

WORLD ECONOMIC OUTLOOK



RESEARCH

Geoeconomic Fragmentation and Foreign Direct Investment

April 2023 Spillover WEO Chapter

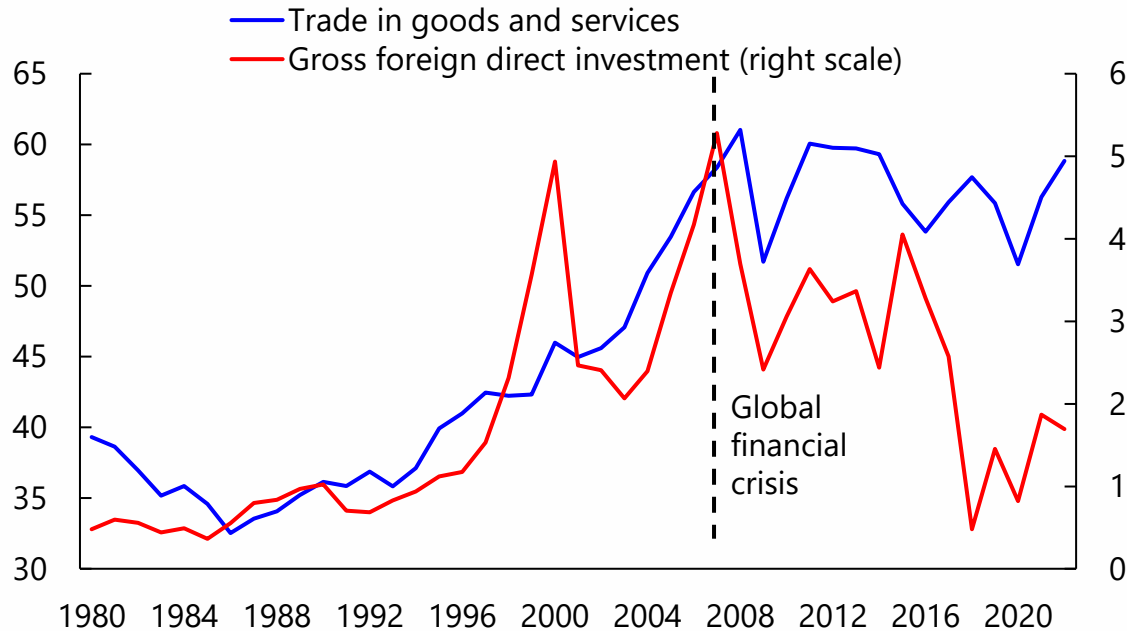
Trade and Global Value Chains In Times Of Insecurity

May 3, 2023

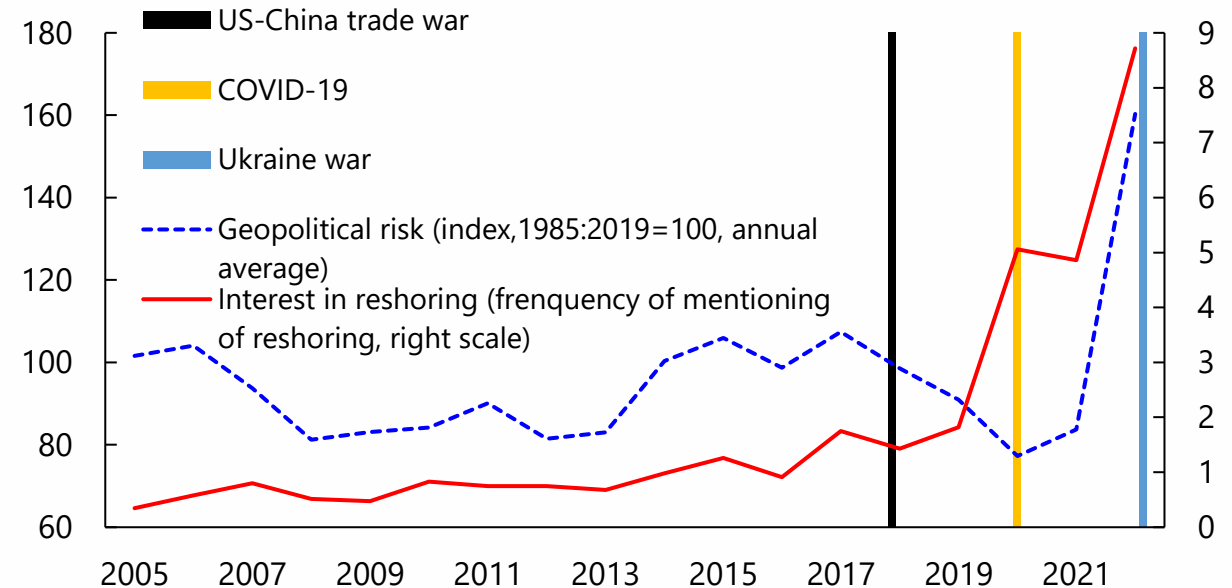
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Growing interest in friend-shoring amid rising geopolitical tensions

“Slowbalization” (Percent of GDP)



Rising geopolitical tensions and FDI fragmentation 1/ (Index; frequency of mentions of reshoring on right scale)



The pandemic, supply-chain disruptions, and rising geopolitical tensions have brought the risks and potential costs of fragmentation to the center of the policy debate (Antràs 2021; Baldwin 2022). Several policymakers (e.g., Janet Yellen; Laurence Boone) have urged building supply chain resilience through reshoring or friend-shoring of FDI

The chapter studies how geoeconomic fragmentation could affect FDI, generating global spillovers

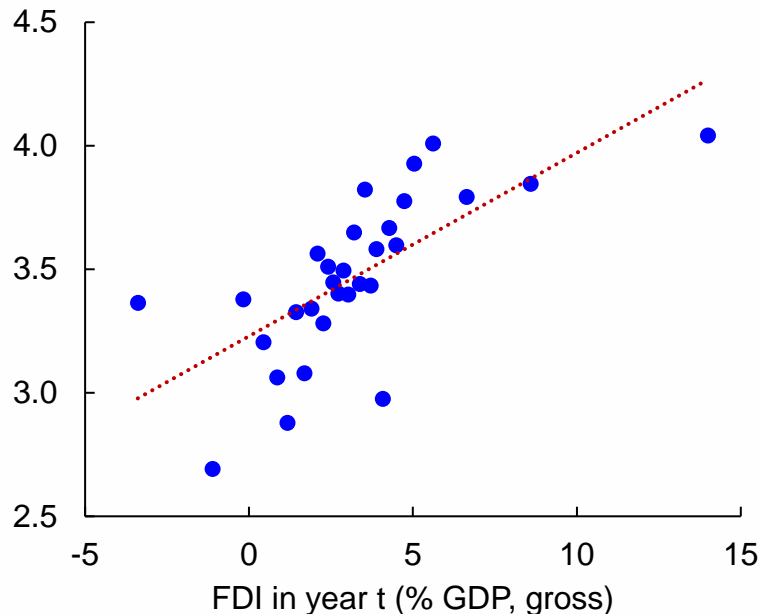
Sources: IMF, *World Economic Outlook*; Caldara and Iacoviello (2022); Hassan and others (2019); NL Analytics; and IMF staff calculations.
1/ The interest in reshoring measures the frequency of mentions of reshoring, friend-shoring, or near-shoring in firms' earnings calls.

FDI is a non-trivial part of capital stock, and is associated with economic growth

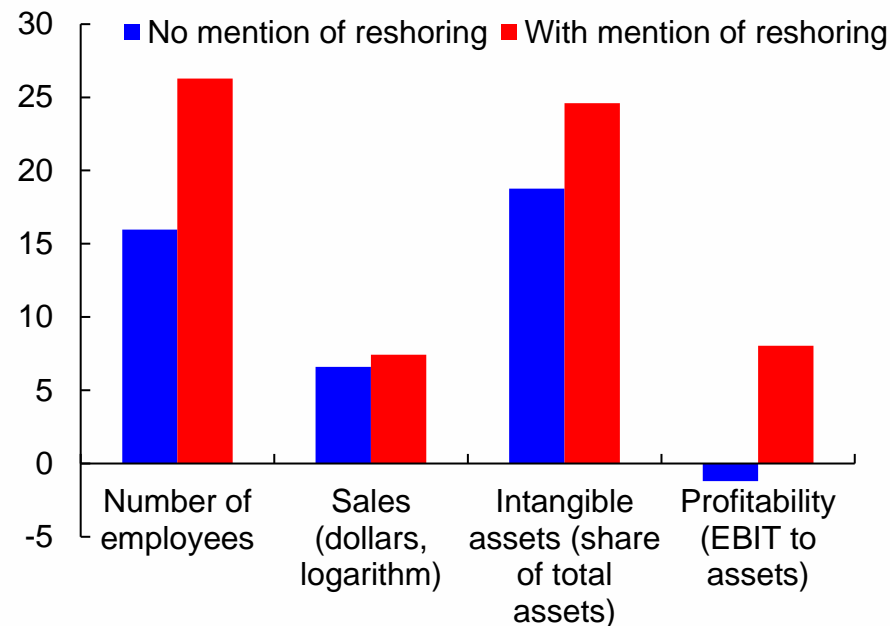
1. FDI inflows are associated with faster GDP growth, especially in EMDEs, and with technology diffusion
2. Firms planning to reshore are larger, more knowledge intensive and more profitable
3. FDI accounts for a relevant share of capital stock (mean 12%, median 9%)

FDI and economic growth 1/

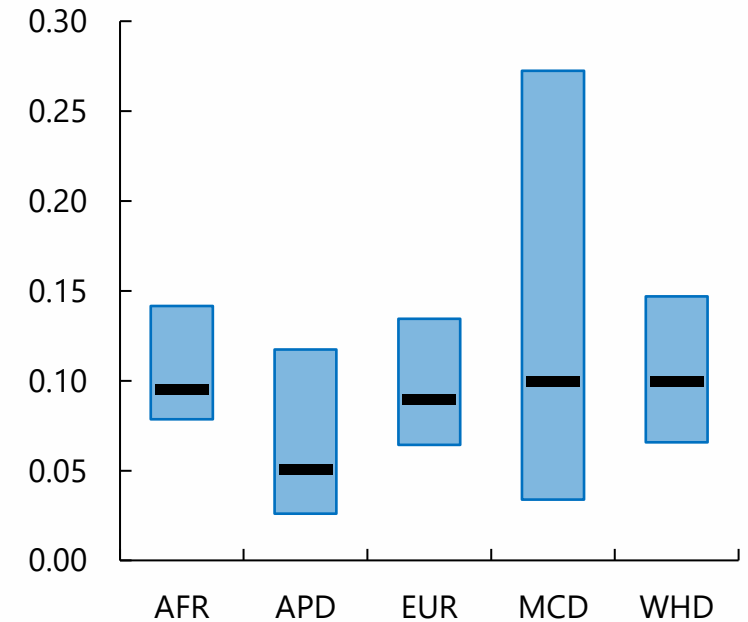
(Real GDP growth between t and $t+3$, percent)



Interest in reshoring and firm characteristics 2/



Estimated FDI to capital stock by region (Inter-quartile range)



Sources: IMF, *World Economic Outlook*; CDIS; Penn World Tables; NL Analytics; Compustat; and IMF staff calculations.

1/ The sample includes 154 countries with at least 30 years of non-missing data between 1980 and 2022. The binned scatterplot is obtained from a regression of the annual real GDP growth between $t+3$ and t against the ratio of gross FDI inflows over GDP at time t , controlling for the logarithm of real GDP at time t and for year and country fixed effects. The regression gives a coefficient of the FDI variable equal to 0.077 (p-value of 0.000).

2/ Simple averages across firms that mentioned or did not mention reshoring, friend-shoring, and near-shoring in earnings calls. Differences across groups are statistically significant. EBIT = earnings before interest and taxes.

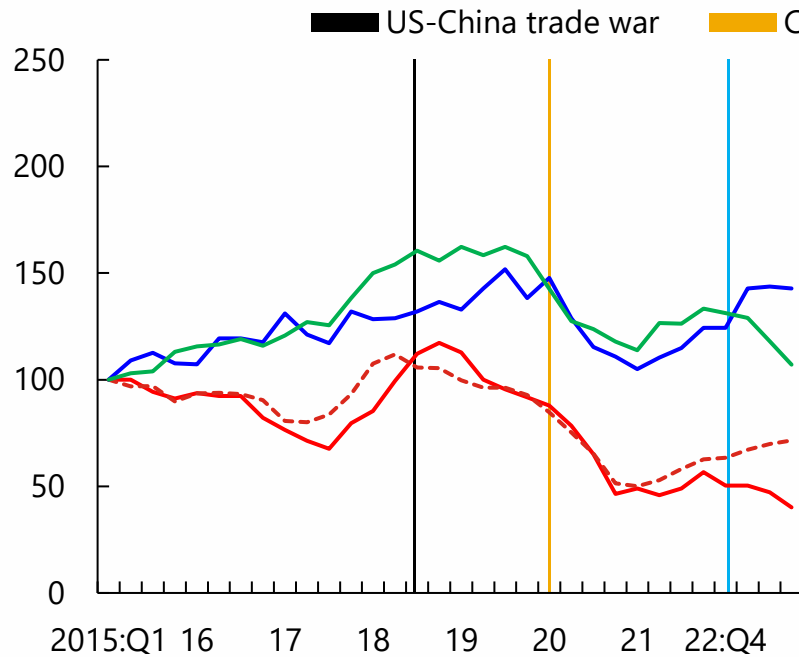
Main questions

1. Are there already signs of FDI fragmentation?
2. Does geopolitical alignment affect FDI flows?
3. Which countries and industries are more exposed to reshoring?
4. Through which channels does FDI affect host countries?
5. What will be the economic costs of fragmentation and how are they distributed across countries?

FDI Fragmentation: Stylized Facts

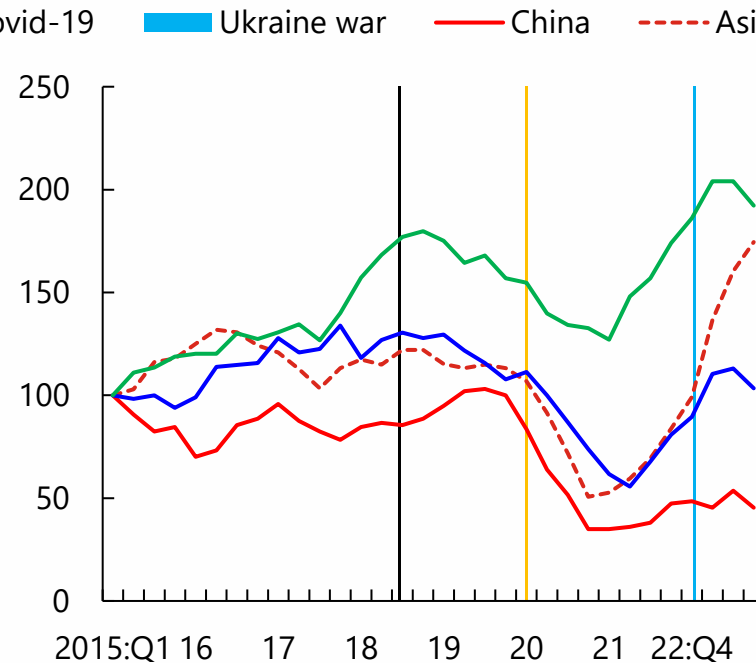
Strategic FDI has been moving from China to other Asian countries, Europe and the US

FDI in strategic sectors

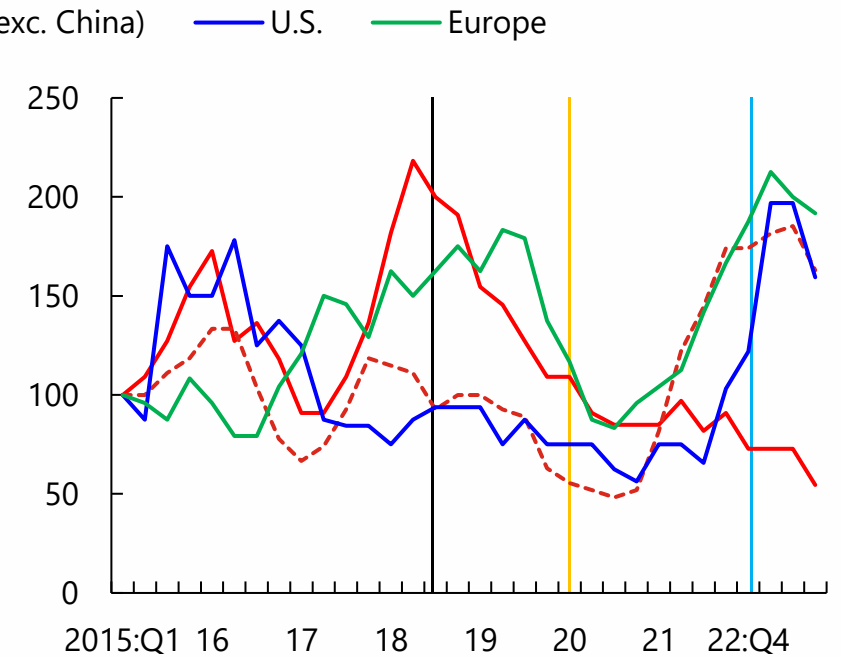


FDI for R&D

(Number of investments; 4-quarter moving average; 2015:Q1=100)



FDI in the semiconductor industry



- Strategic FDI started declining before the pandemic (particularly in Asia), then recovered in the US and Europe, while stagnating in Asia (especially in China)
- These trends are even more visible when looking at FDI for R&D activities and in semiconductors. Post pandemic semiconductor FDI to US, Europe and Asia (exc. China) sharply increased, while that to China kept falling.

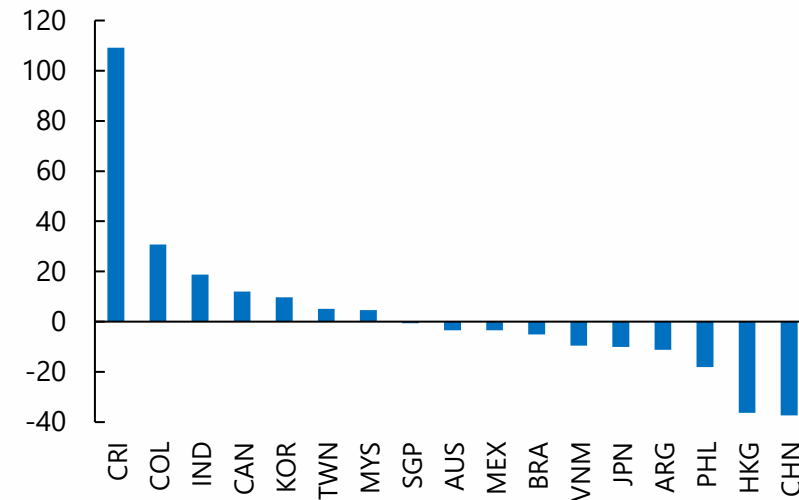
Sources: fDi Markets Database; and IMF staff calculations.

FDI within Western countries has been more resilient than FDI in and out of Asia

FDI reallocation across regions, 2020:Q2–22:Q4 versus 2015:Q1–20:Q1 1/
(Percentage point deviation from aggregate change)

Source regions	Rest of the world	26.4	7.1	5.3	11.4	-3.7	-24.7	18.6
	China	-22.1	-6.9	-17.8	-31.3	-44.3		-31.9
	Asia excl. China	-3.2	-8.7	-11.7	-2.4	-23.7	-49.2	-4.4
	Emerging Europe	27.6	2.9	9.9	18.1	-22.3	13.9	-11.5
	Advanced Europe	7.5	-11.7	9.3	-0.9	-9.8	-19.7	8.6
	Americas excl. US	18.6	27.3	14.9	34.0	5.9	-13.3	27.6
	United States		9.2	0.6	19.4	2.3	-40.6	21.6
		United States	Americas excl. US	Advanced Europe	Emerging Europe	Asia excl. China	China	Rest of the world
Destination regions								

Change in Outward US FDI, 2020:Q2–22:Q4 versus 2015:Q1–20:Q1 2/
(Percentage point deviation from aggregate change)



- Comparing the number of FDI post-COVID with the pre-pandemic period shows that:
 - Asia (and China even more) became less relevant both as source and destination countries
 - Other regions (e.g., Europe) gained in relative terms
- There is not only a reallocation *across* regions, but also *within* regions (e.g., China vs Korea)

Sources: fDi Markets Database; and IMF staff calculations.

1/ Figure shows deviation of regional foreign direct investment change from aggregate change (19.5 percent decline). Changes are computed using the number of greenfield foreign direct investments in 2020:Q2–22:Q4 and average number in 2015:Q1–20:Q1. Green (red) shading denotes positive (negative) numbers.

2/ Figure shows the deviation of outward US foreign direct investment change by destination from aggregate change (24 percent decline). Changes are computed using the number of greenfield foreign direct investments from the United States to Europe and Asia in 2020:Q4–22:Q2 and average number in 2015:Q1–20:Q1. Economy Labels on the x-axis uses International Organization for Standardization (ISO) country codes.

Geopolitical Alignment and FDI

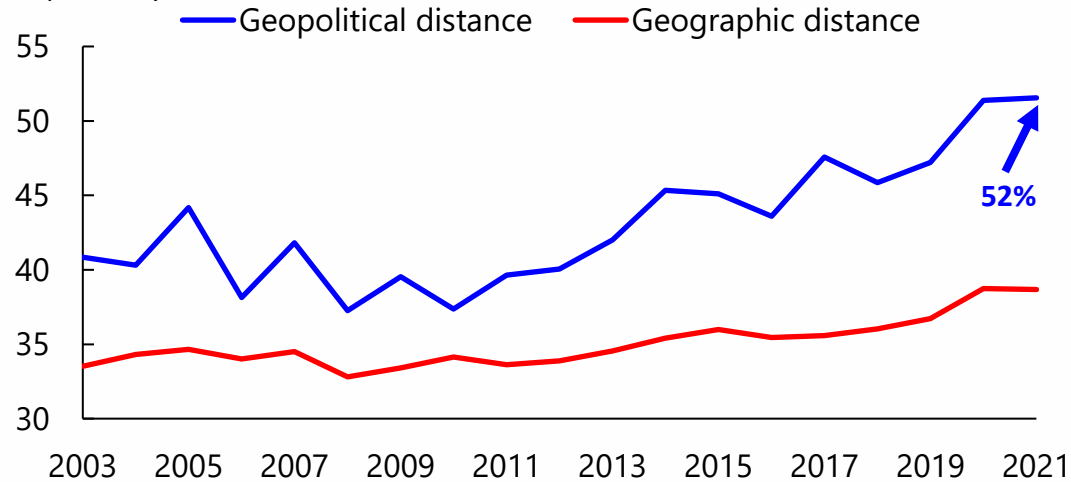
Data: Investment level FDI, UNGA, earnings calls and gravity

- **fDi Markets Database** (FT): investment level information on about 300,000 **FDI** since 2003 (including sector, source and destination country)
- **UNGA** votes and statistical filter in Bailey et al. (2017) to get a measure of geopolitical alignment—“**Ideal Point Distance**” (IPD)
- Text mining of earnings calls (**NL Analytics**) and **Atlantic Council** study to define **strategic sectors**
- **CEPII** bilateral dataset: **gravity measures** like physical distance, shared colonial origins, shared language, etc.

More FDI between aligned countries

FDI between geographically and geopolitically close countries 1/

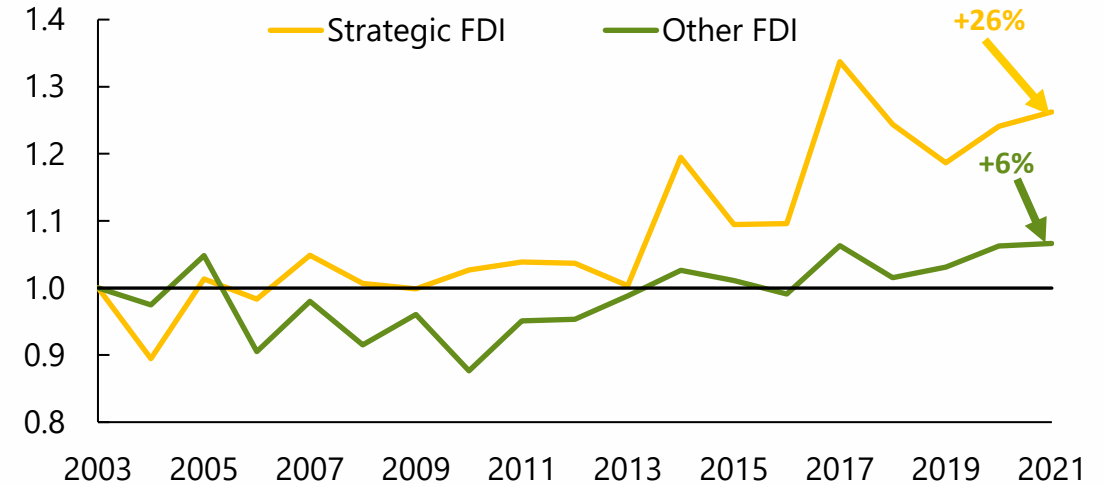
(Percent)



- **52 percent** of FDI taking place between aligned countries in 2021 (2.5 times higher than expected)
- Geopolitical alignment increasingly more relevant than geographical closeness

Geopolitics became more relevant for strategic FDI 2/

(Probability ratios normalized to 1 in 2003)



- Increase in relative importance of geopolitical alignment driven mostly by FDI in strategic sectors.
- FDI share between aligned countries over FDI share between geographically close countries up **26 percent** in strategic sectors and by **6 percent** in others ([robustness with distance from China](#))

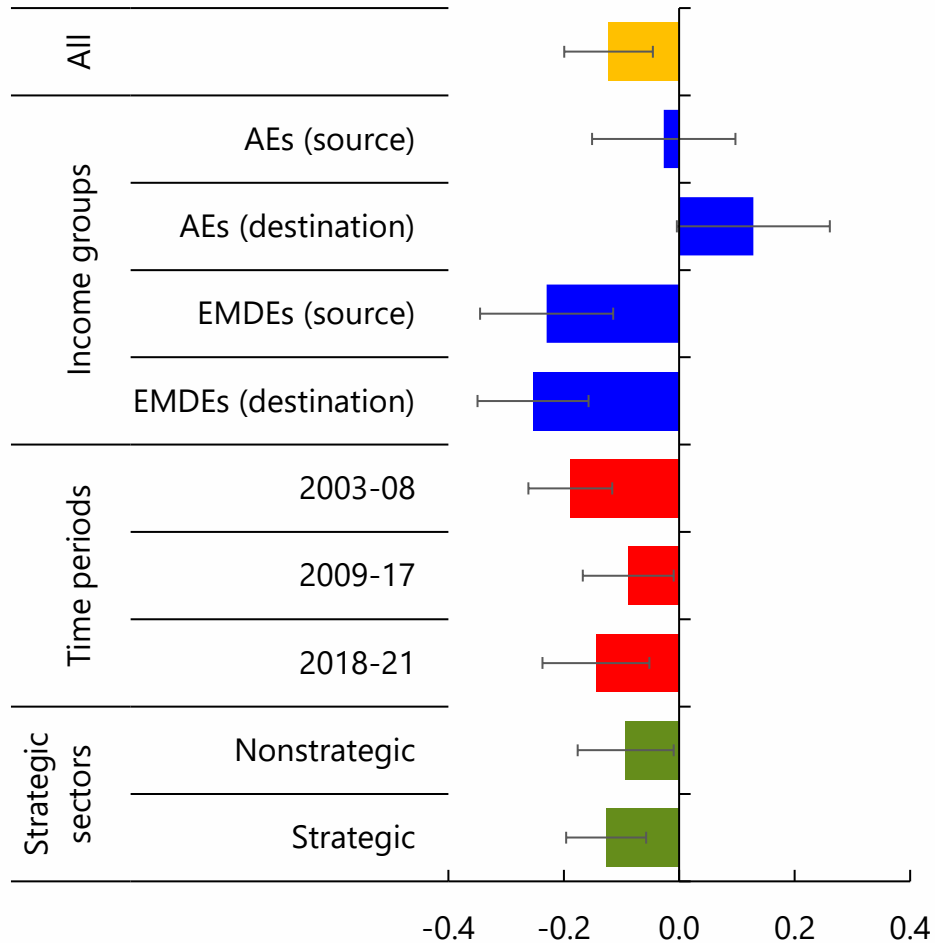
Sources: Bailey, Strezhnev, and Voeten (2017); Centre d'études prospectives et d'informations internationales, Gravity database; fDi Markets; and IMF staff calculations.

1/ Figure shows annual shares of total FDIs between country pairs similarly distant (that is, in same quintile of distance distribution), geopolitically and geographically, from the US.

2/ Probability ratio of strategic FDI taking place between country pairs close politically or geographically (i.e. they are in the same quintile of the relevant distance distribution).

Geopolitical distance is associated with lower FDI, especially in EMDEs, in recent years and in strategic sectors

Gravity model for ideal point distance and FDI (Semielasticities)



Estimate variations on empirical model for FDI from source country s to destination country d . Include IPD, gravity variables, source-time and destination-time FE (with PPML)

$$FDI_{sdt} = g(\alpha IPD_{sdt-1} + \beta X_{sd} + \tau_{st} + v_{dt}, \varepsilon_{sdt})$$

Results:

- **Baseline:** the semi-elasticity of FDI to IPD is -0.12 (moving IPD from 25 to 75 percentile is associated with a FDI decline by 17%)
- **By income groups:** coefficient twice as large if destination or source country is EMDE, and not significant if AE
- **Over time:** coefficient decreasing up to 2017, but back above avg coefficient in the last 4 years
- **By sector:** coefficient is larger on strategic investment than on other sectors (-0.13 vs -0.09) ([Robustness](#) on IPD)

Sources: Atlantic Council; Bailey, Strezhnev, and Voeten (2017); Centre d'études prospectives et d'informations internationales, Gravity database; fDi Markets; NL Analytics; and IMF staff calculations.

Note: Coefficients of ideal point distance are estimated from gravity model for number of foreign direct investments. See Online Annex 4.1 for details. AEs = advanced economies; EMDEs = emerging market and developing economies.

A Multidimensional Index of Exposure to Reshoring

A multidimensional index of vulnerability to FDI relocation

Indices are constructed to capture different dimensions of risks to existing FDI stocks from geo-economic fragmentation for host economies

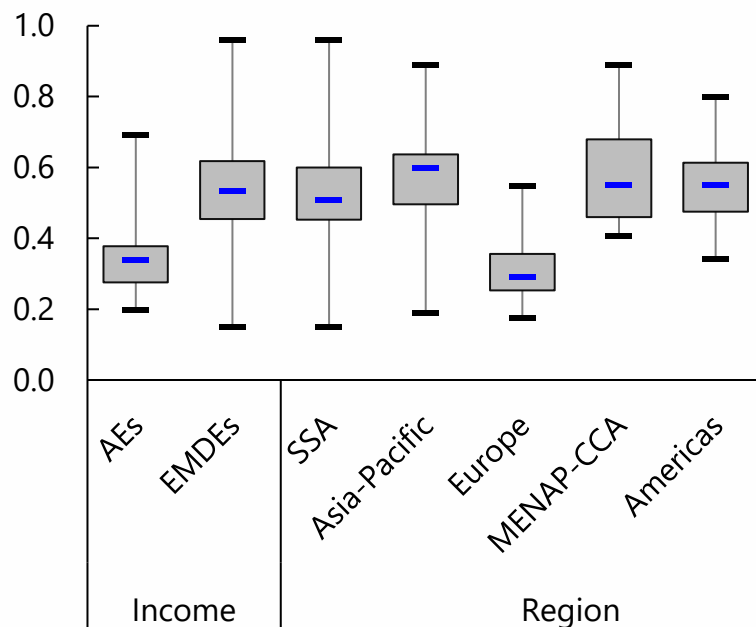
1. **Geopolitical**: FDI stocks from source economies that are more geopolitically distant are more vulnerable to reshoring
2. **Market power**: A host economy's vulnerability to reshoring in a sector may be attenuated if the host is a large player in that sector
3. **Strategic**: A host's vulnerability may be particularly high in sectors deemed strategic



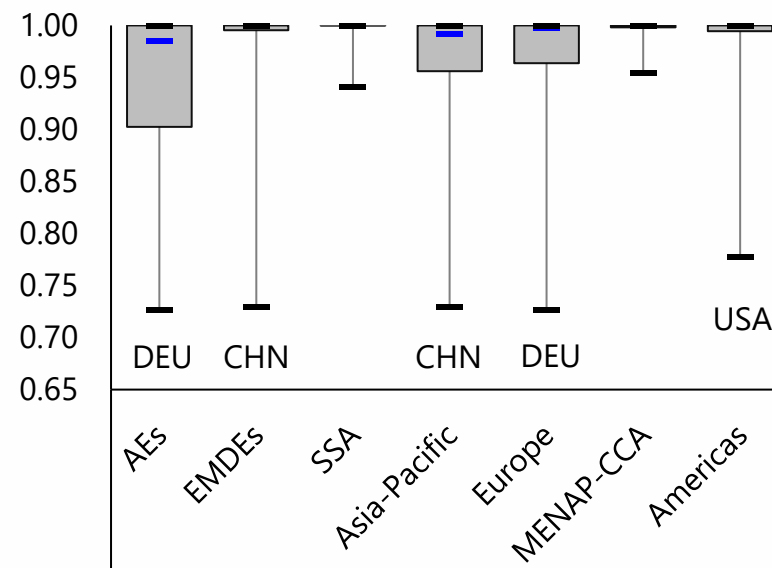
Aggregate index of vulnerability

EMDEs more geopolitically exposed than AEs; market power offers limited protection; strategic exposures significant for AEs and EMDEs

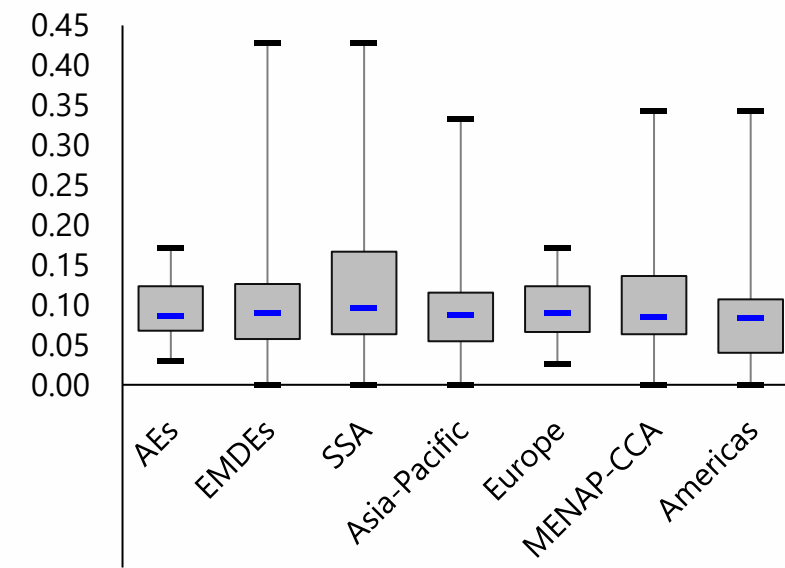
Vulnerability index, geopolitical



Vulnerability index, market power



Vulnerability index, strategic



$$v_{i,t}^{geo} = \sum_j share_{ij,t}^{FDI} * \gamma_t^{geo}(i,j),$$

where $\gamma_t^{geo}(i,j) = ptile(IPD_{ij})$

$$v_{i,t}^{mkt} = \sum_s share_{i,s,t}^{FDI} * \gamma_t^{mkt}(i,s),$$

where $\gamma_t^{mkt}(i,s) = \begin{cases} 0.5 & \text{if } i \text{ is amongst 10 largest exporters in sector } s \\ 1 & \text{if otherwise} \end{cases}$

$$v_{i,t}^{strat} = \sum_s share_{i,s,t}^{FDI} * \gamma_t^{strat}(s),$$

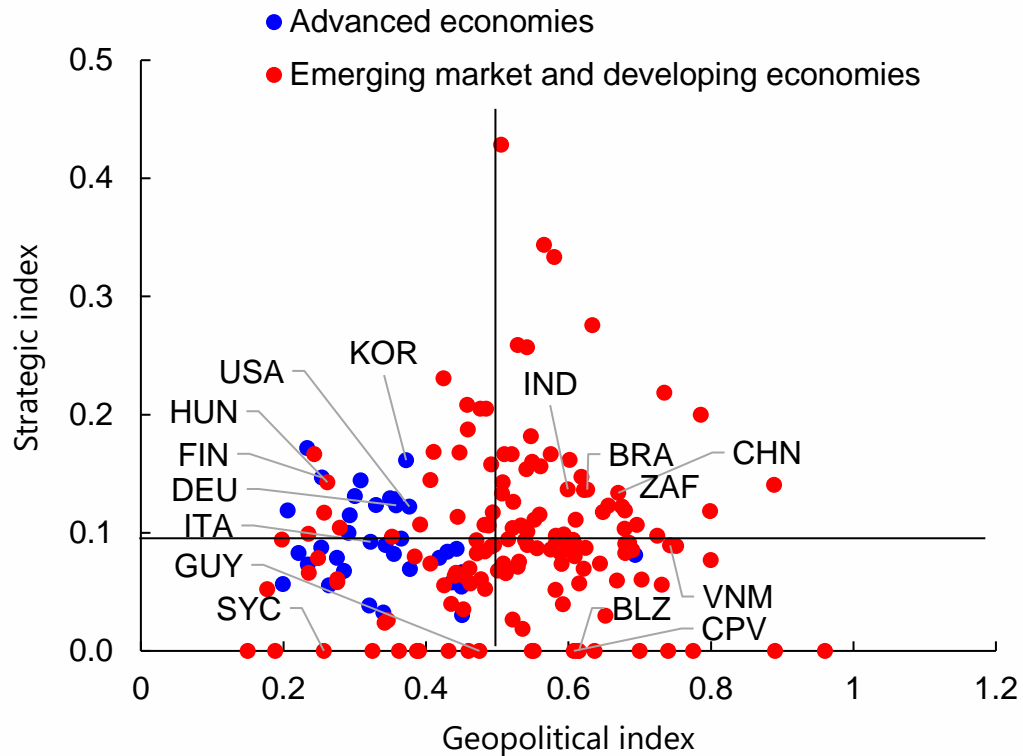
where $\gamma_t^{strat}(s) = \begin{cases} 1 & \text{if sector is strategic} \\ 0 & \text{if otherwise} \end{cases}$

Sources: Atlantic Council; Bailey, Strezhnev, and Voeten (2017); fDi Markets; NL Analytics; Trade Data Monitor; and IMF staff calculations.

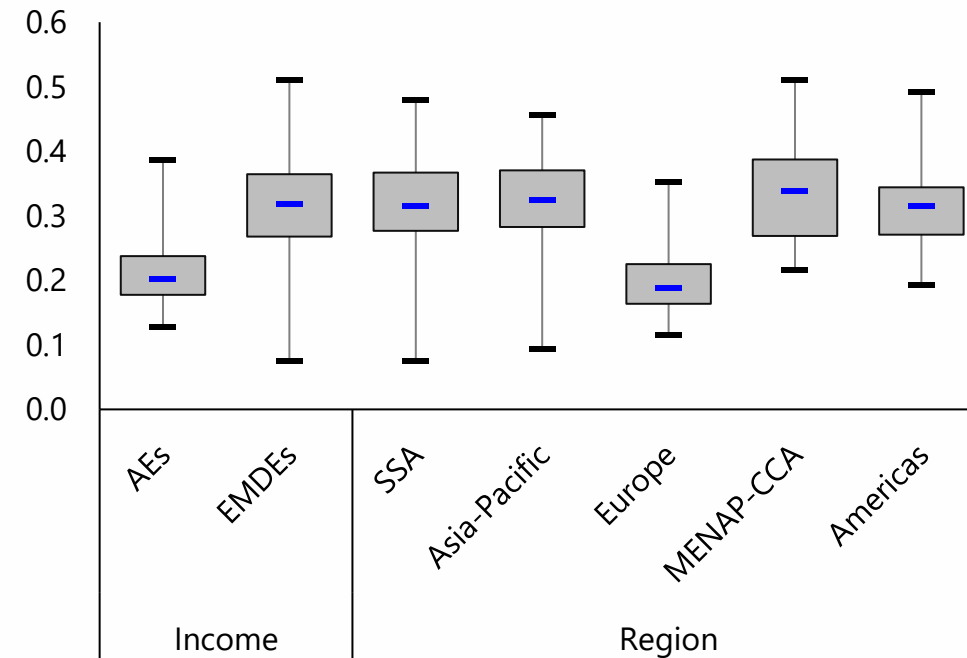
Note: Figure shows distribution of vulnerability index by income and regional groups, based on post-2009 foreign direct investment flows. AEs = advanced economies; EMDEs = emerging market and developing economies; MENAP-CCA = Middle East, North Africa, Afghanistan, Pakistan, Caucasus, and Central Asia; SSA = sub-Saharan Africa.

Aggregate vulnerability is higher for EMDEs than AEs

Geopolitical index and strategic index 1/



Vulnerability index, aggregate 2/



$$v_{i,t}^{agg} = \sum_j \sum_s share_{ij,s,t}^{FDI} * \gamma_t^{agg}(i,j;s),$$

$$where \gamma_t^{agg}(i,j;s) = \frac{1}{2} \gamma_t^{geo}(i,j) * \gamma_t^{mkt}(i;s) + \frac{1}{2} * \gamma_t^{strat}(s)$$

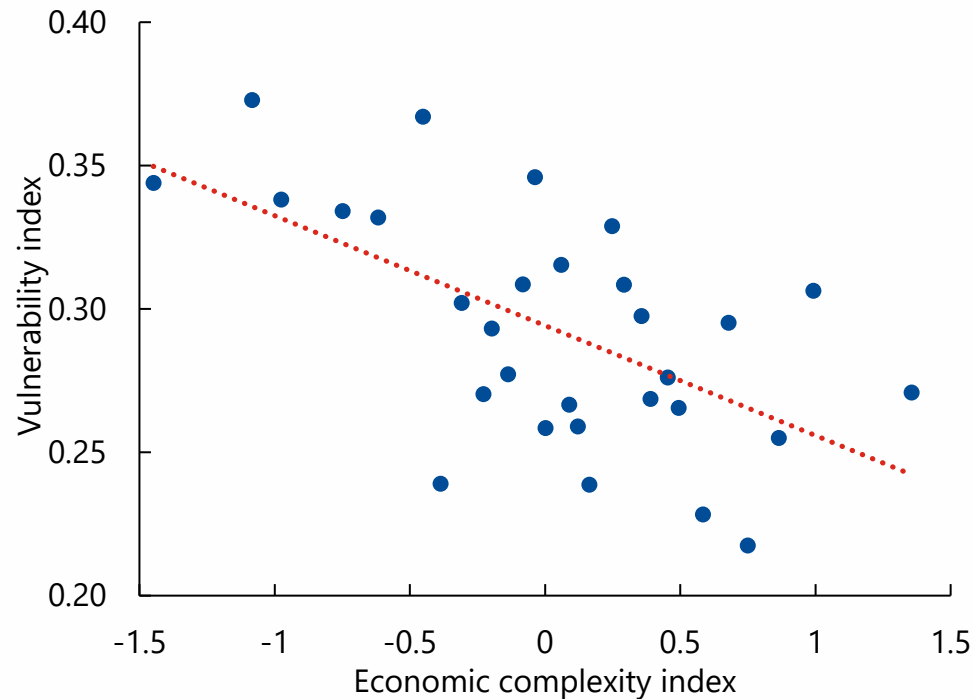
Sources: Atlantic Council; Bailey, Strezhnev, and Voeten (2017); fDi Markets; NL Analytics; Trade Data Monitor; and IMF staff calculations.

1/ Data are based on post-2009 foreign direct investment flows. Horizontal line indicates the median value of strategic index, 0.09, and vertical line indicates the median value of geopolitical index, 0.5. Economy Labels in the figure use International Organization for Standardization (ISO) country codes.

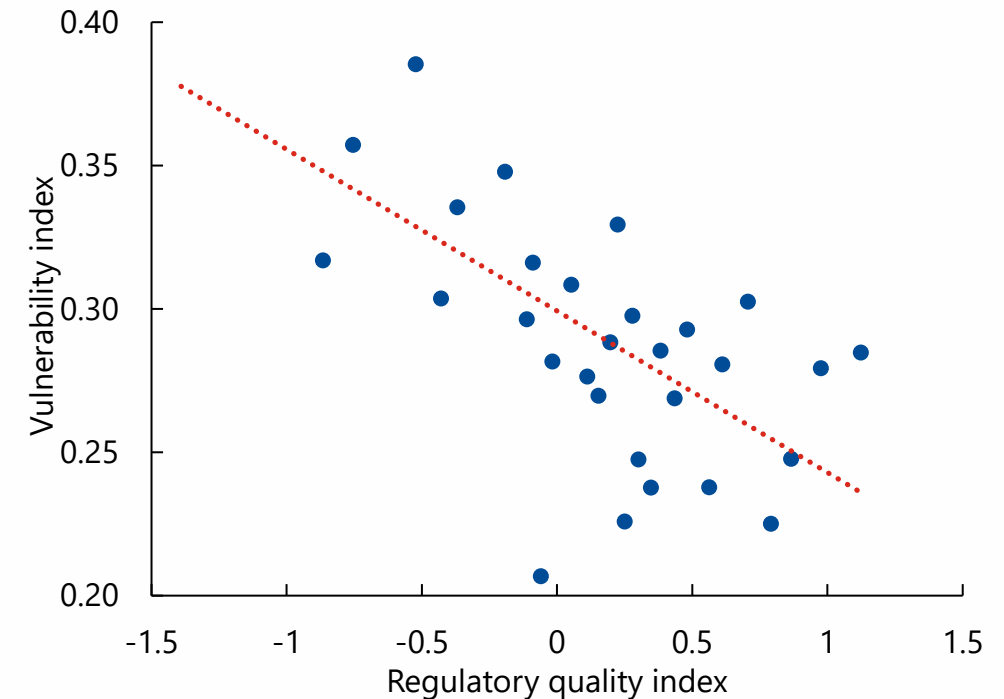
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Vulnerability to reshoring, economic complexity, and domestic policies

Vulnerability index and economic complexity



Vulnerability index and regulatory quality



Sources: fDi Markets; Bailey et al (2017); TDM, NL Analytics; Atlantic Council; The Growth Lab at Harvard University. (2019); World Bank's WGI; and IMF staff calculations.

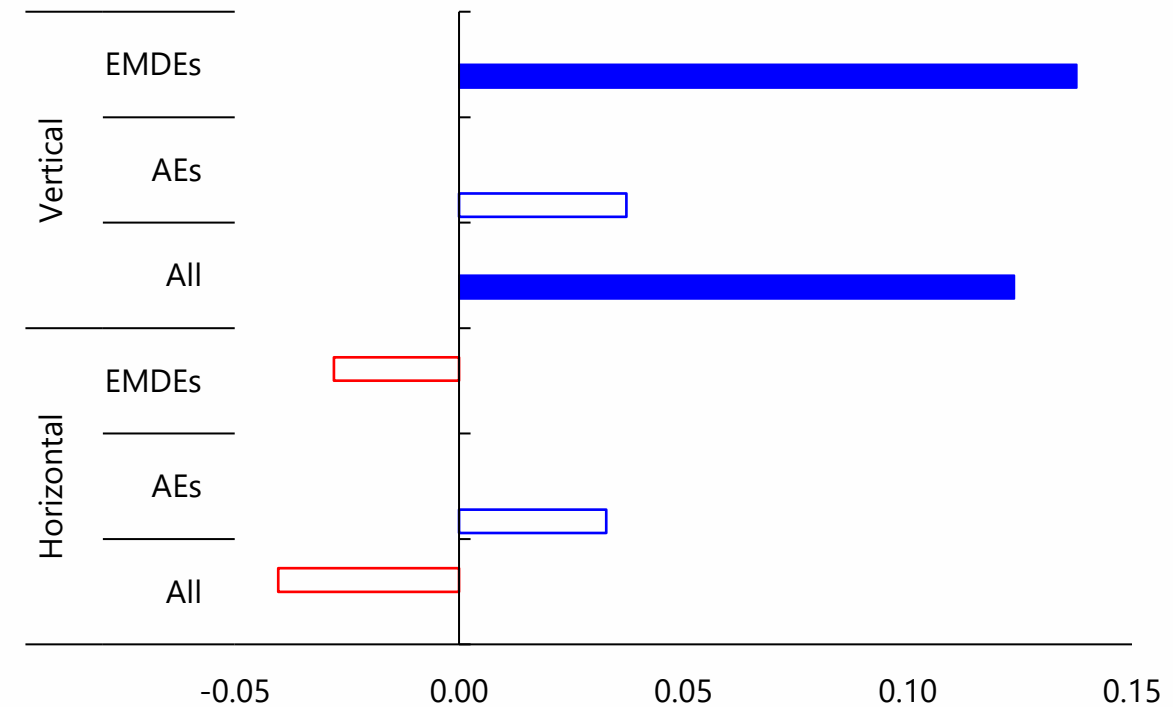
Note: The sample includes a cross section of 128 countries. The binned scatterplots are obtained from a regression of the aggregate vulnerability index against the economic complexity index (LHS chart) and the regulatory quality index (from the World Governance Indicators, RHS chart), controlling for the logarithm of real GDP, trade (% GDP) and FDI inflows (% GDP). All variables are averaged over 2010-2019. The regressions give a coefficient of the economic complexity index equal to -0.039 (p-value of 0.000) and a coefficient of the regulatory quality index equal to -0.057 (p-value of 0.000).

FDI Spillovers to Host Countries

Vertical FDI drives spillovers to host countries

- Cross-country studies reveal that the growth effect of FDI is uneven and depends on host country characteristics/FDI types
 - ▶ **Horizontal FDI:** When MNCs establish foreign subsidiaries to serve a local market directly
 - ▶ **Vertical FDI:** When MNCs establish foreign subsidiaries to produce intermediate inputs in a foreign country and supply to parent (or any other affiliated) firms; *likely more exposed to geoeconomic fragmentation*
- Classifying host countries by FDI types
 - ▶ share of local unaffiliated sales in total sales by foreign affiliates \uparrow = horizontal FDI country (data from the Export-Import Bank of Korea)
- **Results:** The positive association between FDI and growth is found exclusively for vertical FDI (in EMDEs)

FDI and growth: horizontal versus vertical
(Standardized coefficients)



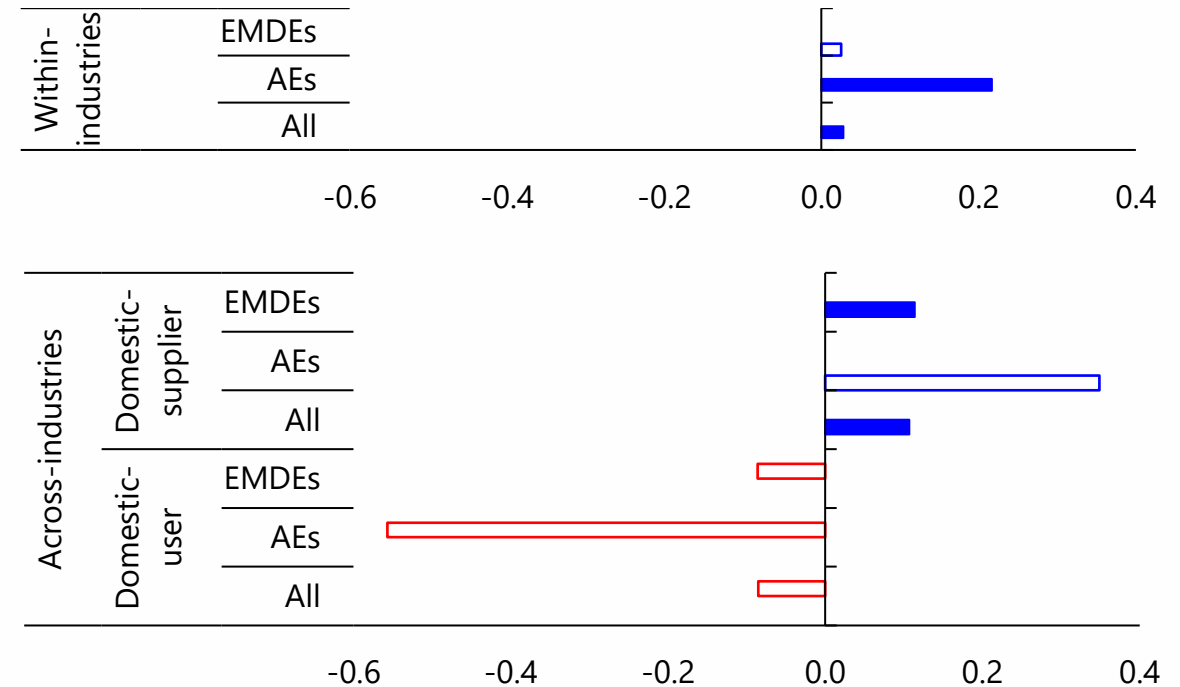
Sources: Export-Import Bank of Korea; and IMF staff calculations.
Note: Figure reports the standardized coefficients obtained from cross-country growth regression estimated separately for countries with horizontal foreign direct investment and those with vertical. Solid bars indicate statistical significance at 1 percent level. See Online Annex 4.3 for details. AEs = advanced economies; EMDEs = emerging market and developing economies.

Competing firms benefit from FDI in AEs, while supplying firms benefit from FDI in EMDEs

- **Firm-level analysis** helps identifying specific channels through which FDI affects local firms' productivity
- **Data:** WBES and fDi Market data matched at the country-sector-year level (repeated cross-sections)
- **Methodology:** firm-level regression of labor productivity growth on measures of (lagged) sectoral FDI
- **Results:**
 - i) **Spillovers to domestic firms in the same industry** are positive and significant in AEs;
 - ii) **Spillovers to domestic suppliers** are positive and significant in EMDEs; and
 - iii) **Spillovers to domestic users** are negative but insignificant

Firm-level FDI spillovers: Within-industries versus across-industries

(Standardized coefficients)



Sources: Eora Global Supply Chain Database; fDi Markets; World Bank Enterprise Survey; and IMF staff calculations.

Note: Figure reports the standardized coefficients obtained from firm-level regression of labor productivity growth as a function of foreign direct investment within and across industries.

Solid bars indicate statistical significance at 1 percent level. See Online Annex 4.3 for details.

AEs = advanced economies; EMDEs = emerging market and developing economies.

The Costs of Fragmentation

Illustrating the long-term impacts of FDI fragmentation

Modeling approach: multi-country DSGE model (i.e., IMF’s Global Integrated Monetary and Fiscal Model) adapted to assess impact of increased trade and investment barriers between geopolitical blocs, using international investment flows as a proxy

- Model allows for up to eight *regions*

Hypothetical scenarios: Rising barriers between geopolitical blocs, centered around the two largest economies—China and the US. Other regions are assigned to a geopolitical bloc, or are non-aligned

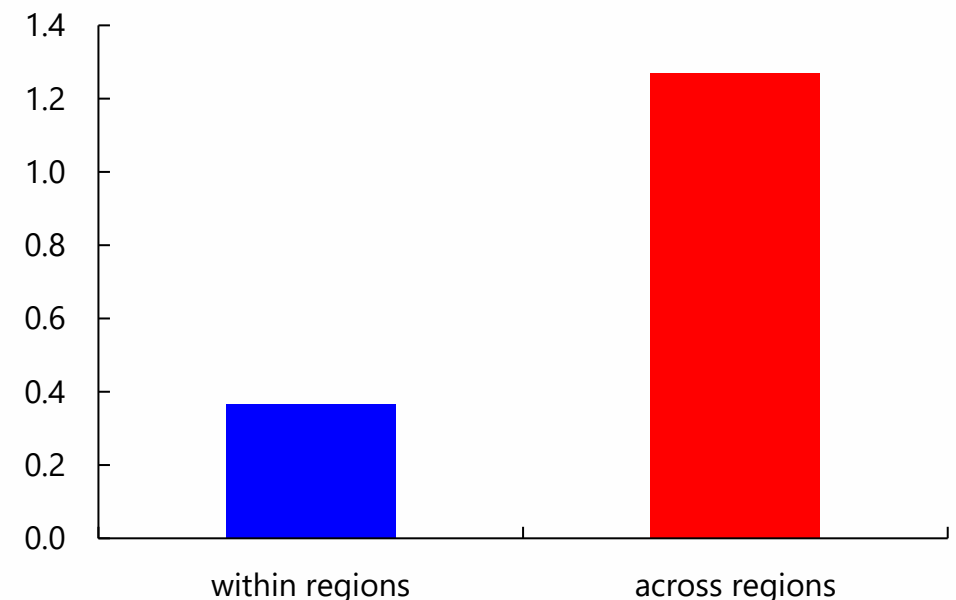
- Two representative EMDE regions: *Latin America and the Caribbean* and *India and Indonesia*, are used to explore the interaction between alignment choices and economic outcomes.

Model regions	Closer to United States	Closer to China	Nonaligned
1. United States	✓		
2. China		✓	
3. Europe	✓		
4. Other AEs	✓		
5. India and Indonesia			✓
6. Other SE Asia		✓	
7. LAC			✓
8. ROW		✓	

Sources: Bailey et al (2017); and IMF staff calculations.

Geopolitical distance is higher across regions than within regions

(Median IPD, 2021)



Illustrating the long-term impacts of FDI fragmentation

FDI fragmentation is modeled by a permanent rise in cross-bloc investment barriers. These higher non-tariff barriers impact both capital stock and productivity

First round effect through higher investment barriers

- *Across blocs:*
 - Bilateral non-tariff barriers are increased on the import of investment goods from opposing-bloc members, targeting a 50% reduction in such flows
- *Non-aligned economies:*
 - No direct imposition of barriers
 - But investment decisions could be affected by uncertainty on future alignment (e.g., Handley & Limao 2017)
 - Assuming a 50% chance of joining the opposing bloc in the future, nonaligned regions face half the barriers on opposing blocs

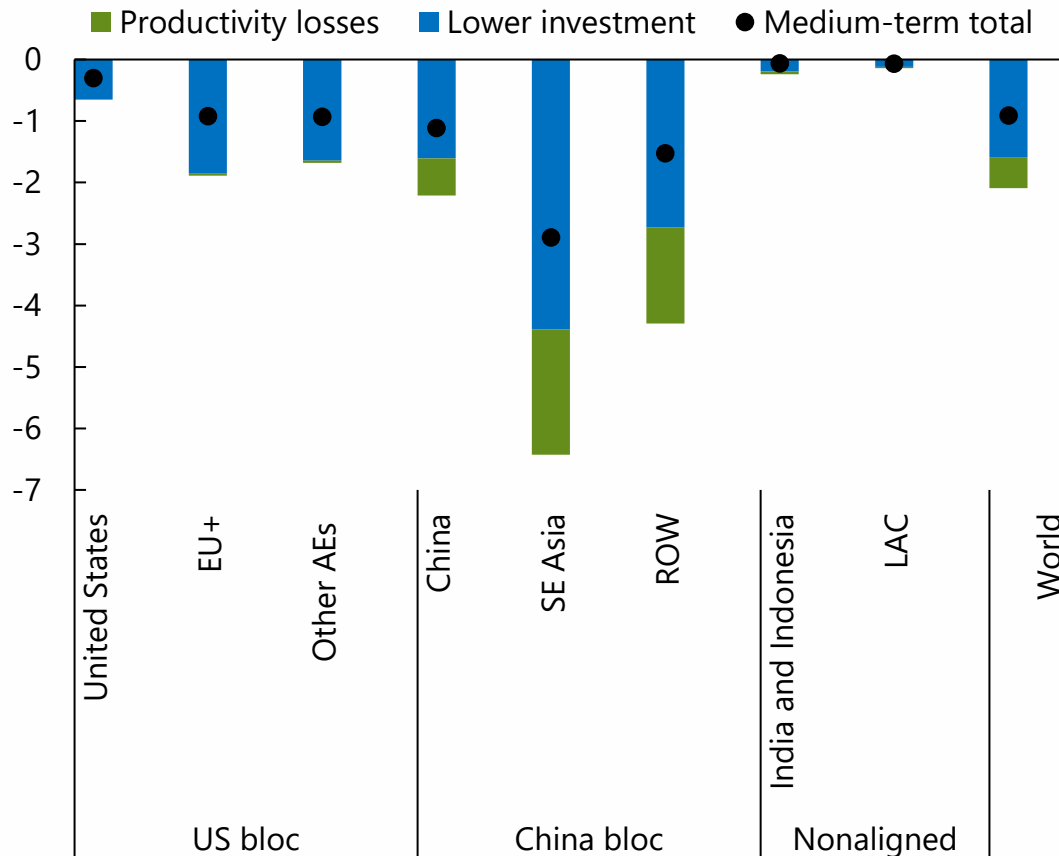
Second round effects on productivity

- EMDE-regions' labor productivity falls alongside flow of FDI from AEs. Estimated correlation between FDI/GDP and labor productivity is used to calibrate the loss

Barriers to investment flows yield significant losses

Impact of investment flow barriers on GDP

(Percent deviation from no-fragmentation scenario)



- Global output losses increase over time, as the effects of less investment and lower productivity transfers cumulate
- EMDE regions facing higher barriers with AEs likely to be more adversely impacted, alongside more open economies with strong pre-existing links to opposing bloc

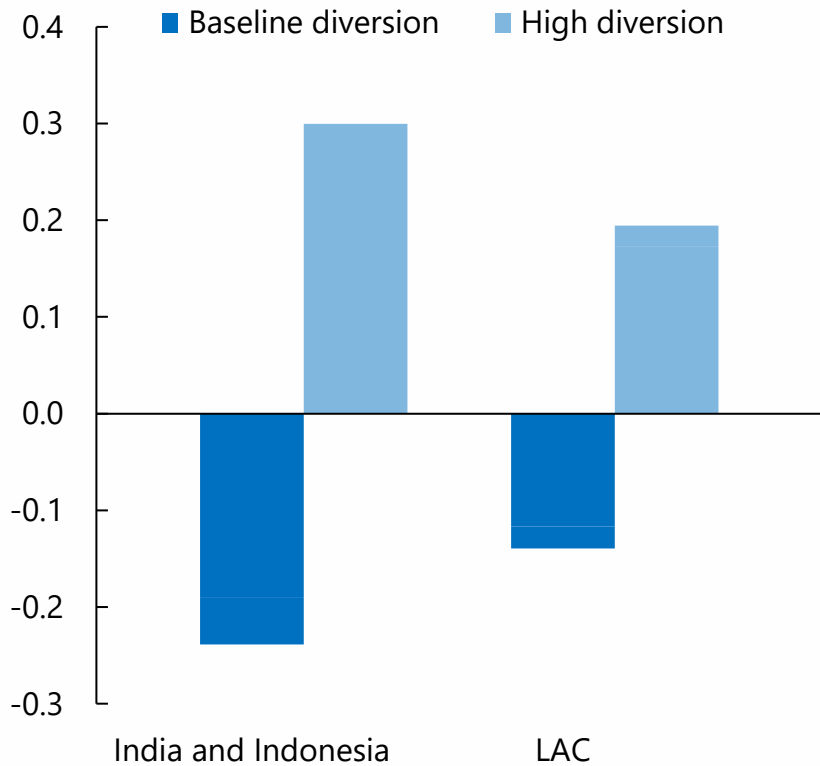
Source: IMF staff calculations.

Note: Baseline fragmentation scenario represents 50 percent decline in investment input flows between China and US blocs and two nonaligned regions (India and Indonesia and Latin America and the Caribbean). Darker bars denote scenario with lower elasticity of substitution (1.5) between foreign sources of investment inputs. Lighter bars denote scenario with higher elasticity of substitution (3.0) between foreign sources of investment inputs and thus a greater role for diversion. AEs = advanced economies; EU+ = European Union and Switzerland; LAC = Latin America and the Caribbean; ROW = rest of the world; SE = Southeast.

Nonaligned countries could gain from diversion but only under strict conditions

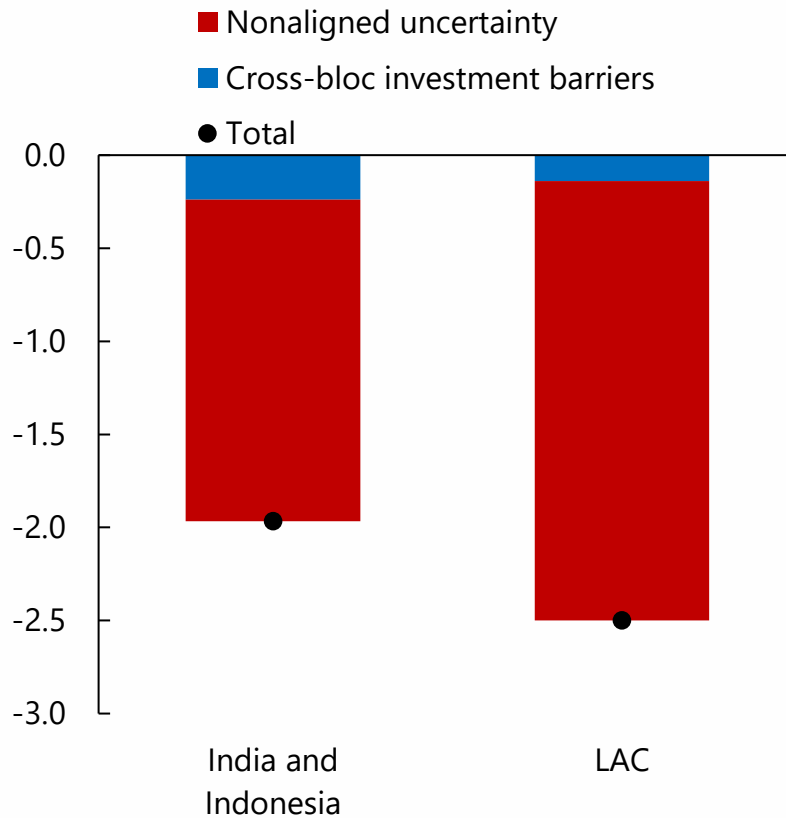
Impact of investment flow barriers on GDP for nonaligned economies 1/

(Percent deviation from no-fragmentation scenario)



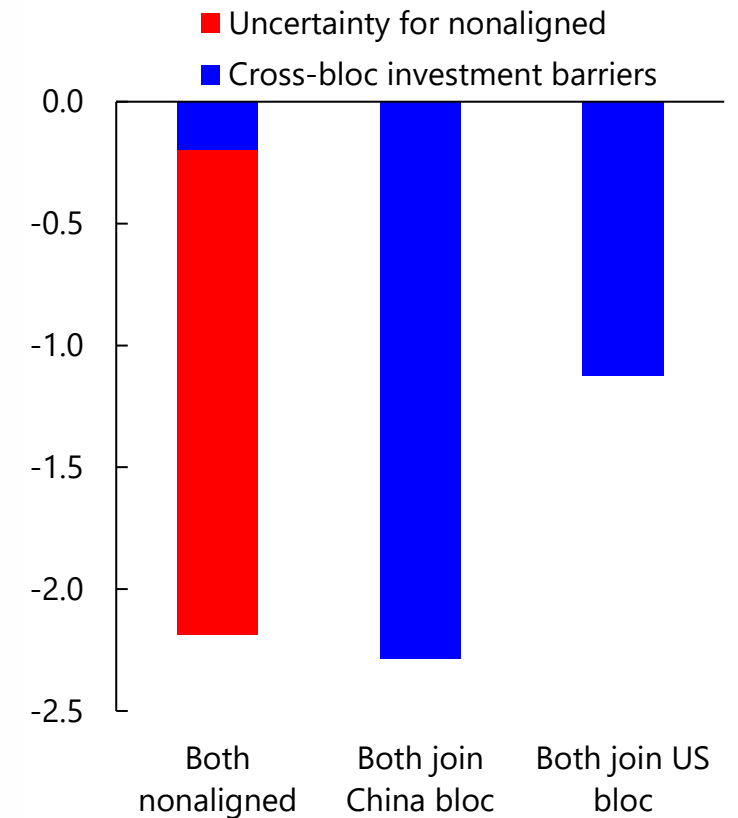
Long-term GDP losses, with uncertainty for nonaligned economies 2/

(Percent deviation from no-fragmentation scenario)



Impact on GDP for bloc members: nonaligned joining blocs

(Percent deviation from no-fragmentation scenario)



Source: IMF staff calculations.

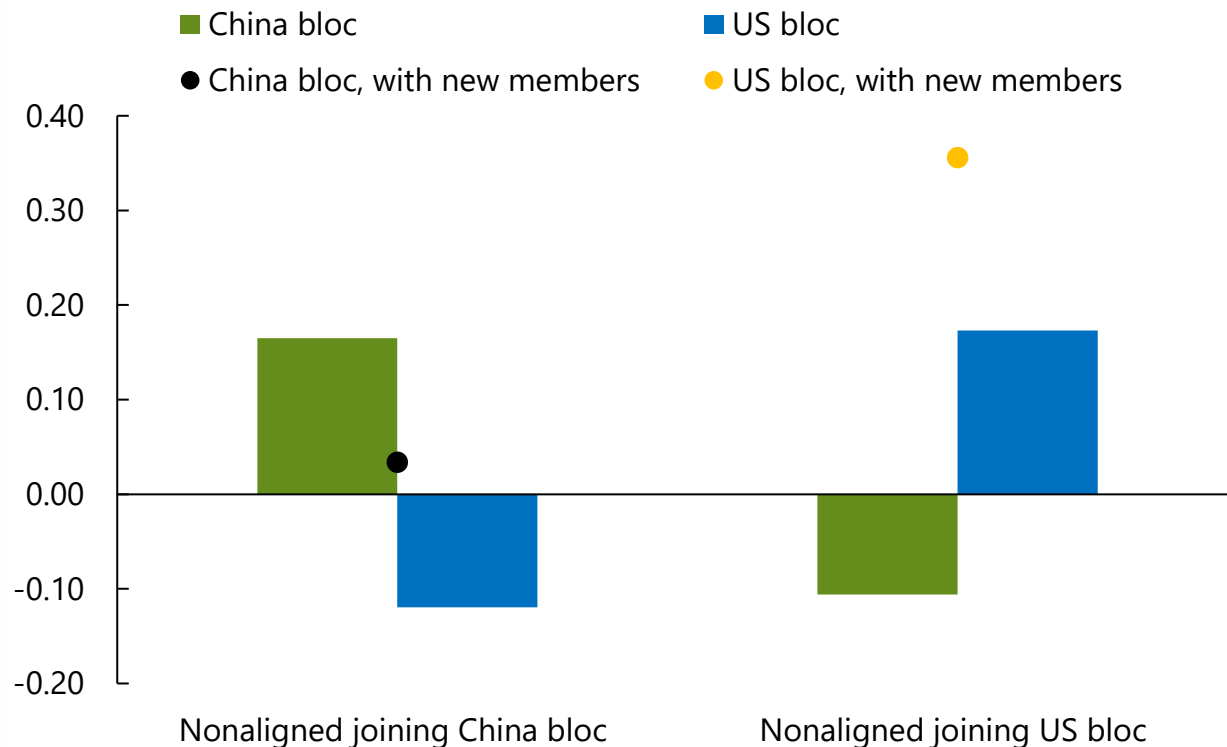
1/ Baseline fragmentation scenario represents 50 percent decline in investment input flows between China and US blocs and two nonaligned regions (India and Indonesia and Latin America and the Caribbean). Darker bars denote scenario with lower elasticity of substitution (1.5) between foreign sources of investment inputs. Lighter bars denote scenario with higher elasticity of substitution (3.0) between foreign sources of investment inputs and thus a greater role for diversion. LAC = Latin America and the Caribbean.

2/ Bars denote scenario with lower elasticity of substitution (1.5) between foreign sources of investment inputs. LAC = Latin America and the Caribbean.

Blocs have incentives to attract nonaligned regions and discourage nonaligned joining the opposing bloc

Impact on GDP on bloc members, from IND/IDN and LAC joining blocs

(Percent deviation; relative to non-aligned scenario with uncertainty)



- Blocs can gain by attracting non-aligned, while imposing costs on opposing blocs
- However, the opposing bloc may be willing to pay to avoid such losses, giving non-aligned regions some negotiating power
- In reality, alignment choices will need to balance multiple considerations and subject to coordination frictions, further underscoring the uncertainty that could weigh on investment

Source: IMF staff calculations.

Note: The nonaligned include India and Indonesia, and Latin America and the Caribbean.

Conclusions

Main findings

1. Are there already signs of FDI fragmentation?
 - Yes, there is evidence of reallocation of FDI across countries, especially in strategic sectors
2. Does geopolitical alignment affect FDI flows?
 - Yes, especially in EMDEs, in recent years and in strategic sectors
3. Which countries and industries are more exposed to reshoring?
 - EMDEs are more exposed than AEs, although strategic vulnerability is high amongst both
4. Through which channels does FDI affect host countries?
 - FDI spillovers come from vertical FDIs, toward competing firms in AEs and suppliers in EMDEs
5. What will be the economic costs of fragmentation and how are they distributed across countries?
 - Costs are economically meaningful and unevenly distributed larger for EMDEs
 - Uncertainty costly especially for nonaligned countries

Policy recommendations

Widespread economic costs from strategic decoupling—about 2 percent of world GDP—provide a **rationale for a robust defense of global integration** despite potential benefits for some countries, at a time when several actors are advocating for inward-looking policies

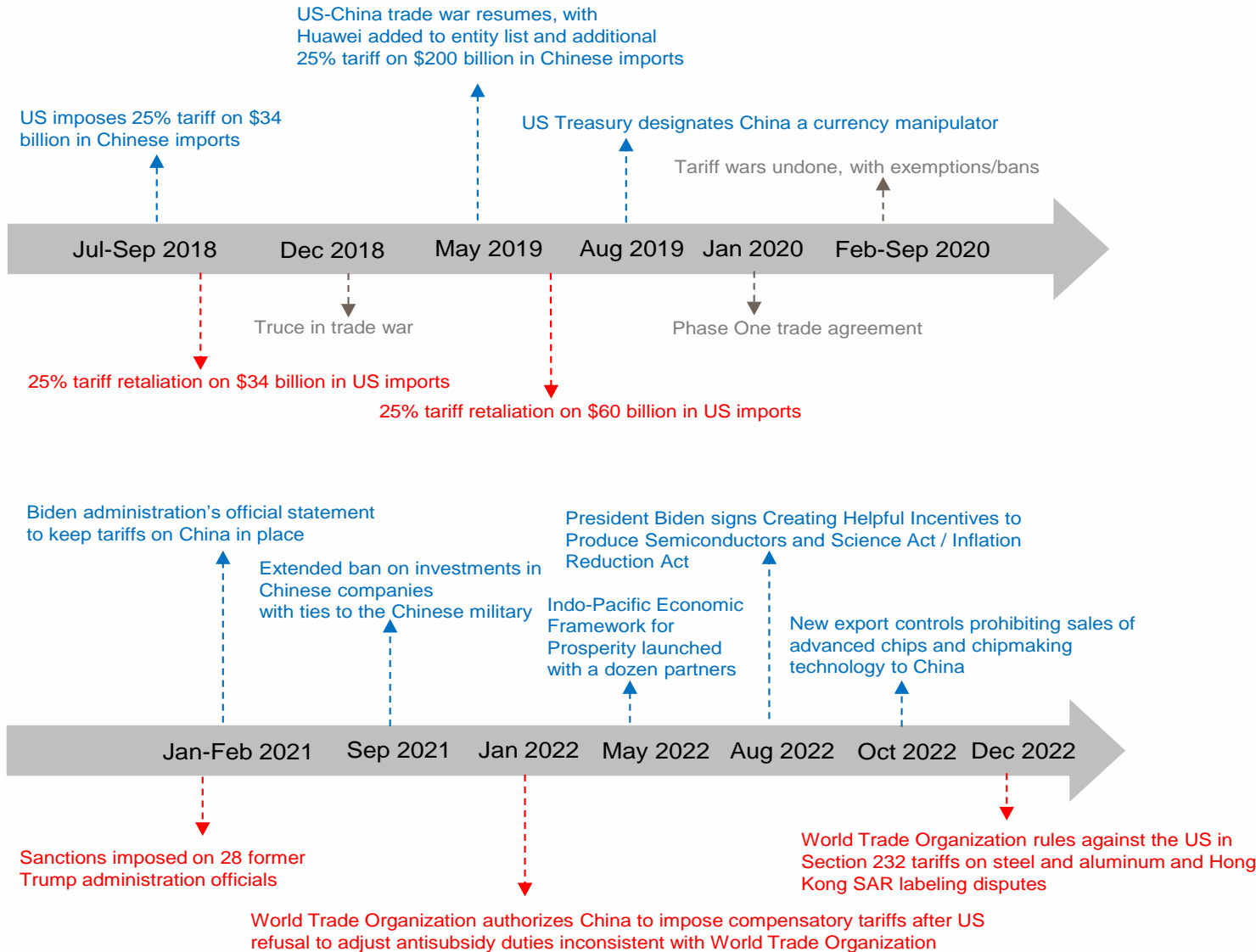
- Preserving a multilateral dialogue is needed to avoid increasing FDI fragmentation

In a more fragmented world:

- Developing a **framework for international consultations**—e.g., on the use of subsidies for reshoring or friend-shoring—could help identify unintended consequences and *reduce uncertainty* on policy options, mitigating cross-border spillovers
- Policies to **promote private sector development** could reduce vulnerability to FDI relocation
- Some countries could take advantage of diversion and attract FDI, by undertaking **structural reforms**, establishing **investment promotion agencies**, and **improving infrastructures**

Boxes

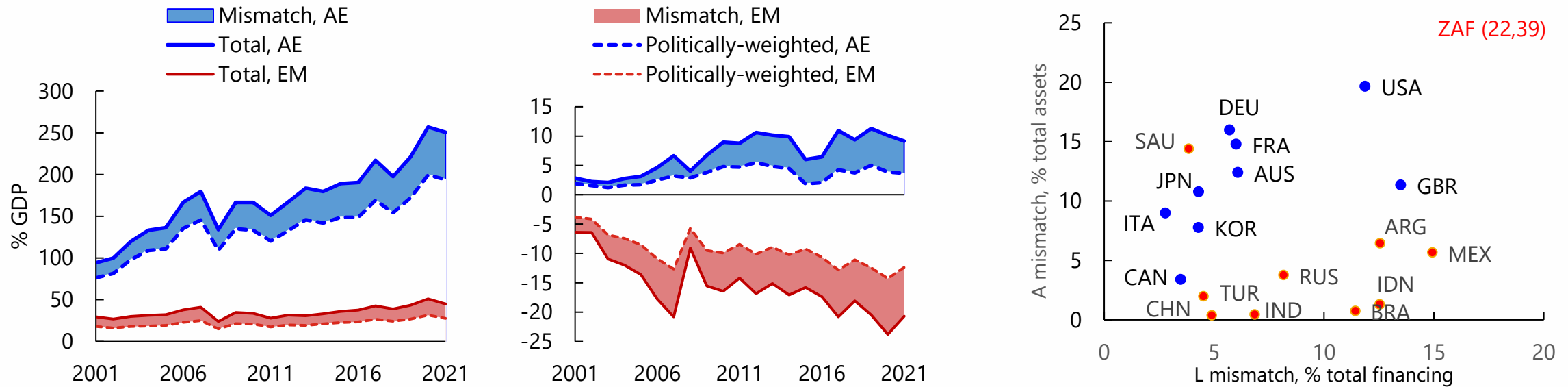
Box 1: Rising Trade Tensions



- US-China trade tensions behind the rising risk of geoeconomic fragmentation
- More active, inward-looking regional industrial policies are gaining prominence
- The European Commission proposed the Net Zero Industry Act to counter the US Inflation Reduction Act subsidies
- China aims to replace imported technology with local alternatives to depend less on geopolitical rivals

Sources: China and U.S. authorities; World Trade Organization; and IMF staff compilation.

Box 2: Balance sheet exposure to fragmentation risk



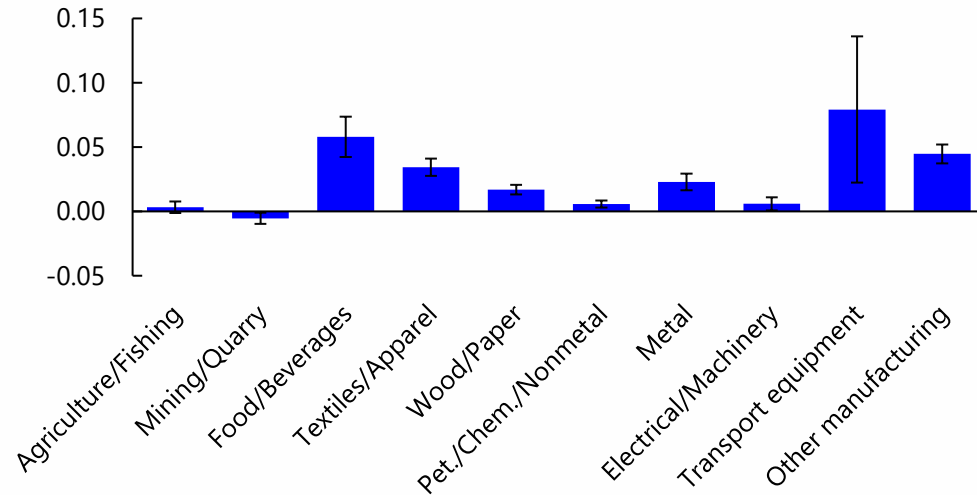
The financial exposure to fragmentation risk increased in the 2000s, as capital has been invested in (or borrowed from) geopolitically distance countries (42 % of GDP in 2021)

- This is particularly true for AEs
- Mismatches in net foreign positions are large & positive in AEs, while large & negative in EMs
- Exposures are heterogeneous across the G20, with some EMs having notable vulnerabilities on the liability side

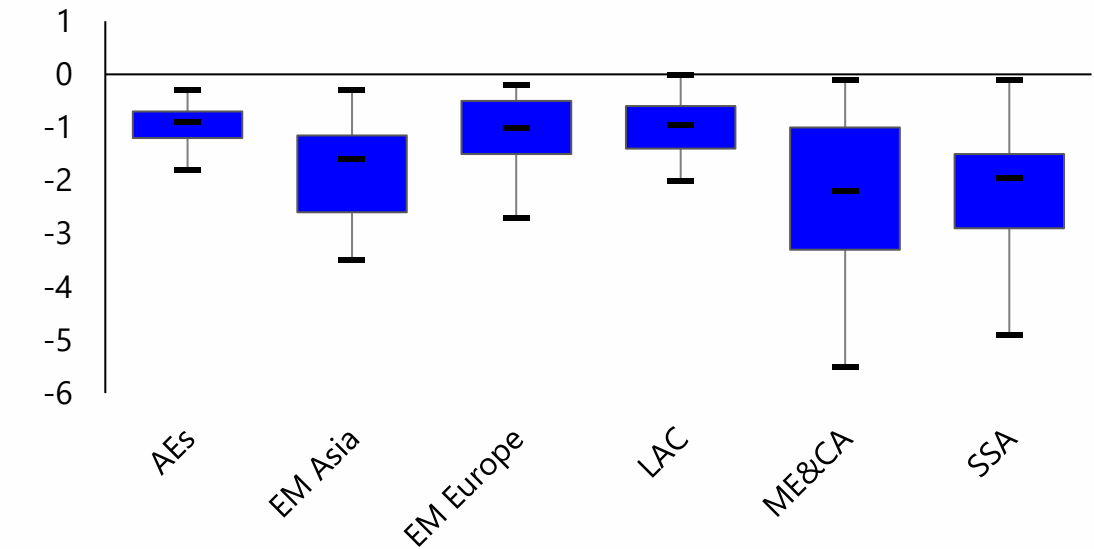
Box 3. Trade and macroeconomic implications of geoeconomic fragmentation

Impact of One-Standard-Deviation Decrease in Geopolitical Alignment on Tariff-Equivalent Trade Barrier

(Log change)



Change in Real Per Capita Income Due to Fragmentation (Percent)



A **gravity model** and a **GE model** suggest that the impact of GEF on trade is **sizable and heterogeneous**:

- Up to an 8 percent increase in tariff-equivalent trade barriers for some FDI-GVC intensive sectors
- For the median EMDE in Africa and central Asia, real income losses due to GEF are more than twice as large as for the median AE

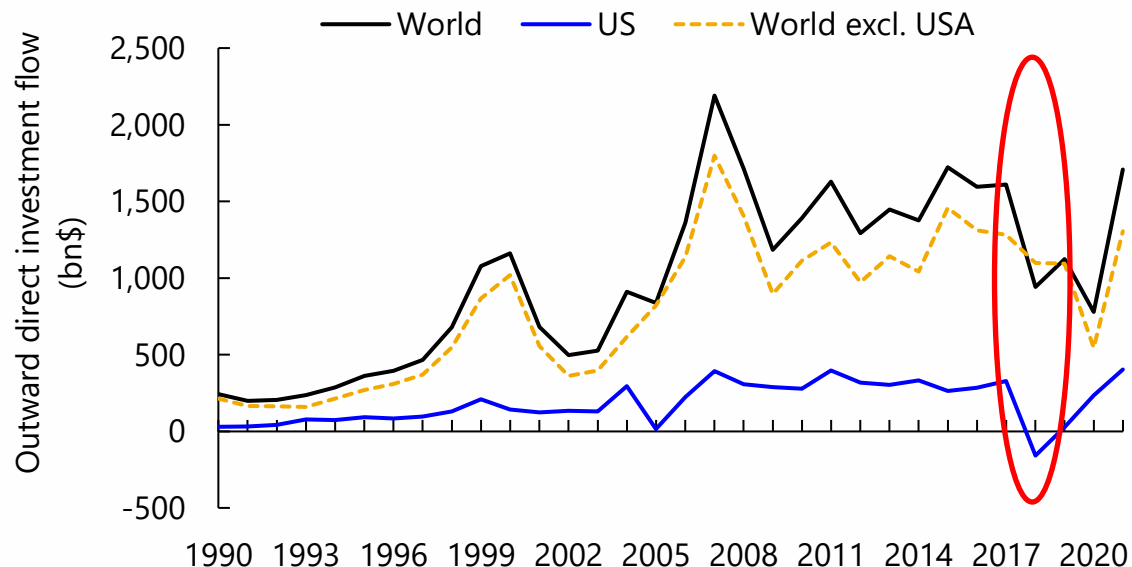
Impact of GEF is more damaging for countries which are (i) small (ii) importing from sectors more sensitive to GEF (iii) not closely aligned with US or China.

Backup slides

(BACKUP) A steep decline in global FDI outflows in 2018

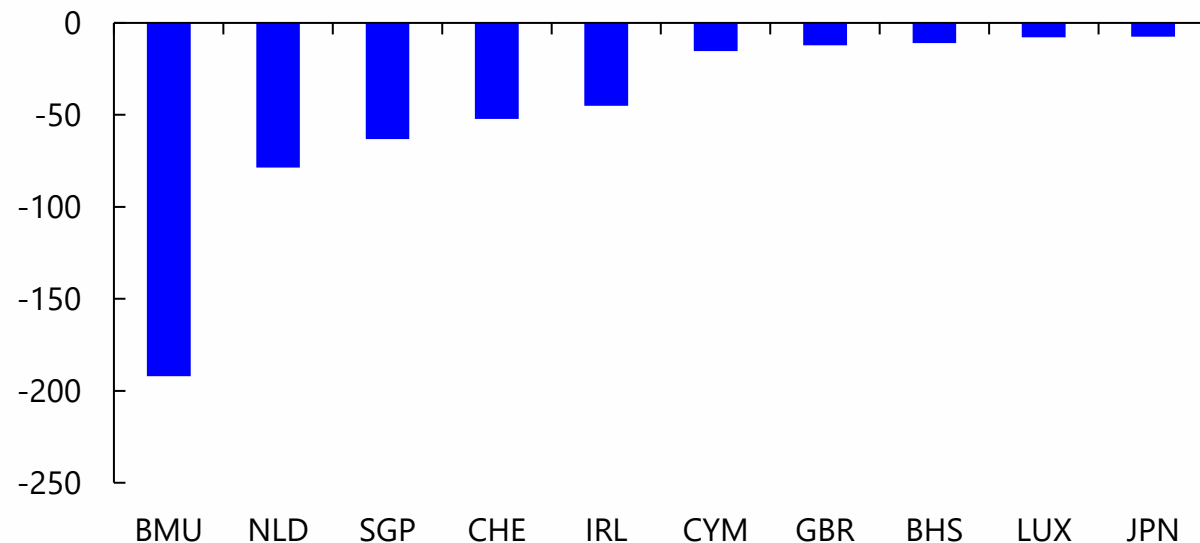
FDI Outflows: World vs. U.S.

(in billion USD)



Changes in FDI inflows from the U.S. :2017-2018

(in billion USD)

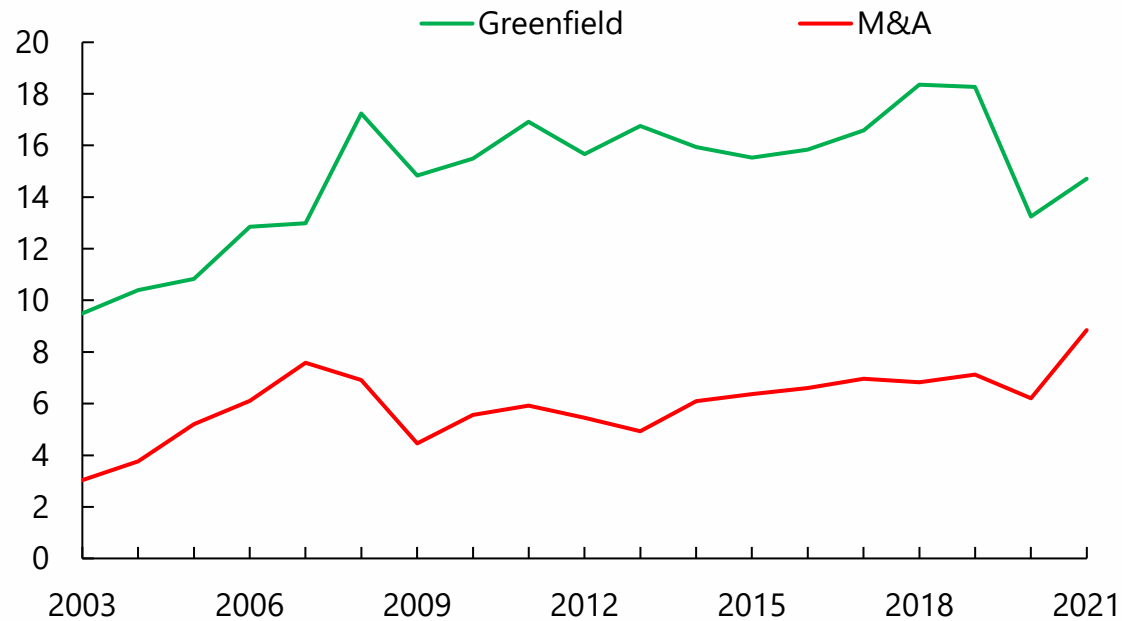


- A steep decline in global FDI outflows in 2018 is mainly driven by the Trump administration's tax policy (the 2017 Tax Cuts and Jobs Act)
- It incentivized US MNCs to repatriate foreign earnings kept abroad
- Top 10 countries with the biggest decline in FDI inflows from the U.S. include Bermuda, Netherlands, Singapore, Switzerland, Ireland, Cayman Islands, The Bahamas, Luxembourg, etc.

(BACKUP) Greenfield FDI outweighs M&As

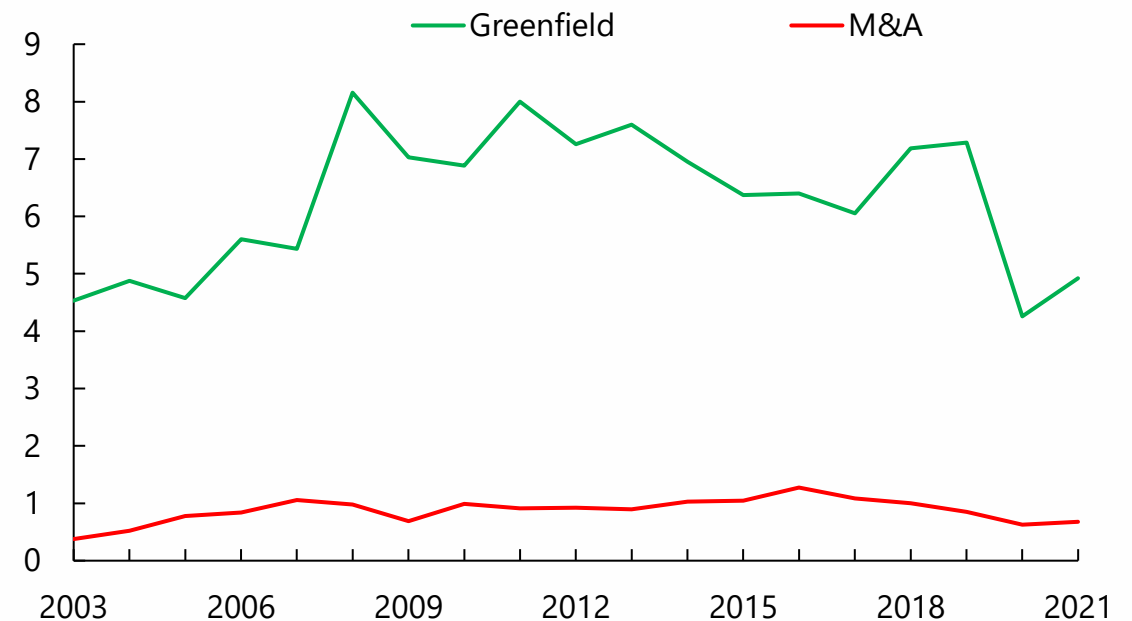
Greenfield FDI vs. M&A: World total

(# of deals, in thousands)



Greenfield FDI vs. M&A: EMDEs

(# of deals, in thousands)

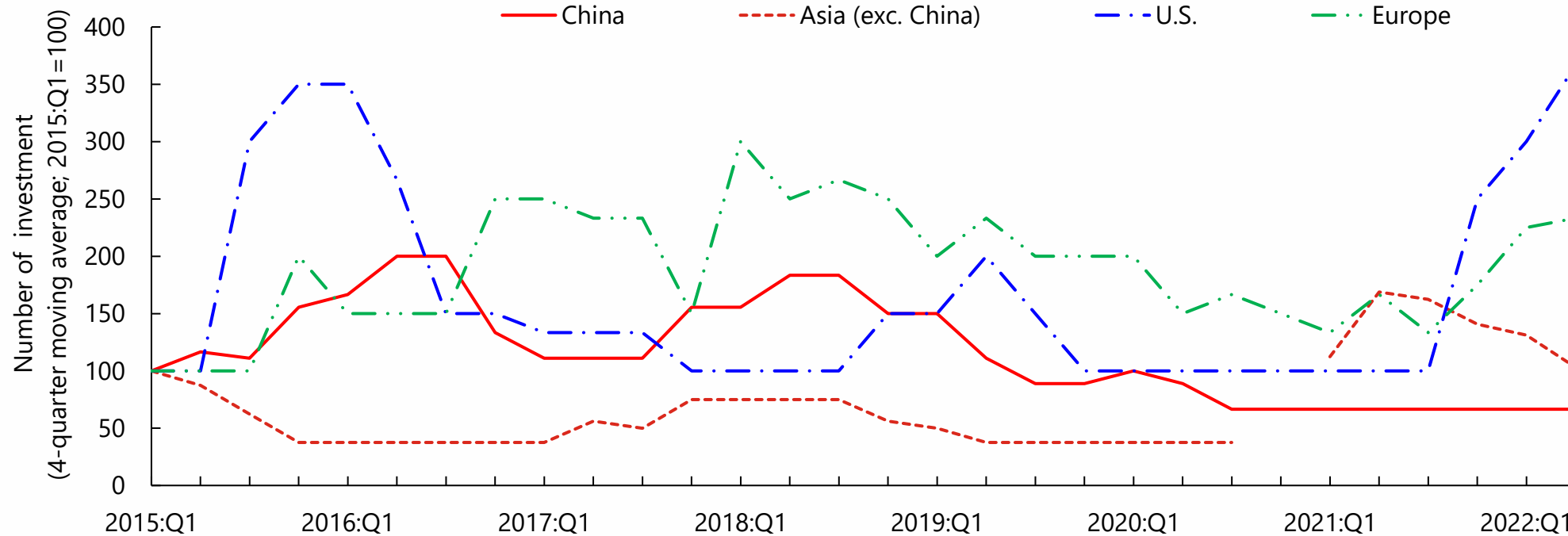


Sources: UNCTAD, *World Investment Report*

- # of Greenfield FDI dominates # of M&As, particularly in EMDEs
- Greenfield FDI was hit harder by COVID-19 in 2020 and less resilient in 2021, possibly reflecting that it is more prone to recent geoeconomics tensions

(BACKUP) Asian chipmakers are moving to the West

FDI in the Semiconductor Industry
(4-quarter moving average; 2015:Q1=100)



Sources: fDi Markets, IMF staff calculations.

- The trend is most pronounced among FDI from Asian countries (excl.China)
- Asian chipmakers responding to the Biden administration's call for friend-shoring (via IPEF, CHIPS, IRA, etc.)

(BACKUP) FDI reallocation around the GFC

Change in the number of FDI across regions 1/ (percent, in deviation from the global change)

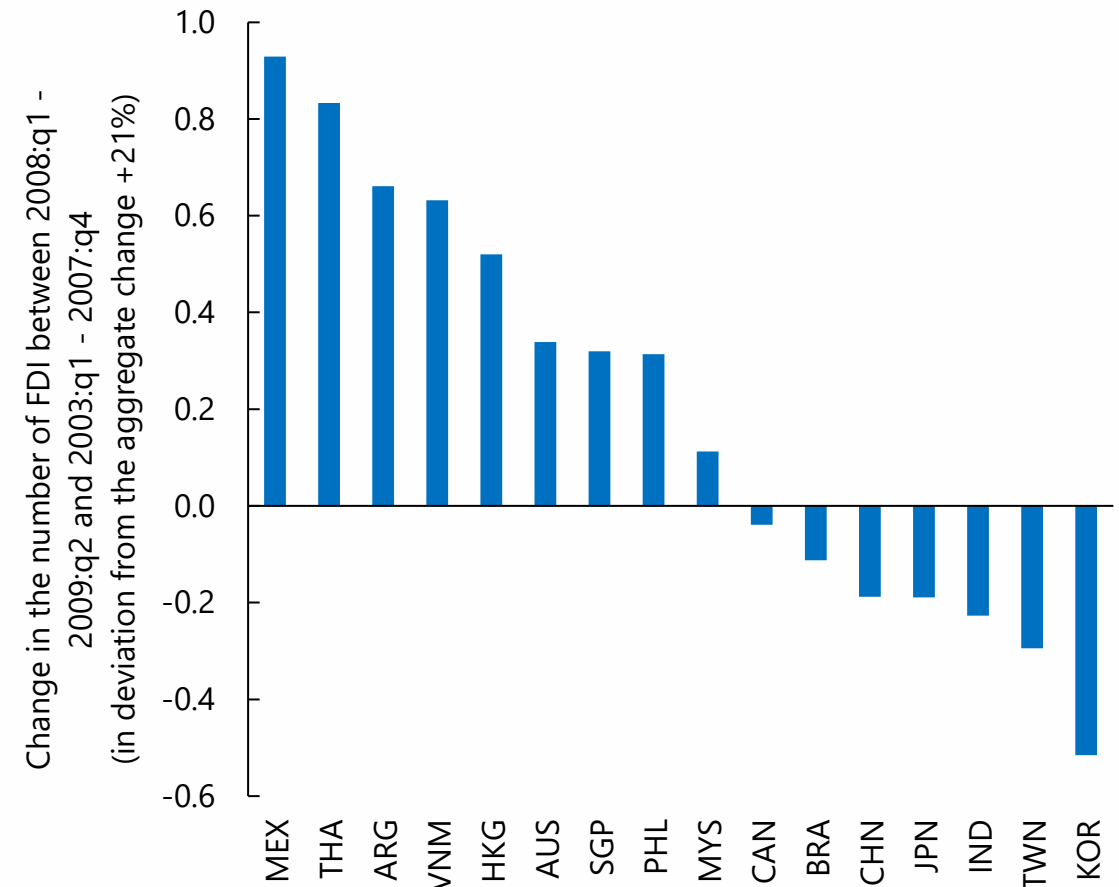
% change in FDI across regions
(2008:Q1 - 2009:Q2 vs 2003:Q2 - 2007:Q4)

Source regions	US	America	Europe	EE	Asia	China	ROW
ROW	51.3	-13.4	47.0	-16.8	34.3	-38.2	70.5
China	88.4	52.7	149.9	-42.4	43.6		58.2
Asia (ex. China)	-34.6	-23.2	7.7	-48.0	21.3	-58.3	27.6
Emerging Europe	25.8	64.9	5.6	-63.3	57.6	-16.0	-15.1
Europe	29.2	26.0	38.8	-33.5	21.6	-23.9	27.9
America (ex. US)	-11.3	-41.4	-14.3	-47.6	19.0	-11.5	-60.8
US		5.5	-11.7	-39.7	-26.3	-41.4	17.7

Sources: fDi Markets Database.

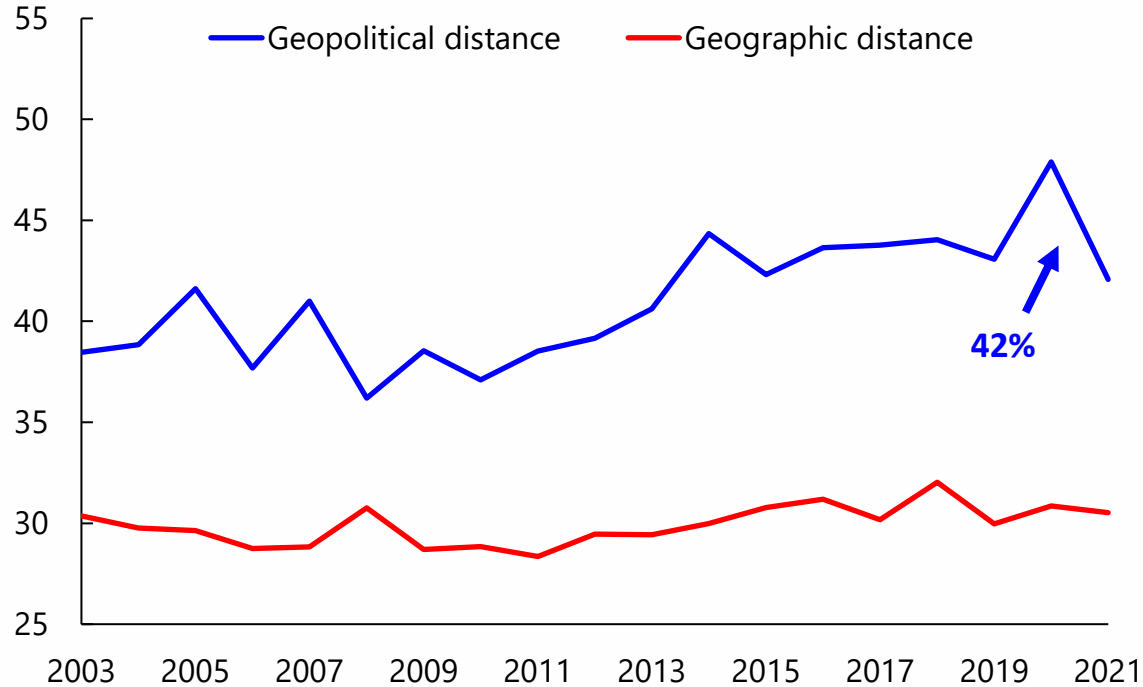
1/ % changes are expressed as deviation from the global % change (+47.3%).

Change in US FDI to selected countries (percent, in deviation from the global change)

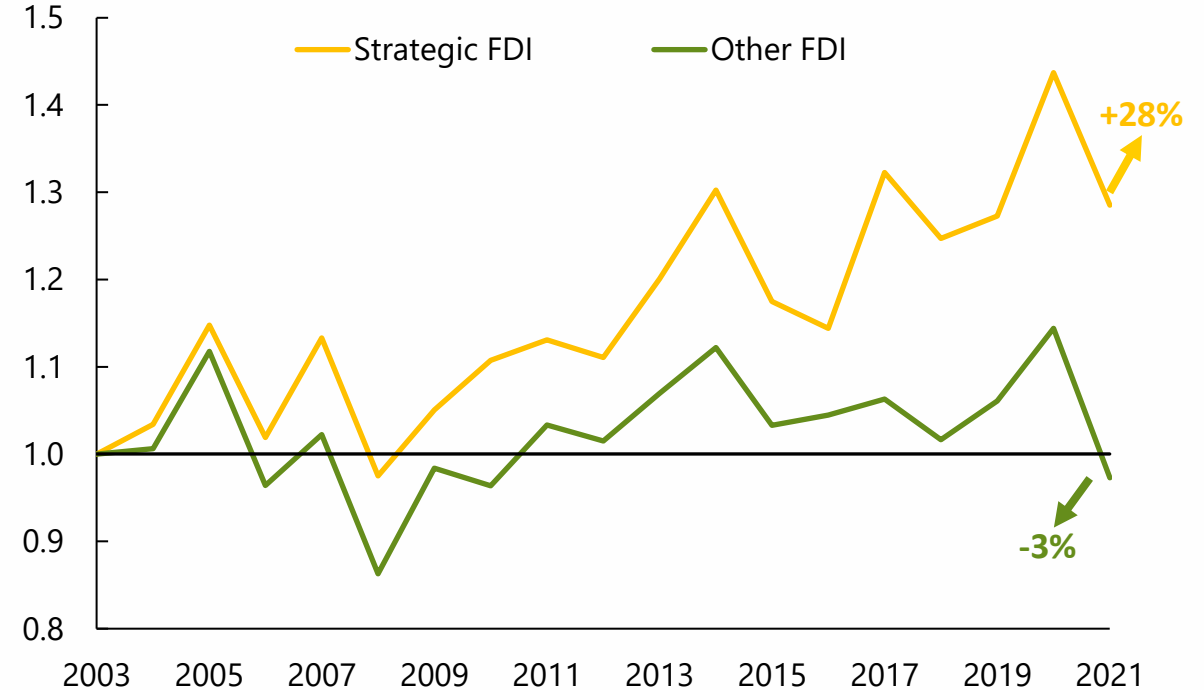


China: More FDI between aligned countries

China: Foreign direct investment between geographically and geopolitically close countries 1/
(Percent)



China: Geopolitics became more relevant for strategic FDI 2/
(Probability ratios normalized to 1 in 2003)



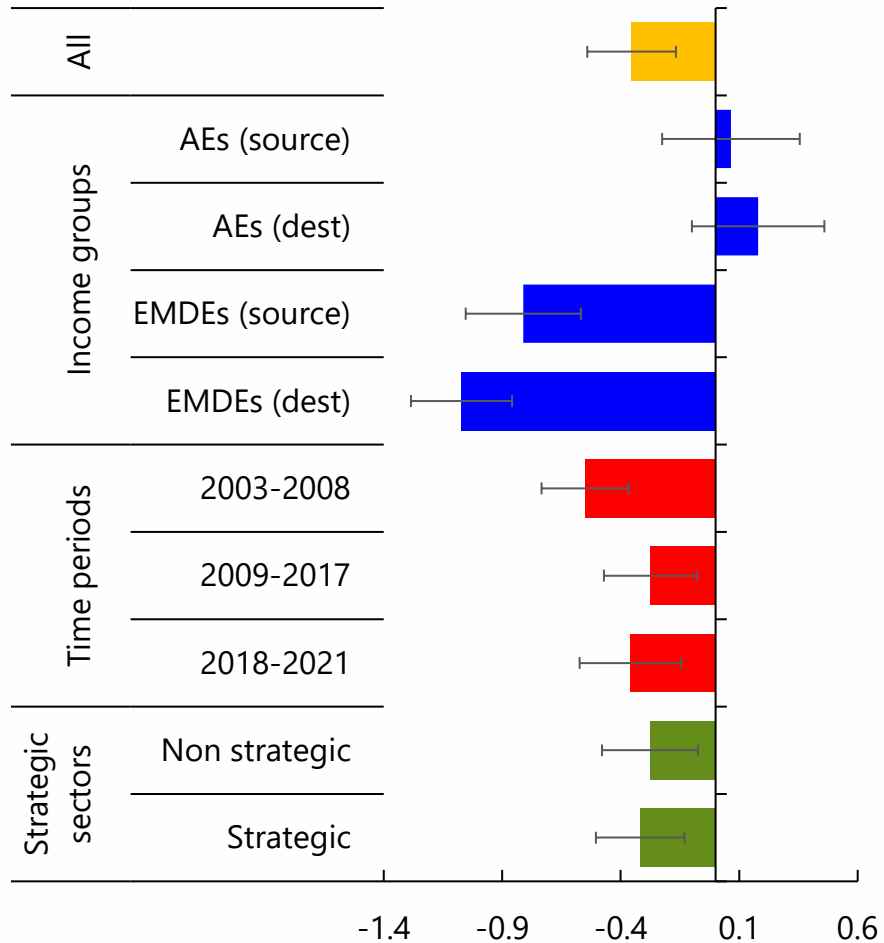
Sources: Bailey, Strezhnev, and Voeten (2017); Centre d'études prospectives et d'informations internationales, Gravity database; fDi Markets; and IMF staff calculations. [\[BACK TO MAIN SLIDE\]](#)

1/ Figure shows annual share of total FDI between country pairs similarly distant (that is, in same quintile of distance distribution), geopolitically and geographically, from China.

2/ Probability ratio of strategic FDI taking place between country pairs close politically or geographically (i.e. they are in the same quintile of the relevant distance distribution).

Geopolitical distance is associated with lower FDI, especially in EMDEs, in recent years and in strategic sectors

Gravity model for IPD and FDI (semi-elasticities)



Estimate variations on empirical model for FDI from source country s to destination country d . Include **percentiles of IPD**, gravity variables, source-time and destination-time FE (with PPML):

$$FDI_{sdt} = g(\alpha IPDperc_{sdt-1} + \beta X_{sd} + \tau_{st} + v_{dt}, \varepsilon_{sdt})$$

Results:

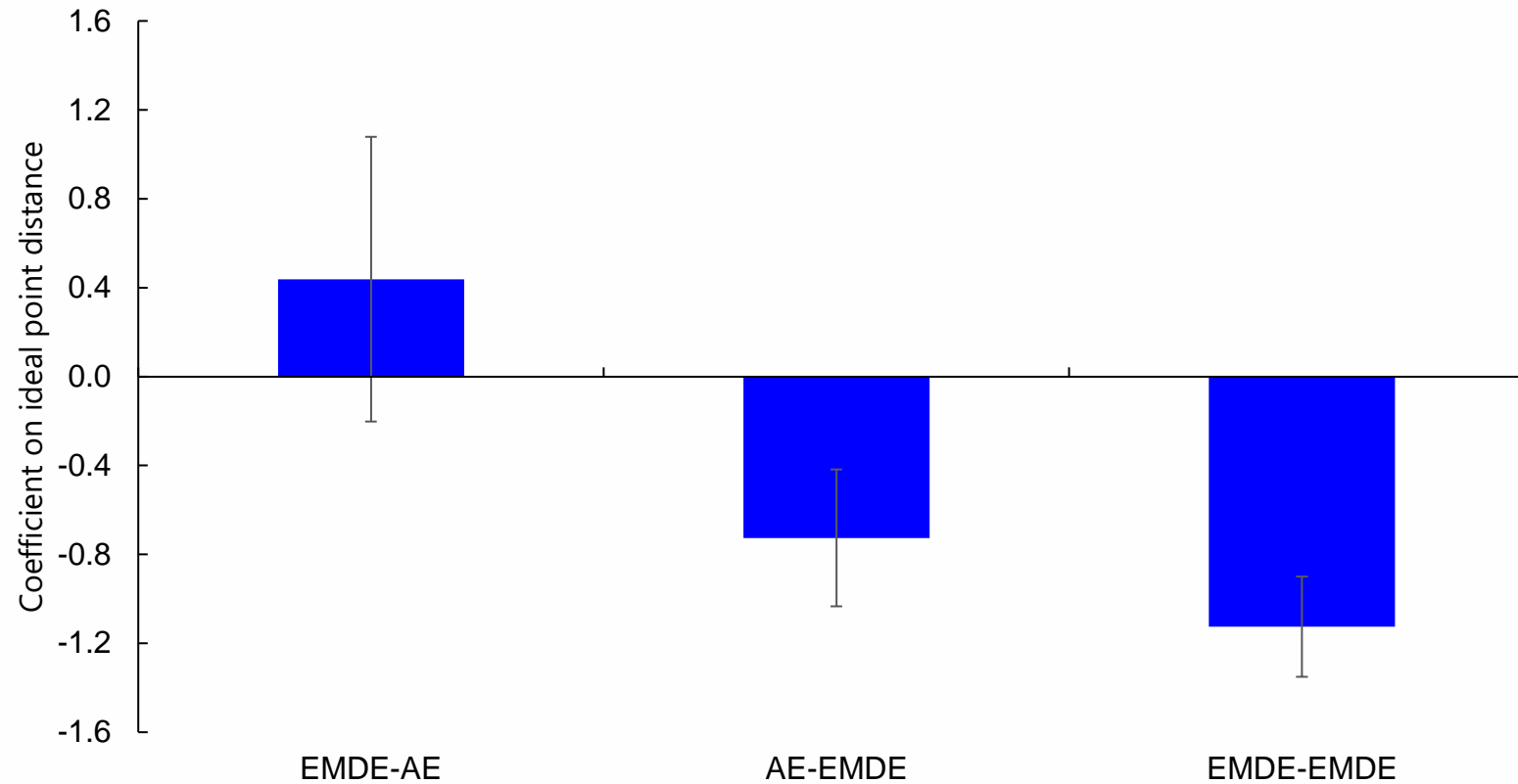
- **Baseline:** the semi-elasticity of FDI to IPD is -0.35 (moving IPD from 75th to 25th percentile is associated with a FDI decline by 17%)
- **By income groups:** coefficient three (two) times as large if destination (source) country is EMDE, and not significant if AE
- **Over time:** coefficient decreasing up to 2017, but back above avg coefficient in the last 4 years
- **By sector:** coefficient is 19% larger on strategic investment than on other sectors [\[back\]](#)

Sources: United Nations (Bailey et al. 2017); CEPII; fDi Markets; Atlantic Council; NL Analytics; and IMF staff calculations.

Note: The coefficients are estimated from a gravity model for FDI estimated with Pseudo-Poisson Maximum Likelihood. The reported coefficients refer to IPD measure from Bayley et al. (2017), normalized to capture the fractiles in the distance distribution between countries.

Flows to/from EMDEs

Gravity model for IPD and FDI
(percentile, semi-elasticities)

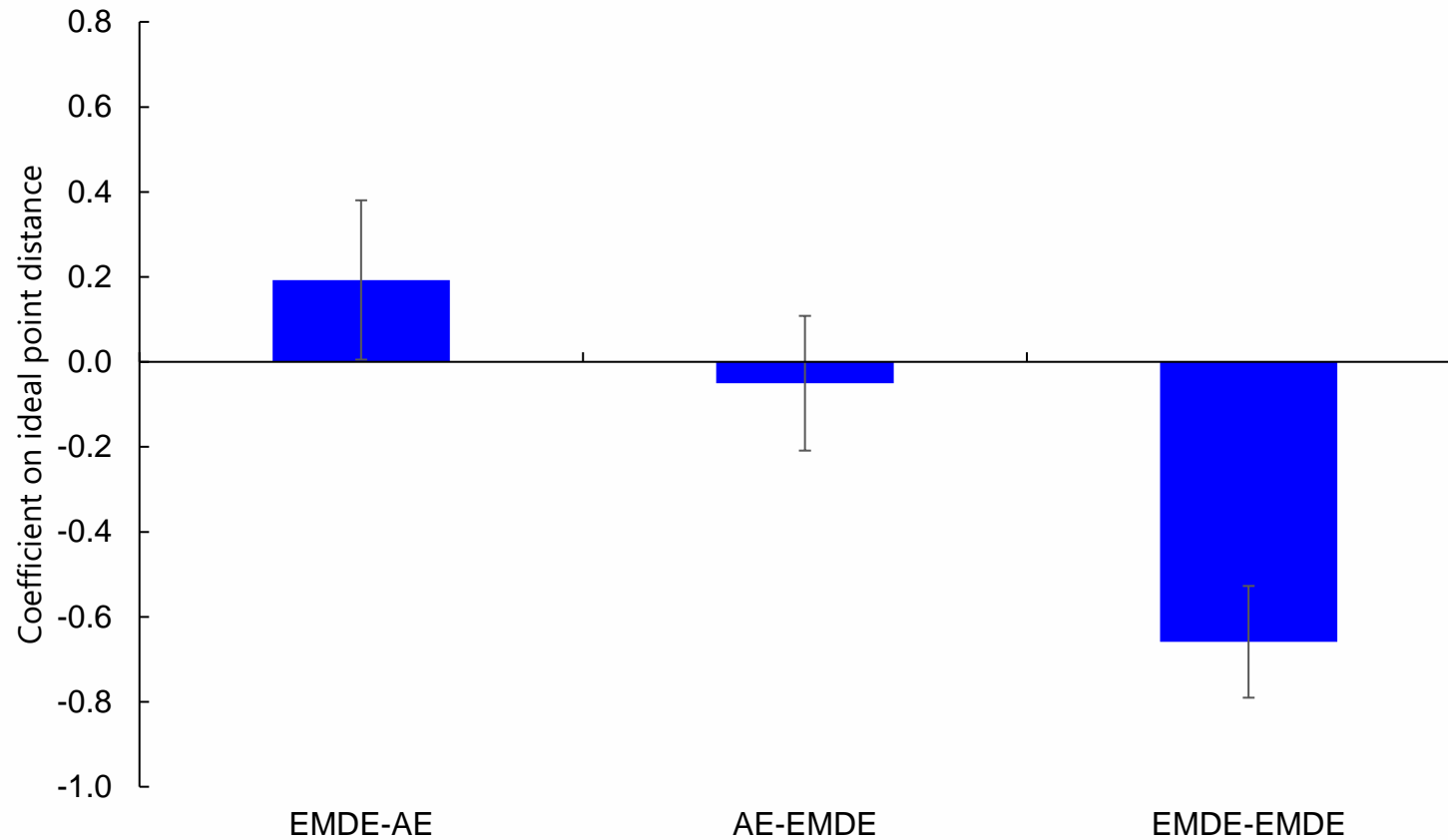


Sources: United Nations (Bailey et al. 2017), CEPII, fDi Markets, Atlantic Council, NL Analytics, and IMF staff calculations.

The coefficients are estimated from a gravity model for FDI estimated with Pseudo-Poisson Maximum Likelihood. The reported coefficients refer to IPD measure from Bailey et al. (2017), normalized to capture the fractiles in the distance distribution between countries.

Flows to/from EMDEs

Gravity model for IPD and FDI
(semi-elasticities)



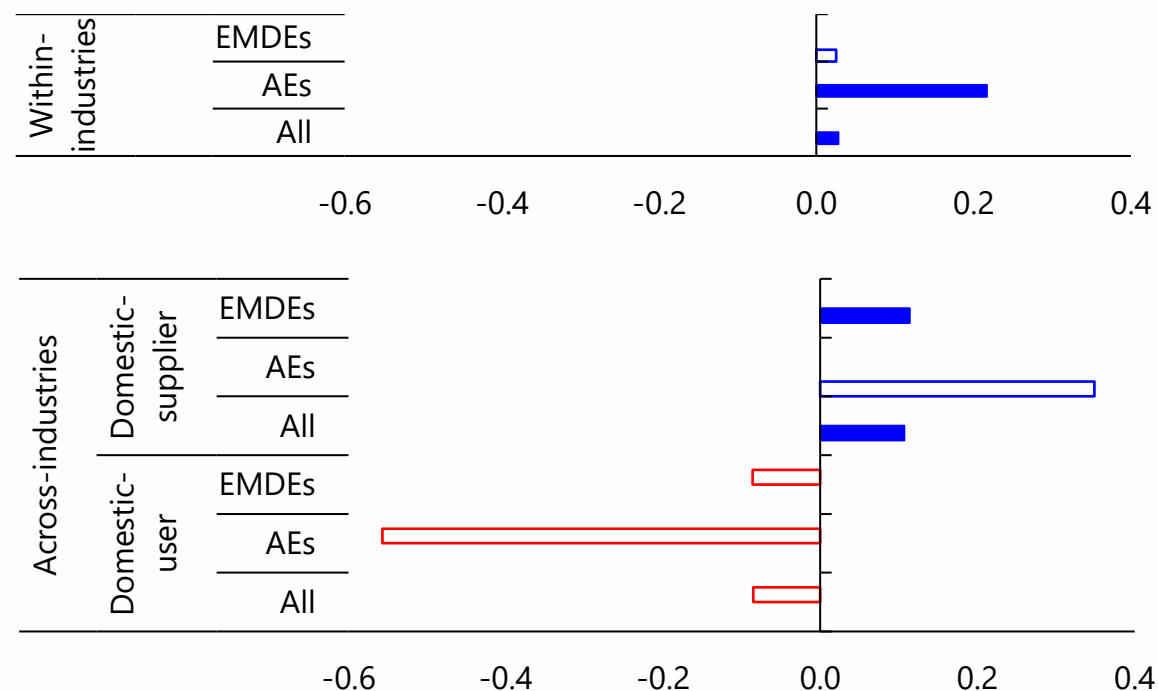
Sources: United Nations (Bailey et al. 2017), CEPII, fDi Markets, Atlantic Council, NL Analytics, and IMF staff calculations.

The coefficients are estimated from a gravity model for FDI estimated with Pseudo-Poisson Maximum Likelihood. The reported coefficients refer to IPD measure from Bailey et al. (2017), normalized to capture the fractiles in the distance distribution between countries.

Competing firms in the same industry benefit from FDI in AEs, while supplying firms benefit from FDI in EMDEs

- **Firm-level analysis** helps identifying specific channels through which FDI affects local firms' productivity
- **Data:** WBES and fDi Market data matched at the country-sector-year level (repeated cross-sections)
- **Methodology:** firm-level regression of labor productivity growth on separate measures of (lagged) sectoral FDI
 - ▶ EORA IO tables to measure inter-industry linkages
 - ▶ Weighted sum of sectoral FDI measures, where weights are taken as the share of input use from (output supply to) respective sectors
- **Results:** i) **Spillovers to domestic firms in the same industry** are positive and statistically only for AEs; ii) **Spillovers to domestic suppliers** are positive and significant, particularly in EMDEs; and iii) **Spillovers to domestic users** are negative but insignificant

**Firm-level foreign direct investment spillovers:
Within-industries versus across-industries**
(Standardized coefficients)

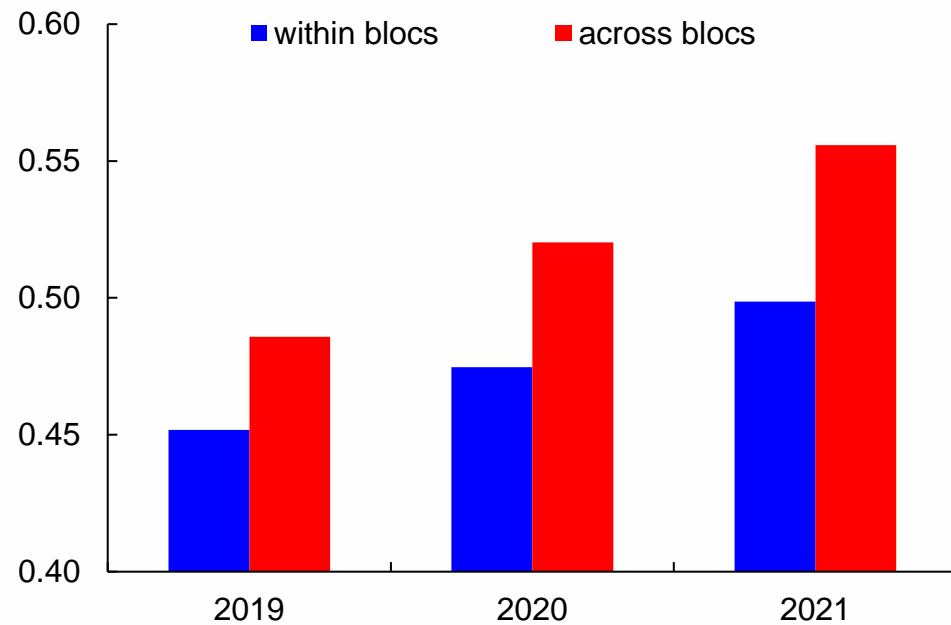


Sources: Eora Global Supply Chain Database; fDi Markets; World Bank Enterprise Survey; and IMF staff calculations.

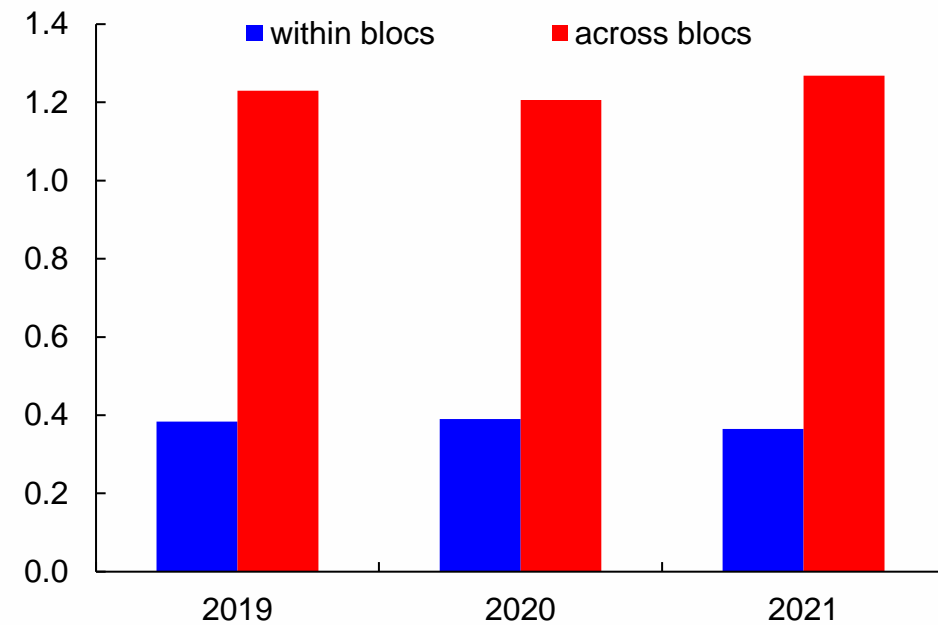
Note: Figure reports the standardized coefficients obtained from firm-level regression of labor productivity growth as a function of foreign direct investment within and across industries. Solid bars indicate statistical significance at 1 percent level. See Online Annex 4.3 for details. AEs = advanced economies; EMDEs = emerging market and developing economies.

Modeling: Reference charts

Share of country-pairs with increasing IPD score



Median IPD across- and within-blocs



Sources: Bailey et al (2017), and IMF staff calculations.

Model: Impact of FDI fragmentation on labor productivity

- Using a cross-country panel, we estimate the correlation between log labor productivity and lagged FDI/GDP, controlling for year and country fixed effects, separately for AEs and EMDEs

$$\log LP_{t+1} = \beta_0 + \beta_1 \log LP_t + \beta_2 \left(\frac{FDI}{GDP} \right)_t$$

- The regression estimates an elasticity of labor productivity to FDI equal to 15% for EMDEs, and not significantly different from 0 for AEs (see Table)

	Dependent variable: Labor productivity	
	(1)	(2)
Lagged FDI over GDP	-0.0000399 (0.0000801)	0.00147** (0.000586)
Labor productivity (lagged)	0.960*** (0.00521)	0.963*** (0.00678)
Constant	0.464*** (0.0586)	0.366*** (0.0647)
Observations	1262	4313
Rsquared	0.997	0.998
Period	1980-2021	1980-2021
Sample	AEs	EMDEs

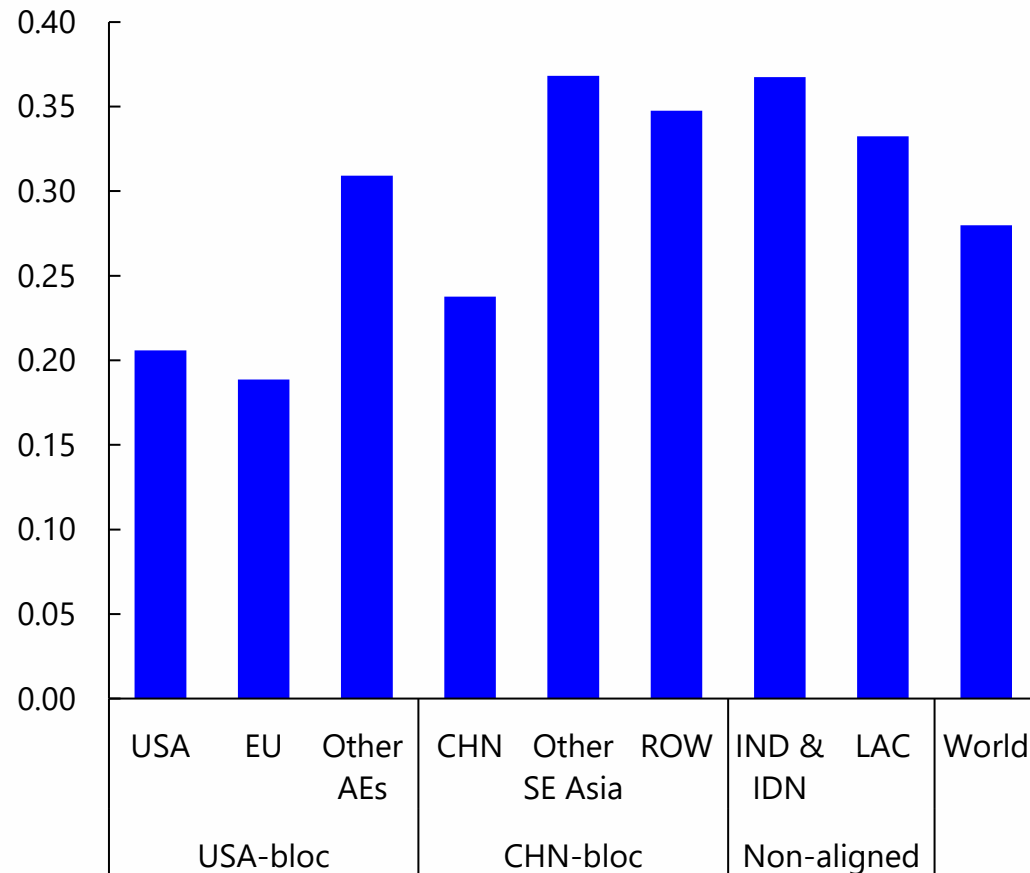
As FDI/GDP changes every year while the shock is permanent, its impact will cumulate. To get an estimate of the difference in labor productivity between the shocked and baseline economies, we run the model for both to obtain equilibrium FDI/GDP series. We use this equation to estimate the implied long-term impact (with s=10)

$$[\log \widetilde{LP}_{t+s} - \log LP_{t+s}] = \beta_2 \sum_{j=0}^s \beta_1^j \left[\left(\frac{FDI}{GDP} \right)_{t+s-1} - \left(\frac{FDI}{GDP} \right)_{t+s-1} \right]$$

Vulnerability to reshoring and losses from FDI fragmentation

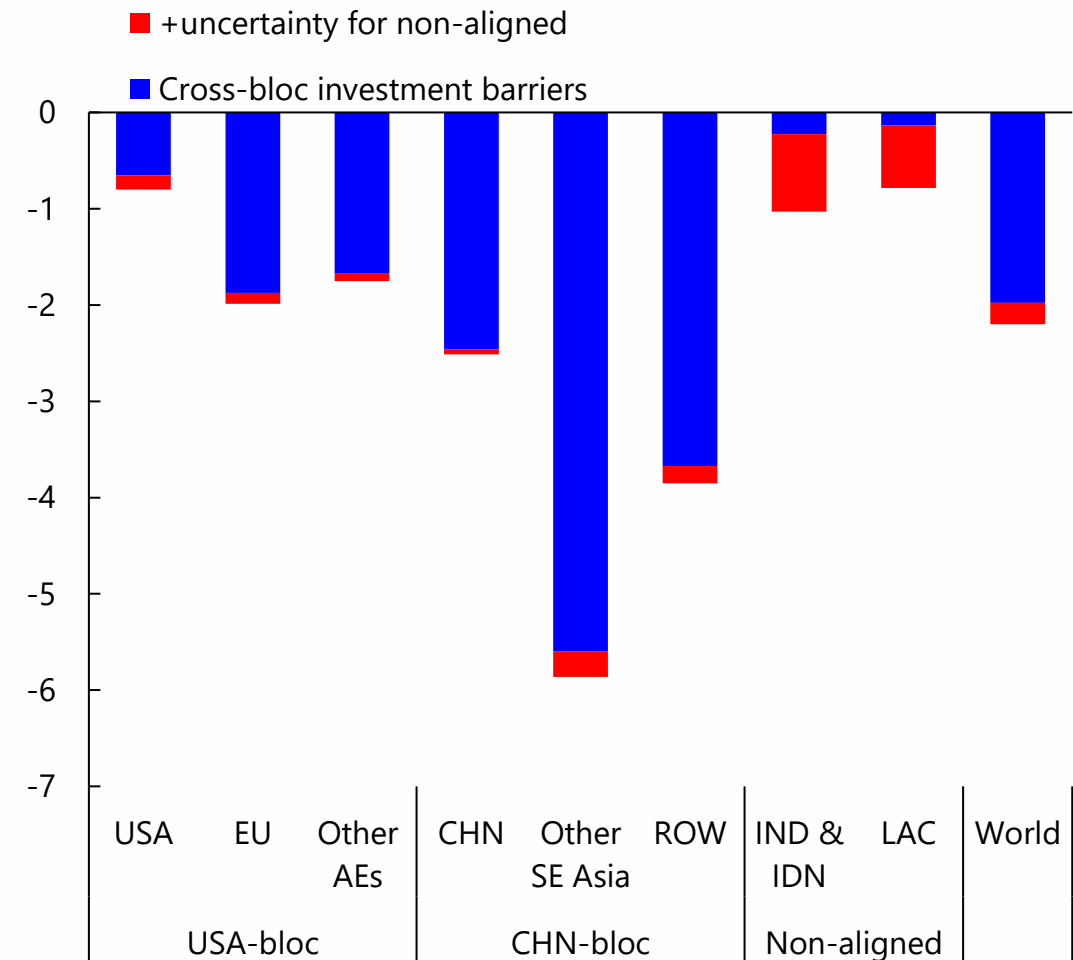
Vulnerability Index, by regions

(GDP-weighted averages)



Long-term GDP losses, with uncertainty for nonaligned

(percent deviation from no-fragmentation baseline)

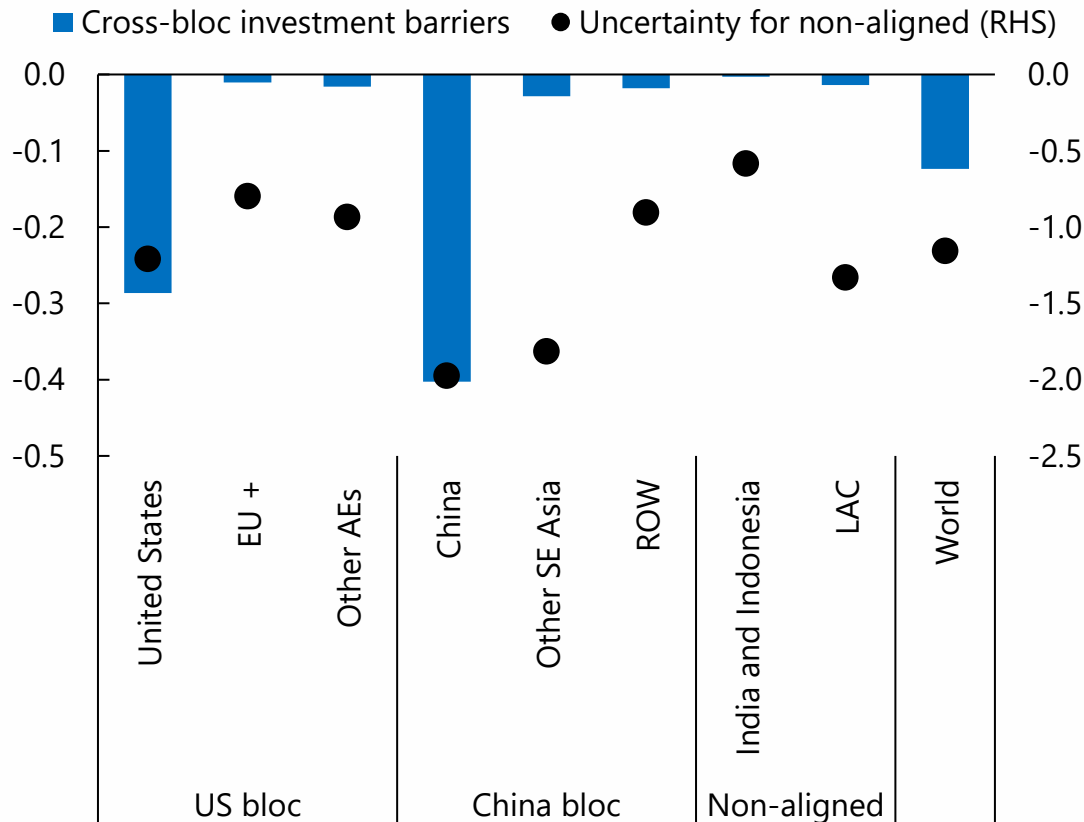


Sources : fDi Markets; Bailey et al (2017); TDM, NL Analytics; Atlantic Council; and IMF staff calculations.

Backup: Limited fragmentation; alternate assumptions on uncertainty

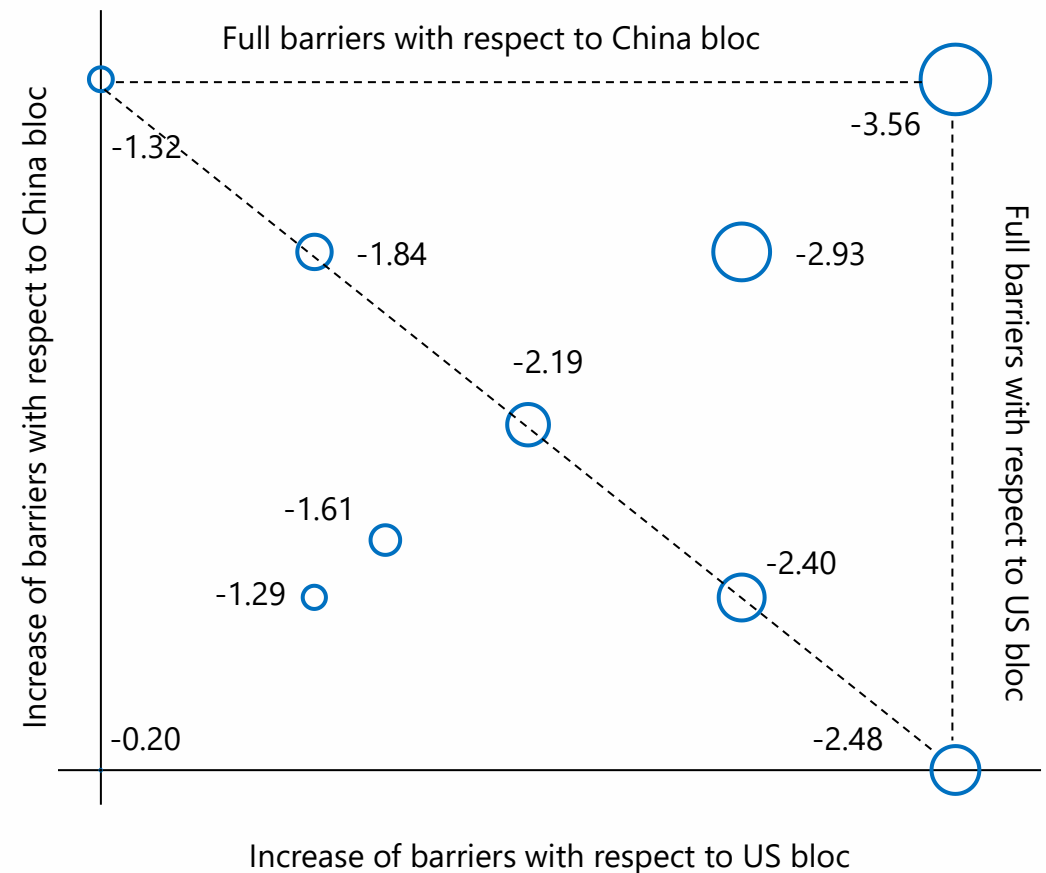
Long-term GDP losses, barriers between China and the United States only 1/

(Percent deviation from no-fragmentation scenario)



Impact on nonaligned GDP, various uncertainty assumptions 2/

(Percent deviation from no-fragmentation scenario)



Source: IMF staff calculations.

1/ Scenario reflects explicit barriers to reduce investment input flows by 50 percent between China and the United States only, while all other regions remain non-aligned. AEs = advanced economies; EU+ = European Union and Switzerland; LAC = Latin America and the Caribbean; ROW = rest of the world; SE = Southeast.

2/ Nonaligned regions are India and Indonesia, and Latin America and the Caribbean. Full barriers refer to nonaligned regions facing same level of investment input import barriers as regions in the opposing bloc. Bubble size represents the level of losses in each scenario.