CHAPTER 3

Geopolitics and Financial Fragmentation: Implications for Macro-Financial Stability

Online Annex 3.1. Data Description and Sources

Online Annex Table 3.1.1. Variable Description and Data Sources

Variable	Description	Source
Geopolitical variables		
Bilateral sanction	Dummy variable equal to 1 if a financial/trade/other sanction has been imposed by source country on recipient country	Global Sanctions Database; and Kirilakha and others (2021)
Geopolitical distance	Foreign policy disagreement based on countries' voting behavior in the UN General Assembly (multiplied by –1); and alternatively, the countries' ideal point distance measure of Bailey and others (2017)	Signorino and Ritter (1999); Häge (2011); and Bailey and others (2017)
Geopolitical risk index	A measure of adverse geopolitical events and associated risks based on a tally of newspaper articles covering geopolitical tensions (index, 1985–2019=100)	Caldara and Iacoviello (2022)
Institutional quality	Average of International Country Risk Guide indicators	The International Country Risk Guide database
International military conflicts	Defined as at least 25 battle-related deaths in one calendar year	The Uppsala Conflict Data Program
Macro-financial variables		
Cross-border banking claims	Total cross-border banking claims (including loans, debt securities or other debt instruments, equity or investment fund shares, and financial derivatives) and liabilities	Bank for International Settlements, Locational Banking Statistics
VIX	Chicago Board Options Exchange's options-implied volatility index for S&P 500	Bloomberg Finance LP
Financial openness	Measuring a country's degree of capital account openness	Chinn and Ito (2006)
Investment fund portfolio equity/bond allocations	Share of a recipient country in total cross-border portfolio allocation of a source country (for equity- and bond- funds respectively, aggregated at a country-level	EPFR Global
Exchange rate regime	An index indicating the degree of exchange-rate flexibility (with higher values indicating more flexibility)	Ilzetzki and others (2021)
Long-term sovereign bond yield	Long-term (10-year or nearest equivalent) government bond yield, in percent	IMF, World Economic Outlook database
Current account balance over GDP	Current account balance over GDP, in percent	IMF, Balance of Payments
Personal transfers	All current transfers in cash or in kind made or received by resident households from nonresident households	IMF, Balance of Payments
Total (net/liability) flows over GDP	Financial liability flows minus financial asset flows excluding reserve asset flows over GDP, in percent	IMF, Balance of Payments
Portfolio investment (net/liability) flows over GDP	Portfolio liability flows minus portfolio investment asset flows over GDP, in percent	IMF, Balance of Payments
Direct investment (net/liability) flows over GDP	Direct investment inward minus direct investment outward over GDP, in percent	IMF, Balance of Payments
Bilateral foreign direct investment assets and liabilities positions	Bilateral data on foreign direct investment positions, 2000–18	European Commission, FinFlows database
Bilateral portfolio investment assets and liabilities positions	Bilateral data on portfolio investment positions, 2000–18	European Commission, FinFlows database
Bilateral foreign direct investment asset and liability positions	Bilateral data on foreign direct investment positions, 2019–21	IMF, Coordinated Direct Investment Survey
Bilateral portfolio investment asset and liability positions	Bilateral data on portfolio investment positions, 2019–21	IMF, Coordinated Portfolio Investment Survey
Real effective exchange rate (deviation from trend)	Log deviation of the real effective exchange rate from trend using an Hodrick-Prescott filter, with penalty parameter 100	IMF, Global Data Source database
Fiscal balance	General government net lending/borrowing, in percent of fiscal year GDP	IMF, World Economic Outlook database
Inflation	Change in the Consumer Price Index	IMF, World Economic Outlook database

International reserves adequacy	Total reserve assets, which includes reserve position at the IMF (BPM6), in percent of GDP	IMF, World Economic Outlook database
Real GDP growth	Real GDP growth, in percent	IMF, World Economic Outlook database
Real GDP per capita	Log of real GDP per capita	IMF, World Economic Outlook database
Real interest rate differential	Difference in real interest rates between domestic economy and the United States, in percentage points	International Financial Statistics database
Market capitalization	Free float-adjusted domestic stock market capitalization, in percent of free float-adjusted global market capitalization	Morgan Stanley Capital International database
Total factor productivity	Welfare-relevant total factor productivity at constant national prices (2017=1)	Penn World Table, version 10.0 (Feenstra and others 2015)
Consumption	Household consumption expenditure (including nonprofit institutions serving households) at current prices in national currency and at constant 2015 prices in national currency	United Nations, The National Accounts Main Aggregates Database
GDP, real	At constant 2015 prices in national currency and at constant 2015 prices in US dollars	United Nations, The National Accounts Main Aggregates Database
GDP, nominal	Nominal GDP (in US dollars)	United Nations, The National Accounts Main Aggregates Database
Imports	Imports of goods and services at constant 2015 prices in national currency and at constant 2015 prices in US dollars	United Nations, The National Accounts Main Aggregates Database
Import partner share	Import partner share (percent)	World Bank, World Integrated Trade Solution
Investment	Gross fixed capital formation (including Acquisitions less disposals of valuables) at current prices in national currency and at constant 2015 prices in national currency	United Nations, The National Accounts Main Aggregates Database
Cost of remittance	Total transaction cost in percentage of the amount sent for sending 200 US dollars charged by each single remittance service provider	World Bank, Remittance Prices Worldwide database
Financial Development Index	Financial Development Index (aggregate)	IMF, Financial Development Index database
Net foreign assets-to-GDP ratio	Net foreign assets relative to GDP	IMF, World Economic Outlook database; and IMF staff calculations
International reserves-to-GDP ratio	Total reserve assets (including reserve position at the IMF) relative to GDP	IMF, World Economic Outlook database
Bank-level variables		
Capital ratio	Total equity/total assets	Fitch Connect; and IMF staff calculations
Cost of funding	Total interest expense-to-total interest-bearing liabilities	Fitch Connect; and IMF staff calculations
Profits	Operating profits normalized by total assets	Fitch Connect; and IMF staff calculations
Liquidity ratio	Liquid assets-to-total assets ratio	Fitch Connect; and IMF staff calculations

Nonperforming loan ratio	Nonperforming loans-to-outstanding gross loans	Fitch Connect; and IMF staff calculations
Real loans	Log of gross loans outstanding (converted into domestic currency and deflated by annual average consumer price index)	Fitch Connect; and IMF staff calculations
Size	Log of total assets (in US dollars)	Fitch Connect; and IMF staff calculations

Online Annex Table 3.1.2. Advanced Economies and Emerging Market and Developing Economies Included in the Sample

Advanced Economies	Emerging Market and Developing Economies
Australia, Austria, Belgium, Canada, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong SAR, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Malta, Netherlands, New Zealand, Norway, Portugal, San Marino, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Taiwan Province of China, United Kingdom, United States	Afghanistan, Albania, Algeria, Angola, Anguilla, Antigua and Barbuda, Argentina, Armenia, Azerbaijan, The Bahamas, Bahrain, Bangladesh, Barbados, Belarus, Belize, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Brunei Darussalam, Bulgaria, Burkina Faso, Burundi, Cabo Verde, Cambodia, Cameroon, Central African Republic, Chad, Chile, China, Colombia, Comoros, Democratic Republic of the Congo, Republic of Congo, Costa Rica, Croatia, Côte d'Ivoire, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Eritrea, Ethiopia, Fiji, Gabon, The Gambia, Georgia, Ghana, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hungary, India, Indonesia, Iran, Iraq, Jamaica, Jordan, Kazakhstan, Kenya, Kiribati, Kosovo, Kuwait, Kyrgyz Republic, Lao P.D.R., Lebanon, Lesotho, Liberia, Libya, former Yugoslav Republic of Macedonia, Madagascar, Malawi, Malaysia, Maldives, Mali, Marshall Islands, Mauritania, Mauritius, Mexico, Micronesia, Moldova, Mongolia, Montenegro, Morocco, Mozambique, Myanmar, Namibia, Nepal, Nicaragua, Niger, Nigeria, Oman, Pakistan, Palau, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Qatar, Romania, Russia, Rwanda, Samoa, Saudi Arabia, Senegal, Serbia, Seychelles, Sierra Leone, Solomon Islands, Somalia, South Africa, South Sudan, Sri Lanka, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Sudan, Suriname, Swaziland, Syria, São Tomé and Príncipe, Tajikistan, Tanzania, Thailand, Timor-Leste, Togo, Tonga, Trinidad and Tobago, Tunisia, Türkiye, Turkmenistan, Tuvalu, Uganda, Ukraine, United Arab Emirates, Uruguay, Uzbekistan, Vanuatu, Venezuela, Vietnam, Yemen, Zambia, Zimbabwe

Source: IMF staff.
Note: The exact sample composition varies across empirical analyses based on data availability.

Online Annex 3.2. Construction of Key Variables

Geopolitical Distance Measures

Measures based on UN voting behavior. To measure the geopolitical distance between countries, the chapter relies primarily on countries' observable behavior on foreign policy issues, such as disagreements in their voting behavior in the United Nations General Assembly (UNGA). To construct this measure, the UNGA voting dataset (Voeten 2013, version 29) is used. The dataset includes roll-call votes in the UNGA sessions 1-76 and covers the 1946–2021 period.

The literature offers different ways to map the observed voting behaviors of countries into bilateral geopolitical distance measures (see, for example, Gartzke 1998; Signorino and Ritter 1999; Häge 2011; and Bailey and others 2017). The baseline measure of geopolitical distance used in the chapter is the *S* score in Häge (2011), which is based on Signorino and Ritter (1999). As subsequently explained, this measure calculates the average disagreement in UNGA voting based on the squared sum of the distance between two countries and normalizes the value such that 1 and –1 represent complete disagreement and agreement, respectively.

Computing the *S* score consists of three steps: (a) assigning numerical values to voting behavior in UNGA (excluding absences as these could be due to temporary lack of government), (b) calculating the disagreement as the sum of squared differences of these values, and (c) normalizing it. Hence:

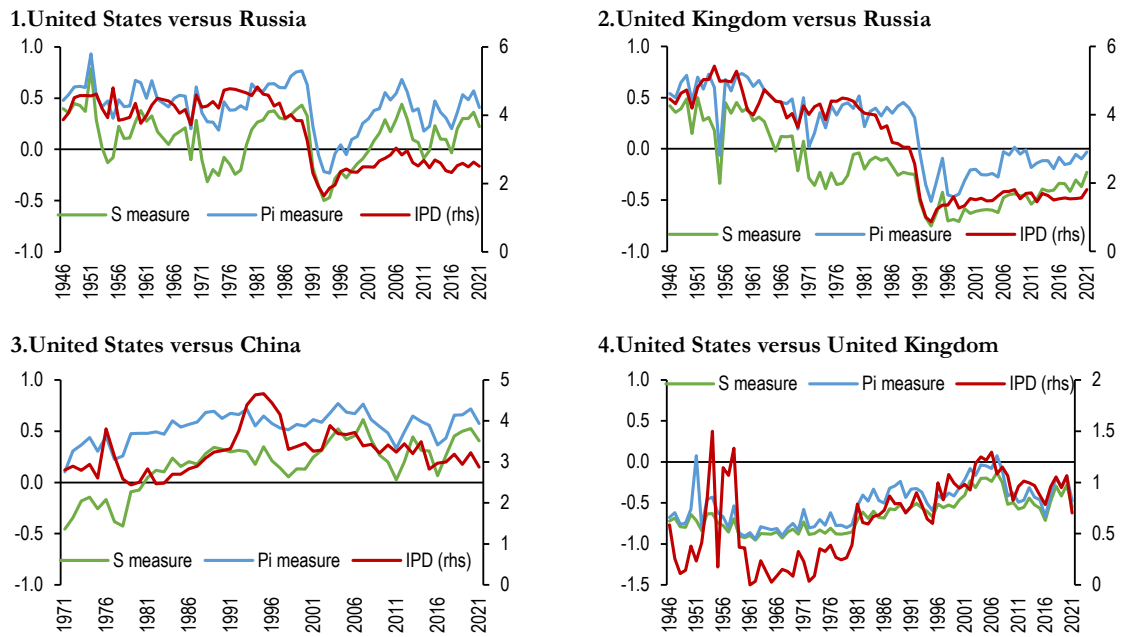
$$Geopolitical\ Distance\ (GPD)_{a,b} = (-1) * \overbrace{\left[1 - \frac{\sum_v (X_{av} - X_{bv})^2}{\frac{1}{2}\sum_v (d_{max})^2}\right]}^{S\ score} \quad (1),$$

where X_{av} denotes voting behavior (*v*) of country *a*, X refers to votes (yea=1, abstain=2, and nay=3), and *v* indexes voting during sessions in a calendar year (adjusted for sessions toward the end of the year that could potentially run into January of the n year). The time dimension (year) is subsumed in the aforementioned formula. d_{max} stands for the maximum possible distance between the country pairs (which is 3–1=2 in this case). For instance, for a country pair with one voting yea and the other nay in a session, the implied distance would be 1. If the two countries voted the same, then the distance would be –1. The normalization factor in the *S* score can also be interpreted as a "chance correction" (Häge 2011) as it reflects the dissimilarity expected by chance, which is constant at ½. Häge (2011) offers an alternative measure, π (pi), that improves the "chance correction" and cost of forming ties. Häge (2011) argues that the π measure has more desirable distributional properties and passes some key face validity tests. Bailey and others (2017) offer a further alternative to *S*, the ideal point distance (IPD), by estimating a discrete choice model with latent preferences.

Overall, the three measures—*S,* pi, and IPD—are highly correlated, with the correlation ranging from 0.66 (pi versus IPD) to 0.84 (*S* versus IPD) and evolve quite similarly over time for country pairs (Online Annex Figure 3.2.1). The chapter relies mainly on the *S* measure in the empirical analysis because it is a commonly used measure in the literature and conducts robustness of the results to the other two measures, pi and IPD, proposed by Häge (2011) and Bailey and others (2017), respectively.[1]

[1] *S* and pi measures were based on UN voting data from 1946 to 2015. Both measures were expanded by using Erik Voeten's database, which is a dataset of roll-call votes in the UN General Assembly from 1946 to 2021 (sessions 1-76). The database contains information on 196 economies.

Online Annex Figure 3.2.1. Geopolitical Distance Measures Based on UN Voting Behavior



Sources: Häge (2011); Bailey and others (2017); and IMF staff calculations.
Note: Higher values indicate greater geopolitical distance. IPD = ideal point distance (from Bailey and others 2017).

Measures based on bilateral arms trade and financial sanctions. In addition to the geopolitical distance measures based on UNGA voting patterns, the chapter uses the following measures for robustness purposes:

1. **Bilateral arms trade**. Arms trade between countries can be a useful proxy for geopolitical proximity as military cooperation tends to occur between countries that have a close strategic relationship. To capture this relation, the following measure is constructed:

$$ArmsTradeToGDP_{i,j,t} = \frac{ExportArms_{i,j,t} + ImportArms_{i,j,t}}{\sqrt{GDP_{i,t} \cdot GDP_{j,t}}}, \quad (2)$$

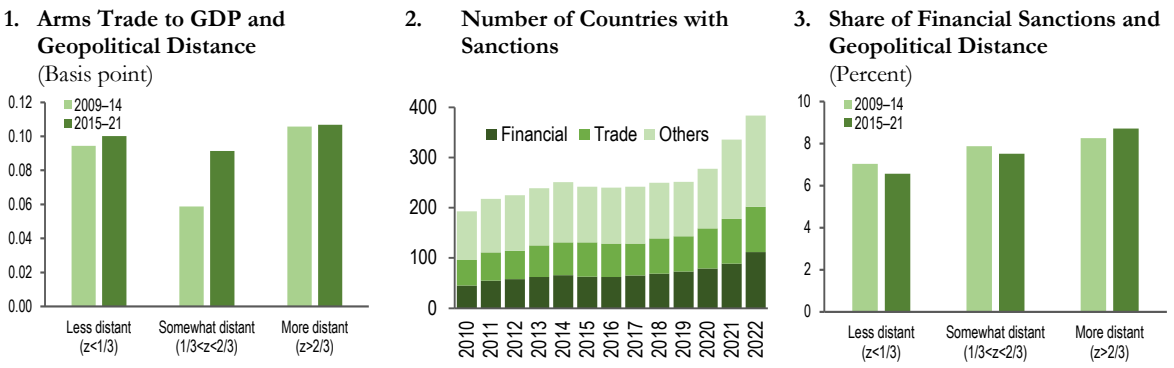
where $ArmsTradeToGDP_{i,j,t}$ is the ratio of total arms trade between countries *i* and *j* (in US dollars) in time *t*, divided by the (geometric) mean of the nominal GDPs of countries *i* and *j* (in US dollars). $ExportArms_{i,j,t}$ ($ImportArms_{i,j,t}$) are the exports (imports) of arms and ammunitions from (to) country *i* to (from) country *j*. The data on bilateral arms trade are available at an annual frequency from the World Integrated Trade Solution database, which draws on UN COMTRADE data.

The overall correlation of the bilateral arms trade variable with our preferred geopolitical distance measure, *S,* is small (0.03). This appears to be the case because for some country pairs, arms trade is quite significant despite a low similarity in foreign policy outlook as captured by UN voting behaviors (Online Annex Figure 3.2.2, panel 1).[2]

2. **Bilateral sanctions**. Sanctions against geopolitically rival countries are a common tool and hence could be a good proxy for geopolitical distance. This measure is constructed as a dummy variable taking a value of 1 if a source country has a type of sanction (financial, trade, or other) imposed on a recipient country. In addition, the use of sanctions has increased over time (Online Annex Figure 3.2.2, panel 2), and they are more likely to be imposed on countries with greater disagreement in UNGA voting (Online Annex Figure 3.2.2, panel 3).

[2] Such pairs include, for example, North America countries and several countries in the Middle East.

Online Annex Figure 3.2.2. Alternative Measures of Geopolitical Tensions



Sources: UN COMTRADE; Global Sanction Database; World Economic Outlook database; Häge (2011); Signorino and Ritter (1999); and IMF staff calculations.
Note: Panel 1 shows the average bilateral arms trade relative to GDP as defined in equation (2), grouped by bilateral geopolitical distance (as defined in equation 1) between countries. The "z" represents the percentile of the geopolitical distance variable. Panel 2 shows the total number of countries subject to different types of sanctions over the years. Panel 3 shows the share of countries that are sanctioned grouped by the geopolitical distance measure.

Measures of financial concentration. To measure the concentration of international financial exposures, Herfindahl–Hirschman Index (HHI) is computed using the share of bilateral total exposure (sum of assets and liabilities of each pair of counterparties relative to the sum of the total assets and liabilities of the reporting country). Specifically, it is computed as the sum of squares of each reporting country's bilateral exposure to all counterparties.

$$HHI_{it} = \sum_{j=1, j\neq i}^{m} \left(Share_{i,j,t}\right)^2 \text{ where } Share_{i,j,t} = \frac{Assets_{ijt} + Liabilities_{ijt}}{\sum_{l=1,l\neq i}(Assets_{ilt} + Liabilities_{ilt})}, \quad (3)$$

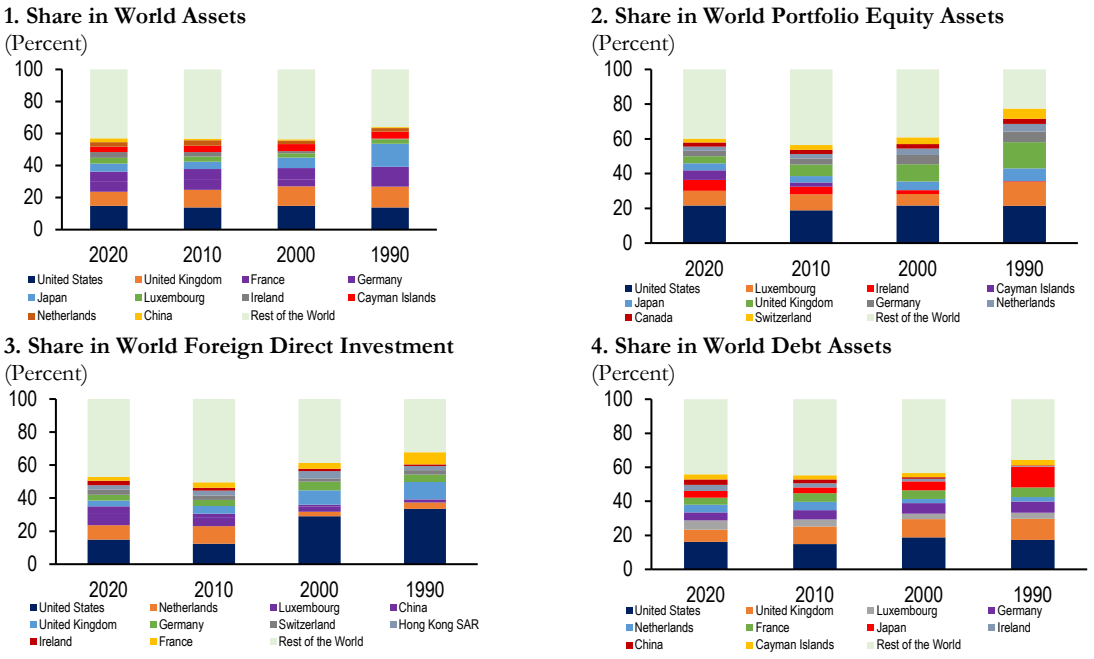
where $Assets_{ijt}$ denotes the assets of country i in country j at time t, $Liabilities_{ijt}$ denotes the liabilities of country i owed to country j at time t, and m is the number of countries. The HHI is also computed using countries' bilateral liabilities only as follows:

$$HHI^{L}_{it} = \sum_{j=1, j\neq i}^{m} \left(\frac{Liabilities_{ijt}}{\sum_{l=1,l\neq i} Liabilities_{ilt}}\right)^2. \quad (4)$$

Data on bilateral foreign direct and portfolio investment cover the 2000–18 period for about 60 countries and are taken from the FinFlows database provided by the Joint Research Centre of the European Commission (Zeugner and others 2020). This dataset is extended to 2021 using the IMF's Coordinated Portfolio Investment Survey and the IMF's Coordinated Direct Investment Survey.

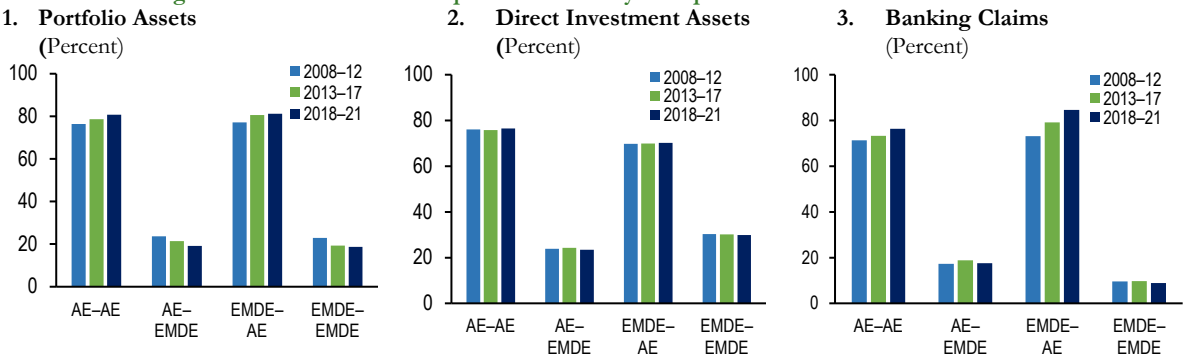
Online Annex 3.3. Additional Stylized Facts

Online Annex Figure 3.3.1. Countries with Largest Share in Global External Assets



Sources: Lane and Milesi-Ferretti (2018); and IMF staff calculations.
Note: The bars represent the evolution of the share of external assets in total world assets of countries with the largest share in 2020.

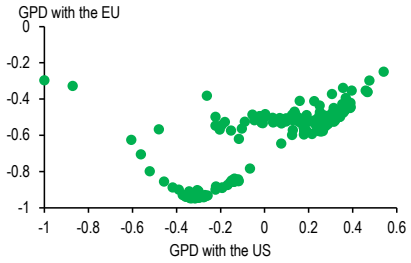
Online Annex Figure 3.3.2. Cross-Border Exposure of Country Groups



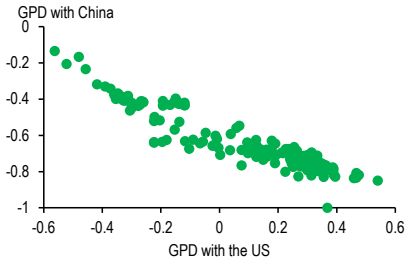
Sources: Bank for International Settlements, Locational Banking Statistics; IMF, Coordinated Direct Investment Survey; IMF, Coordinated Portfolio Investment Survey; and IMF staff calculations.
Note: Bars represent the share of claims of advanced economies on advanced economies (AE–AE), of advanced economies on emerging market and developing countries (AE–EMDE), of emerging market and developing economies on advanced economies (EMDE–AE) and of emerging market and developing economies on emerging market and developing economies (EMDE–EMDE).

Online Annex Figure 3.3.3. Clustering of Geopolitical Disagreements

1. Disagreement with the United States and the European Union in UNGA Voting, 2016–21



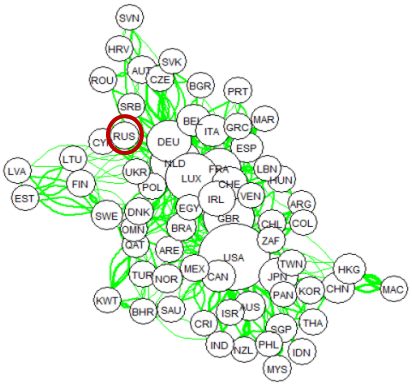
2. Disagreement with the United States and China in UNGA Voting, 2016–21



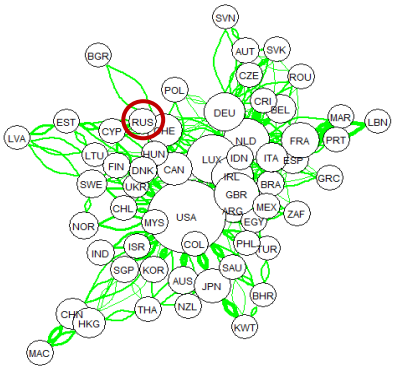
Sources: Häge (2011); Signorino and Ritter (1999); and IMF staff calculations.
Note: GPD = geopolitical distance measure given in (1) formula. The chart shows the distribution of countries' geopolitical distance to the United States, the European Union, and China, and shows that countries that disagree with the United States often disagree with the European Union, and countries that degree with China tend to disagree with the United States and the European Union.

Online Annex Figure 3.3.4. Cross-Border Financial Network

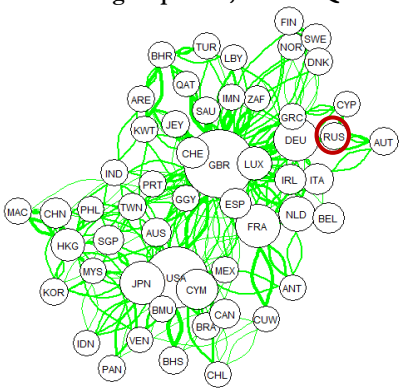
1. Portfolio and Direct Investment Exposure, 2013



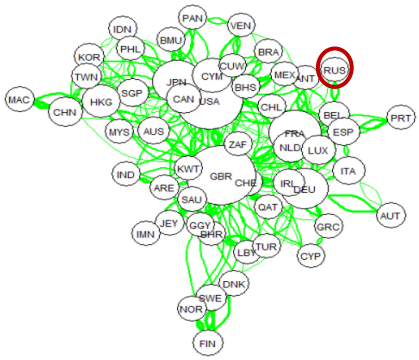
2. Portfolio and Direct Investment Exposure, 2021



3. Banking Exposure, Second Quarter of 2013



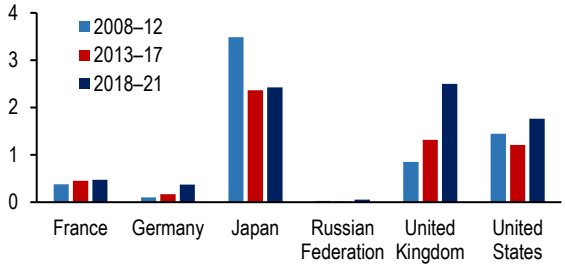
4. Banking Exposure, Second Quarter of 2022



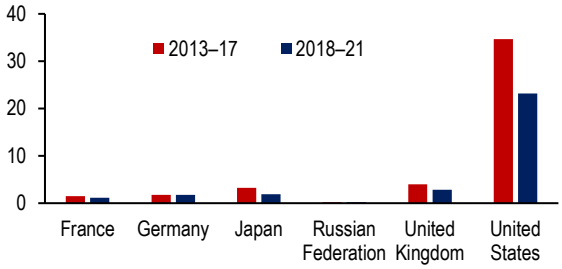
Sources: Locational Banking Statistics by Residence (restricted version); FinFlows; IMF, Coordinated Direct Investment Survey; IMF, Coordinated Portfolio Investment Survey; and IMF staff calculations.
Note: The charts compare the global financial network for 2013 (before financial sanctions on Russia were imposed for its invasion of Crimea) and for the most recent available year (2021 for portfolio and direct investment and the second quarter of 2022 for banking claims). The width of the edges of the network represents the average share of the bilateral cross-border exposure (=sum of bilateral asset and liability relative to the total exposure of foreign asset and foreign liability positions). Edges smaller than 5 percent are trimmed. The red node represents Russia. The size of the nodes represents the share of each country in world total. Panels use International Organization for Standardization (ISO) country codes. The sample coverage is limited to 54 countries including 49 reporting countries and five non-reporting countries with the largest cross-border exposures. The data used in the figure does not include any confidential information.

Online Annex Figure 3.3.5. Selected Countries Financial Linkages with China

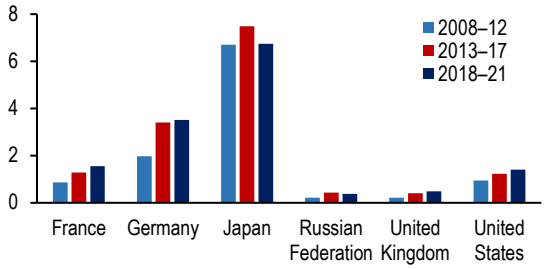
1. Selected Countries' Portfolio Investment in China
(Percent)



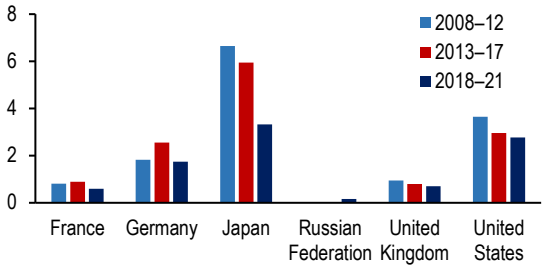
2. Selected Countries' Portfolio Investment from China
(Percent)



3. Selected Countries' Outward Direct Investment to China
(Percent)



4. Selected Countries' Inward Direct Investment from China
(Percent)



Sources: IMF, Coordinated Direct Investment Survey; IMF, Coodinated Portfolio Investment Survey; and IMF staff calculations.
Note: In panels 1 and 3, the bars represent the share of the specified country's investment in China. In panels 2 and 4, the bars represent the share of Chinese investment in the specified countries.

Online Annex 3.4. Geopolitical Factors and Cross-Border Capital Allocation

To examine whether geopolitical factors matter for cross-border capital allocation, a "gravity" model is estimated following Portes and Rey (2005), Coeurdacier and Rey (2013), and Okawa and van Wincoop (2012),[3] and the following model is estimated as a baseline:

$$\log(X_{c,c',t}) = \beta \cdot Geopolitical\ Distance_{c,c',t-1} + \delta \cdot Gravity\ Controls_{c,c'} + \nu_{c',t} + \nu_{c,t} + \epsilon_{c,c',t} \quad (5),$$

where $X_{c,c',t}$ is the portfolio share of recipient country c in the total cross-border allocation of source country c' at time t; $Geopolitical\ Distance_{c,c',t-1}$ is the (lagged) S measure of geopolitical distance of countries c and c', based on their voting behavior in the UNGA (Signorino and Ritter 1999; Häge 2011),[4] and $Gravity\ Controls_{c,c'}$ include a large set of bilateral (country-pair-specific) variables that may reflect the degree of access to local information or affect the cost of financial transactions between the source and recipient countries, including (a) (log of) geographical distance (that is, distance in kilometers between the most populated cities in each country), (b) contiguity (a dummy variable equal to one if the countries share a common border), (c) common colonial history (a dummy variable equal to 1 if the countries share a common colonizer after 1945 and 0 otherwise); (d) common language (a dummy variable equal to one if the countries share a common language spoken by at least nine percent of the population, and 0 otherwise), (e) common religion (through an index variable bounded between 0 and 1 that is increasing if the country pair has a common religion by vast majority of populations)).[5] $\nu_{c',t}$ denote source country-time fixed effects to account for relevant time-varying characteristics of source country c'. $\nu_{c,t}$ denote recipient-country-time fixed effects to capture any relevant time-varying recipient country-specific factors. ϵ is an random error term. The model is estimated using ordinary least squares, and standard errors are clustered at the country-pair level (source-recipient country).

If source countries allocate a smaller share of their cross-border investment to countries that are geopolitically more distant, after controlling for bilateral gravity controls, then $\beta < 0$ holds.

Equation (5) is estimated using (a) bilateral country-level portfolio equity/bond fund investment data from the EPFR Global database at monthly or annual frequency[6]; (b) overall bilateral cross-border portfolio investment from the FinFlows/Coordinated Portfolio Investment Survey database, available at annual frequency;[7] and (c) quarterly bilateral cross-border claims of banks in country c' on country c (on all segments: banks, nonbank financials, nonfinancial corporations, households, and general government of country c; and in all currencies), provided by the Bank for International Settlements' Locational Banking Statistics.[8]

Empirical Results

Equity and bond fund flows. Estimating equation (5) for portfolio equity and bond fund allocations shows that a higher geopolitical distance is associated with significantly lower fund cross-border allocation (Online Annex Table 3.4.1). The estimated effect is on average stronger for emerging market and developing economies compared to advanced economies, and robust to using alternative geopolitical distance measures. The results are not only statistically significant, but also economically relevant. An increase of one standard deviation in geopolitical distance of a recipient country to a source country (magnitude of which corresponds to the increase in foreign policy dissimilarity between the United States and China during trade tensions) is associated with a 25 percent decline in the share of the recipient country in the source country's cross-border equity or bond portfolio, as shown in columns (1) and (6), respectively.[9] The results are robust to several alternative specifications (available upon request): (1) controlling for bilateral trade; (2) controlling for recipient country macroeconomic fundamentals (while dropping recipient country-time fixed effects and including recipient country fixed effects), (3) excluding international financial centers from the source countries for which measuring bilateral geopolitical distance in relation to ultimate lenders is not feasible,

[3] Okawa and van Wincoop (2012), in particular, provides theoretical foundations for gravity-type models in international finance, and links (log) of portfolio shares to bilateral information frictions (potentially reflected by, for example, differences in language and regulatory systems).
[4] The geopolitical distance measure is lagged to mitigate potential endogeneity concerns, for example, countries may adjust their UN voting.
[5] Gravity controls are obtained from CEPII Gravity Database (Conte, Cotterlaz, and Mayer 2022). Note that depending on the underlying data source, equation (5) may use variables with different frequencies. For example, portfolio shares are available at monthly frequency in the EPFR Global database, whereas geopolitical distances are available at yearly frequency. The way variables are lagged is compatible with the frequency of the variables. For instance, geopolitical distance is lagged by one year. The results are robust to using annual data consistently across all the variables.
[6] The EPFR Global database covers a large subset of cross-border portfolio investors, mainly mutual funds, exchange traded funds, closed-end funds, variable annuity funds, and insurance-linked funds. Koepke and Paetzold (2020) show that EPFR Global data have significant predictive content for balance of payment–based portfolio flows, rendering forecast errors that are on average 80–90 percent lower compared with an autoregressive model. The EPFR Global data also perform well in capturing stocks. For example, total allocation of EM-dedicated cross-border investment funds covered by the EPFR Global Research database accounts for one-third to one-half of the total stock of external portfolio liabilities of emerging markets (where external liabilities are obtained from External Wealth of Nations database of Lane and Milesi-Ferretti (2018), available at https://www.brookings.edu/2021/09/16/the-external-wealth-of-nations-september-2021-update/).
[7] It covers cross-border portfolio positions involving equity or debt securities, excluding cross-border direct investment or reserve assets.
[8] The data includes not only portfolio investments but also loans and equity ownership. Claims include loans, debt securities or other debt instruments, equity or investment fund shares, and financial derivatives.
[9] The estimated coefficient multiplied by the standard deviation of geopolitical distance (S measure) (which is equal to 0.30) implies 25.1 percent decline in portfolio equity share, and 24.51 percent decline in portfolio bond share. Also, gravity controls appear to have intended effect on portfolio shares (for example, similar in sign to the related literature), with lower geographic distance or closer cultural ties implying higher portfolio shares.

and (4) excluding the United States from the source countries (the largest portfolio investor country other than international financial centers).[10]

As noted, the results are also robust to using alternative measures of geopolitical distance, namely Häge (2011)'s pi and Bailey and others (2017)'s ideal point distance (IPD) measures (columns (4) and (5) for equity, and columns (9) and (10) for bonds), and imply effects of a similar magnitude.

Online Annex Table 3.4.1. The Effect of Geopolitical Distance on Cross-Border Portfolio Equity and Bond Allocations

	Equity					Bond				
Recipients:	All	AEs	EMDEs	All	All	All	AEs	EMDEs	All	All
Geopolitical Distance Measure:		Baseline (S)		Pi	IPD		Baseline (S)		Pi	IPD
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Geopolitical Distance$_{ij,t-1}$	-0.832***	-0.404**	-0.945***	-0.552***	-0.315***	-0.813***	-0.321	-0.399***	-0.574***	-0.311***
	(0.148)	(0.177)	(0.257)	(0.101)	(0.053)	(0.141)	(0.348)	(0.139)	(0.097)	(0.051)
Distance$_{ij}$	-0.358***	-0.314***	-0.584***	-0.335***	-0.349***	-0.373***	-0.431***	-0.411***	-0.340***	-0.365***
	(0.044)	(0.053)	(0.063)	(0.044)	(0.044)	(0.039)	(0.065)	(0.053)	(0.039)	(0.038)
Common Language$_{ij}$	0.312***	0.315***	0.280***	0.294***	0.306***	0.059	0.132*	-0.000	0.043	0.054
	(0.060)	(0.073)	(0.073)	(0.060)	(0.060)	(0.053)	(0.079)	(0.055)	(0.053)	(0.053)
Common Colonial History$_{ij}$	0.544**	0.282	0.294	0.485**	0.480**	0.099	0.292	0.194	0.020	0.013
	(0.216)	(0.309)	(0.225)	(0.224)	(0.220)	(0.241)	(0.390)	(0.282)	(0.249)	(0.247)
Common Religion Index$_{ij}$	-0.114	-0.177	-0.052	-0.123	-0.119	0.150	0.205*	0.145**	0.147	0.145
	(0.106)	(0.125)	(0.122)	(0.105)	(0.105)	(0.114)	(0.110)	(0.067)	(0.114)	(0.114)
Contiguity$_{ij}$	0.089	-0.088	0.139	0.108	0.101	-0.038	-0.220*	0.061	-0.009	-0.025
	(0.138)	(0.127)	(0.220)	(0.137)	(0.137)	(0.132)	(0.120)	(0.211)	(0.130)	(0.131)
Source Country x Month Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recipient Country x Month Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	358,841	134,912	223,929	358,841	358,340	331,166	106,523	224,643	331,166	331,108
R-squared	0.892	0.859	0.902	0.892	0.893	0.864	0.861	0.925	0.865	0.864

Source: IMF staff calculations.
Note: The dependent variable is (log) share of country i in country j's total cross-border portfolio investment (for equity (columns (1) to (5)) and bonds (columns (6) to (10)), separately). Standard errors are clustered at source-recipient country, and provided in parantheses. Significance levels: 10 percent indicated by *, 5 percent indicated by **, 1 percent indicated by ***. "Yes" indicates that corresponding fixed effects are included. AE = advanced economy, EMDE = emerging market and developing economy.

Overall portfolio flows. Estimating the model in equation (5) with FinFlows and Coordinated Portfolio Investment Survey data (which have broader coverage of investors but are sampled at annual frequency) leaves the qualitative conclusions broadly unchanged (Online Annex Table 3.4.2, columns 1 through 5). Numerically, the results suggests that an increase of one standard deviation in geopolitical distance of a recipient country to a source country is associated with a 14 percent decline in the share of the recipient country in the source country's international portfolio (Online Annex Table 3.4.2, column 1). Because this magnitude is lower than the 25 percent estimated previously for investment funds, other portfolio investors seem to be less responsive to changes in the geopolitical landscape than investment funds. One important difference to the baseline results is that the estimated coefficient on geopolitical distance is not significant when the model is estimated for emerging market and developing economies (EMDEs) only—although it continues to be negative. The results are also robust to using alternative geopolitical distance measures (Online Annex Table 3.4.2, columns 4 and 5).

Cross-border banking. Previous results hold qualitatively for cross-border banking claims (Online Annex Table 3.4.2, columns 6 through 10). The results are robust to using alternative geopolitical distance measures (Online Annex Table 3.4.2, columns 9 and 10).

[10] The results are robust to the exclusion of the following international financial centers: Bermuda, British Virgin Islands, Cayman Islands, Hong Kong SAR, Ireland, Luxembourg, The Netherlands, and Singapore.

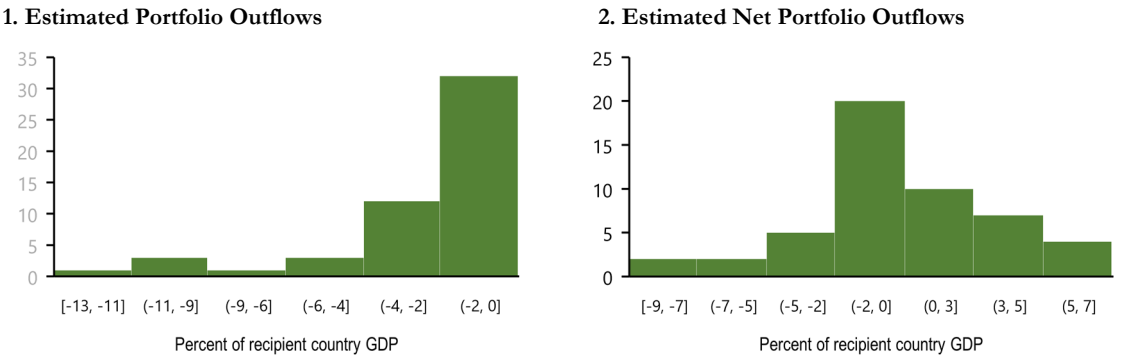
Online Annex Table 3.4.2. Geopolitical Distance: Overall Portfolio Investment and Banking Claims

	Overall Cross-border Portfolio Allocations (FINFLOWS/CPIS)					Cross-border Banking Claims Allocation (BIS-LBS)				
Recipients:	All	AEs	EMDEs	All	All	All	AEs	EMDEs	All	All
Geopolitical Distance Measure:		Baseline (S)		Pi	IPD		Baseline (S)		Pi	IPD
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Geopolitical Distance$_{ij,t-1}$	-0.449**	-0.928***	-0.196	-0.517***	-0.162***	-0.531*	-0.474	-0.220	-0.655***	-0.252**
	(0.190)	(0.334)	(0.328)	(0.121)	(0.062)	(0.318)	(0.511)	(0.628)	(0.234)	(0.123)
Distance$_{ij}$	-0.706***	-0.628***	-0.904***	-0.669***	-0.704***	-1.281***	-1.038***	-1.739***	-1.249***	-1.279***
	(0.041)	(0.058)	(0.066)	(0.043)	(0.042)	(0.084)	(0.121)	(0.114)	(0.086)	(0.085)
Common Language$_{ij}$	0.617***	0.597***	0.534***	0.601***	0.613***	0.796***	0.447**	1.137***	0.774***	0.792***
	(0.084)	(0.115)	(0.132)	(0.083)	(0.084)	(0.126)	(0.184)	(0.142)	(0.127)	(0.126)
Common Colonial History$_{ij}$	0.261	0.822*	-0.077	0.136	0.230	--	--	--	--	--
	(0.267)	(0.488)	(0.356)	(0.278)	(0.270)					
Common Religion Index$_{ij}$	0.778***	1.001***	0.728***	0.773***	0.776***	1.098***	2.023***	0.154	1.106***	1.100***
	(0.135)	(0.155)	(0.194)	(0.135)	(0.135)	(0.239)	(0.302)	(0.264)	(0.239)	(0.239)
Contiguity$_{ij}$	-0.023	-0.176	0.204	-0.000	-0.018	-0.570**	-0.324	0.292	-0.552*	-0.565**
	(0.143)	(0.153)	(0.272)	(0.141)	(0.142)	(0.286)	(0.283)	(0.398)	(0.285)	(0.286)
Source Country x Month Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recipient Country x Month Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	22,094	11,147	10,947	22,094	22,047	77,283	27,465	49,818	77,283	77,103
R-squared	0.813	0.812	0.763	0.814	0.813	0.790	0.769	0.746	0.790	0.790

Source: IMF staff calculations.
Note: The dependent variable is (log) share of country *i* in country *j*'s total cross-border investment. Standard errors are clustered at source-destination country, and provided in parantheses. Significance levels: 10 percent indicated by *, 5 percent indicated by **, 1 percent indicated by ***. "Yes" indicates that corresponding fixed effects are included. Columns 6 through 10 exclude international financial centers from source countries (Bermuda, British Virgin Islands, Cayman Islands, Hong Kong SAR, Ireland, Luxembourg, The Netherlands, and Singapore). AE = advanced economy, EMDE = emerging market and developing economy.

Predicting the effect on aggregate capital outflows from changes in bilateral capital allocation. Previous results suggest that higher geopolitical distance is associated with smaller portfolio investment allocation by source countries. This could potentially translate into significant outflows from recipient countries relative to the size of these economies. To assess the possible magnitude of such outflows, the estimates obtained in Online Annex Tables 3.4.1 and 3.4.2 are used (Online Annex Figure 3.4.1).[11] In particular, if a recipient country becomes one-standard-deviation geopolitically more distant to the source countries that were already relatively distant (that is, those source countries that were above the median geopolitical distance measure), the reduction in portfolio investment amounts to about 3 percent of GDP on average. The effect is highly heterogeneous and could be as large or more than 10 percent of GDP (Online Annex Figure 3.4.1, panel 1) and could be lower in case recipient country gets geopolitically closer to some source countries, in particular to those that are below the median distance (Online Annex Figure 3.4.1, panel 2).

Online Annex Figure 3.4.1. Predicted Portfolio Outflows
(Number of countries)



Sources: IMF staff calculations.
Note: Panel 1 plots the estimated portfolio outflows in response to an increase of one standard deviation in geopoliticaly distance in relation to lenders that were above-median distance before the shock (using the estimated coefficient in Online Annex Table 3.4.2, panel 1, column 1), normalized by recipient country GDP. Panel 2 plots the estimated net portfolio outflows, assuming in addition that the recipient country gets geopolitically closer to the lenders that were below-median distance before the shock (using the same estimated coefficient in panel 1).

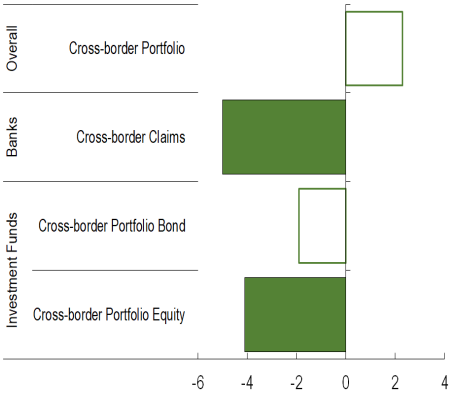
Further robustness tests. The aforementioned results are also qualitatively robust to using logistic transformation of portfolio share; using the Poisson Pseudo-Maximum Likelihood estimation; using end-of-the-year portfolio allocations (for databases with higher frequency than annual); and studying emerging markets rather than EMDEs (results available upon request). They are also broadly robust to using bilateral arms trade is an alternative measure of geopolitical distance (Online Annex Figure 3.4.2).

[11] To translate the estimated percent change in portfolio allocations into the amount of outflows, the estimated percent change in the allocation is multiplied by the bilateral portfolio allocation and the standard deviation of geopolitical distance. This measure is then divided by recipient country nominal GDP. The results are broadly robust to using bilateral country group-specific standard deviations of geopolitical distances (AEs in relation to AEs, AEs in relation to EMDEs, EMDEs in relation to EMDEs, AE=advanced economies, and EMDE=emerging market and developing economies).

Is geopolitical distance more relevant recently? Estimating equation (5) for two periods (2000–15 and 2015–21) shows that geopolitical distance matters more in the recent years for cross-border portfolio bond investment compared to earlier periods. This result is robust across geopolitical distance measures. Yet, the evidence for equity investment poses a mixed picture, where the effect of geopolitical distance is lower in the recent period. Considering overall portfolio investment, there is some evidence that geopolitical distance matters particularly in the recent period (based on the *S* and IPD measures), though the difference does not seem to be statistically significant and does not hold for the pi measure (results available upon request).

Country heterogeneity. To assess whether results differ across different types of recipient countries, equation (5) is augmented with interaction terms of the geopolitical distance variable with (lagged) recipient country characteristics (keeping all else constant in the empirical framework). The recipient country characteristics considered for this exercise are the financial development index, international reserves and net financial assets relative to GDP. The results suggest that lenders reduce their cross-border capital allocations more strongly for (ex ante) less financially developed countries, or countries with low international reserves and net foreign assets.

Online Annex Figure 3.4.2. Change in Cross-Border Capital Allocation After a Decline of One Standard Deviation in Bilateral Arms Trade
(Percent)

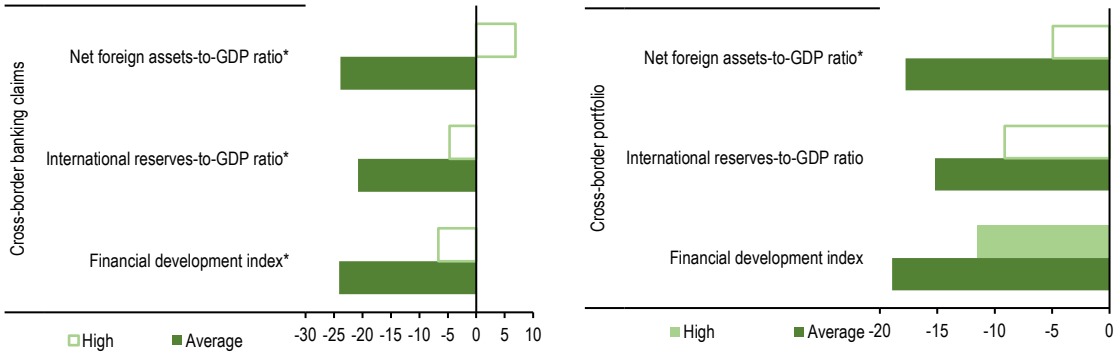


Source: IMF staff calculations.
Note: The bars show the estimated percent change in portfolio investments and banking claims by the source country in response to a decline of one standard deviation in arms trade between the source and the recipient countries, where arms trade is normalized by the geometric mean of the countries' GDPs. The solid bars indicate statistical significance at the 10 percent or lower level.

Online Annex Figure 3.4.3. Country Heterogeneity
(Percent)

1. Cross-Border Banking Claims

2. Cross-Border Portfolio



Source: IMF staff calculations.
Note: Panel 1 plots the percent change in cross-border banking claims allocation, depending on whether the recipient country is ex ante at the upper quartile of the distribution of financial development, international reserves-to-GDP ratio, or net foreign assets-to-GDP ratio ("high") or at the lowest three quartiles ("average" for the sake of brevity). Panel 2 plots results from a similar exercise, based on overall portfolio allocation using FinFlows/Coordinated Portfolio Investment Survey. The solid bars indicates statistical significance at 10 percent. The asterisk next to an indicator means the difference between average and high is statistically significant at 10 percent.

Online Annex 3.5. The Effect of Geopolitical Tensions on Capital Flows and Remittances

Country-Level Analysis of Cross-Border Capital Flows

By altering investor preferences and bilateral cross-border asset allocation, geopolitical shocks could adversely affect aggregate (net) capital flows to recipient countries. To empirically examine whether this is the case, the following regression is estimated:

$$y_{c,t} = \beta \cdot AGPD_{c,t-1} + \mu_c + v_t + Macro\ Controls_{c,t-1} + e_{c,t} \quad (6)$$

where $y_{c,t}$ denotes total net capital flows to GDP (alternatively net portfolio flows to GDP, portfolio liability flows to GDP, net FDI flows to GDP, FDI liability flows to GDP) in country c at time t. μ_c and v_t denote country-fixed and time effects, respectively.

$AGPD_{c,t}$=$\sum_{c'}(CBLE_{c,c',t-1} \cdot Geopolitical\ Distance_{c,c',t})$ is the average change in geopolitical distance, calculated as the weighted average of bilateral disagreement in the UNGA between countries c and c', with weights defined by $CBLE_{c,c',t-1}$. $CBLE_{c,c',t-1}$ are the (lagged) cross-border liability exposure of country c to country c' normalized by the total cross-border liabilities of country c.[12]

$Macro\ Controls_{c,t-1}$ include (lagged) country-level variables that could affect capital flows, such as real GDP growth, log of real GDP per capita, real interest rate differential against the United States, real exchange rate deviation from the trend, exchange rate regime (flexibility), institutional quality, and financial openness.[13] If capital flows to the recipient country are disrupted by geopolitical shocks, then $\beta < 0$.

Annual data on (net) capital inflows are obtained from the IMF Balance of Payment Statistics. Data for all other variables are obtained from the World Economic Outlook database, International Financial Statistics, World Development Indicators, and Haver. The data on financial openness, institutional quality, and exchange rate flexibility come from the Chinn-Ito Index (Chinn and Ito 2006), the ICRG database, and the dataset of Ilzetzki, Reinhart, and Rogoff (2019), respectively. The sample covers 56 countries for the 2001–21 period.[14] The regression results for the effect of geopolitical shocks on net capital flows to GDP and net/liability portfolio flows to GDP are presented in Figure 3.8 in the main text.[15]

The Effect on Cross-Border Remittances

To assess the effect of geopolitical tensions on cross-border remittances (Box 3.1), the effect of financial sanctions on the cost and volume of remittances to sanctioned countries (relative to changes observed globally) is examined through cumulative abnormal returns (CAR) analysis. Specifically, the following model is estimated at the country level:

$$\Delta Cost_{i,t} = \alpha_i + \beta_i \cdot \Delta Cost_{global,t} + \Gamma_i \cdot Controls_{i,t-1} + \epsilon_{i,t}^{Cost} \quad (7)$$

where $\Delta Cost_{i,t}$ is the change in the remittance cost ratio of total cost to the remitted 200 US dollars to country i, $\Delta Cost_{global,t}$ is the change in the global remittance cost ratio (average across all countries), and $Controls_{i,t-1}$ denotes control variables such as domestic real GDP growth rate, the change in nominal exchange rates, inflation rate, current account balance to GDP, and the unemployment rate.

For each sanction event, the estimated coefficients ($\widehat{\alpha_i}, \widehat{\beta_i}, \widehat{\Gamma_i}$) in equation (7) are used to compute the expected change in the remittance cost ratio τ quarters after sanctions are imposed, as follows: $\hat{\mu}_{i,t,\tau}^{\Delta Cost} = \widehat{\alpha_i} + \widehat{\beta_i} \cdot \Delta Cost_{global,t} + \widehat{\Gamma_i} \cdot Controls_{i,t}$. The corresponding abnormal change in cost ratio is given by $AC_{i,t,\tau} = \Delta Cost_{i,t} - \hat{\mu}_{i,t,\tau}^{\Delta Cost}$, and the cumulative abnormal change is computed by summing up the abnormal changes for up to six quarters after the sanction is imposed. A similar procedure is carried out to calculate the abnormal growth of remittance volume.

To estimate equation (7), quarterly remittance cost data is obtained from the World Bank Remittance Prices Worldwide database and covers the period between the fourth quarter of 2012 and the second quarter of 2022. This includes 367 country corridors worldwide with 105 receiving countries and 48 sending countries. The quarterly (aggregate) remittance volume data is obtained from the IMF Balance of Payment Statistics and spans the period between the first quarter of 1980 and the second quarter of 2022 for 55 recipient countries. The data on financial sanctions is obtained from the Global Sanctions Database by Kirilakha and others (2021). The annual data of the Global Sanctions Database is converted to quarterly frequency by identifying the timing of sanctions using the announcement of the sanctions by authorities including the UN Security Council, US Treasury, US State Department, EUR-Lex, and information from EU Sanctions Map and various news articles. For countries with missing announcements, it is assumed that all sanctions were imposed in the fourth quarter of the specified year.

[12] When the dependent variable is net portfolio flows over GDP or portfolio liability flows over GDP, the weights are given by the portfolio liability exposure of the reference country to all other countries. When the dependent variable is net FDI flows over GDP or FDI liability flows over GDP, the weights are given by the FDI liability exposure of the reference country to all other countries.
[13] See, for example, Ghosh and others (2014).
[14] Missing data points regarding financial openness (in 2021) and exchange rate regimes (after 2019) are extrapolated with previous values. The results are robust without extrapolation.
[15] The full set of results (with all control variables) for this exercise is available upon request.

Online Annex 3.6. Geopolitical Tensions and Banking Stability

To assess the effect of geopolitical shocks on banking sector stability, the analysis uses unconsolidated annual bank-level financial statements data from Fitch Connect for 30 advanced and 20 emerging and developing countries from 2001 to 2021. The Bank for International Settlements' Locational Banking Statistics are used to calculate a measure of gross cross-border exposures of these countries to a large set of source economies (through banking claims), and the following specification is estimated:

$$Y_{b,c,t} = \beta_1 \cdot AGPD_{c,t-1} + \beta_2 \cdot AGPD_{b,c,t-1} \cdot HIGH\left(AGPD_{c,t-1}\right) + BankControls_{b,c,t-1} + MacroControls_{c,t-1} + \rho \cdot Y_{b,c,t-1} + \mu_b + \nu_t + \epsilon_{b,c,t} \quad (8)$$

where $Y_{b,c,t}$ denotes the following bank outcome variables: cost of funding (=total interest expenses relative to total average interest-bearing liabilities); profitability (=(log) operating profits relative to total assets); and banks' lending (=(log) outstanding real loans (gross loans in local currency terms divided by domestic consumer price index), of bank *b* in country *c* at year *t*.

$AGPD_{c,t} = \sum_{c'}(CBBE_{c,c',t-1} \cdot Geopolitical\ Distance_{c,c',t})$ denotes the weighted-average bilateral geopolitical distance between countries *c* and *c'*, with $CBBE_{c,c',t-1}$ indicating the weights defined as the (lagged) size of bilateral cross-border claims on country *c* of the banking sector in country *c'*, normalized by the total cross-border bank claims on country *c* (based on the Bank for International Settlements' Locational Banking Statistics). To explore any nonlinear effects of geopolitical distance on the banking sector, $AGPD_{c,t-1}$ is interacted with a dummy variable, $HIGH\left(AGPD_{c,t-1}\right)$, which takes a value one if $AGPD_{c,t-1}$ is higher than the 75th percentile of the distribution of $AGPD_{c,t-1}$ (the thresholds estimated separately for emerging market and developing economiesand advanced economies) (considered as highly geopolitically distant financial partners), and 0 otherwise.

$BankControls_{b,c,t-1}$ are bank (log) total assets (measured in US dollars), bank capital ratio (equity-to-total assets ratio), liquidity ratio (liquid assets-to-total assets), asset quality (nonperforming loans-to-gross loans ratio), and profitability (operating profits-to-total assets), all measured with a one-period lag. $MacroControls_{c,t-1}$ include country-level variables such as real GDP growth, economic size (log nominal GDP in US dollars), inflation (consumer price index–based annual inflation), net capital flows-to-GDP ratio, short-term deposit rates, long-term government bond yields, and institutional quality index (comprising of measures of bureaucracy quality, corruption, democratic accountability, government stability and law and order from the International Country Risk Guide database). μ_b and ν_t denote bank and time fixed effects, respectively.

If following an increase in geopolitical distance of country *c* in relation to its lenders, banks in country *c* are adversely affected, through higher funding costs and lower profitability, and reduce bank lending, then $\beta_1 < 0$. If the effect of geopolitical shocks is larger at higher levels of geopolitical distance, then $\beta_2 < 0$. Equation (8) is estimated separately for a sample of advanced and emerging and developing economies. In addition, to assess whether the effect of geopolitical shocks varies according to bank capitalization, equation (8) is estimated separately for less (more) well-capitalized banks, defined as those with equity-to-total assets ratio below (above) the 75th percentile of equity-to-total assets ratio of banks within a country in a given year.

The results show that after an increase in geopolitical distance in relation to nonresident lenders, banks' funding costs (interest expenses-to-interest-bearing liabilities) increase and profits decline. In line with this finding, bank lending contracts. The estimated effects are stronger for emerging market and developing economies compared to advanced economies, and suggest the presence of nonlinear effects, particularly for bank lending (Online Annex Table 3.6.1). The effect is also more pronounced for less well-capitalized banks relative to more well-capitalized banks in emerging and developing economies (Online Annex Table 3.6.2).

Online Annex Table 3.6.1. The Effect of Higher Geopolitical Distance on Bank Stability

Dependent Variable:	Cost of Funding	Profitability	Real Gross Loans	Cost of Funding	Profitability	Real Gross Loans
Sample:	EMDEs			AEs		
	(1)	(2)	(3)	(4)	(5)	(6)
$AGPD_{c,t-1}$	0.023***	-0.496***	-0.267***	0.005***	-0.422***	0.132***
	(0.005)	(0.174)	(0.094)	(0.001)	(0.082)	(0.028)
$AGPD_{c,t-1}$ * I(High Distance)$_{c,t-1}$	-0.005**	-0.018	-0.284***	0.003***	0.057**	0.029***
	(0.002)	(0.104)	(0.046)	(0.000)	(0.026)	(0.009)
Bank Controls	Included	Included	Included	Included	Included	Included
Country Macro Fundamentals	Included	Included	Included	Included	Included	Included
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,334	10,311	12,041	39,930	34,708	40,521
R-squared	0.861	0.602	0.999	0.900	0.729	0.998
# of banks	1404	1340	1417	4,188	4,037	4,209
# of countries	20	20	20	30	30	30

Sources: IMF staff calculations.
Note: Standard errors are clustered at the bank level. All columns include lagged dependent variable. Significance levels: 10 percent indicated by *, 5 percent indicated by **, 1 percent indicated by ***. AE = advanced economy, EMDE = emerging market and developing economy. Expanded set of results are available upon request.

Online Annex Table 3.6.2. The Effect of Higher Geopolitical Distance on Less versus More Well-Capitalized Banks in Emerging Market and Developing Economies

Sample:	High Capital Ratio Banks			Low Capital Ratio Banks		
Dependent Variable:	Cost of Funding	Profitability	Real Gross Loans	Cost of Funding	Profitability	Real Gross Loans
	(1)	(2)	(3)	(4)	(5)	(6)
$AGPD_{c,t-1}$	0.015	-0.175	0.032	0.024***	-0.703***	-0.279***
	(0.010)	(0.443)	(0.242)	(0.004)	(0.160)	(0.081)
$AGPD_{c,t-1}$ * I(High Distance)$_{c,t-1}$	-0.010*	-0.020	-0.153	-0.006**	-0.152	-0.259***
	(0.005)	(0.223)	(0.118)	(0.002)	(0.100)	(0.040)
Bank Controls	Included	Included	Included	Included	Included	Included
Country Macro Fundamentals	Included	Included	Included	Included	Included	Included
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,735	2,428	2,935	10,618	9,548	11,205
R-squared	0.852	0.681	0.998	0.864	0.598	0.999
# of banks	569	521	590	1,417	1,341	1,445
# of countries	19	18	19	20	20	20

Sources: IMF staff calculations.
Note: Standard errors are clustered at the bank level. All columns include lagged dependent variable. Significance levels: 10 percent indicated by *, 5 percent indicated by **, 1 percent indicated by ***. Expanded set of results are available upon request.

Online Annex 3.7. Financial Fragmentation and Macro-Financial Volatility

The Effect of External Shocks on Capital Flows

To examine whether financial fragmentation increases a country's exposure to adverse external shocks, the effect of a change in the foreign monetary policy rate—defined as the monetary policy rate of a country's major financial partner—on net capital flows (to GDP) is estimated for countries with a high and low degree of concentration in their international financial positions, through the following equation:[16]

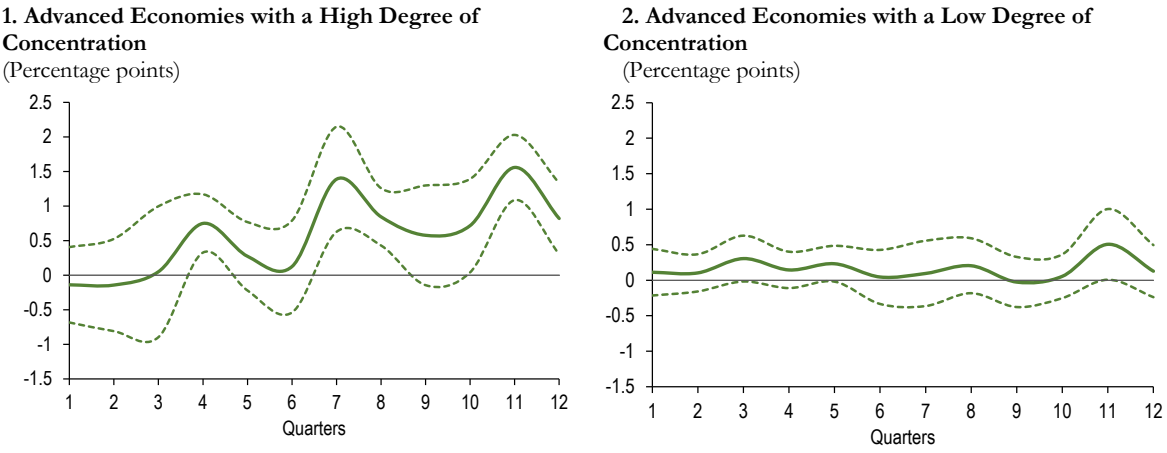
$$FlowsToGDP_{i,t+h} = \mu_i + \zeta_h^* \cdot InterestRate_{it}^* + \kappa' \cdot Control_{it} + \nu_t + e_{i,t+h}, \qquad (9)$$

where $FlowsToGDP_{it}$ is total net capital flows to GDP for country *i* at time *t+h* (where h=1, 2…*H*), $InterestRate_{it}^*$ is the interest rate in country i's largest financial partner, and $Control_{it}$ is a vector of controls (lagged domestic real GDP growth, domestic interest rate spread relative to the United States, the Chinn-Ito financial openness measure, domestic real effective exchange rate deviation from trend, and domestic current account balance to GDP.[17] μ_i are country-specific fixed-effects and ν_t are time-fixed effects to capture the effect of common shock across countries. Equation (9) is estimated through the local projections method, and ζ_h^* is the impulse response at horizon h for $h = 1, \ldots, H$ of the dependent variable to the interest rate of country i's largest financial partner. κ is a vector of coefficients on the control variables, and $e_{i,t+h}$ is an error term.

The panel local projections are estimated using quarterly data from the first quarter of 2000 to the fourth quarter of 2021 for 24 advanced economies and 18 emerging market economies. Equation (9) is separately estimated for countries with HHI of international investment positions greater (lower) than the sample median to capture high (low) degree of concentration, where the HHI is computed using equation (3).

As shown in Figure 3.10 in the main text, the results suggest that net capital inflows (in percent of GDP) to emerging market economies with a high degree of concentration decline significantly after an increase in foreign interest rates, but those to countries with a low degree of concentration are not significantly affected. Net capital flows to advanced economies do not appear to be significantly affected, irrespective of the concentration of their international investment portfolios (Online Annex Figure 3.7.1).

Online Annex Figure 3.7.1. Cumulative Impulse Response of Net Capital Flows to GDP to an Increase in Foreign Interest Rates



Source: IMF staff calculations.
Note: In panels 1 and 2, the horizontal axis indicates the number of quarters after an increase in foreign monetary policy rate (defined as the policy rate of a country's largest financial partner) of 100 basis points. The dotted lines represent 95 percent confidence bands.

The Effect of Foreign Exposure Concentration on Net Capital Flow Volatility

The increase in concentration of foreign liability exposures could increase the volatility of capital flows because of limited risk diversification opportunities for recipient countries in the face of external shocks. To study if this is the case, the following regressions are estimated:

$$Net\ Capital\ Inflows/GDP_{c,t} = \mu_c + \nu_t + \alpha' \cdot Controls_{c,t-1} + e_{c,t}, \qquad (10)$$

[16] High concentration could be driven by geopolitical factors, but also other factors (such as closer historical ties). It is possible that higher concentration driven because of reducing exposure to geopolitical rival countries that could become a source of future shocks may lower capital flow volatility in the longer-term.
[17] Lags are taken to mitigate potential endogeneity concerns between the control variables and the dependent variable. As the data is at quarterly frequency, four lags of each control variable are used.

$$|e|_{c,t} = \mu_c^e + v_t^e + \beta \cdot HHI_{c,t-1}^L + \epsilon_{c,t}, \qquad (11)$$

where $Net\ Capital\ Inflows/GDP_{c,t}$ is total net capital flows to GDP of country c at time t, μ_c and μ_c^e denote country-fixed effects, v_t and v_t^e denote time effects, $Controls_{c,t-1}$ include (lagged) country-level variables that could potentially affect capital flows such as domestic real GDP growth, real interest rate differential against the United States, current account balance to GDP, real exchange rate deviation from the trend, exchange rate regime, institutional quality, and financial openness, and $e_{c,t}$ and $\epsilon_{c,t}$ are error terms. In equation (11), $|e|_{c,t}$ is the absolute value of the residuals from the country-specific mean, and $HHI_{c,t-1}^L$ is the (lagged) HHI of cross-border liability exposures to partner countries computed using equation (4). Equations (10) and (11) are estimated for a sample of 56 advanced and emerging market economies covering the period from 2001 to 2020.[18] If capital flow volatility is amplified by an increase in the concentration of cross-border liability exposures, then $\beta > 0$. The full set of regression results is summarized below in Online Annex Table 3.7.1.[19]

Online Annex Table 3.7.1. Concentration of Cross-Border Exposures and Capital Flow Volatility

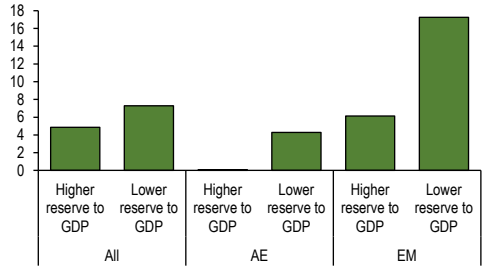
Dependent variable: **total net flows to GDP**

	(1) total net flows to GDP	(2) absolute value of the residuals in (1) (from the country-specific mean)	(3) absolute value of the residuals in (1) (from the country-specific mean)
Financial openness (Chinn-Ito Index)	-1.148***		
Exchange rate regime (degree of flexibility)	0.357		
Institutional quality	0.405		
Current account over GDP (deviation from trend)	-0.334***		
Real GDP growth	0.267**		
Real effective exchange rate (deviation from trend)	-0.029		
Real interest rate differentials (domestic - USA)	-0.064		
HHI (cross-border liability exposure)		**5.459*** **	
x Advanced Economies			**2.885***
x Emerging Market Economies			**6.491*** **
Country fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Countries	56	56	56
Observations	1,058	1,058	1,058
R squared	0.58	0.29	0.29

Source: IMF staff calculations.
Note: All explanatory variables are one-year lagged. Standard errors are clustered at the country level. Significance levels: 10 percent indicated by *, 5 percent indicated by **, 1 percent indicated by ***.

Online Annex Figure 3.7.2. The Effect of Concentration of Portfolio Liabilities on Capital Flows Volatility and the Role of Reserve Adequacy

(Percent of GDP)



Sources: FinFlows; Coordinated Direct Investment Survey; Coordinated Portfolio Investment Survey; and IMF staff calculations.
Note: The panel shows the effect of an increase in the foreign portfolio concentration measure (captured by the Herfindahl–Hirschman Index of portfolio and direct investment liability exposures) from 0 (full diversification) to 1 (full concentration). Countries with reserve assets to GDP ratio higher than top two thirds (lower than bottom one third) of the sample are classified as higher (lower) reserve to GDP. AE = advanced economies; EM = emerging market economies. The solid bars indicate statistical significance at the 10 percent level or lower.

The Role of International Reserve Adequacy

The effect of concentration on capital flow volatility could be conditional on the stock of international reserve assets held by countries. To examine the potential effect of reserves in mitigating the effect of financial concentration on capital flow volatility, equation (11) is estimated for two subsamples: countries with (lagged) reserves-to-GDP ratio that falls in the top two-thirds of the entire distribution of reserves to GDP, and countries with (lagged) reserves-to-GDP ratio in the bottom one-third of the sample distribution.

The results presented below suggest that the effect of higher concentration (high HHI) is more pronounced when countries have lower reserves-to-GDP in both advanced and emerging market economies (Online Annex Figure 3.7.2).

[18] Safe-haven advanced economies such as Germany, Japan, Switzerland, and the United States are excluded from this analysis, but the results remain broadly robust if these countries are included. The end of the sample period is 2020 because a proxy for exchange rate regime (Ilzetzki, Reinhart, and Rogoff 2021) is available only until 2019.

[19] One of the factors that could affect volatility of capital flows is the volatility of macro-financial variables (such as output) in the source countries (and its correlation with the volatility of macro-financial variables in the recipient country). If this volatility (correlation) is stable over time or across countries, this effect is captured in the individual country or time fixed effects, respectively.

Financial Fragmentation and Macro-Financial Volatility in G7 Economies

To estimate the effect of financial fragmentation on macro-financial volatility and the resultant loss of diversification benefits in the Group of Seven (G7) economies (Box 3.2), the two-country open economy model of Coeurdacier, Kollmann, and Martin (2010) is applied. The approach is as follows:

Scenarios. The two-country open economy model of Coeurdacier, Kollmann, and Martin (2010) is applied by considering the home country as any of the G7 economies and the foreign country as the rest of the world. In the "full integration" scenario, the rest of the world is composed of other G7 economies and the 53 largest (non-G7) economies—ranked based on nominal GDP in 2021. In the "moderate" and "extreme" fragmentation scenarios, countries are ordered according to the average of their bilateral geopolitical distance from the (G7) home country and excluded from being a trading partner if their distance to the home country exceeds the top 25th and 50th percentiles of the cross-country distribution, respectively.[20] Online Annex Table 3.7.2 lists the economies that are included under each scenario.

Online Annex Table 3.7.2. Economies Included in Different Scenarios

1	United States	XXX	16	Mexico	XX	31	Nigeria	XX	46	Romania	XXX
2	China	X	17	Indonesia	X	32	Egypt	X	47	Czech Republic	XXX
3	Japan	XXX	18	Netherlands	XXX	33	United Arab Emirates	X	48	Portugal	XXX
4	Germany	XXX	19	Saudi Arabia	X	34	South Africa	XX	49	New Zealand	XXX
5	United Kingdom	XXX	20	Türkiye	XXX	35	Bangladesh	X	50	Peru	XX
6	India	X	21	Switzerland	XXX	36	Denmark	XXX	51	Greece	XXX
7	France	XXX	22	Poland	XXX	37	Singapore	XX	52	Iraq	X
8	Italy	XXX	23	Sweden	XXX	38	Philippines	XX	53	Ukraine	XXX
9	Canada	XXX	24	Belgium	XXX	39	Malaysia	XX	54	Kazakhstan	XX
10	Korea	XXX	25	Thailand	XX	40	Hong Kong SAR	X	55	Hungary	XXX
11	Russia	XX	26	Ireland	XXX	41	Vietnam	X	56	Qatar	X
12	Australia	XXX	27	Israel	XXX	42	Pakistan	X	57	Algeria	X
13	Brazil	XX	28	Argentina	XX	43	Chile	XX	58	Morocco	XX
14	Islamic Republic of Iran	X	29	Norway	XXX	44	Colombia	XX	59	Kuwait	X
15	Spain	XXX	30	Austria	XXX	45	Finland	XXX	60	Slovak Republic	XXX

Sources: Häge (2011); and IMF staff calculations.
Note: The order of the listed economies corresponds to the ranking in terms of 2021 nominal output, based on the October 2022 *World Economic Outlook*. "XXX" represents partner economies for G7 economies under all scenarios. "XX" represents partner economies for G7 economies only under full integration and 25 percentile (moderate fragmentation) scenarios. "X" represents partner economies for G7 economies only under the full integration scenario.

Numerical parameterization. While in Coeurdacier, Kollmann, and Martin (2010), all model parameters are calibrated, in this chapter some parameters are estimated (Online Annex Table 3.7.3).[21] The estimated parameters—which determine the inverse elasticity of intertemporal substitution and the elasticities of substitution in consumption and investment between domestic and foreign goods—are critical to improve the fitness of the model simulations to the data on consumption, investment, and output volatility in each of the G7 economies under "full integration."[22] The remaining parameters are calibrated, as in Coeurdacier, Kollmann, and Martin (2010), but using longer time series that include more recent data. Specifically, home biases in consumption and investment are updated based on historical import ratios for the 1992–2019 period. Also, the parameters of total factor productivity (TFP) and investment efficiency processes are updated based on estimates with extended series (for the 1994–2019 period). The estimation of parameters corresponding to home biases in consumption and investment, TFP, and investment efficiency processes in the "foreign" country depends on the scenario (Online Annex Table 3.7.4)—and TFP and investment efficiency represent average TFP and investment efficiency across foreign country groups.[23]

Fit of the model to data. Online Annex Table 3.7.5 compares the volatility (standard deviation), cyclicality (correlation with output), and cross-country correlation of key macroeconomic variables (output, consumption, and investment) generated by model simulations with their empirical counterparts (for the 1992–2019 period).[24] The model performs well: it replicates closely the observed volatility of the key variables and their correlation with output—although it is less successful in explaining observed cross-country correlations. In addition, the degree of equity home bias implied by the model closely matches the bias observed in G7 economies.

[20] Pairwise geopolitical distances (between G7 economies and non-G7 countries) are measured with the average *S* score (Signorino and Ritter 1999) based on countries' voting in the UNGA during the 2012–21 period. Note that China's geopolitical distances to G7 economies are also assigned to Hong Kong SAR. In addition, the Taiwan Province of China (ranked 22nd in terms of 2021 nominal output) is excluded from the sample.
[21] The estimation and calibration exclude the observation during the COVID-19 pandemic from the samples after 2019.
[22] Specifically, the parameters are estimated by Bayesian estimation using yearly data from 1992 to 2019. The data set consists of two Hodrick-Prescott filtered variables (smoothing parameter is 100, the same applies to the other Hodrick-Prescott–filtered variables) in home country: (real) consumption and output.
[23] Home bias in consumption and investment under fragmentation scenarios are calculated by assuming that currently imported goods from countries that are excluded from trading partners are produced by home country and countries that remain included in trading partners, in proportion to the current ratio of the production by home and those countries, based on import shares in 2019. Country-specific TFP series are obtained from the Penn World Table version 10 (Feenstra and others 2015). Country-specific investment efficiency series are calculated as the ratio of the country's consumption deflator to the investment deflator, which are obtained from the UN's National Accounts Main Aggregates Database. These series are first detrended using the Hodrick-Prescott filter and aggregated across countries (as weighted averages based on real GDPs in US dollars) to obtain the "foreign" TFP and investment efficiency series. These series are then used to estimate the "foreign" AR(1) processes for TFP and investment efficiency.
[24] Empirical statistics are based on Hodrick-Prescott filtered variables. The variables for foreign country are calculated as the sum of the variables in US dollars basis.

Online Annex Table 3.7.3. Parametrization of the Model

parametrization	United States	Japan	Germany	United Kingdom	France	Italy	Canada
Calibration (Coeurdacier, Kollmann, and Martin 2010)	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Estimation (prior distribution: Uniform [1,2])	1.04	1.01	1.01	1.03	1.02	1.01	1.06
Calibration (Coeurdacier, Kollmann, and Martin 2010)	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Estimation (prior distribution: Uniform [0.6,1.5])	0.77	0.90	1.26	0.75	0.76	0.66	0.95
Estimation (prior distribution: Uniform [0.6,1.5])	0.90	1.01	1.14	0.89	0.87	0.75	1.03
Calibration (Coeurdacier, Kollmann, and Martin 2010)	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Calibration (Coeurdacier, Kollmann, and Martin 2010)	0.10	0.10	0.10	0.10	0.10	0.10	0.10

Source: IMF staff calculations.
Note: Parameters are common between home and foreign countries. Estimated parameters show the posterior mean.

Online Annex Table 3.7.4. Parametrization of Home Bias in Consumption and Investment, TFP, and Investment Efficiency Processes

	United States			Japan			Germany			United Kingdom			France			Italy			Canada		
	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)
home bias in consumption and investment	0.87	0.90	0.93	0.85	0.91	0.94	0.70	0.73	0.75	0.76	0.79	0.80	0.75	0.78	0.80	0.77	0.80	0.81	0.70	0.73	0.76
standard deviation of home TFP shock	0.67			0.72			0.67			0.86			0.63			0.92			0.78		
standard deviation of foreign TFP shock	0.61	0.70	0.58	0.54	0.63	0.59	0.53	0.63	0.58	0.52	0.60	0.55	0.52	0.61	0.57	0.52	0.61	0.56	0.51	0.61	0.57
correlation of home and foreign TFP shocks	0.17	0.17	0.55	0.27	0.41	0.36	0.30	0.36	0.40	0.39	0.56	0.76	0.58	0.69	0.74	0.47	0.48	0.61	0.67	0.65	0.38
persistence of home TFP process	0.84			0.69			0.59			0.85			0.74			0.76			0.54		
persistence of foreign TFP process	0.72	0.50	0.64	0.72	0.67	0.79	0.72	0.67	0.78	0.70	0.62	0.76	0.69	0.64	0.77	0.71	0.65	0.77	0.69	0.65	0.78
standard deviation of home inv. efficiency shock	0.60			0.34			0.42			0.90			0.40			0.50			0.76		
standard deviation of foreign inv. efficiency shock	0.52	0.55	0.32	0.47	0.47	0.43	0.46	0.45	0.41	0.46	0.43	0.39	0.46	0.45	0.40	0.46	0.44	0.40	0.45	0.43	0.39
correlation of home and foreign inv. efficiency shocks	0.27	0.56	0.63	0.19	0.16	0.15	0.29	0.38	0.37	0.34	0.42	0.32	0.29	0.30	0.41	0.20	0.38	0.38	0.28	0.50	0.58
persistence of home inv. efficiency process	0.76			0.81			0.87			0.58			0.81			0.69			0.78		
persistence of foreign inv. efficiency process	0.87	0.81	0.77	0.87	0.79	0.75	0.88	0.81	0.78	0.87	0.80	0.77	0.87	0.80	0.77	0.87	0.80	0.77	0.87	0.80	0.77

Sources: IMF staff calculations.
Note: Home bias in consumption and investment is common between home and foreign countries. The (a) columns represent the parameters for simulation to replicate the current state of the economy (full integration scenario), the (b) columns represent the parameters for 25 percentile (moderate fragmentation) scenario, and the (c) columns represent the parameters for 50 percentile (extreme fragmentation) scenario. The shock processes are estimated based on Hodrick-Prescott filtered (smoothing parameter: 100) TFP and investment efficiency series. The series for foreign country are calculated as the weighted average of each country by real output (US dollars). TFP = total factor productivity.

Online Annex Table 3.7.5. Fit of the Model to Data

	United States		Japan		Germany		United Kingdom		France		Italy		Canada	
	Model	Data	Model	Data	Model	Data	Model	Data	Model	Data	Model	Data	Model	Data
Standard deviations (percent)														
Output	1.99	1.43	1.60	1.31	1.43	1.21	2.51	1.57	1.51	1.22	2.15	1.68	1.66	1.29
Consumption	1.53	1.54	1.05	0.75	0.88	0.86	1.83	1.90	1.04	1.10	1.49	1.74	1.03	0.80
Investment	4.31	4.78	3.90	3.20	4.14	2.68	6.34	3.81	3.67	3.16	5.06	5.07	5.88	3.53
Correlation with domestic Output														
Consumption	0.86	0.94	0.83	0.69	0.74	0.60	0.84	0.95	0.84	0.82	0.87	0.88	0.68	0.50
Investment	0.81	0.93	0.86	0.82	0.74	0.83	0.69	0.92	0.81	0.96	0.82	0.96	0.68	0.53
Cross Country Correlation														
Output	0.29	0.33	0.33	0.69	0.35	0.63	0.58	0.61	0.66	0.66	0.63	0.60	0.60	0.60
Consumption	0.44	0.27	0.51	0.22	0.86	0.20	0.79	0.59	0.81	0.70	0.74	0.63	0.88	0.81
Investment	0.17	-0.12	0.18	0.46	-0.05	0.50	0.00	0.45	0.36	0.43	0.33	0.21	-0.11	0.69
Asset Portfolio														
Equity home bias	0.63	0.59	0.59	0.68	0.28	0.37	0.39	0.49	0.38	0.60	0.41	0.30	0.28	0.49

Source: IMF staff calculations.
Note: Empirical statistics are based on Hodrick-Prescott filtered variables (smoothing parameter: 100). The equity home bias of country *i* is calculated as 1 minus share of foreign equities in the country's equity holdings/share of foreign equities in the world market portfolio in the year 2019. Regarding the missing market capitalization data for several countries (2015 for the United Kingdom and Italy; 2019 for France), the value is extrapolated by assuming that the changes in market capitalization follow those in Germany.

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