***
	(0.003)		(0.003)	(0.006)
Observations	1,098	1,098	1,098	1,098
R-squared	0.687	0.792	0.717	0.580
Time fixed effects	No	Yes	No	No
Country fixed effects	No	No	Yes	No

Source: Chainalysis and IMF staff calculations.
Note: Stablecoin flows are computed from the sum of gross USDC and USDT flows. Crypto flows refer to unbacked crypto flows, computed from the sum of BTC and ETH. For detail on variable definition and sources, see Online Annex Table 2.2. The inclusion of country fixed effects precludes the MMF-access variable as it does not vary through time.

References

Adrian, Tobias, Daniel Stackman, and Erik Vogt. 2019. “Global Price of Risk and Stabilization Policies.” *IMF Economic Review* 67(1): 215–260.

Ahir, Hites, Nicholas Bloom, and Davide Furceri. 2022. “The World Uncertainty Index.” NBER Working Paper 29763, National Bureau of Economic Research, Cambridge, MA.

Akinci, Ozge. 2013. “Global Financial Conditions, Country Spreads, and Macroeconomic Fluctuations in Emerging Markets.” *Journal of International Economics* 91(2), 358–371.

Akinci, Ozge, and Alberto Queralto. 2024. “Exchange Rate Dynamics and Monetary Spillovers with Imperfect Financial Markets.” *Review of Financial Studies* 37(2), 309–355.

Arslanalp, Serkan, Dimitris Drakopoulos, Rohit Goel, and Robin Koepke. 2020. “Benchmark-driven Investments in Emerging Market Bond Markets: Taking Stock.” IMF Working Paper 20/192. International Monetary Fund, Washington, DC.

Avdjiev, Stefan, Bryan Hardy, Şebnem Kalemli-Özcan, Luis Servén. 2022. “Gross Capital Flows by Banks, Corporates, and Sovereigns.” *Journal of the European Economic Association* 20(5), 2098–2135.

Auer, Raphael, Ulf Lewrick, and Jan Paulick. 2025. “DeFiying Gravity? An Empirical Analysis of Cross-Border Bitcoin, Ether and Stablecoin Flows.” BIS Working Paper 1265. Bank for International Settlements, Geneva, Switzerland.

Cardozo, Pamela, Andrés Fernández, Jerzy Jiang, and Felipe Rojas. 2024. “On Cross-Border Crypto Flows: Measurement, Drivers, and Policy Implications.” IMF Working Paper 24/261. International Monetary Fund, Washington, DC.

Cerutti, Eugenio, Stijn Claessens, and Damien Puy. 2019a. “Push Factors and Capital Flows to Emerging Markets: Why Knowing your Lender Matters more than Fundamentals.” *Journal of International Economics* 119, 133–149.

Cerutti, Eugenio, Stijn Claessens, and Andrew K. Rose. 2019b. “How Important is the Global Financial Cycle? Evidence from Capital Flows.” *IMF Economic Review* 67, 24–60.

Cerutti, Eugenio, and Stijn Claessens. 2024. “The Global Financial Cycle: Quantities versus Prices.” IMF Working Paper 24/158. International Monetary Fund, Washington, DC.

Cerutti, Eugenio, Jiaqian Chen, and Martina Hengge. 2025. “A Primer on Bitcoin Cross-Border Flows: Measurement and Drivers.” *Journal of International Money and Finance*, 159, 103424.

Chari, Anusha. 2023. “Global Risk, Non-bank Financial Intermediation, and Emerging Market Vulnerabilities.” *Annual Review of Economics* 15: 549–572.

Converse, Nathan, Eduardo Levy-Yeyati, and Tomas Williams. 2023. “How ETFs Amplify the Global Financial Cycle in Emerging Markets.” *Review of Financial Studies* 36(9): 3423–3462.

Coppola, Antonio. 2025. “In Safe Hands: The Financial and Real Impact of Investor Composition over the Credit Cycle.” *Review of Financial Studies* 38: 2275–2325.

Fang, Xiang, Bryan Hardy, and Karen K. Lewis. 2025. “Who Holds Sovereign Debt and Why it Matters.” *The Review of Financial Studies* 38: 2326–2361.

Fricke, Daniel. 2025. “Synthetic Leverage and Fund Risk-Taking.” *Journal of International Money and Finance*, *forthcoming*.

Gabaix, Xavier, and Ralph S. J. Koijen. 2024. “Granular Instrumental Variables.” *Journal of Political Economy* 132(7), 2274–2303.

Salganik-Shoshan, Galla. 2016. "Investment flows: Retail versus institutional mutual funds," Journal of Asset Management, Palgrave Macmillan, vol. 17(1), pages 34-44, January.

Gelos, Gaston R., and Shang-Jin Wei. 2005. “Transparency and International Portfolio Holdings,” *Journal of Finance* 60(6), 2987–3020.

Goldberg, Linda S. 2023. “Global Liquidity: Drivers, Volatility and Toolkits.” NBER Working Paper No. 31355. National Bureau of Economic Research, Cambridge, MA.

Greenwood, Robin, and David Thesmar. 2011. “Stock Price Fragility.” *Journal of Financial Economics* 102, 471–490.

He, Zhiguo, Bryan Kelly, and Asah, Manela. 2017. “Intermediary Asset Pricing: New Evidence from Many Asset Classes.” *Journal of Financial Economics* 126, 1–35.

Kacperczyk, Marcin, Jaromir Nosal, and Tianyu Wang, 2025. “Global Volatility and Firm-level Capital Flows.” *Journal of Financial Economics* 169, 104078.

Koont, Naz, Yiming Ma, Lubos Pastor, and Yao Zeng. 2025. “Steering a Ship in Illiquid Waters: Active Management of Passive Funds.” *The Review of Financial Studies*, *38*(10), 2887–2935.

Reuter, Marco. 2025. “Decrypting Crypto: How to Estimate International Stablecoin Flows.” IMF Working Paper 25/141. International Monetary Fund, Washington, DC.

Rey, Hélène. 2013. “Dilemma not Trilemma: The Global Financial Cycle and Monetary Policy Independence.” Proceedings – Economic Policy Symposium - Jackson Hole, Federal Reserve Bank of Kansas City, 285-333.