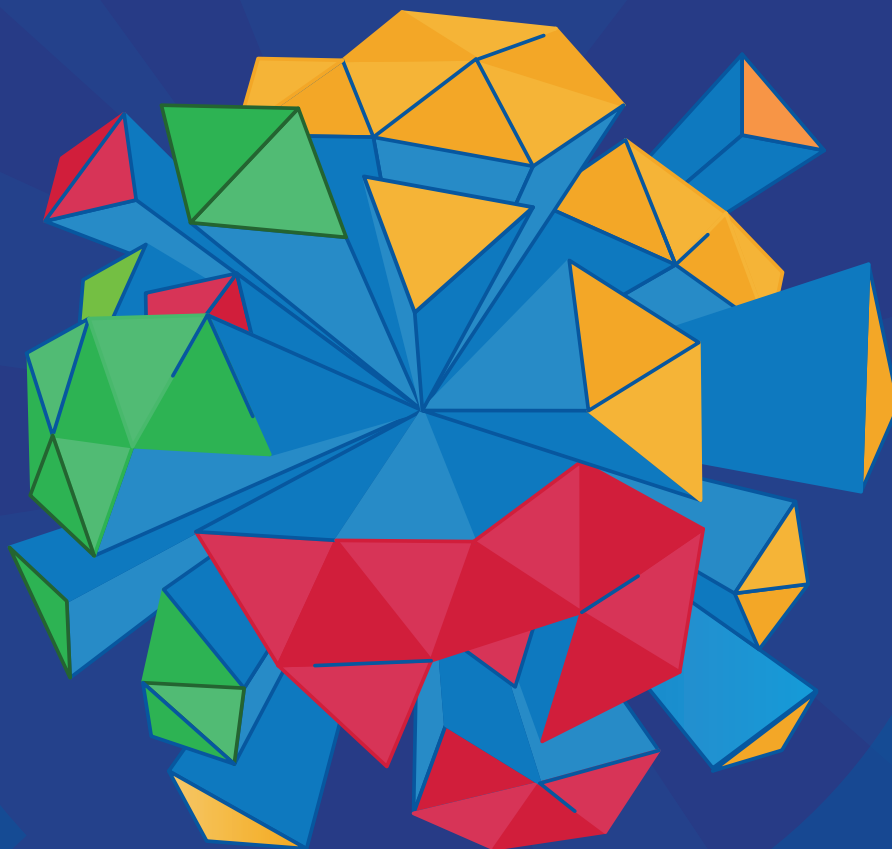CEPR PRESS

Edited by Shekhar Aiyar, Andrea F. Presbitero and Michele Ruta

Geoeconomic Fragmentation
The Economic Risks from a Fractured World Economy

INTERNATIONAL MONETARY FUND

CENTRE FOR ECONOMIC POLICY RESEARCH

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The International Monetary Fund (IMF) is an organization of 190 countries, working to foster global monetary cooperation, secure financial stability, facilitate international trade, promote high employment and sustainable economic growth, and reduce poverty around the world.

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Foreword

The world is facing the risk of fragmentation, with early signs taking root. The number of trade and foreign direct investment (FDI) restrictions has increased three-fold since 2018. There is evidence that trade patterns are shifting, as firms respond to growing policy uncertainty and look for ways to insulate their supply chains from geopolitical risks. FDI is also increasingly concentrated among geopolitically aligned countries.

As geoeconomic fragmentation can potentially have enormous ramifications for the global economy in the years and decades ahead, the purpose of this CEPR-IMF eBook, which publishes the proceedings of a conference held at the IMF in May 2023, is to highlight the importance of carrying out rigorous research in this area. By bringing together fresh work done at the IMF and by scholars in other institutions, we want to shine a spotlight on this topic.

There are so many open and difficult questions and so much that we don't know.

1. First, what are the data telling us about the extent of fragmentation? How are the policies affecting the patterns of trade, capital flows and investment? Are some regions more exposed than others?

2. Second, fragmentation affects the global economy through many channels, but how are these channels interrelated? Do trade, investment, technological, and financial fragmentation reinforce each other? How can we assess such interlinkages?

3. Third, what are the steps that governments can take to limit fragmentation? What safeguards can be put in place? And how can third countries – the innocent bystanders of geoeconomic fragmentation – navigate a more uncertain policy environment?

4. What should be the role of multilateral institutions, such as the IMF and the WTO? What actions and reforms can allow a new form of 'pragmatic multilateralism', as the Fund recently called it, to emerge?

The ideas shared in this eBook will contribute to this critical research agenda, which will be at the core of the Fund's work – and, we hope, of the broader CEPR and economic research community – in the coming months.

CEPR, which takes no institutional positions on economic policy matters, is delighted to provide a platform for an exchange of views on this important topic, and is grateful to the editors, Shekhar Aiyar, Andrea Presbitero and Michele Ruta, for their enthusiasm in putting together this volume, as well as Anil Shamdasani for his skilled handling of the production.

Gita Gopinath

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September 2023

Introduction

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After decades of increasing global economic integration, the world is facing the risk of fragmentation. A shallow and uneven recovery from the global financial crisis (GFC) was followed by Brexit, US–China trade tensions, the COVID-19 pandemic, and a growing number of military conflicts. Disruptions to the international trade and monetary system have deep roots and did not materialise overnight (Aiyar et al. 2023), but developments in recent years present several features of concern. The post-GFC era has seen a levelling-off of global flows of goods and capital, and a surge in restrictions on trade and foreign direct investment (FDI). The COVID-19 pandemic and Russia's invasion of Ukraine have further tested international relations and increased scepticism about the benefits of globalisation. With the world facing the risk of policy-driven geoeconomic fragmentation, this eBook aims at presenting a collection of state-of-the-art studies on the economic risks of a fractured world economy, and outlining avenues for future research in this area. The studies summarised in this volume were presented at a Conference on Geoeconomic Fragmentation[1] organised by the International Monetary Fund in May 2023. The discussants' comments are also included in the volume.

The eBook is divided into six sections. Section 1 opens by discussing what we mean by geoeconomic fragmentation and lays out the main channels through which it might affect the global economy. Sections 2 to 5 zoom in on specific aspects of fragmentation: trade (Section 2), technology diffusion (Section 3), financial flows (Section 4), and firms' production networks (Section 5). Each section of the eBook includes chapters outlining the key findings of the studies and a discussion of these contributions by a leading expert. Section 6 reflects on what we have learned so far and maps out some of the main avenues for future research. The remainder of this introduction provides a brief summary of the individual sections.

Section 1 presents an overview chapter by Aiyar and Ilyina, that begins by proposing a working definition of geoeconomic fragmentation: a policy-driven reversal of global economic integration often guided by strategic considerations. The chapter moves on to provide some suggestive evidence on fragmentation, placing current developments in perspective against the historical record from the latter half of the 19th century onwards. It examines the interconnected channels through which fragmentation is likely to affect the global economy, including international trade, cross-border migration, capital flows, technology diffusion and the provision of global public goods. It considers implications for the international monetary system. Finally, it discusses how the rules-based multilateral

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1   https://www.imf.org/en/News/Seminars/Conferences/2023/05/25/imf-workshop-on-geoeconomic-fragmentation

system needs to adapt to changes in the global economic landscape to preserve the benefits of global economic integration and avoid runaway fragmentation. Thus, the chapter comprises a map of the broad terrain of fragmentation, with subsequent sections and chapters exploring individual areas more finely.

Section 2 focuses on trade fragmentation. The chapter by Javorcik, Kitzmueller, Schweiger and Yildirim aims to quantify the economic costs of 'friend-shoring' using a quantitative model that incorporates inter-country inter-industry linkages. The analysis models friend-shoring as the polarization of the world into two blocs, defined by the recent UN General Assembly vote on the war in Ukraine, and assumes near prohibitive trade costs between the two blocs. These trade costs are then used to calibrate a general equilibrium model based on Baqaee and Farhi (2019). Javorcik and co-authors find that friend-shoring may lead to real GDP losses of up to 4.6% of global GDP. The biggest losses are in countries that currently have a high level of integration with both blocs, but all countries lose out. This is because friend-shoring policies concentrate trade among countries which are similar in many dimensions, and therefore countries are unable to benefit from specializing according to their respective comparative advantages, which negates gains from trade.

The chapter by Bolhuis, Chen and Kett illustrates the importance of accounting for granular commodity production and trade linkages when estimating the output losses associated with various trade fragmentation scenarios. The authors construct a new database which covers production and trade in 136 primary commodities and 24 manufacturing and service sectors for 145 countries. The authors then develop a multi-country, multi-sector, general equilibrium model that accounts for the unique demand and supply characteristics of commodities. The results show that fragmentation-induced output losses can be sizeable. This is especially true for commodity-dependent low-income countries that face an output drop of 4.3% over the long run in the case of severe fragmentation. These results underscore the vulnerability of lower-income countries to trade barriers and the risks of forcing them to choose between groups.

Section 3 focuses on technology diffusion. The chapter by Goes and Bekkers relies on a multi-sector multi-region quantitative model incorporating dynamic sector-specific knowledge diffusion, which can magnify welfare losses from trade conflicts. The authors use the model to study a scenario in which the global economy splits into two blocs along UN General Assembly voting patterns. They find that the projected welfare losses for the global economy of a decoupling scenario can be drastic, as large as 15% in some regions and largest in the lower-income regions – given that they would now benefit less from technology spillovers from richer areas. The two most affected regions are India and the group of smaller countries in the Eastern bloc, due to the slowdown of catch-up productivity growth and pre-existing input-output linkages across the two blocs which would be disrupted. The size and pattern of welfare effects are driven by disruptions in the diffusion of ideas, pointing to how important this channel is in accounting for the negative welfare effects that fragmentation could have on the world economy.

The chapter by Cerdeiro, Eugster, Mano, Muir and Peiris provides a framework to understand the ways in which global trade in high-tech sectors could fragment and the different channels through which this could affect the global economy. They consider the short- and long-term effects of a standard trade channel, the long-term effects of a sectoral misallocation channel, and the short- and long-term effects of a diminished knowledge diffusion channel. The analysis is done by calibrating a dynamic general equilibrium model, adapted to include the misallocation and knowledge diffusion channels, under different scenarios. The results show that technological decoupling is typically very costly, particularly if considering effects through channels beyond the basic trade channel. The losses are especially large for the main technology hubs and scale up with the degree of fragmentation. While some non-hub countries sometimes gain in scenarios where they continue to trade freely with all technology hubs, these trade-diversion gains are always small, and dwarfed by the potential downsides when countries are expected to align with a hub.

Section 4 zooms in on financial flows. The chapter by Correa, Di Giovanni, Goldberg and Minoiu focuses on the effects of the US-China trade tensions on US banks. Using confidential regulatory data, the authors show that US banks with large exposures to trade uncertainty reduce credit supply to *all* firms in the economy. More exposed banks cut loan volumes and raise loan prices not only to firms in sectors affected by trade tariffs and trade policy uncertainty but also to other firms. The authors also show that the contraction in bank credit has adverse effects on firms not only in terms of their ability to borrow, but also in terms of their ability to grow their capital investment and balance sheets. These findings point to a novel amplification effect of trade fragmentation through the banking sector and show that it is important to account for the *endogenous* financial sector response to fragmentation events when we assess the overall effect on the economy.

The chapter by Catalan and Tsuruga takes a global perspective to investigate how financial fragmentation – brought on by rising geopolitical tensions – could impact global financial stability by affecting the cross-border allocation of capital, international payment systems, and asset prices. The authors show that countries tend to allocate less capital to countries with a less similar foreign policy outlook. An increase in geopolitical tensions with major partner countries could cause a sudden reversal of cross-border capital flows, with the impact being notably larger for emerging and developing economies. These patterns could pose macro-financial stability risks through an increase in banks' funding costs, a decline in their profitability, and lower credit provision to the private sector. Finally, the authors show that financial fragmentation could exacerbate macro-financial volatility in the longer term by reducing international risk diversification opportunities in the face of adverse domestic and external shocks.

Section 5 focuses on global supply chains and FDI. The chapter by Freund, Mattoo, Mulabdic and Ruta studies how tariffs imposed on China in 2018 and 2019 by the US impacted global supply chains. The analysis is based on detailed US import data between

2017 and 2022 and relies on differences between trade in tariffed and un-tariffed goods. The chapter has four main findings. First, China's export growth was significantly slower than that of other countries in the set of products subject to US tariffs. Second, there is some evidence of nearshoring, but it is exclusive to border nations, and no consistent evidence of major changes that would be associated with reshoring or diversification. Third, China is primarily being replaced by individual exporters that are large, developing countries with revealed comparative advantage in a product, and that are intricately linked to China's supply chain. And finally, linkages with China turn out to be especially important for replacing China in strategic industries.

The chapter by Aiyar, Ahn, Habib, Malacrino, Muir and Presbitero enters the debate on reshoring and friend-shoring of FDI, showing how fragmentation is already shaping the geographical footprint of FDI and how these changes could weight on the global economy if fragmentation were to increase. The authors start by showing that FDI flows are becoming increasingly regionalised, with some regions recently losing ground as fragmentation pressures rose in reaction to a variety of global shocks. Next, the chapter points to the key role of geopolitical factors in shaping the allocation of FDI, especially in strategic sectors, with flows more likely to take place among geopolitically aligned countries. These trends make countries vulnerable to fragmentation pressures, particularly these relying on strategic investments from countries which are geopolitically distant. To quantify the costs, the authors use a dynamic general equilibrium model and find that FDI fragmentation could reduce the global output level by about 2% in the long term. Costs are unevenly distributed and particularly large for emerging and developing countries, which would lose access to much foreign capital in a scenario in which they fall into a separate bloc from the largest advanced economies.

Section 6 concludes with some considerations by Pierre-Olivier Gourinchas aimed at summarising the main takeaways of the eBook. It also discusses promising directions for future research – both from the modelling and empirical side – and the policy choices that domestic and international institutions will have to face in a more fragmented world. We, the editors, share his view that while the research discussed in this eBook is a crucial first step, much more has to be done to understand how geoeconomic fragmentation might reshape the world economy.

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SECTION 1
GEOECONOMIC FRAGMENTATION

CHAPTER 1

Geoeconomic fragmentation: An overview[1]

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International Monetary Fund

INTRODUCTION

Global cross-border flows of goods, services and capital have slowed down markedly since the global financial crisis (Figure 1), reversing a multi-decade expansion dating to the middle of the 20th century. The reversal has occurred against the backdrop of increasing trade tensions between the US and China, and more generally a rise in populism and greater scepticism about the benefits of globalisation (Ottaviano et al. 2021). Notably, these trends predated the Covid-19 pandemic and the war in Ukraine, events that have further tested international relations.

FIGURE 1   GLOBAL FLOWS OF GOODS, SERVICES AND FINANCE
(\$ trillion, unless indicated otherwise)
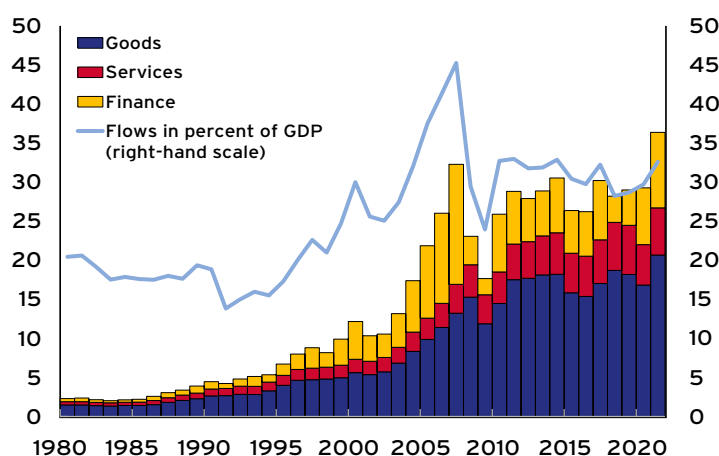
Sources: IMF Balance of Payments, World Bank and IMF staff calculations
Note: The figure shows exports only.

Geopolitical rivalries have fuelled greater protectionism and the increasing use of cross-border restrictions on national security grounds. Data from the Global Trade Alert database shows a rising number of trade restrictions imposed by countries (Figure 2).

FIGURE 2   TRADE RESTRICTIONS
(number)
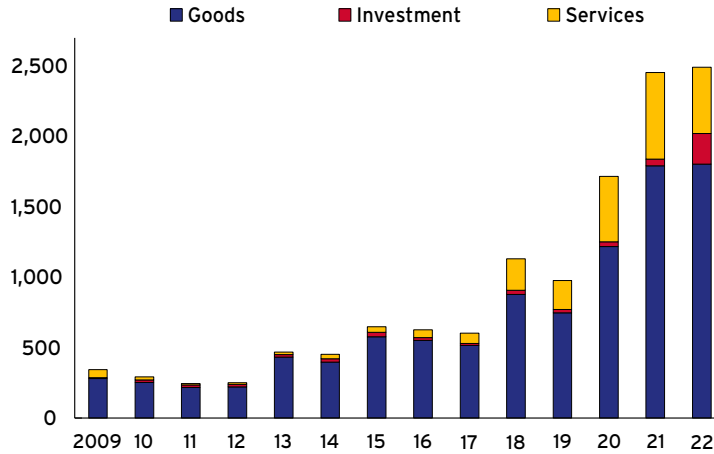
Sources: Global Trade Alert, updated as of 7 December 2022.

The IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions* shows a striking increase in the number of times that "national security" is mentioned in country reports (Figure 3). Official policies are mirrored in heightened private sector concerns about the length and orientation of supply chains. Data from corporate earnings reports show a sharp rise in mentions of terms such as "onshoring", 'friendshoring" and "nearshoring" (Figure 4).

FIGURE 3   MENTIONS OF "NATIONAL SECURITY" IN IMF AREAER REPORTS
(number)
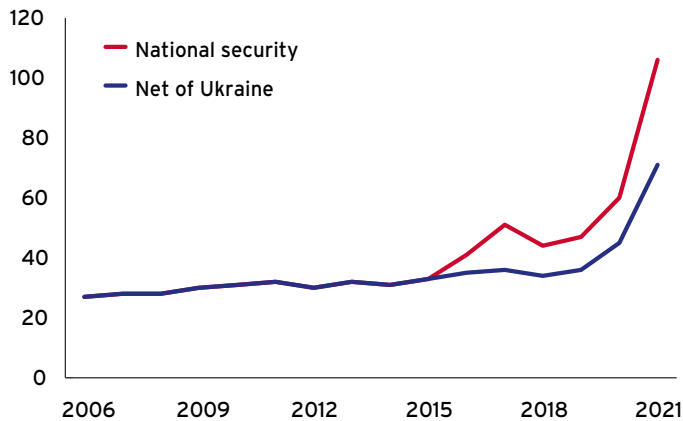
Sources: IMF (2022).

FIGURE 4   MENTIONS OF KEY TERMS IN CORPORATE PRESENTATIONS
(number)
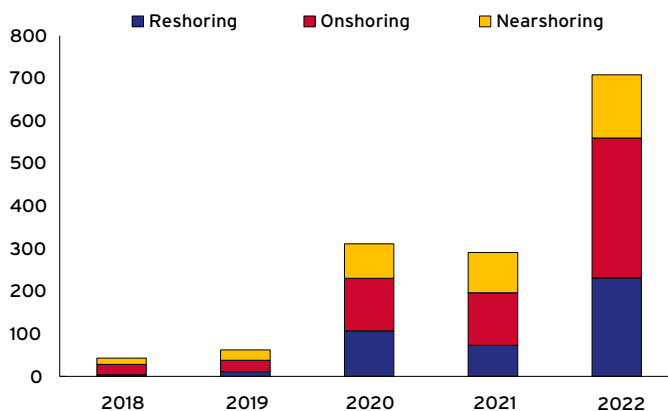
Sources: IMF (2022).

In Aiyar et al. (2023), we document these developments and coins the term 'geoeconomic fragmentation' to describe *a policy-driven reversal of global economic integration often guided by strategic considerations.* These considerations could include national or economic security, as well as enhancing autonomy via reduced reliance on other countries. They could arise as a product of geopolitical rivalry or as a consequence of primarily domestic economic policy objectives – for example, a desire to incentivise production and employment within national borders. Note that our definition of geoeconomic fragmentation explicitly excludes a reversal of economic integration due to *autonomous* shifts in preferences or technology, such as a shift away from manufacturing goods (which tend to be more tradeable) towards services (which tend to be less tradeable). Nor does it include a reduction of cross-border exposures driven by *prudential* policies that are undertaken to improve domestic financial stability.

TRANSMISSION CHANNELS

Just as greater global economic integration impacted the world economy through multiple inter-connected channels, so too is geoeconomic fragmentation likely to exercise the opposite impact through much the same channels. For several decades, *international trade* acted as a catalyst for catch-up in incomes across countries (Figure 5), a large reduction in global poverty and cheaper prices, especially for low-income consumers. These gains stand at risk from geoeconomic fragmentation. *Cross-border migration* provided tangible benefits to both people and firms, conferring efficiency gains in the allocation of labour across countries at different levels of income and productivity, while generating remittances that often acted as a macroeconomic stabiliser for source countries. *Capital flows*, especially the more stable variety of *foreign direct investment*, provided less-developed economies with a valuable source of external financing,

contributing to rising firm productivity and deeper domestic financial markets. All these channels, moreover, contributed to *technological diffusion* from the world scientific frontier to diverse countries, via the ideas embodied in trade, investment and people.

FIGURE 5   GROWTH OF GDP AND TRADE, 1945-2014
(Average annual change in real GDP per capita vs. average annual change in exports as share of GDP, percent)
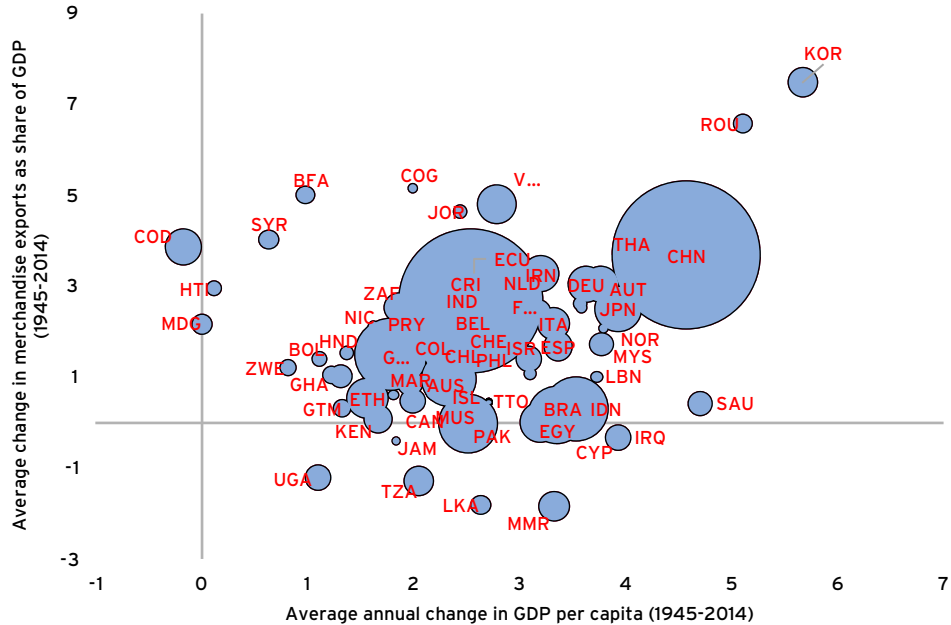
Sources: Fouquin and Hugot (2016) and Maddison Project Database 2020.
Note: Dot size is proportional to population.

Of course, global economic integration also had unintended consequences in some economies. For example, some of the rise in domestic inequality in advanced economies could be attributed to trade integration. But the remedy is not to shut the door on trade, but to ensure that the gains from trade are distributed more broadly and equitably. A number of complementary domestic policies – including carefully targeted fiscal measures, job counselling and retraining, productive infrastructure investment, labour market reforms and greater financial inclusion – are crucial (Antras et al. 2017, Lyon and Waugh 2018).

Looking ahead, geoeconomic fragmentation will make it much more difficult to make progress on providing global public goods, such as climate action and pandemic preparedness. And as fragmentation continues to unfold, the attendant uncertainty during the transition to a more fragmented world is likely to exercise an independent drag on economic growth, for example as firms delay investment decisions and households increase precautionary savings.

IMPLICATIONS FOR THE INTERNATIONAL MONETARY SYSTEM

Several aspects of the international monetary system could be transformed or put in jeopardy by geoeconomic fragmentation.

- The *international payment system* may be at risk of becoming more fragmented. After Russia's invasion of Ukraine in February 2022, key Russian banks were banned from using SWIFT, thus limiting their ability to make transactions with the rest of the world. If geoeconomic fragmentation continues to unfold, other countries may seek to become less reliant on international financial infrastructure and standards. As a result, new parallel systems that lack inter-operability may emerge, leading to higher transaction costs and other inefficiencies.

- Geoeconomic fragmentation could also limit gains from *digitalisation*. New forms of both central bank and privately issued digital money have the potential to significantly improve payment efficiency domestically and across borders (BIS 2022). However, the widespread adoption of digital currencies in the context of geoeconomic fragmentation raises the risk of fragmentation in regulation and supervision (IMF 2021), which may compromise an orderly transition to a modernised digital international monetary system and give rise to new risks.

- Currently, the US dollar is a *dominant currency* for most cross-border transactions and dollar sovereign bonds are the most widely held safe assets globally (Figure 6). If geoeconomic fragmentation continues unabated, the global currency configuration may have to adjust to reflect new economic realities. Countries are now more sensitised to the possibility of financial sanctions (Muhleisen 2022). Both sanctions as well as broader national/economic considerations may drive a reshaping of trade and global value chains. This may lead to less trade invoicing in dollars and a greater use of other currencies in cross-border transactions. The transition may be bumpy.

- Geoeconomic fragmentation could also induce a shift from financial globalisation to *financial regionalisation*, weakening international risk-sharing and leading to greater macroeconomic volatility at the country level. International policy coordination and global liquidity provision may be hampered as well. As a result, countries would have to rely on bloc-specific adjustment mechanisms and costly self-insurance (such as reduced reliance on external debt and higher FX reserves). Crises could become more severe.

GEOECONOMIC FRAGMENTATION

FIGURE 6 ROLE OF MAJOR CURRENCIES IN THE INTERNATIONAL MONETARY SYSTEM
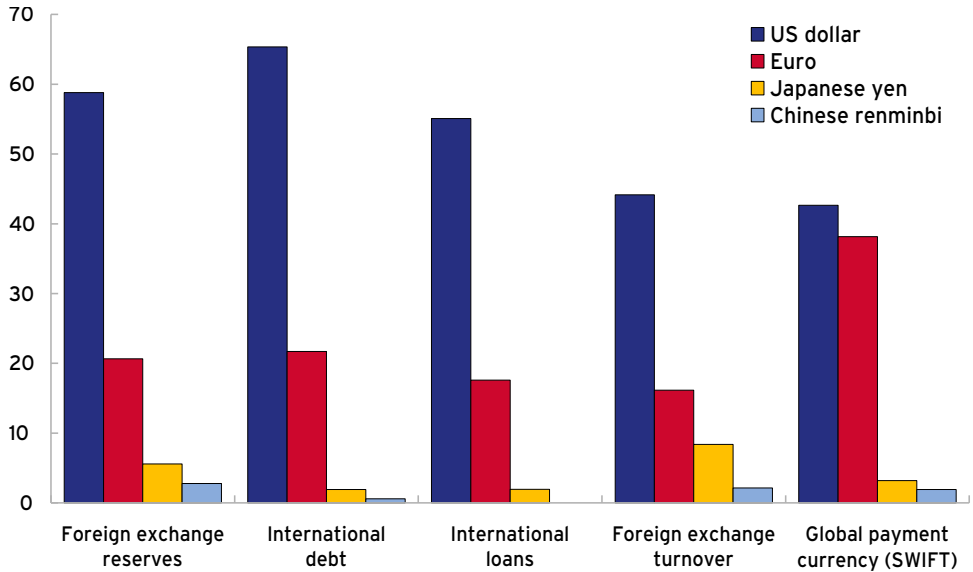
- *Crisis resolution* could become more complicated. Since the 1990s, the foreign creditor base for low-income countries (LICs) has become more diverse: the share of Paris Club official creditors has declined, while the share of China, India, and other non-Paris Club official creditors has increased (Figure 7). If the world were to divide along geopolitical lines, debt resolution could become even more difficult, especially in LICs.

FIGURE 7 CREDITOR BASE FOR THE PRGT-ELIGIBLE COUNTRIES, 1996 VS 2020
(percent of total external debt)
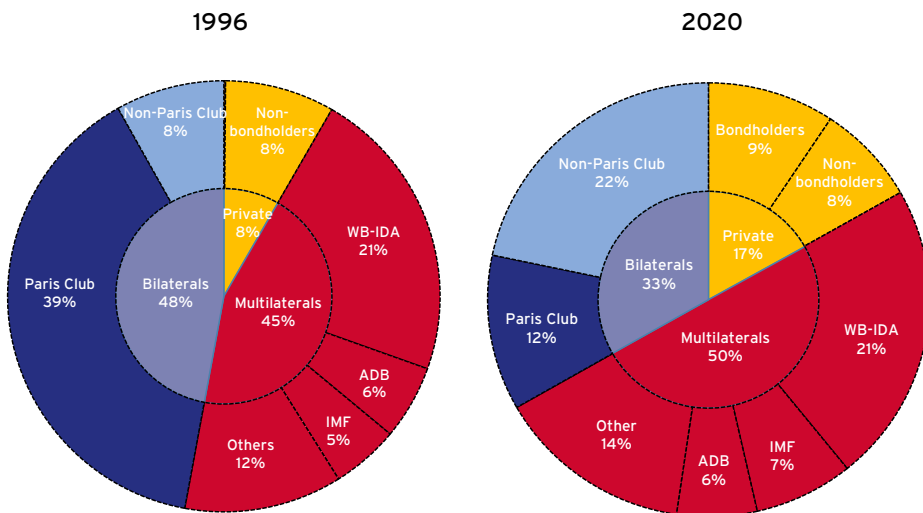
- Geoeconomic fragmentation could affect both the demand and supply of resources from the *global financial safety net* (GFSN). The current GFSN has four layers (IMF 2016): central banks' FX reserves, bilateral swap lines (BSLs), Regional Financing Arrangements (RFAs), and the IMF (Figure 8). The IMF is the only GFSN layer that has global coverage.

  - On the *supply side*, geoeconomic fragmentation could lead to a reconfiguration of BSLs and RFAs along geopolitical lines, which (at least during transition) could disrupt liquidity provision. The bloc-specific importance of BSLs and RFAs will likely increase, but their coverage and governance could become more uneven and less coordinated with the rest of the GFSN. As a result, the GFSN could become more fragmented and under-resourced.

  - On the *demand side*, geoeconomic fragmentation could induce a reconfiguration of trade and financial links, a process that would likely be accompanied by greater capital flows and financial volatility. Bloc-specific arrangements could, in principle, provide some safety net but may be insufficient against large shocks. Thus, geoeconomic fragmentation would likely increase demand for GFSN resources.

FIGURE 8   EVOLUTION OF THE GLOBAL FINANCIAL SAFETY NET,1995-2021 (PERCENT OF GLOBAL GDP)
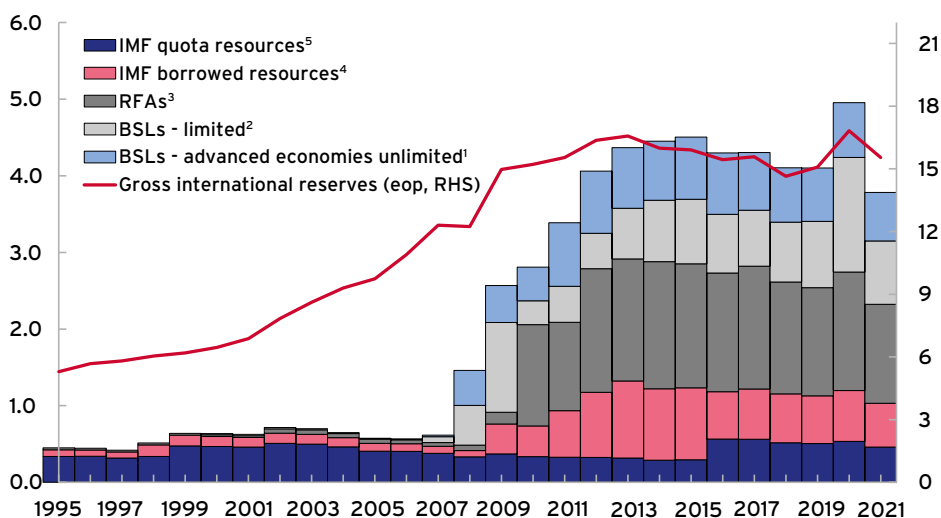
Sources: Central cank websites; Regional Financing Arrangements annual reports; and IMF staff estimates.

Note: Two-way arrangements are counted only once.

1 Permanent swap lines among major advanced economy central banks (Federal Rserve Board, European Central Bank, Bank of England, Bank of Japan, Swiss National Bank, Bank of Canada). The estimated amount is based on known past usage or, if undrawn, on average past maximum drawings of the remaining central bank members in the network, following the methodology in Denbee and others (2016).

2 Limited-amount swap lines include all arrangements with an explicit amount limit and exclude all CMIM arrangements, which are included under Regional Financing Arrangements.

3 Based on explicit lending capacity/limit where available, committed resources, or estimated lending capacity based on country access limits and paid-in capital.

4 After prudential balances.

5 Quota for countries in the Financial Transaction Plan after deducting prudential balance..

A WAY FORWARD: PRAGMATIC MULTILATERALISM

The path to a new and more stable multilateral system that reflects the new economic realities will not be easy. We need to find a way to preserve international cooperation and gradually rebuild trust.

What is the best way forward? We outline a pragmatic approach based on the idea that countries should remain engaged, but that specific forms of engagement should be calibrated based on the extent of alignment of countries' preferences and actions (Figure 9).

FIGURE 9   A PRAGMATIC APPROACH TO INTERNATIONAL COOPERATION

Alignment of countries' preferences and actions	Corresponding types of international engagement
I — Issues where preferences are aligned and globally coordinated action is feasible	**I** — Multilateral engagement, open and inclusive
II — Issues where preferences are not aligned and globally coordinated action is not feasible	**II** — Plurilateral initiatives with 'safeguards' (open, non-discriminatory)
III — Issues where preferences are not aligned and governments opt for unilateral actions	**III** — 'Guardrails' to minimise cross-border spillovers from unilateral actions

Sources: IMF staff.

- In areas of common interest – such as climate change mitigation, food security, pandemic preparedness and debt issues – *multilateral effort* is the best and only way to make progress. A recent positive example is provided by the 12th Ministerial Conference of the WTO in July 2022, where a range of measures were agreed, including the exemption of World Food Program purchases from export restrictions and a partial five-year waiver from WTO intellectual property rules for Covid vaccines.

- When multilateral negotiations stall, *open and non-discriminatory plurilateral initiatives* (fewer countries wanting to do more) could be a practical way forward. Agreements are 'open' when members keep an open-door policy for others who are willing and able to commit to the same rules and norms of conduct, and 'non-discriminatory' when members do not discriminate between different foreign producers or service providers.

- But when countries opt for unilateral actions, credible '*guardrails*' are needed to mitigate global spillovers and protect the vulnerable. Examples of such guardrails could include *multilateral platforms* for consultations on policy measures that might entail economic costs for other countries (see, for example, the recent proposal for a consultation framework on the use of subsidies; IMF et al. 2022),

and developing commonly agreed norms of conduct such as agreements on 'safe corridors' to ensure a minimum level of cross-border flows in critical goods and services.

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CHAPTER 2

Discussion of geoeconomic fragmentation and the future of multilateralism[1]

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The paper explores the potential economic implications of geoeconomic fragmentation, a multidimensional, policy-driven reversal of global economic integration mainly driven by strategic considerations. As the authors clarify, geoeconomic fragmentation does "*not* include fragmentation arising from autonomous shifts in preferences or technology". Furthermore, the term excludes fragmentation "caused by *prudential* policies that are undertaken in an internationally coordinated manner, for example, those directed at improving domestic financial stability". The topic of choice is highly relevant, as the authors convincingly show, particularly for small open economies that have benefited from liberalisation and rely upon the world economy for growth and development. As countries have grown and developed, the post-WWII order that gave birth to the central multilateral institutions has changed. As the authors document, poorer nations are likely to lose from the current policy environment and thus plead, once again, for restraint and cooperation.

The paper is clear, well-written, and thought-provoking. The document is structured around four main topics. The first section on the state of global economic integration defines and describes the problem. The second, on transmission channels, characterises and discusses the economic implications. At the same time, the section on the international monetary system draws implications around the global payment system, reserve currency, crisis prevention, mitigation and solutions, and the overall global financial safety net. The final section presents implications and policy options.

I will focus my comments on two main issues. The first set of comments discusses the distinction between positive facts and policy trends. I will draw on the work of Antràs (2021), Baldwin (2022), and Goldberg and Reed (2023), who present a more nuanced analysis of trends but agree with the significant concern advanced by the paper: the changing public sentiment in rich countries against globalisation and the subsequent policy trends. I will draw on recent work by Alfaro et al. (2023), who study public sentiment on trade policy. In terms of implications, the paper offers an exhaustive analysis. My

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second set of comments revolves around thoughts on possible self-evaluation of the role of the multilateral in encouraging these changing policy sentiments. Here I will return to the definition, particularly what the authors clarify as not considered to be geoeconomic fragmentation. I argue that the distinction is subtle, allowing for confusion and possibly encouraging the current protectionist policy environment. This opinion, of course, requires further study, and I hope further evaluation is done on this concern.

First, regarding actual trends in globalisation, the work by Antràs (2021) cautions about the "over-sensationalisation" of the trends. As the author notes, "[...] although the growth of international trade flows relative to that of GDP has slowed since the Great Recession, this paper finds little systematic evidence indicating that the world economy has already entered an era of deglobalization. [...] the observed slowdown in globalization is a natural sequel to the unsustainable increase in globalization experienced in the late 80s, 90s, and early 2000s." He adds that the "case of de-globalization based on technological facts is somewhat weak. [...] New technologies have and will continue to enhance the ability of economic agents to trade services at long distances." However, Antràs does conclude that "the risk of policy factors leading to an era of increased isolationism deserves much closer attention".

In his work, he further notes that "the bulk of multinational firm activity takes place between countries with similar relative factor endowments and factor prices". This is a fact advanced in Alfaro and Charlton (2009) when describing horizontal and vertical FDI patterns, which continues to be mostly the case. Although patterns of foreign investment are recognised as complex, for analytical simplicity the literature has traditionally distinguished between two forms of, and motivations for, locating activities abroad: horizontal (replicating a subset of activities or processes in another country) and vertical (fragmenting production by function). The bulk of multinational activity occurs between rich nations. Many vertical subsidiaries, which we find to be larger than commonly thought and generally located in sectors related to higher skill input in high-skill countries, have been assumed to be market-seeking.[2] Alfaro and Charlton (2009) termed such subsidiaries "*intra*-industry vertical FDI" and show them to be qualitatively different from vertical subsidiaries that cross two-digit industry codes (i.e. *inter*-industry vertical FDI). Although both are vertical, intra-industry FDI is more challenging to explain via standard theories emphasising factor cost differences as the primary motivation for fragmentation. Instead, the patterns of vertical FDI and the basis for sourcing inputs within firm boundaries also involve its position in the production chain. As Antràs (2021) notes, "[t]he gains from specialization do not rely solely on factor price differences across countries but can also stem from idiosyncratic cross-country

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2   That firm-level trade data for the United States, for example, shows a high proportion of intra-firm trade between developed countries is further evidence of important rich countries' MNC vertical activity.

differences in productivity in different goods. In that sense, the possibility of fragmenting production across borders gives rise to a finer international division of labour and greater gains from specialization."

This finding further highlights that different globalisation 'forces' can act as complements or substitutes. That is, not all changes in trade flows indicate deglobalisation; it may just be taking place through a different 'mode'. For example, trade and horizontal FDI tend to be substitutes (export a product or sell directly to a market after setting up a plant abroad). At the same time, trade and vertical FDI are likely complements (sourcing inputs in one country and finishing production in another). In general, trade, FDI, capital flows, and migration (as well as technology) can be complements or substitutes. Thus, one must carefully examine the patterns to infer deglobalisation from their trends.

Further cautioning over the current interpretation of trends, Baldwin (2022) notes that the so-called peak in trade in goods as a share of GDP was "not synchronised", while some of the largest trading economies have not peaked. He further notes that 60% of the decline in the trade in goods "was due to a reduction in the value of commodities trade, all of which was due to a decline in prices from the mid-2010s to 2020". More generally, he notes that "the future of globalisation is not goods but services – in particular, intermediate services ('tele migration')", which has not peaked in the way goods trade has.

Finally, Goldberg and Reed (2023) further note that the "traditional metrics of globalization (trade; capital flows; immigration) still show no sign of trend reversal – if anything, they suggest that trade has rebounded after the COVID pandemic". [3] As the previous authors, they argue that a few large economies (China and India) drive the global trade trend, while further noting that "global trade was remarkably resilient during the pandemic, and supply shortages would likely have been more severe in the absence of trade". Finally, the authors conclude that the policy environment and public sentiment toward globalisation have fundamentally changed, especially in the largest economies, as argued by Aiyar et al. (2023), noted in Colantone et al. 2022 and further explored in Alfaro et al. (2023).

Alfaro et al.'s (2023) findings further expand these concerns as they find that research-based information influences the public's trade policy preferences in complex, and sometimes unexpected, ways. The authors investigate the role of evidence-based information in shaping individuals' preferences for trade policies through a series of survey experiments that contain randomised information treatments in the United States from 2018 to 2023 using nationally representative samples. Each treatment provides a concise statement of findings from economic research on how openness to trade has affected labour market outcomes or goods prices. Information highlighting

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3   Note also that although tariffs have increased, the use of capital controls has remained relatively stable, as documented by IMF (2023, Figure 3.4).

the link between trade and manufacturing job losses significantly raises expressed preferences for more limits on trade. Strikingly, information on trade price benefits (or the cost of tariffs) also induces protectionist policy choices, indicating that these preferences do not respond symmetrically to information on the gains versus losses from trade. These expressed preferences are partly driven by how the received information interacts with one's political identity, resulting in prior-biased belief updating, and by pre-existing concerns over the impact on American jobs and over-trade with China. Regarding economic fragmentation, their work implies that individuals' preferences over trade policies are not formed in isolation from the identity of the US' key trading countries and further suggests that public messaging focusing solely on communicating trade benefits is unlikely to succeed unless it addresses broader geopolitical concerns and concerns about the impact on jobs.

As Aiyar et al. (2023) document, governments, arguably fuelled by this sentiment, have been explicitly implementing policies to reduce this dependence on trade. The paper then discusses implications that involve a more fragmented payment system; the potential emergence of alternative currencies in foreign reserves, the hampering of crisis prevention, mitigation, and solution mechanisms leading to potentially more challenging resolutions and more severe crises; and overall, a weaker and more fragmented global safety net. The section clearly presents different effects. Here, I would like to make two comments.

First, although the current environment is unlikely to improve current affairs, it is worth remembering that the existing tools and mechanisms for dealing with financial crises and sovereign defaults are far from optimal. The World Bank, for example, has worried about the lack (or at the very least, the extremely inefficient nature) of global crisis and default management resolution mechanisms (World Bank 2022). At their core, default and crisis management have always been geopolitical issues involving sovereigns as explicit or implicit parties.

Second, the chapter would perhaps have benefited from some evaluation of the role of multilateral institutions in the changing policy sentiment. As the authors explain in their definition, geoeconomic fragmentation "excludes fragmentation driven by prudential policies that are undertaken in an internationally coordinated manner, for example, those directed at improving domestic financial stability". But as they note, this difference is not straightforward: "In practice, however, there is often no bright light between prudential and protectionist policies." One may argue that this subtle distinction of objectives can open the door to restrictions based on other motivations. For example, the IMF's capital flows policy (IMF 2012) has been advocated as a macroprudential measure designed to mitigate systemic risk and the volatility of foreign capital flows. However, controls can also have an implicitly protectionist or mercantilist motive to maintain persistent currency undervaluation (Magud et al. 2018). There is ample evidence that capital controls have not been used as 'precautionary models' based on pecuniary externalities (Klein 2012,

Acosta-Henao et al. 2021).[4] Of course, the question emerges if capital controls are not being optimally used as advocated by models, are controls reducing instability? Are they increasing resilience? Is this subtle distinction of motives (prudential very geopolitical) opening the gates to justifying other considerations?

Similarly, one can argue that calls for "*whatever it takes*" after every crisis (the global financial crisis, Covid-19, the invasion of Ukraine, climate, inequality, etc.) mean precisely just that: "whatever it takes." The line between industrial policy, protectionism, and geopolitical motivations is generally poorly defined. But maybe all the demands for unlimited action have provided cover for any objective and 'released the Kraken'. As Goldberg and Reed (2023) note, we don't have models for new geopolitical objectives and no "quantitative benchmark for how much resilience is optimal". Implicitly, we tend to have some form of 'checks and balances' or, more generally, ideological anchor. Perhaps we have all forgotten the more fragile equilibria – one of keeping sovereigns in check. As noted in the Federalist Papers No. 51, "[...] In framing a government which is to be administered by men over men, the great difficulty lies in this: you must first enable the government to control the governed, and in the next place oblige it to control itself". As they state, "ambition must be made to counteract ambition.

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SECTION 2
TRADE

CHAPTER 3

Economic costs of friend-shoring

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INTRODUCTION

The nature of international trade has changed significantly since the early 1990s: the liberalisation of cross-border transactions, advances in information and communication technology, reductions in transport costs, and innovations in logistics have given firms greater incentives to break up the production process and locate its various stages across many countries. As a result, global supply chains have become very common, accounting for around a half of global trade in 2020 (World Bank 2020).

The prevalence of global value chains has been underpinned by the well-functioning international trade rule enshrined in the General Agreement on Tariffs and Trade (GATT) and later the WTO, as well as regional agreements. However, geopolitical tensions and disruptions to global value chains – ranging from cyber-threats, the US-China trade war (Fajgelbaum et al. 2022), and the Russian invasion of Ukraine to systemic issues such as the Covid-19 pandemic and the climate crisis – have led policymakers to re-evaluate their approach to globalisation. Many countries are considering 'friend-shoring' – trading primarily with countries sharing similar values (such as democratic institutions or maintaining peace) – as a way of minimising exposure to weaponisation of trade and securing access to critical inputs, particularly those required for green transition (Arjona et al. 2023, Attinasi et al. 2023).

In contrast to optimisation under free trade, friend-shoring – by imposing constraints – is likely to be less efficient. But how high is the price that needs to be paid for the alleged insurance benefits brought about by friend-shoring? To shed some light on this question, this chapter assesses the economic costs of friend-shoring, with a focus on broadly defined emerging Europe and European neighbourhood economies. We make three main points. First, we show that, in the medium run, friend-shoring is bad for most economies and generally leads to real output losses globally. Second, only countries that manage to remain non-aligned may see real output gains, but these gains are much smaller than the losses incurred by other countries and not guaranteed. Third, economic costs of friend-shoring are higher than the economic costs of sanctions imposed on Russia after its invasion of Ukraine.

ECONOMIC MODEL

We use a general equilibrium model incorporating inter-country inter-industry linkages based on Baqaee and Farhi (2019) and Çakmaklı et al. (2021). In this model (Figure 1), each country produces a different range of products within a given industry. The production process in a sector in a given country combines labour and other inputs from different industry bundles, which, in turn, are based on product varieties from different countries. For example, the German automotive industry uses labour, as well as industry bundles such as steel and plastic. The steel bundle consists of German steel, Turkish steel, Chinese steel, and so on. Meanwhile, consumers in a country decide to spend their income on consumption bundles, which again consist of different ranges of products from different countries.

FIGURE 1   SCHEMATIC OF THE MODEL
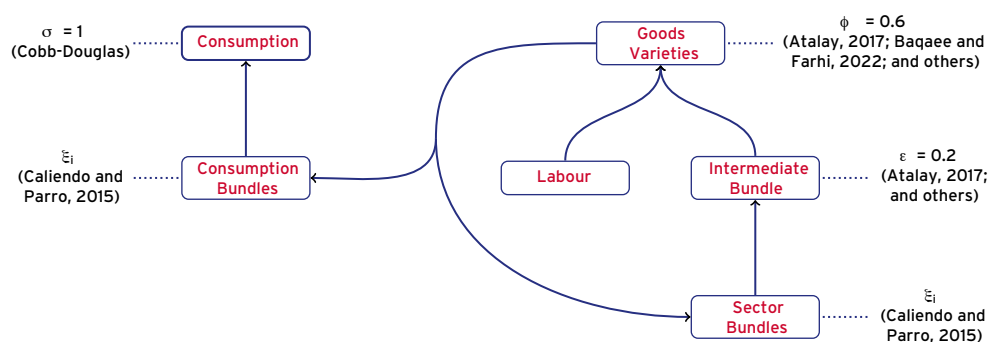
Note: This figure summarises our model. The boxes on the left represent consumption, while the right side is related to production. Each country-industry pair is represented by the Goods / Varieties box.

The model is based on the following assumptions: (1) the ranges of products produced by countries are substitutable, with an industry-specific constant elasticity of substitution (i.e. as in the Armington 1969 model); (2) inputs are complementary to each other; and (3) consumption is based on a Cobb-Douglas aggregation with an elasticity of 1. Our selected elasticity values come from the literature (see Figure 1).

We assume that labour is the only factor of production, and it is mobile between sectors within a country but cannot move between countries. Ruling out labour mobility across countries as well as productivity changes and changes along the extensive margin of trade makes our model suitable for modelling the medium-term rather than the long-term horizon.

We solve for perturbations to the equilibrium induced by an iceberg trade cost or a tariff shock via log-linearisation around the equilibrium and quantifying the changes in equilibrium wages, prices and labour allocations through the differential hat-algebra,

which is heavily used in the trade literature (see Costinot and Rodríguez-Clare 2014 for a review). This is akin to Euler's method to solve for differential equations. To make the log-linearisation more precise, we split our aggregate shock into smaller shocks.

DATA

We calibrate our model by using the 2018 (latest available) version of the OECD Inter-Country Input-Output (ICIO) Tables (OECD 2021). In its original form, the dataset covers 45 industries and 67 countries. To make the computations more feasible, we aggregate data to 39 countries or country groups and 16 industries. On the country side, we kept the granularity for emerging Europe and European neighbourhood economies, because we would like to assess whether these countries in particular might benefit from friend-shoring. On the industry side, the main aggregation is for services, which are relatively less prevalent in international trade.[1]

We use tariff data from United Nations Conference on Trade and Development (UNCTAD) Trade Analysis Information System (TRAINS), accessible through the World Integrated Trade Solutions (WITS) tool. The original database contains information on tariffs for 119 countries at the reporter-partner-product level. To harmonise the tariff data with the input-output data, we aggregated the tariff data to the same 39 country groups and 16 industries using imports (in US dollars) as weights. We use the pre-pandemic tariff data from 2018 and the effectively applied tariff rates calculated by WITS as the lowest available tariff.

We define four different country blocs using the United Nations (UN) voting behaviour. In bloc definition A, we split countries into two blocs. Bloc 1 consists of countries that voted in favour of the UN General Assembly resolution on "Aggression against Ukraine"[2] condemning the aggression against Ukraine on 2 March 2022, and Bloc 2 consists of those that voted against it, abstained or were absent from the voting. Two of the country groupings we use – Southeast Asia (Indonesia, Cambodia, Laos, Myanmar, Malaysia, Philippines, Thailand and Vietnam) and the rest of the world – contain both countries that should be in Bloc 1 and countries that should be in Bloc 2. We assign these groups to Bloc 2.

In the remaining three bloc definitions, we use data on UN General Assembly voting between 2014 and 2021 from a dataset maintained by Voeten (2013) and, following a large political science literature, measure countries' bilateral political attitudes towards one another using the similarity of their UN votes. Specifically, in bloc definition B, countries are allocated to two blocs based on the 2014-21 average 'ideal points' on a unidimensional scale and Jenks natural breaks classification with two clusters (Bailey et al. 2017). This yields Russia as a cut-off point.

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1   See Javorcik et al. 2022 for details.
2   See UN General Assembly Resolution ES-11/1 (https://digitallibrary.un.org/record/3959039), accessed 21 September 2022.

In bloc definition C, we define three blocs – friends, non-friends, and non-aligned – based on the clusters visually emerging in heat maps of bilateral vote similarity using three similarity measures: S-score (Signorino and Ritter 1999), π-score (Scott 1955), and κ-score (Cohen 1960).[3] These measures produce the same country groupings. 'Rest of the world' is assigned to the non-friends bloc (Bloc 2). In bloc definition D, we use the same bloc definition as in bloc definition C, but assign the 'rest of the world' to the non-aligned bloc (Bloc 3).

In the scenarios to which our model is applied, countries that condemned Russia's aggression (Bloc 1) are assumed to place value on sourcing inputs from other countries that condemned the invasion of Ukraine and thus increase trade barriers vis-à-vis countries in Bloc 2. We assume that Bloc 2 countries employ similar measures vis-à-vis Bloc 1 countries. In the medium term, this results in a polarised world. Bloc 3 countries in definitions C and D remain neutral.

RESULTS

We model the impact of friend-shoring by assuming either an additional iceberg trade cost of 20% or an additional 20% increase in tariffs applied by Bloc 1 countries on Bloc 2 countries and vice versa. Figures 2 and 3 show the resulting model estimates. Iceberg trade costs do not generate any revenues for the countries involved in trade and could be used to model sanctions or other non-tariff barriers. An increase in tariffs results in tariff revenues for importing countries, thus leading to lower losses than iceberg trade costs. We impose the same cost in each industry.

Regardless of the type of additional trade cost applied, there are no winners under bloc definitions A and B – all countries lose in terms of real GDP under friend-shoring. As expected, losses are lower in the increase in tariffs scenario than in the increase in iceberg trade cost. The ranking of countries in terms of the impact of friend-shoring on real GDP changes somewhat if we use a different bloc definition: when using bloc definitions B, C or D, Tunisia – rather than Morocco – is the biggest loser. The reason Tunisia is not among the top losers under bloc definition A is that it voted in favour of the UN General Assembly resolution condemning the aggression against Ukraine on 2 March 2022 and was thus in the 'friends' bloc. Its bilateral voting record between 2014 and 2021, however, puts it into the group of less politically aligned countries – the 'non-friends' bloc. A similar, though less striking pattern is observed for Saudi Arabia. The common pattern among the countries that are the biggest losers is that they tend to trade with both blocs.

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3   See Kleinman et al. (2022) for a more detailed discussion of these measures.

FIGURE 2   FRIEND-SHORING: AN ADDITIONAL 20% ICEBERG TRADE COST INCREASE IMPOSED IN EACH INDUSTRY
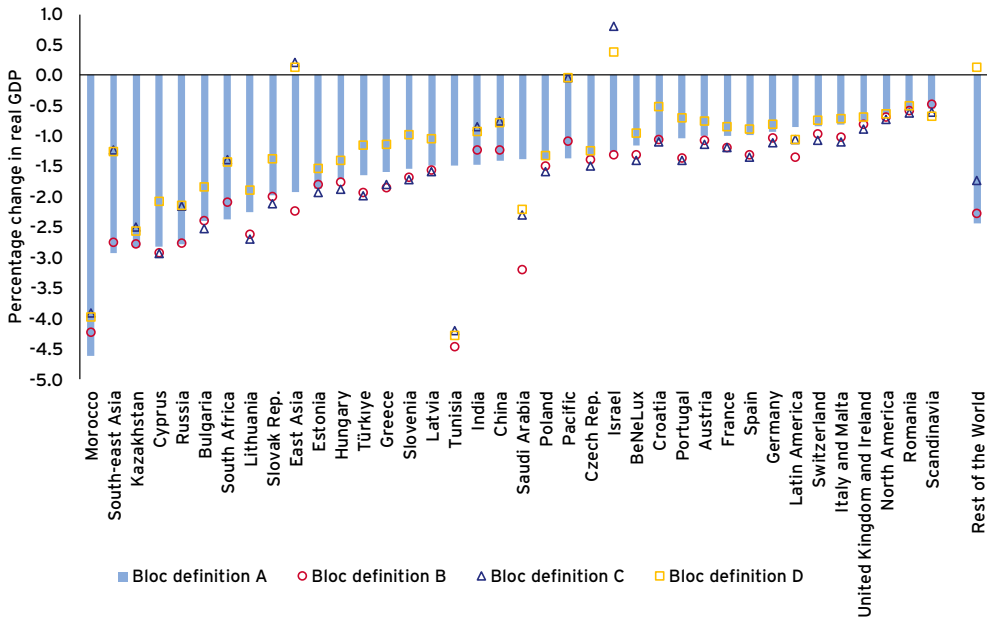
Note: Based on a modelling exercise. To make the computations feasible in this model, the OECD's ICIO Tables data have been aggregated to 39 countries or 'country groups' and 16 industries. Details of assignment of countries and country groups to blocs under each definition can be found in Javorcik et al. (2022).

Source: OECD's ICIO Tables, WITS website and authors' calculations.

FIGURE 3   FRIEND-SHORING: AN ADDITIONAL 20% TARIFF INCREASE IMPOSED IN EACH INDUSTRY
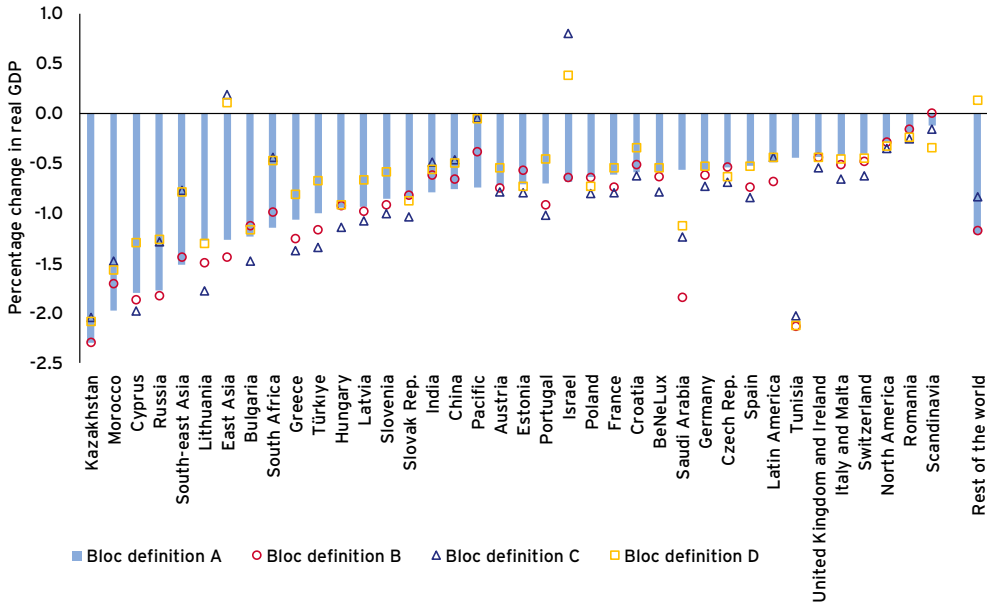
Note: Based on a modelling exercise. To make the computations feasible in this model, the OECD's ICIO Tables data have been aggregated to 39 countries or 'country groups' and 16 industries. Details of assignment of countries and country groups to blocs under each definition can be found in Javorcik et al. (2022).

Source: OECD's ICIO Tables, WITS website and authors' calculations.

There are also a few economies that experience gains in real GDP when we allow some countries to remain non-aligned (bloc definitions C and D). The common denominator is that under these definitions, these economies manage to remain non-aligned. However, managing to remain non-aligned does not always result in gains from friend-shoring – it may merely reduce the losses, as is the case for the Pacific region.

How do the economic costs of friend-shoring compare with economic costs of other policies? We compare the economic cost of friend-shoring with the economic cost of sanctions imposed on Russia owing to its invasion of Ukraine by assuming a 20% hike in iceberg trade costs between Russia and Bloc 1 countries under bloc definition A.[4] This leads to a decline in Russia's real GDP of nearly 3% (Figure 4). Countries where production is more reliant on imports from Russia also experience sizeable losses, but they are lower than under any of the friend-shoring scenarios.

FIGURE 4   SANCTIONS IMPOSED ON RUSSIA OWING TO ITS INVASION OF UKRAINE
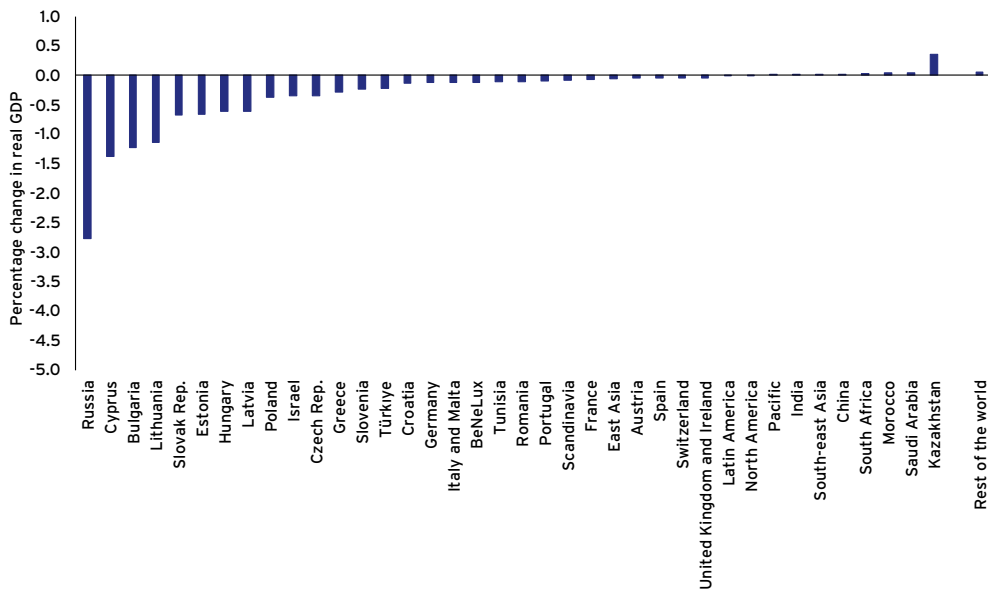
Note: Based on a modelling exercise. To make the computations feasible in this model, the OECD's ICIO Tables data have been aggregated to 39 countries or 'country groups' and 16 industries. Details of assignment of countries and country groups to blocs can be found in Javorcik et al. (2022).

Source: OECD's ICIO Tables, WITS website and authors' calculations.

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4   These costs could be related to price caps on Russian commodity exports, restricted access to the SWIFT payment system, costs of additional due diligence or simply costs of evading sanctions.

LIMITATIONS OF THE MODEL

As is the case with most economic models, our analysis is subject to some limitations. First, due to computational limitations and data availability, we work at a rather aggregated industrial level of 16 industries and 39 countries or country groups. We also have a single mobile factor of production – namely, labour – so we might not be capturing all dimensions of the value-added.

Second, we use the iceberg trade costs as a way to introduce complex trade frictions between countries. For instance, sanctions imposed at the detailed Harmonized System six-digit level are modelled to be an iceberg trade shock. Moreover, our model does not allow a complete shutdown of any industries – that would be equivalent to an infinite iceberg cost which cannot be approximated by log-linearisation.

Third, our model is not capable of predicting changes on the extensive margin. This means we cannot predict a new trade partnership at the industry or at the country level. The model captures only the shifts among the already existing trade partnerships.

Finally, there are other underlying changes in the consumption and production patterns. For example, climate change and push for green technologies might replace some of the dependencies between countries. Hence, energy sources such as hydrocarbon-based products might lose their prevalence, while minerals such as lithium might be more important as the world requires more of these metals to transition to green production and consumption.

CONCLUSIONS

Using a rich economic model incorporating international production networks with a focus on economies in emerging Europe tied to European global value chains, we show that most countries lose in terms of real GDP from friend-shoring in the medium run. Our results indicate that the countries with deep economic ties with both blocs are the ones that bear the largest costs. Friend-shoring efforts will eventually force these countries to be more integrated with one of these blocs. Only countries that manage to remain non-aligned may see some benefit from friend-shoring, but not all non-aligned countries gain from friend-shoring.

Although friend-shoring is driven by some legitimate goals such as securing long-term access to critical raw materials, particularly those needed for green transition, achieving these goals may come at a very high price of undermining (if not outright destroying) the system of global trading rules. This may result in the escalation of protectionist measures, introduction of export restrictions, subsidy competition and uncertainty about future treatment of goods traded across international borders.

Elements of friend-shoring can already be seen, among others, in both the US and EU approach to diversifying their supply chains. Both have defined their critical and strategic raw materials (European Commission 2023, White House 2021), with the aim of reducing dependence on China through strategic partnerships (EU) or incentives for domestic production (US Inflation Reduction Act of 2022). Early estimates of the impact of the Inflation Reduction Act suggest substantive effects in the US sectors directly affected by the Act as well as non-negligible losses in specific EU sectors (Attinasi et al. 2023). The friend-shoring philosophy is also echoed in the US CHIPS and Science Act and the European Chips Act that is being considered. And the first retaliation measures in the form of export restrictions on germanium and gallium, rare metals critical for the semiconductor industry, have already been introduced by China. All of these measures may be harbingers of a new global trading order.

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CHAPTER 4

Geoeconomic fragmentation: Accounting for commodities

Marijn A. Bolhuis, Jiaqian Chen and Benjamin Kett[1]

International Monetary Fund

On the 24th of February, Russia invaded Ukraine, with widespread adverse effects on the global economy (Rohner et al. 2022). As the invasion disrupted production in Ukraine and Western countries imposed sanctions on Russia, the global trade of key commodities was curtailed. Within days, energy, food, and certain mineral prices shot to record levels.

The disruption in global trade following the Russian invasion of Ukraine is not an isolated event. In recent years, trade restrictions in sectors like commodities and semiconductors that are seen as crucial for national security and strategic competition have increasingly taken precedence over global economic integration and its shared benefits. The United Kingdom's decision to leave the European Union in 2016 was an example of this broader trend. The world's two largest economies, the United States and China, have imposed a series of bilateral trade barriers in recent years. While trade barriers were generally on a decreasing path throughout the 20th century, this trend has reversed over the past decade (Ottaviano et al. 2021). These events may be early signs of broader geoeconomic fragmentation – defined as a policy-driven reversal of economic integration, of which international trade is a central component (Aiyar et al. 2023).

The rise in trade barriers in recent years has gone together with a plateauing of global trade integration, measured as the sum of exports and imports as a percentage of global GDP. In the three decades preceding the Global Financial Crisis, global incomes and international trade increased in tandem. For many low-income countries and emerging markets, this integration into the global economy was a crucial contributor to their development, providing access to affordable imports, extensive export markets, and foreign technology.

A NEW DATASET THAT ACCOUNTS FOR COMMODITIES

Motivated by the large shock to commodity markets after Russia's invasion of Ukraine, our recent paper aims to quantify the economic costs of fragmentation from an international trade perspective, with a particular focus on production and trade of commodities (Bolhuis et al. 2023). More specifically, we examine how various fragmentation scenarios affect output in different country groups by applying a newly developed dataset that accounts for granular production and trade in commodities to a multi-country, multi-sector quantitative trade model that explicitly considers the uniqueness of commodity production. While there has been a growing number of studies attempting to gauge the potential economic effects of fragmentation scenarios (e.g. Cerdeiro et al. 2021, Góes and Bekkers 2022, Javorcik et al. 2022), our paper shows that not properly accounting for commodity trade and production can lead to significant underestimation of the associated costs.

To effectively account for spillovers from trade fragmentation, we construct a new dataset that covers a granular level of trade and production in commodities. Standard datasets typically provide this information at an aggregated sectoral level (e.g. "Mining and Quarrying"), leaving commodities aggregated and treating products as dissimilar as gold and natural gas as perfect substitutes. Our approach allows us to capture the imperfect substitutability of different commodities, along with the fact that production of specific commodities is often concentrated in a few countries. Both elements are critical to improve the estimated cost of higher trade barriers.

The starting point for our data construction is the EORA 26 global input-output table, which provides a wide country coverage for this necessarily global analysis (Lenzen et al. 2012). We then disaggregate the Mining and Quarrying and Agriculture sectors into granular upstream commodities, combining detailed production data from the British Geological Survey (BGS) and the Food and Agricultural Organisation (FAO), with trade data at the 6-digit HS product level from BACI II. The final dataset trade and production data for 136 commodities as well as 24 aggregated manufacturing and services sectors across 145 countries representing 99% of global GDP.

USING A QUANTITATIVE TRADE MODEL TO STUDY FRAGMENTATION

We explore different illustrative scenarios using a quantitative, multi-country model of international trade that allows us to simulate the impact of changes in trade barriers on prices, trade flows, and incomes. Given the importance of commodities in global trade and recent restrictions, along with their propensity to be produced in a relatively small set of countries, we utilise the dataset described above which allows for significantly more detailed coverage of their trade and production as an input to the model.

It is worth noting that our work focuses on the output losses of geoeconomic fragmentation through *trade*. The *total* losses of fragmentation will likely be even larger.

Broadly speaking, the general equilibrium effects of higher trade barriers on welfare can be summarised in three terms. Consider a country that imposes an import tariff on semiconductors. First, for consumers who buy computers, a tariff immediately increases the price they pay. Even though domestic firms will expand production, this is costly as consumers had revealed their preferences for the foreign chips through their original purchasing choices, either due to lower prices or product characteristics. Consumers are therefore worse off.

Second, with a shrinking access to their export markets, workers in the country producing semiconductors will see their income fall.

Third, higher semiconductor prices can affect the prices of other goods and services that use computers as inputs. These indirect effects through complex supply chains can be large and have knock-on effects on consumers in other countries as well.

THE IMPORTANCE OF ACCOUNTING FOR TRADE AND PRODUCTION IN COMMODITIES

To illustrate the importance of importance of using a more granular dataset to account for production and trade in commodities, we compare the welfare change calculated under two experiments with and without disaggregated commodity sectors (i.e. the only difference is the input dataset, with both using the same trade model and elasticities). For simplicity, both experiments consider the output loss of moving to autarky. We find that the loss more than doubles for low-income countries, which are heavily dependent on trade in commodities, while for advanced economies and emerging markets the welfare losses increase by 4% and 25%, respectively.

RUNAWAY FRAGMENTATION WOULD BE COSTLY

We use the new dataset and model to examine the costs of fragmentation in a number of illustrative scenarios. Specifically, we examine a scenario (strategic decoupling) in which trade fragmentation is limited to the elimination of all trade between Russia on the one hand, and the United States and the European Union on the other, as well as the elimination of trade in high-tech sectors between China and the United States and European Union. This scenario is akin to a broadening of current sanctions on Russia to the entire spectrum of trade in goods and services, expanding beyond the current focus on semiconductor chips to all high-tech goods.

Such a strategic decoupling would lead to permanent GDP losses of 0.3% globally, roughly equivalent to the annual output of Norway (Figure 1). This global negative impact masks some heterogeneity. Indeed, as long as the rest of the world keeps trading freely with Russia, China, the United States and the European Union, some countries may even see

small gains. Commodity exporters, for example, that can eventually replace Russia as a key supplier would see their incomes increase. Some Asian countries would benefit if semi-conductor supply chains were relocated from China.

FIGURE 1   THE COSTS OF FRAGMENTATION (PERMANENT REAL GDP LOSSES, %)

A world split into two exclusive trading blocs would result in permanent losses to global GDP, most severely in low-income countries.

■ Strategic decoupling   ■ Geoeconomic fragmentation
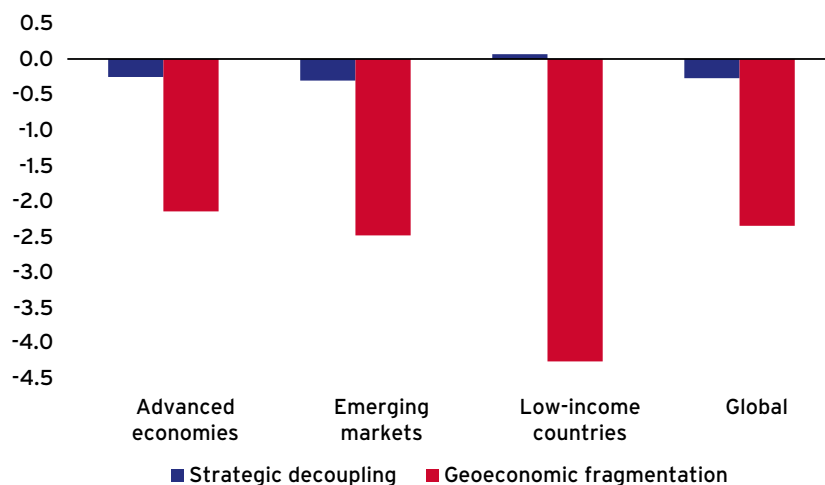
Source: Bolhuis et al. (2023).

Second, we look at a more severe scenario – geoeconomic fragmentation – in which all countries are forced to choose between either the US-EU bloc or the China-Russia bloc, with no trade between these two blocs. In this illustrative scenario, countries are grouped based on how much they trade with either the United States or China.

In this case, global output losses would be substantial at 2.3% of global GDP, equivalent to the size of the French economy (Figure 1).

Permanent losses for advanced economies and emerging markets would be on the order of 2% to 3%. And low-income countries would come under significant pressure, losing more than 4% of GDP. These losses would deepen risks of debt crises and exacerbate social instability and food insecurity. Poorer countries are typically most at risk from geoeconomic fragmentation because they are heavily dependent on the imports and exports of key products for which it is more costly to find new suppliers, including commodities.

How large are these losses relative to historic events? To provide some comparison, global GDP losses would be on the order of the 2020 output losses due to COVID-19. However, these losses would be permanent.

How bad things get would not just depend on the extent of trade restrictions and how countries sort into blocs; the adjustment process itself can be challenging. If fragmentation occurs quickly, it will be very costly for supply chains to adapt. This will also imply greater global GDP losses: in our simulations, these can be as high as 7% if adjustment costs are particularly large.

CONCLUSIONS AND POLICY IMPLICATIONS

Not accounting for granular commodity production and trade linkages leads to underestimation of the output losses associated with trade fragmentation, especially for low-income countries. Output losses tend to be larger the deeper the fragmentation scenario, and if forced to choose, low-income countries experience larger losses than advanced economies and emerging markets. Trade barriers that are limited to specific countries or specific sectors, whilst allowing the rest of the world to trade freely, lead to relatively contained GDP losses in the long run as production processes and source countries adjust and trade diversion provides a boost to countries outside of the main trade blocs. In contrast, a severe fragmentation scenario leads to larger losses, particularly for low-income countries that are forced to choose between one bloc or the other.

What can be done to prevent the worst losses from runaway fragmentation, including for the most vulnerable economies? A recently published IMF Staff Discussion Note (Aiyar et al. 2023) outlines possible modalities of international cooperation that could help limit the risk of, and the damage from, trade fragmentation when geopolitical tensions are high. Attempts to engage in 'friendshoring' or 'reshoring' by implementing discriminatory measures against foreign competitors could generate a trade environment in which 'innocent bystanders' would be disproportionally affected. A first policy priority, therefore, should be to avoid runaway fragmentation. Ultimately, the rules-based trading system will have to adapt to a changing world. Efforts should focus on reforms with high impacts where preferences of countries are broadly aligned. Yet, in the current environment, progress through multilateral consensus may not always be possible. In areas where countries' preferences are not well aligned, deeper regional trade integration, while remaining open and non-discriminatory to other countries, can be a way forward. It is key that low-income countries, most vulnerable to the adverse growth effects of runaway fragmentation, do not get caught in the crossfire. If and when countries undertake unilateral actions, credible 'guardrails' will be needed to protect the vulnerable and mitigate global spillovers. These guardrails could include, for example, safe corridors for food and medicine, along with multilateral consultations to assess the economic impact of unilateral actions and identify their unintended consequences.

The trend towards geoeconomic fragmentation is a significant challenge that will have far-reaching economic consequences for countries across the world. But by strengthening and modernising the global trading system, we can overcome these challenges and preserve the large benefits of economic integration.

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CHAPTER 5

Estimating the costs of geoeconomic fragmentation to the global economy[1]

Michael G. Plummer

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One hears frequently that the halcyon days of free trade are over, with the global financial crisis (GFC) of 2008-09 demarcating its peak. There are at least two problems with this perception. First, trade was never anywhere near 'free'; open trade and investment always had a long way to go. Average tariffs[2] have fallen over time but remain positive and feature spikes in key sectors, and non-tariff barriers (NTBs) continue to present significant obstacles to trade, particularly in services.[3] Second, while economic integration has perhaps underperformed relative to trend, it is not in a free-fall – at least not yet. International commerce did advance significantly in the quarter century leading up to the GFC (trade as a percentage of GDP rose from about one-third in 1980 to almost two-thirds in 2008)[4] and slowed down after the GFC, but it has been rebounding from the Covid-19 pandemic and nominal trade values hit a historical high of \$24.9 trillion in 2022.[5] Foreign direct investment (FDI) inflows, another measure of integration, have been volatile but are on the rebound in the wake of the pandemic and, in fact, the stock of global FDI more than doubled between 2010 and 2021 to \$44.4 trillion (UNCTAD 2022). To paraphrase Mark Twain, the reports of the death of globalisation are greatly exaggerated.

Nevertheless, international trade is undoubtedly facing severe policy headwinds and a reversal is still conceivable in the future. Trade frictions between major economies due to strategic competition, concerns about supply chain resilience to global shocks, and the oft-cited fears that trade destroys jobs, worsens inequality, and damages the environment are some of the more prominent drivers behind the current backlash against the global liberal order. The inward-looking responses to these perceived threats take many forms, including higher trade barriers in 'strategic' sectors, restrictions on inward and outward FDI in sensitive areas, and strong incentives to encourage locally produced manufactured goods. These reactive policies result in 'geoeconomic fragmentation' and, if current policy trends continue in the direction they are ostensibly heading, threaten not only the

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1   This discussion relates to the papers as presented at the IMF conference rather than the respective chapters in this eBook.
2   https://data.worldbank.org/indicator/TM.TAX.MRCH.WM.AR.ZS
3   https://stats.oecd.org/Index.aspx?DataSetCode=STRI
4   https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS
5   https://stats.wto.org/

health of the international marketplace but also prospects for global growth, innovation, economic development, and poverty reduction, which have benefitted significantly from economic integration.

Hence, the stakes are high and the theme of this conference is extremely relevant. In what follows, I would like to make a few general comments regarding the papers included in the trade session in the context of the literature and then complement their work with some related empirical research I have done with my co-author, Peter Petri of Brandeis University, on geoeconomic fragmentation, that is, the economic effects of reshoring, nearshoring and friend-shoring using a computable general equilibrium (CGE) model (Petri and Plummer 2023).

SESSION PAPERS

Quantifying the effects of geoeconomic fragmentation on trade and other economic variables is critical to understanding not only how an associated policy affects its strategic target but also its knock-on effects. The interconnectedness caused by the rapid rise in globalisation and proliferation of global value chains underscores the importance of a general-equilibrium approach. The empirical literature on geoeconomic fragmentation is fledging but certainly is not being built from scratch; there is a long tradition of tractable empirical trade models in the trade literature that can be mobilised for the purposes of estimating the effects of related policy shocks. For example, a recent literature review of empirical studies focusing on geoeconomic fragmentation can be found in Aiyar et. al. (2023), who conclude that existing research puts the costs of fragmentation in the range of 0.2% to 7.0% of GDP, and even up to 12% if technological decoupling is included. This wide range of results in part reflects the diversity of models employed but more importantly the size and nature of the assumed geoeconomic interventions and how to measure them. It is straightforward to estimate, for example, the imposition of an *ad valorum* tariff on semiconductors but more complicated to model export controls and inward/outward FDI screening. Definitions are important: supporting supply-chain resiliency and 'de-risking' mean different things to different scholars and policymakers.

The two papers included in the trade session, "The Economic Costs of Friend-shoring" (Javorcik et al. 2023) and "Fragmentation in Global Trade: Accounting for Commodities" (Bolhuis et al. 2023), add much to the geoeconomic fragmentation debate by providing additional empirical insights into the related costs. Javorcik et. al. (2023) is one of the first to quantify the economic effects of friend-shoring, developing a model that allows for inter-country and inter-industry linkages and using OECD Intercountry Input-Output Tables. The authors find that friend-shoring could lead to significant long-term losses of up to 4.7% of real GDP, depending on the country, assumed policy (via tariffs or iceberg trade costs) and the definition of friendly 'blocs', for which simulations are run for several

possibilities.[6] Most countries lose in the simulations. Bolhuis et al. (2023) construct a new database that permits significant disaggregation of agricultural commodities, underscoring the importance of granular detail. For example, they find that losses for low-income economies due to various geoeconomic fragmentation scenarios are twice as high when commodities are disaggregated, and low-income economies are more at risk from 'deep' geopolitical fragmentation than are emerging and developed economies.

Each paper adds to the literature in interesting ways. It is telling, however, that, while using very different models and approaches, they both come to the same general conclusions that (1) geoeconomic fragmentation leads to significant losses in output, and (2) the biggest losers tend to be low-income countries. Bolhuis et al. (2023) also underscore the importance of considering adverse sectoral effects that need to be incorporated in any strategic, political economy calculus. In fact, a first suggestion for the authors would be that, given the political arguments behind geoeconomic fragmentation, both papers might consider more in detail the implications of their respective results for policy. Second, the use of tariffs and iceberg trade costs by Javorcik et al. (2023) to simulate the effects of friend-shoring makes sense; however, subsidies are also being mobilised to reach its strategic goals. It would be interesting to see if the authors can include these in some future scenarios. In addition, the authors assume that there are no costs to remaining outside of friendly blocs; hence, some non-aligned countries actually gain from friend-shoring. While this could be a possibility, it is unlikely that there would be no costs to joining a bloc in the friend-shoring scenarios. This certainly is a major concern of open Asian developing economies.

FRAGMENTATION EFFECTS OF RESHORING, NEARSHORING, AND FRIEND-SHORING

There are many ways that geoeconomic fragmentation can evolve and any attempt to formulate policy changes are naturally highly stylised. The two papers in this session contribute to the literature some interesting possibilities. In Petri and Plummer (2023), we delineate three approaches to geoeconomic fragmentation. In addition to *friend-shoring*, we consider *re-shoring* (an old idea for protecting domestic industry under a new name) and *near-shoring*. The motivation for near-shoring assumes that trade risks rise with distance and incentivises trade within a regional neighbourhood. Near-shoring has gained currency in the wake of the Covid-19 pandemic; proponents believe, for example, that the supply shocks associated with geopolitical friction and the pandemic would have been less severe with shorter supply chains connecting nearby firms. It is difficult to find empirical evidence for this argument, but it has popular appeal and some consumer-oriented companies claim to have benefitted from it (Harr 2021). As articulated in

6   In addition to friend-shoring, the paper undertakes interesting exercises by applying the model to a zero-Covid policy in China and sanctions on Russia due to its aggression in Ukraine.

Javorcik et al. (2023), the friend-shoring approach was proposed by US Treasury Secretary Janet Yellen in 2022 (Yellen 2022) and is the most explicitly geopolitical of the alternatives. The approach intends to restrict trade that might be subject to political manipulation and also to deny economic and potentially strategic benefits to political competitors. Historical examples of 'friend-shoring' are numerous but in the context of economic *cooperation* through regional trading agreements; contrary to the past, current proposals threaten raising barriers against outsiders.

The model we use to simulate the effects of these geoeconomic alternatives is an adaptation of the WTO's Global Trade Model. Details of the model can be found in Petri and Plummer (2023). CGE modelling has a long tradition in the international trade literature; in fact, over the past decade we have used a previous CGE model to assess the economic effects of regional economic integration particularly in the Asia-Pacific context.[7] In our simulations, all three geoeconomic fragmentation scenarios are implemented with barriers (represented by tariffs) that restrict trade in line with scenario objectives. In practice, policymakers often prefer the predictable option of direct regulation of trade to tariffs, so tariffs are understood here to represent various barriers with equivalent protective effects. Our scenarios are defined as follows: (1) *Re-shoring*: barriers against all imports into large economies, applying protection levels of 7.5% to general imports (and 15% to sensitive imports); (2) *Near-shoring*: seven regional blocs apply protection levels of 7.5% to general imports (15% to sensitive imports) on all extra-regional trade; and (3) *Friend-shoring*: the United States and China construct blocks with their close allies, applying a 7.5% penalty on imports (15% on sensitive imports) to trade between blocs. Regions not included in either bloc – neutral economies – face half the tariffs on trade with bloc members under friend-shoring.

The results for selective organisations, including ASEAN (10)[8], CPTPP (11)[9], RCEP (15)[10] and NATO+,[11] are summarised in Figures 1 and 2 for changes in real income and exports, respectively, through 2035 for each geoeconomic intervention.[12] Consistent with the papers presented in this session, the simulations show that the global effects of geoeconomic fragmentation tend to be negative and in some cases significantly so. In particular, open developing economies like those in ASEAN are the most vulnerable to these shocks, especially near-shoring given that their export markets are global rather than just regional; ASEAN real incomes contract by about 5% on a permanent basis. NATO+ economies, which are all OECD members, are far less vulnerable to fragmentation. Still, the United States is the only one that happens to be both sufficiently large and well enough endowed across all economic sectors to achieve slight income

7   Studies we have published using our earlier CGE model can be found at http://asiapacifictrade.org.
8   Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Thailand, Singapore, and Vietnam.
9   Australia, Brunei Darussalam, Canada, Chile, Japan, Mexico, Malaysia, New Zealand, Peru, Singapore, and Vietnam.
10   ASEAN countries plus Australia, China, Japan, New Zealand, and South Korea.
11   Given the geopolitical nature of these simulations, we include a NATO+ group, which includes Australia, Canada, Europe, Japan, New Zealand, South Korea, United Kingdom, and the United States.
12   Detailed estimates at the country level can be found in Petri and Plummer (2023), Tables 6.5 and 6.6 for real incomes and exports, respectively.

gains (two-tenths of 1% of 2035 income), whereas global incomes decline overall by nearly 1%. Trade implodes. Global export declines are much greater overall than income, with contractions of over 12% under re-shoring and near-shoring and about 7% under friend-shoring. Near-shoring is particularly damaging to Asian economies; ASEAN trade contacts by about 18% and RCEP by about 15% on a permanent basis. These are large hits to countries that have led the globalisation process over the past generation and demonstrated how outward-oriented policies could raise significantly standards of living, stimulate growth and productivity, and reduce poverty.

FIGURE 1   GEOECONOMIC FRAGMENTATION EFFECTS: REAL INCOME
(percent change in 2035)
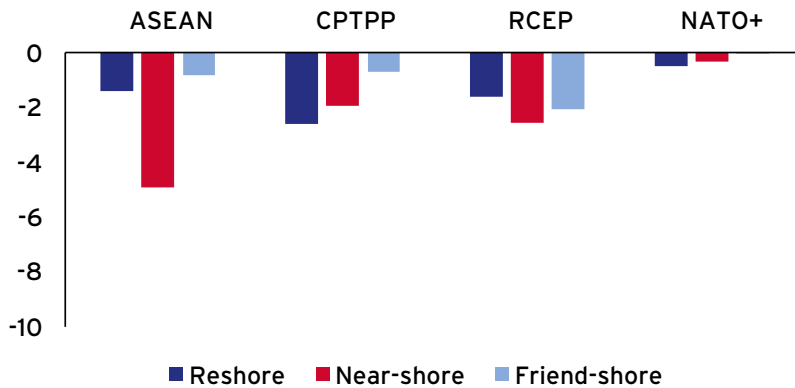
Source: Petri and Plummer (2023).

FIGURE 2   GEOECONOMIC FRAGMENTATION EFFECTS: EXPORTS
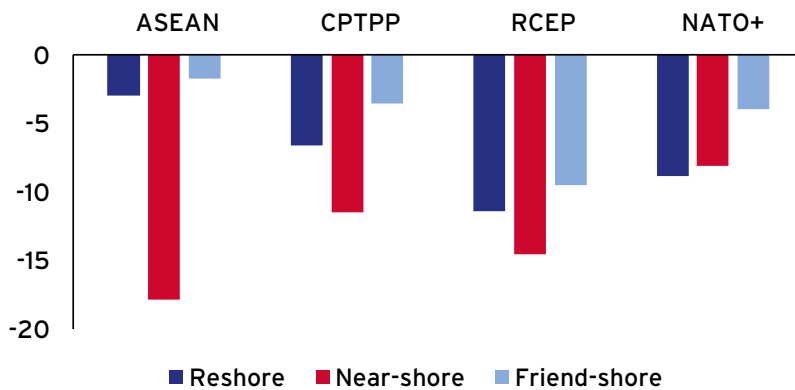
Source: Petri and Plummer (2023).

CONCLUSION

Geoeconomic fragmentation is being advocated in some cases for clearly legitimate reasons, for example to reduce reliance on unpredictable sources in techno-strategic industries. Other arguments are arguably more dubious and reflect political rather than strategic calculations. Empirical studies like the ones presented in this trade session and elsewhere in the literature underscore the costs of inward-looking approaches to managing globalisation, particularly to open developing economies who are using the global marketplace to advance development and prosperity. In this sense, they play an invaluable role in informing policymakers of the costs associated with fragmentation of the global economy.

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SECTION 3
TECHNOLOGY

CHAPTER 6

The potential impact of global decoupling accounting for innovation spillovers from trade

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INTRODUCTION

Since World War II, open markets and free trade have been important principles of the global order. During this time, there has been a strong agreement on the advantages of reducing trade barriers and focusing on the gains derived from trade, resulting in a continuous strengthening of the international trade system. This consensus expanded towards the East after the end of the Cold War, with the European Union expanding its membership and several countries, including Russia and China, joining the WTO.

However, in the past decade, there has been growing opposition against global trade integration. Scholars in political science suggest that the rise of China as a new superpower, challenging the existing dominance of the United States, could lead to strategic competition between these nations. This competition may imply that geopolitical objectives and a desire to limit interdependence will overshadow the cooperative and mutually beneficial aspects of international cooperation.[2]

The Russian invasion in Ukraine led to sanctions imposed by a group of Western economies and has reinforced the debate on decoupling between blocs of regions, which started with the US-China trade tensions in 2018. This raises the question how much real income might be lost if the global economy were to fragment geoeconomically, disintegrating into an Eastern bloc and a Western bloc.

Geoeconomic fragmentation would generate economic costs along various channels (Aiyar et al. 2023): less trade integration, technology diffusion, flows and capital and labour, and heightened uncertainty. Existing trade models only capture static welfare losses of foregoing the classical gains from trade through international labour division, scale effects, and selection effects and do not incorporate the other channels. In Góes and

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Bekkers (2022), we explore the potential impact of increased and persistent large-scale geopolitical conflicts between an Eastern and Western bloc on economic growth and technological innovation, building a multi-sector multi-region general equilibrium model of Bertrand competition with dynamic sector-specific knowledge diffusion. Following Buera and Oberfield (2020), who generalised the approach of Alvarez et al. (2013), the arrival of new ideas is modelled as a learning process from suppliers to a given country-sector. Through engaging in international markets, domestic innovators have access to new sources of ideas, whose quality depends on the productivity of the source country-sector. Idea diffusion is mediated by the input-output structure of production, such that both sectoral intermediate input cost shares and import trade shares characterise the source distribution of ideas.[3]

CALIBRATION

The strength of ideas diffusion in the model is controlled by a parameter which determines the speed of diffusion of ideas.[4] We calibrate this parameter using a simulated method of moments approach, minimising the difference between historical growth rates and simulated growth rates from 2004 to 2019, showing that the model can replicate historical GDP growth rates well (Figure 1).[5]

FIGURE 1   HISTORICAL AND SIMULATED GDP GROWTH RATES, AVERAGE 2004-2019
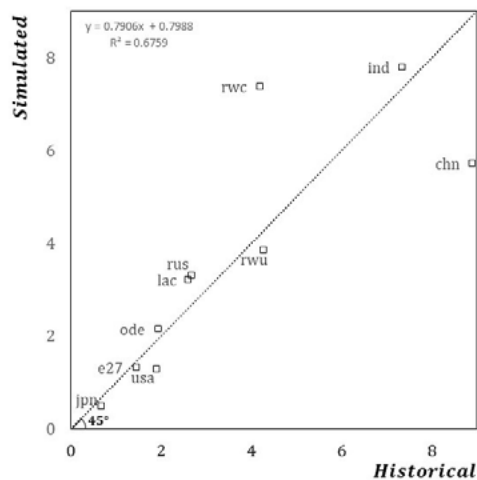
Country codes: chn: China; ind: India; rus: Russia; rwc: Rest of the Eastern bloc; rwu: Rest of the Western bloc; lac: Latin America and Caribbean; e27: European Union; jpn: Japan; ode: Other developed; usa: United States.

3   Productivity in different sectors evolves according to a trade-share weighted-average of trade-partners sectoral productivities. Productivity thus evolves endogenously as a by-product to micro-founded market decisions – i.e. an externality that market agents affect with their behaviour but do not take into account when making decisions.
4   Initial productivity at the sector-country level is proportional to PPP-adjusted sectoral labour productivity combining two sources: the World Input-Output Database and the World Bank's Global Productivity Database.
5   Figure 1 indicates that China has been growing more than the model projects, whereas Rest of world China (rwc) has been growing less, which could be due to additional policies not captured by the model such as industrial policy, the level of education, and quality of institutions.

COUNTERFACTUAL EXPERIMENTS

To explore the potential impact of a decoupling of the global economy, we classify different regions as belonging to either a US- or a Chinese-centric bloc, based on the Foreign Policy Similarity Database, which uses UN General Assembly voting for a large set of countries to calculate foreign policy similarity indices for each country pair (Häge 2011).[6] Intuitively, the index takes countries who vote similarly in the United Nations as being similar in their foreign policy. We ranked country groups in terms of their foreign policy similarity with China and the United States in order to place the ten regions of the model either in a Western or an Eastern bloc.[7] The classifications do not reflect any value judgements by the authors on the various geopolitical views of the groups, but do reflect the FPSD similarities and, of course, the core economic circumstances and relationships found in the model data.

Figure 2 shows that Europe, Canada, Australia, Japan, South Korea would fall in the Western bloc. Latin America and sub-Saharan Africa fall somewhere in between, with the former being closer to the United States than the latter. India, Russia, and most of North Africa and Southeast Asia fall closer to China.[8]

FIGURE 2   DIFFERENTIAL FOREIGN POLICY SIMILARITY INDEX
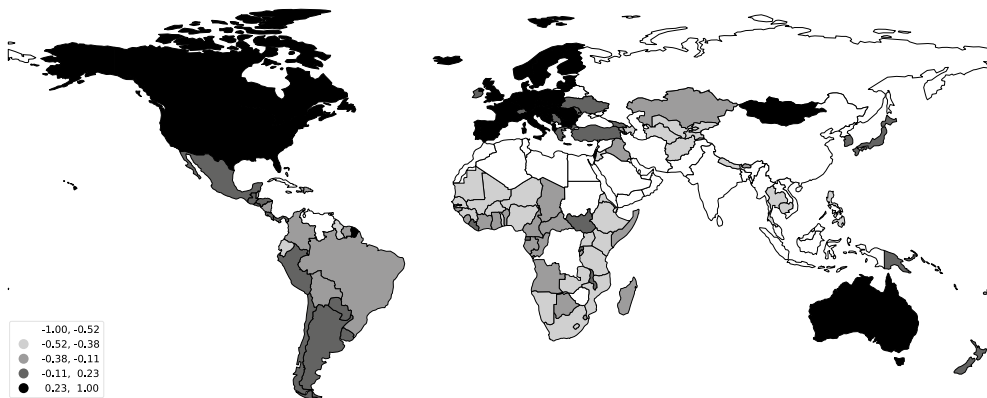
Notes: The map shows the difference between pairwise foreign policy similarity indices of the US and China based on vote similarity in the United Nations General Assembly. More details of foreign policy similarity are in Häge (2011).

6   Initially, our work was inspired by the possible 'technological fragmentation' that could occur due to deep philosophical differences in approaches to cybersecurity and online privacy – particularly security discussions around the technology for 5G.
7   Results are essentially the same if we were to use Russia instead of China as the geopolitical centre of gravity of the Eastern bloc.
8   The similarity index with Russia as the central country of the Eastern bloc is very close to the similarity index with China as the central country of the Eastern bloc.

After classifying the regions into Eastern or Western influence blocs, two different policy experiments are designed: a full decouple scenario in which iceberg trade costs between different blocs rise to prohibitive levels (160%), and a tariff decouple scenario with tariffs increasing on average by 32% from the current cooperative to a non-cooperative level based on the work by Nicita et al. (2018).

THE WELFARE COSTS OF GLOBAL DECOUPLING

As expected, under all scenarios, cross-bloc trade would fall dramatically after the introduction of the policy intervention – in the full decouple scenario by 98%. Figure 3 shows that both the increases in iceberg trade costs (full decouple) and retaliatory tariff hikes (tariff decouple) induce substantial welfare decreases for all countries. The effects, however, are asymmetric. While welfare losses relative to a baseline without decoupling in the Western bloc range between -1% and -8% (median: -4%), in the Eastern bloc they are in the -8% to -11% range (median: -10.5%), with a global projected real income loss of about 5%.

FIGURE 3   CUMULATIVE PERCENTAGE CHANGE IN REAL INCOME AFTER POLICY CHANGE, BY 2040
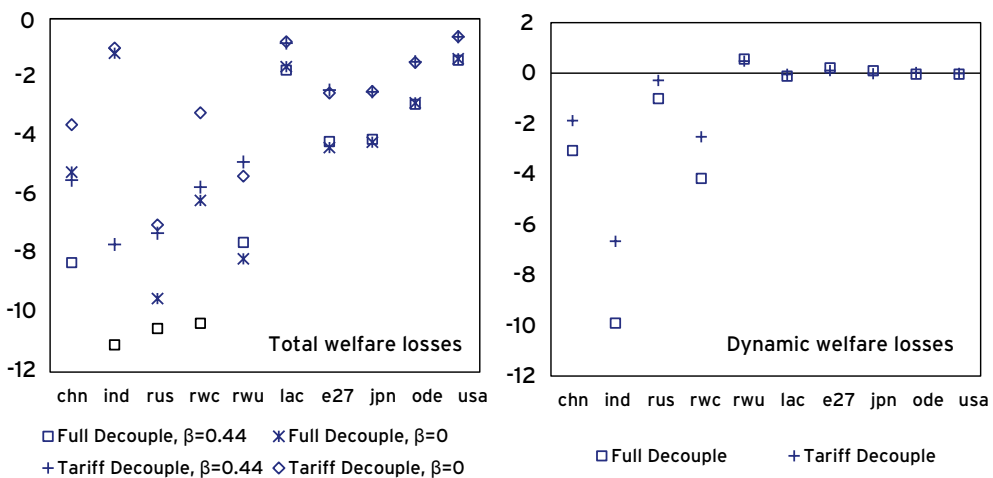
Notes: Full decouple increases iceberg trade costs by 160 percentage points between blocs. Tariff decouple increases bilateral tariffs by 32 percentage points between blocs. β is a parameter controlling the diffusion of ideas.

The underlying factor driving the divergence in results between the two blocs is a difference in the evolution of productivity. Losing access to high-quality designs does not only lead to static losses, but also to a lower level of future innovation, which implies larger dynamic losses. Hence, countries in the Eastern bloc that currently have a lower level of productivity and have larger ties with innovative countries have larger losses. There is a stark contrast between the different evolution of the (Fréchet distribution) location parameter of productivity in the regions in the two blocs (Figure 4). By cutting ties with richer and innovative markets, destination countries in the East shift their

supply chains towards lower-quality inputs, which, in turn, induce less innovation. By contrast, while countries in the Western bloc also suffer welfare losses, their innovation paths appear virtually unchanged after decoupling, suggesting that nearly all of their losses are static, rather than dynamic. In the right panel of Figure 3 this is illustrated for the two poorer regions of the Eastern bloc, with dynamic losses far outsizing static losses.

FIGURE 4   CUMULATIVE PERCENTAGE CHANGE IN THE FRÉCHET DISTRIBUTION LOCATION PARAMETER AFTER POLICY CHANGE, BY 2040
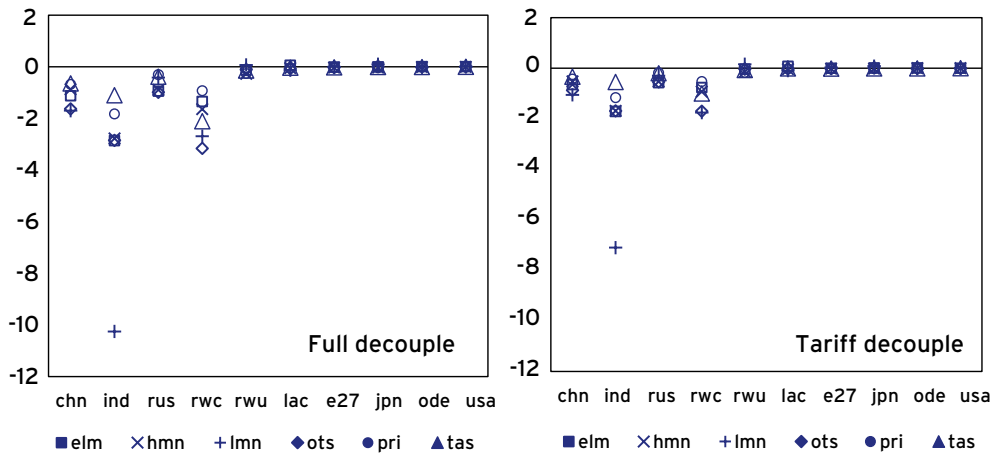
Sector codes: elm: Electronic Equipment; hmn: Heavy manufacturing; lmn: Light manufacturing; ots: Other Services; pri: Primary Sector; tas: Business services.

CONSEQUENCES OF BLOC MEMBERSHIP

An interesting question is what the implications are of bloc membership. We evaluate the implications of bloc membership by comparing the effects of decoupling for one of the regions when switching blocs. We choose, solely to illustrate this point, a hypothetical switch for the LAC region. Figure 5 compares the results of identical decoupling scenarios for LAC, showing that welfare losses of decoupling in LAC are about 100–150% larger when it is included in the Eastern bloc. The domestic trade share in LAC is virtually identical under both settings (with LAC in the Western or in the Eastern bloc), implying similar static welfare losses. This suggests that the increased losses from switching blocs stem almost entirely from dynamic losses.

FIGURE 5   ILLUSTRATIVE IMPACTS ON CUMULATIVE PERCENTAGE CHANGE IN REAL INCOME IN LAC REGION, BY SCENARIO
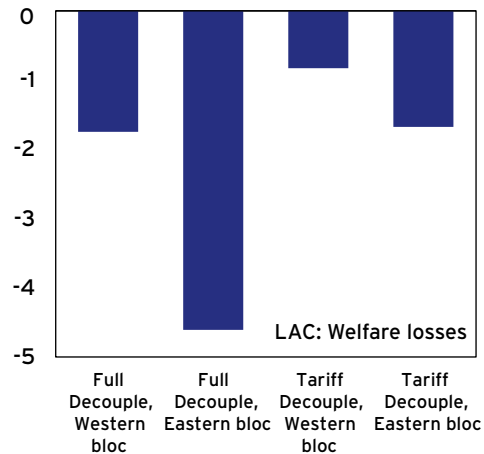
CONCLUDING REMARKS

Our research demonstrates that a disintegration of the global trading system into blocs due to shifts in trade policies driven by geopolitical factors would generate substantial costs. These costs would far exceed the projections of conventional trade models not accounting for the technology spillovers resulting from trade. Moreover, in a scenario where regions are forced to choose between the two blocs presented in our simulations, either due to geopolitical reasons or incompatible technological systems, the consequences would be especially burdensome for the lowest income regions. They would be compelled to forgo the beneficial spillovers from one of the blocs.

These findings have two significant implications for the multilateral trading system. First, the current system, which upholds global trade rules and ensures open and unrestricted trade among major players, is exceptionally critical for the lowest income regions. Second, if geopolitical considerations lead to a division of major players into two blocs, it is crucial to maintain an institutional framework that enables smaller countries to maintain open trade relationships with both blocs, particularly for the lowest income regions.

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CHAPTER 7

Sizing up the effects of technological decoupling[1]

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Recent concerns about intellectual property protection, data privacy, and national security among large economies have led to rising prospects of a 'technological decoupling'. Such a decoupling can be defined as the undoing of cross-border trade and knowledge flows in high-end technologies. How could such a decoupling affect major economies that may drive this fragmentation? And what about third countries – how are they affected?

Barriers to trade in high-tech sectors between major economies could have profound effects on world production and consumption patterns because they affect some of the fastest growing and *most trade-intensive* sectors in most economies. For example, the share of foreign value added in gross exports in the electronics sector is significantly higher than for all other sectors, especially in Asia (Figure 1). Other forms of restrictions, such as those on participation in 5G infrastructure or access to software and patents, can limit technological diffusion and spill over by discouraging associated research and development and foreign direct investment. All this suggests that barriers to trade in high-tech sectors through tariffs or non-tariff measures have the potential to reverberate throughout the global economy.

Despite its growing importance in international policy debates and evident signs that their effects could be of first-order importance,[2] surprisingly little is known about what such strategies might entail for the affected economies. The academic literature initially focused predominantly on theoretical aspects of technological decoupling (Garcia-Macia and Goyal 2020 and references therein) and innovation and research and development (R&D) spillovers (Cai et al. 2019). More recent contributions have looked at the effect of undoing global value chains (Kukharsky et al. 2021) and cutting off technology diffusion (Bekkers and Goes 2022) within sectoral trade models. In contrast, we aim to account, within a single framework, for the combined effects of sectoral misallocation, lower knowledge diffusion, as well as dynamic investment effects generally absent in trade models.

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1   The views expressed here are those of the authors and should not be attributed to the International Monetary Fund, its Executive Board, or its management.
2   See the discussions in a recent IMG blog (Georgieva 2023) and on VoxEU (Evenett and Fritz 2022, Aiyar and Ilyina 2023).

FIGURE 1   INTERDEPENDENT HIGH-TECH

(share of foreign value added in gross exports, 2019, in percent)
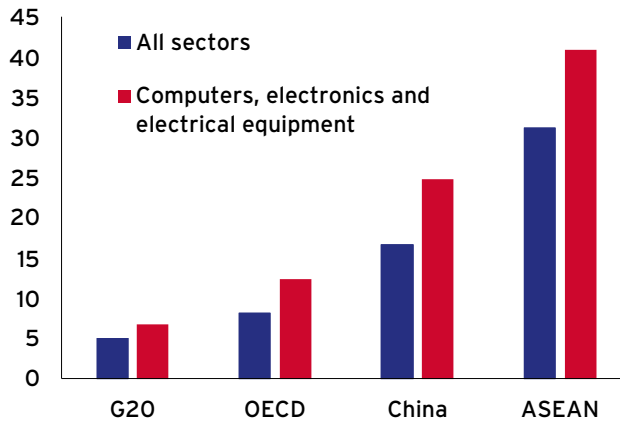
Sources: OECD TiVA and authors' calculations.

A COHERENT LENS TO APPROACH A MULTIDIMENSIONAL PROBLEM

Our working assumption is that technological decoupling consists in eliminating trade in high-tech sectors and cutting off knowledge flows – an extreme situation, but one that can help bound the losses from the pursuit of policies in this direction.[3]

Suppose, then, that trade in these high-tech sectors and knowledge flows are eliminated between countries that decouple from each other. As the restrictions are put in place, relatively more efficient producers that are prevented from selling across the decoupling border would need to be replaced by less efficient producers. This, in turn, will absorb resources from other sectors, thus forcing firms in unrelated sectors to go out of business as well. In short, the restrictions would trigger economy-wide productivity losses due to a *sectoral misallocation* of resources. The negative effects on productivity would not stop there, as countries would also see the productivity benefits from *knowledge flows* curtailed as access to some foreign innovations is interrupted. Last but not least, there is the direct effect from the restricted *trade flows*: as firms in high-tech sectors lose access to markets, they will also scale back their production and any investments needed to maintain their productive capacity.

Technological decoupling can end up affecting living standards through various channels. No single modelling approach can simultaneously handle all these dimensions, but at the same time an informed debate can greatly benefit from attempts to estimate their combined effect. We approach the problem by carefully combining estimates from different methodologies, each of which we deem best suited to quantify the channel at

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3   The definition of high-tech sectors we use is based on earlier OECD work (OECD 2011), which is in turn based on sectors' R&D intensity, while knowledge flows are measured through data on patents.

hand. Productivity losses from *sectoral misallocation* are estimated based on a sectoral general equilibrium trade model (Caliendo et al. 2023). The effects from the shutting down of *knowledge diffusion* are derived using panel data estimation techniques from data on patents, R&D spillovers, and their productivity effects among technological leaders. Estimates, originally produced for IMF (2018), are extended to include China and Korea. Both these channels are then fed into the IMF's workhorse macroeconomic model – the Global Integrated Monetary and Fiscal model (GIMF), as Anderson et al. (2013) and Kumhof et al. (2010) – which can not only incorporate these productivity estimates but also directly handle the effect from restricted *trade flows*.

Specifically, in GIMF, firms scale back investment not only as they lose market access, but as incentives to invest also suffer as economies' overall productivity declines, as provided by the two other models. Output then falls both because of lower productivity and smaller capital stocks. This ultimately affects consumption as countries face permanent income losses. In short, all three channels considered are combined into one coherent presentation.

Our work does not capture all possible mechanisms through which policies aimed at technological decoupling may affect economic activity, many of which are summarised in Aiyar et al. (2023). The effects of decoupling through lower FDI flows are not explicitly modelled, nor are those from the provision of foreign services through commercial presence.[4,5] Also not modelled is the potential endogenous non-macroeconomic policy response to decoupling, such as industrial policies that aim to make up for the loss of access to foreign technology. Lastly, technological decoupling can over time give rise to diverse, incompatible standards. Diverging standards could effectively lock in the losses uncovered in this paper, as reversing the decoupling (or 're-coupling') would become increasingly difficult (see the pioneering discussion by David 1985).

DECOUPLING SCENARIOS

In addition to the specific channels through which technological decoupling operates, there is the question of which countries it affects. We consider three very stylised and hypothetical alternatives (Table 1). The first, and most prominent in recent discussions, is the possibility of China–US decoupling. The second is one where OECD economies as a bloc decouple from China. The third is a tripolar world, for illustration only, comprising three technology hubs that decouple from one another formed around the United States, China, and Germany.

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4 Effects of decoupling through FDI flows are considered in Ahn et al. (2023). There, FDI is proxied through flows of imported investment goods using another version of GIMF.
5 Other than finance, tourism and transportation, services as recorded in input-output matrices are largely non-tradable. Services provided under mode 3 (commercial presence; e.g. telecoms) belong to domestic production, in line with national accounting practices. Some services related to certain technology gains are partly and indirectly modeled through the knowledge-diffusion channel, to the extent that they are reflected in patent and R&D data.

TABLE 1   HYPOTHETICAL TECHNOLOGICAL DECOUPLING SCENARIOS

Scenario #	Global hubs	Preferential attachment by non-hub countries?
1	China | United States	No
2		Yes
3	China | OECD	No
4		Yes
5	China | United States | Germany	No
6		Yes

Notes: In all scenarios, non-tariff barriers are raised so asto nearly eliminate trade in high-tech sectors.

This still leaves open the question of how the other non-hub countries would interact with each of the hubs. Two possibilities are considered: non-hub countries trade with each hub freely, or they align themselves with the hub for which their total trade is highest and only trade with other countries in that bloc. The latter possibility is labelled 'preferential attachment'.

HIGH-LEVEL RESULTS

Figure 2 presents results for the six technological decoupling scenarios outlined in Table 1. All results are measured in percent of GDP deviations from a situation where no decoupling takes place, with the baseline projections being those in the IMF's October 2020 *World Economic Outlook* (WEO). China usually loses the most in each scenario, reflecting very large effects through the trade and sectoral misallocation channels, although all major global production hubs tend to face nontrivial losses. Generally, some countries (India, Japan, Korea) can marginally gain in the scenarios without preferential attachment, as those countries act as partial substitutes for a hub. Scenarios 3 and 4 lead to the largest losses for China, as it breaks up two pairs (China and Japan; China and Korea) that are present in the other four scenarios, and are highly beneficial to China, Japan and Korea. Other regions outside of Asia lose the most under Scenario 6, as regions would no longer trade with two major hubs instead of just one.

FIGURE 2 TECHNOLOGICAL DECOUPLING SCENARIOS: REAL GDP FOR SELECTED REGIONS

(percent deviation from the IMF's October 2020 WEO)

Scenario 1: China-US w/o preferential attachment
Scenario 2: China-US with preferential attachment
Scenario 3: China-OECD w/o preferential attachment
Scenario 4: China-OECD with preferential attachment
Scenario 5: China-US-Germany w/o preferential attachment
Scenario 6: China-US-Germany with preferential attachment
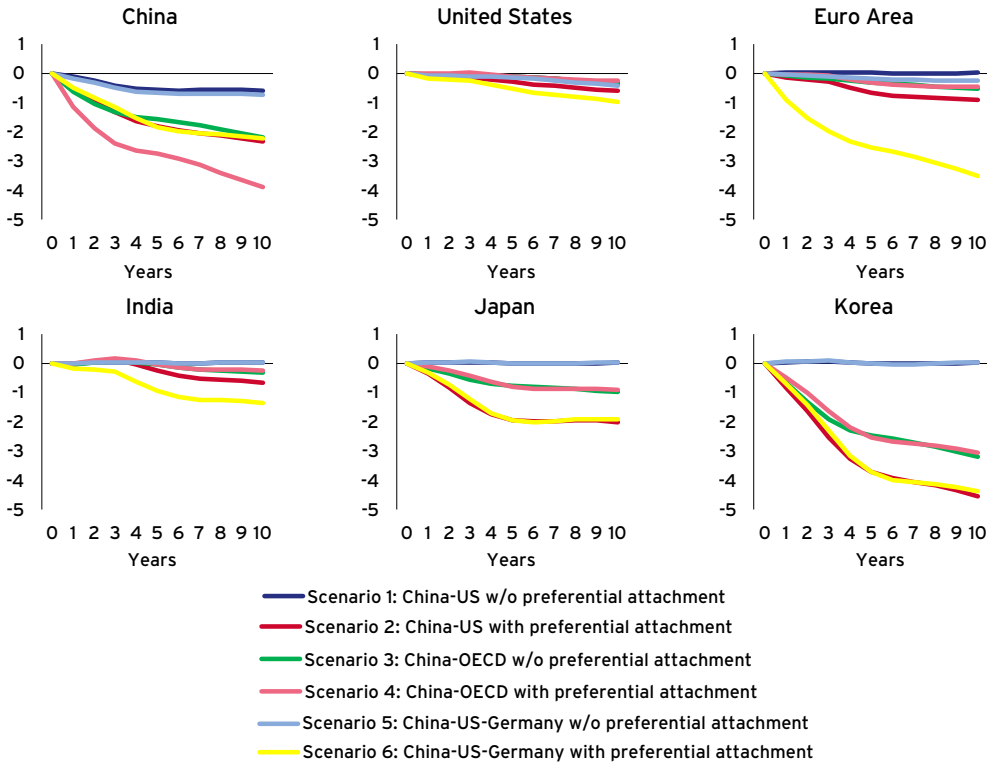
Sources: Authors' calculations.

CONTRIBUTIONS OF THE THREE CHANNELS AND THEIR REGIONAL IMPACTS

To understand how the three channels of decoupling affect the aggregate results, it is useful to drill down for some of the regions using the example of the China–US decoupling scenario, without and with preferential attachment (Figure 3). The first layer (the dotted lines) shows the impact of the collapse in high-tech goods trade. The second layer (the dashed lines) adds the costs due to sectoral misallocation, which significantly amplifies the effects on GDP. The third layer (the solid lines) further assumes temporary reductions in labour productivity growth in tradable goods sectors, arisingdue to lower knowledge diffusion. This last layer significantly impacts the United States, but also has a notable impact elsewhere.

Considering all three layers, China and the United States experience significant losses to GDP, though the impact is relatively larger on China, given its strong connections with the United States through all three channels (trade, sectoral misallocation and knowledge

diffusion). The United States loses almost as much as China through knowledge diffusion when only China and the United States decouple, but (notably) more than China under preferential attachment as it benefits significantly from other foreign knowledge flows.

FIGURE 3   CHINA-US TECHNOLOGICAL DECOUPLING SCENARIOS: REAL GDP FOR SELECTED COUNTRIES

(Percent deviation from the IMF's October 2020 WEO)

.... No Preferential Attachment - Reduced High-Tech Trade Shock

– – – No Preferential Attachment - Add Sectoral Misallocation Shock

——— No Preferential Attachment - Add Lower Knowledge Diffusion Shock

.... Preferential Attachment - Reduced High-Tech Trade Shock

– – – Preferential Attachment - Add Sectoral Misallocation Shock

——— Preferential Attachment - Add Lower Knowledge Diffusion Shock
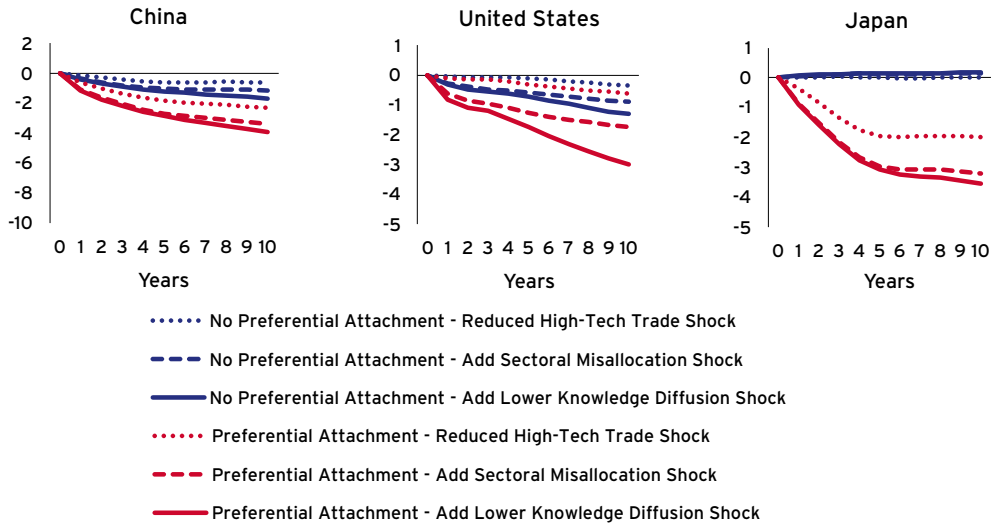
Sources: Authors' calculations.

The effects on non-hub countries, such as Japan (Figure 3, right-hand panel), crucially depend on whether there is preferential attachment. If only China and the United States stop trading, Japan marginally gains from trade diversion, taking advantage from trading with both. However, Japan will lose with preferential attachment to China[6] because it breaks its strong links to the United States, especially through the trade and sectoral misallocation channels.

THE ECONOMIC MECHANISMS IN DETAIL

What are the underlying economic mechanisms driving the aggregate real GDP effects discussed so far? Consider the case of the United States under Scenario 2, where China and the United States decouple with preferential attachment (Figure 4).

The layer related to reduced global trade flows (dotted lines) has its strongest impacts on export and import volumes and leads to an appreciation of the real effective exchange rate (REER), meaning there is only a slight adjustment in the current account position.

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6   This is assumed in this scenario due to Japan's closer trade ties with China. The OECD scenario assumes Japan sides with the United States.

The fall in imports sees a substitution to domestic production, which helps also minimise the impact from lower exports. Therefore, real GDP falls by a limited amount, also reflected in consumption. Because the United States curtails its imports of high-tech goods, the price of investment increases, even with substitution towards US high-tech goods.

FIGURE 4   THE IMPACT ON THE UNITED STATES OF CHINA-US TECHNOLOGICAL DECOUPLING WITH PREFERENTIAL ATTACHMENT

(percent deviation from the IMF's October 2020 WEO)
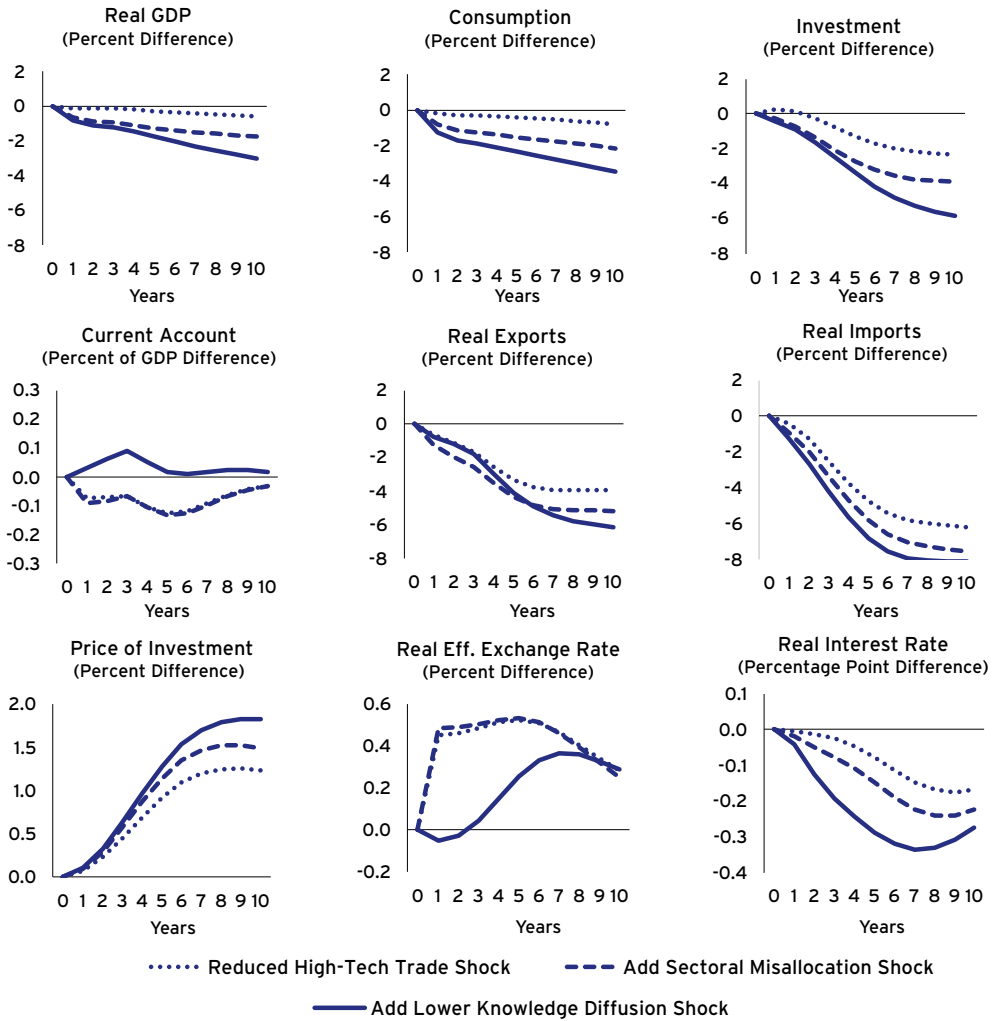
Sources: Authors' calculations.

The layer illustrating the decline in productivity because of sectoral misallocation (the gap between the dotted and dashed lines) reduces US productive capacity, increasing the relative price of investment further, discouraging investment and causing a fall in wealth and therefore consumption. Export demand falls since US goods are more expensive abroad, while import demand falls in line with consumption and investment. The impact is about as large on real GDP as the trade layer.

Finally, the layer illustrating lower knowledge diffusion (the gap between the dashed and solid lines) behaves much like that of sectoral misallocation, but is of a greater magnitude. The one key difference is the behavior of the REER, where the decrease in tradables relative to non-tradables productivity leads to a Balassa-Samuelson effect, depreciating the REER.

While the scenarios abstract from structural or industrial policies, they account for the (endogenous) reaction of macroeconomic policies. Monetary policy – where low (high) inflation is returned to its target level by cutting (raising) interest rates – is offsetting some of the short-term effects of the shocks affecting the economies involved, as inflation declines in line with economic activity and due to the appreciation of the REER. These impacts outweigh the inflationary pressures associated with the declines in labour productivity in two of the layers. Fiscal policy – an automatic stabiliser where transfers to households increase (decrease) as output decreases below (increases above) its potential path – plays only a small role in mitigating the short-term negative impacts. This is because the underlying shocks affect the supply-side of the economy, which means that potential output falls almost as fast as output.

Each region experiences similar impacts qualitatively to the United States across the three layers, but the magnitudes differ. Magnitudes are smaller for non-hub countries in the scenarios without preferential attachment. In all scenarios, more open economies (especially those with smaller shares in the global economy) experience larger negative impacts, especially since monetary policy cannot be as effective because of leakages through trade flows.

CONCLUDING REMARKS

When it comes to high-tech trade, policymakers around the world may have no shortage of legitimate concerns. These go beyond the more traditional concerns such as the labour market dislocations caused by greater trade integration, and include the use of trade-distorting practices that create unfair advantages to foreign producers, national security concerns, and the possibility that trading partners may weaponise trade. However, addressing these concerns bluntly and without institutional guardrails (such as those afforded by the WTO) may ultimately lead to sharp fragmentation scenarios. In particular, our results show that sharp technological decoupling scenarios can be very costly – not just for bystanders but also for the main global technology hubs. These

results underscore the need to find, instead, 'surgical' solutions that address underlying concerns without creating a policy vortex with ever-increasing rounds of restrictions that would leave everyone worse off.

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CHAPTER 8

The impacts of technological geoeconomic fragmentation: Comments and observations[1]

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INTRODUCTION

National policies that raise barriers to access to advanced technologies are significant and expanding. Just in the United States we have seen encouragements for 'friend-shoring', industrial policy favouring domestic production of semiconductors and electrical vehicles and batteries, proliferating export barriers in key technologies, and greater government screening of potential inward foreign investments. These policies are discriminatory across countries and sometimes extraterritorial in application. High-tech industrial policies, subsidies, and trade protection are growing in other major economies as well, perhaps best exemplified by China's "Made in 2025" initiative. Further, government regulations of data flows and digital trade continue to diverge among key economies.

This environment portends a deep shift toward global geoeconomic divisions based on technological protectionism, a first-order issue for analysis. The roots of this trend are familiar: concerns over cyber risks and national security more broadly, the backlash against hyper-globalisation, and a preference for 'resilience' to guard against foreign protectionism and sanctions. Technology-based fragmentation raises deep questions at the heart of this conference. How might it interfere with the considerable dynamic gains from trade, foreign direct investment, and production networks that have been identified in the literature? Is there a risk that it will extend to other key channels of information diffusion, including skilled labour migration, R&D networks, international technology sharing, and data flows?

It is essential to understand these potential effects and I applaud the IMF for taking the lead through their research program on geoeconomic fragmentation. In this note I comment on two excellent papers focused on the costs of limiting technology diffusion through the emergence of trade blocs, a reasonable depiction of emerging trends. These comments are followed by thoughts on the importance of additional channels that may be similarly limited by policy restrictions.

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1   This discussion relates to the papers as presented at the IMF conference rather than the respective chapters in this eBook.

PAPER 1: "THE IMPACT OF GEOPOLITICAL CONFLICTS ON TRADE, GROWTH, AND INNOVATION" BY CARLOS GOES AND EDDY BEKKERS

This paper builds from the important observation that trade in high-technology intermediates is perhaps the primary channel of international technology diffusion, implying that blocking such trade will generate significant dynamic losses. Further, the extent of such information to which any importing country has access depends closely on the productivity of its exporting partners in producing new ideas and embodying them in traded intermediates. In brief, the key insight is that if a country wishes to benefit from technological learning and spillovers, the factors that really matter are which countries it imports from and in which sectors.

The authors incorporate this insight into a multi-sector, dynamic general equilibrium (GE) model of the world economy in which labour productivities evolve according to the amounts of new ideas imported and domestically innovated. Geoeconomic fragmentation is represented starkly: the world is split into two blocs (lower-productivity East and higher-productivity West), essentially centred on China and the US-EU. All other countries (arranged in seven regions according to the GTAP database) are assigned to either East or West, depending on the affinity of their votes with China and the US at the United Nations. There are two policy experiments: a maximalist fragmentation, in which all trade is eliminated between the blocs; and a minimalist one, in which just trade in electronic equipment is banned. The former should capture a complete geopolitical rupture between East and West, while the latter reflects the strategic emphasis on semiconductors and digital equipment. Presumably, these experiments should reflect the possible extreme outcomes of trade bans on diffusion and growth.

In the model, countries import goods from the cheapest source, which favours the most productive and innovative sources in Bertrand competition. Being forced into one bloc immediately removes the possibility of importing from the lowest-cost regions in the other bloc. As a result, all regions lose access to a range of efficient intermediates but the loss is substantially greater in the East bloc, where ideas arrive more slowly. This problem generates both static allocative losses and dynamic innovation losses and slower productivity growth everywhere, with larger impacts on members of the East group. The calibrated model and simulations find that the cumulative welfare losses of a full trade ban can be substantial, reducing future real national incomes by up to 12% in lower-income regions in the East bloc, with lower but still notable losses in the West bloc.

I find this analysis to be insightful and convincing, in part because of the discipline asserted on the results from a dynamic GE model. A less rigorous approach could readily result in substantially greater, and less realistic, welfare impacts by precluding various substitution channels that offset what is, after all, a massive trade shock. For example, the balanced-trade requirement results in reorientation of trade sources for West bloc countries toward the US and EU, diminishing the welfare losses. Such adjustments are critical for assessing the potential scope of dynamic impacts.

Nevertheless, I have some comments and questions aimed at unpacking some of the more technical aspects of the model. First, the authors could be clearer on the relative contributions of different mechanisms to the overall costs. In essence, though this is a simplification, there are static losses from countries being forced by the bloc segmentation to allocate imports away from the efficient sources in the Eaton-Kortum setup and there are dynamic losses from lower spillovers and imitation and innovation by domestic firms. A clearer representation of how these effects operate and interact would be helpful for readers not seeking to work through the mechanics. Second, in the model countries and regions have exogenously growing endowments of a single type of labour, which may be necessary for tractability. But countries differ in their endowments of higher-skilled versus lower-skilled workers, which would affect their abilities to adapt and innovate from new imported ideas.

Third, in the theory new ideas come from random processes combined with idea-productivity parameters. Innovation is then effectively the outcome of exogenous processes, rather than purposeful R&D investments, the incentives for which would be altered by trade fragmentation. How do the model results capture this essential component of innovation? Fourth, for tractability the model incorporates just six sectors, one of which is business services. This is the only sector that would seem to cover certain essential technical inputs, such as platform software, social media, data, and other processes that network across regions and would be severely disrupted by trade blocs. It may be of interest to consider a scenario in which both electric equipment and this sector are subject to trade bans, to see what the additional contribution of an 'information technology' ban, writ large, could be.

Fifth, the assignment of countries to blocs based on (weighted) UN voting similarity to China and the US is understandable but it rests on the assumption that prior foreign policy interests would drive bloc selection. However, rational countries would recognise that assignment to the East bloc would relegate them to lower long-run growth and reduced incomes, making it less likely that they would agree to such an allocation, whatever their voting patterns were. An alternative assignment mechanism might be devised, based on factors such as investment dependency on China versus the US/EU or similar measures that offer the central countries in each bloc more persuasion power to get others to join. I do not imagine this would change the basic message of the analysis, however.

PAPER 2: "SIZING UP THE EFFECTS OF TECHNOLOGICAL DECOUPLING" BY DIEGO CERDEIRO, JOHANNES EUGSTER, RUI MANO, DIRK MUIR, AND SHANAKA PERIS

The fundamental idea in this paper is similar to that in the first: restrict high-technology trade between various definitions of post-fragmentation blocs and simulate the impacts on technology diffusion, creation and welfare through a dynamic macro-GE model, which permits long-run adjustments in macroeconomic balances. Other countries and

regions are assigned to blocs based on their trade shares. An important difference is that access to foreign technical information is more purposeful here, in that domestic spillovers depend on both foreign and domestic knowledge, which result from past R&D investments. Diffusion weights depend on predicted bilateral patent citations, a direct if limited measure of learning. Another is the richer set of scenarios, with up to three blocs and either trade only within blocs ('preferential attachment') or trade across blocs in nonrestricted sectors.

The simulations again find significant cuts in output and exports, even within hubs and partners. In the worst case (a China bloc versus an OECD bloc, with no inter-bloc trade), China suffers a loss in GDP of around 8% in the long run, simply from decoupling its high-tech sectoral trade. South Korea sees a loss of more than 7%, arising from its exclusion from the higher-productivity OECD bloc. The US and EU experience much smaller losses because they sustain within-OECD access to advanced technologies. Interestingly, some smaller economies may gain output if their trade is concentrated on a hub within the bloc, such as Mexico vis-à-vis the US, because trade diversion expands their exports overall. This result points out the potential for complex trade responses to bloc formation. Finally, output losses are notably smaller if intra-bloc trade is permitted.

Following are some comments and questions on this approach. First, is it sensible to assign countries to blocs based solely on their bilateral trade shares? These shares depend heavily on market size and proximity, rather than international relations. For example, in a primary scenario Japan and South Korea are place in the China bloc, even though they surely would recognize their dynamic preference for aligning with the more productive US bloc. Second, bilateral patent citations are an imperfect indicator of learning opportunities. Firms in all countries can read patent applications, while effective spillovers are more likely to result from trade and investment relations. Moreover, it seems unlikely that countries in geo-fragmented blocs would enforce patents filed from other blocs, opening another channel for diffusion. Third, while losses are limited by permitting non-restricted trade across blocs, such trade potentially embodies indirect access to technological advances through intermediate inputs in production, which would contradict the policy objectives. It may be interesting to experiment in further work with measures to restrict such indirect trade.

A BROADER PERSPECTIVE: SKILLED MIGRATION

The excellent papers in this session study how significant trade disruptions may reduce innovation and diffusion, with dynamic costs spread around the globe. This is important because trade barriers are the first-order policies undergirding fragmentation. However, there are other be policy levers, such as FDI limits, subsidies to reshoring and friend-shoring, geographical restraints on R&D networks and knowledge sharing, data localisation and other regulations that could bottle data flows into information blocs. The IMF research programme addresses some of these.

I wish to conclude with some thoughts about a final important information channel, skilled labour migration, which also could become increasingly restricted in a fragmented world. Empirical evidence from both developed and emerging economies suggests the criticality of this channel. For example, foreign graduate students, scientists, and entrepreneurs contribute disproportionately to knowledge creation and growth in the US and EU. 'Brain circulation', or the temporary movements abroad and home of skilled workers, is a significant means of two-way technological diffusion and learning, resulting in large positive technology spillovers. Migration abroad builds trade and information networks with global productivity gains. Skilled immigrants arriving in developed and emerging countries send home substantial remittances, which may be used for additional educational and productivity investments by households in recipient nations. And migration of younger skilled workers in medicine, STEM fields, and management help fill growing demographic shortages in developed nations, while establishing incentives at home for further education. These technology-based impacts add to the substantial net income gains available to skilled migrants.

These gains to higher migration are large. Recently I produced a study of how a modest increase in global bilateral skilled migration would generate welfare costs and benefits across the world (Maskus 2023). While these estimates are rough approximations, they establish the importance of skilled labour flows, with welfare impacts disaggregated into 25 regions. In the central case, a ten percent rise in bilateral migration of physicians and STEM workers, relative to an estimate of initial migrant stocks, would generate discounted global benefits of around $384 billion, compared to costs of just $19 billion. A notable share of the gains would be associated with technology spillovers. For example, in destination countries (both developed and developing) over $56 billion in benefits would arise from productivity spillovers and gains from relaxing demographic shortages. In source countries the gains from foreign information networks and greater investments would be significant, though somewhat less than the demographic losses from losing younger skilled workers. In the maximal case of a similar rise in migration of all workers with advanced educations, the net dynamic gains across the globe would come to $191 billion.

Thus, even modest policy restrictions to cut skilled migration would impose substantive costs through diminished technology information, induced productivity spillovers, and diminished investments in human capital. These impacts may seem small in relation to the trade-induced costs in the two papers reviewed above, but those studies imposed massive cuts via fragmentation into blocs. This rough comparison suggests that similarly draconian limits on migration could impose substantial welfare costs as well, an important subject for further study.

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SECTION 4
FINANCIAL FLOWS

CHAPTER 9

What is the evidence that trade uncertainty affects US bank lending?[1]

Ricardo Correa,[a] **Julian di Giovanni,**[bd] **Linda S. Goldberg**[bd] **and Camelia Minoiu**[c]
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[c]Federal Reserve Bank of Atlanta; [d]CEPR

After decades of international trade expansion and production integration, the period following the Global Financial Crisis was marked by a dramatic increase in international trade uncertainty. Events such as Brexit and the abrupt changes in trade tariffs in the late 2010s brought into question the future of international trade. Ahir, Bloom and Furceri (2022) show that trade uncertainty — represented by the red bars in Figure 1 — was a key contributor to the significant increase in overall uncertainty before the COVID-19 pandemic. Given that financial intermediaries play a critical role in supplying credit to facilitate trade transactions globally (Amiti and Weinstein 2011), an important question is whether and how trade uncertainty affects their lending activities and the real economy.

In recent work, we study how trade uncertainty affects banks' supply of credit and their US borrowers (Correa, di Giovanni, Goldberg and Minoiu 2023). We focus on the increase in uncertainty in 2018 and 2019, colloquially referred to as the 'trade war', which was marked by the renegotiation of trade agreements between the United States and other countries, as well as changes in tariffs, especially for products traded between the United States and China. Based on evidence for this period compared with prior years, our research shows that trade uncertainty leads to a significant contraction in bank credit supply and real economic activity. We also examine potential mechanisms through which the rise in trade uncertainty affected banks' lending activities.

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1   The views expressed in this chapter are those of the authors and do not necessarily represent those of the Federal Reserve Bank of New York, Federal Reserve Bank of Atlanta, the Board of Governors of the Federal Reserve, or the Federal Reserve System.

FIGURE 1   CONTRIBUTIONS TO GLOBAL UNCERTAINTY
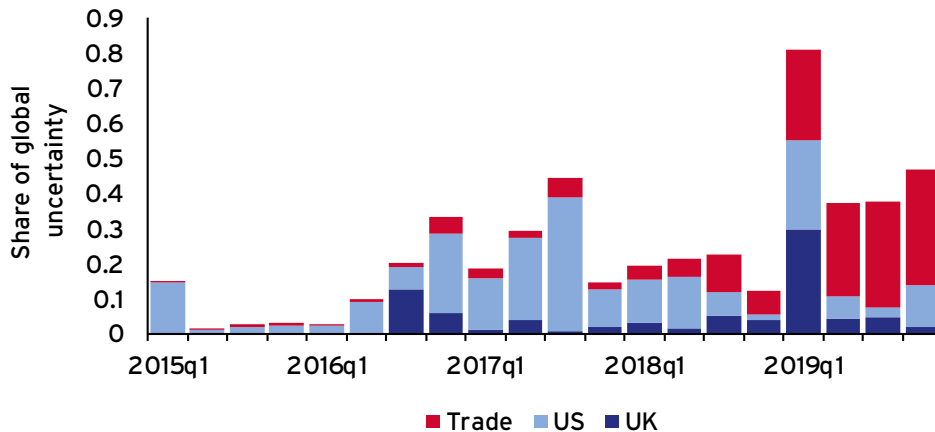
Note: The figure depicts the contributions to world (overall) uncertainty of trade, and of US- and UK-spillover uncertainty during 2015-2019. Uncertainty measures are based on textual analysis of Economist Intelligence Unit (EIU) country reports. The world and trade uncertainty indexes are defined as GDP-weighted averages of the frequency (number) of occurrences of the word "uncertainty" (or related terms) and, for trade uncertainty, those occurrences in conjunction with words related to trade, as a share of the total number of words in EIU country reports. Uncertainty spillover indexes represent the frequency (number) of the word "uncertainty" (or related terms) in proximity of words associated with a country (i.e. US and UK) in EIU reports, as a share of the total number of words in these reports. Counts of the word "uncertainty" across indexes may overlap, therefore their individual contributions need not add up to overall uncertainty.

Sources: Authors' calculations using data from https://worlduncertaintyindex.com/ and Ahir, Bloom and Furceri (2022).

WHY WOULD BANKS CUT CREDIT AS TRADE UNCERTAINTY RISES?

Uncertainty raises the prospect of future loan losses, which may affect banks' ability to intermediate credit. How do banks react to a rise in uncertainty? When adverse shocks hit bank borrowers in a given sector, banks need to decide between scaling back exposures and providing additional lending to help affected borrowers weather the shock. Banks that specialise in lending to certain sectors have been shown to lend more to those sectors to limit potential balance sheet losses (Favara and Gianetti 2017, Giannetti and Saidi 2019). But uncertainty can also make banks more cautious overall. Banks may behave similarly to non-financial firms, which tend to postpone investing in new projects when uncertainty increases (Bernanke 1983, Pindyck 1991, Dixit and Pindyck 1994). A rise in uncertainty may push banks to reduce their exposures to risky sectors, and more generally to pull back from risk taking until the uncertainty resolves. In particular, banks may postpone new lending or tighten their terms – for instance, they may reduce approval rates on new loans, increase loan spreads, shorten loan maturities, or require more collateral on existing loans.

In the case of the United States, we can take cues about credit supply dynamics during the trade war from bank surveys. In April 2019, the Senior Loan Officer Opinion Survey of the Federal Reserve asked banks to report how developments in Asia and Europe over the previous year affected commercial lending conditions to firms with operations in the United States and with significant exposure to these regions. Nearly 70 large US banks

(with at least $2 billion in total assets) responded to this question and highlighted the mitigating actions they were adopting to manage risks in light of international trade developments. More than 40% of survey respondents indicated they were tightening credit standards to exposed firms. In addition, about 20% of banks were buying derivatives to hedge credit risks, increasing collateral requirements, restructuring loans, and invoking covenants to limit credit line drawdowns. Close to 15% of banks were anticipating a deterioration in loan quality and thus increasing their loan loss provisions.

HOW DO US BANKS RESPOND TO TRADE UNCERTAINTY?

To examine banks' response to an increase in trade uncertainty, we use a comprehensive data set collected through the Federal Reserve (FR) Y-14Q form. The data set reports individual loans from 30 large bank holding companies to tens of thousands of public and private firms. We also construct a measure of bank exposure to trade uncertainty by proceeding in two steps. First, we obtain trade uncertainty measures at the sector level by taking averages of firm-level trade risk and uncertainty indicators for US firms from Hassan, Hollander, van Lent and Tahoun (2019). These indicators are based on textual analysis of transcripts from quarterly earnings calls of US listed firms and measure the frequency of mentions of synonyms for risk or uncertainty in conjunction with trade-related words.

FIGURE 2   AVERAGE CHANGE IN TRADE UNCERTAINTY BY 3-DIGIT NAICS SECTOR
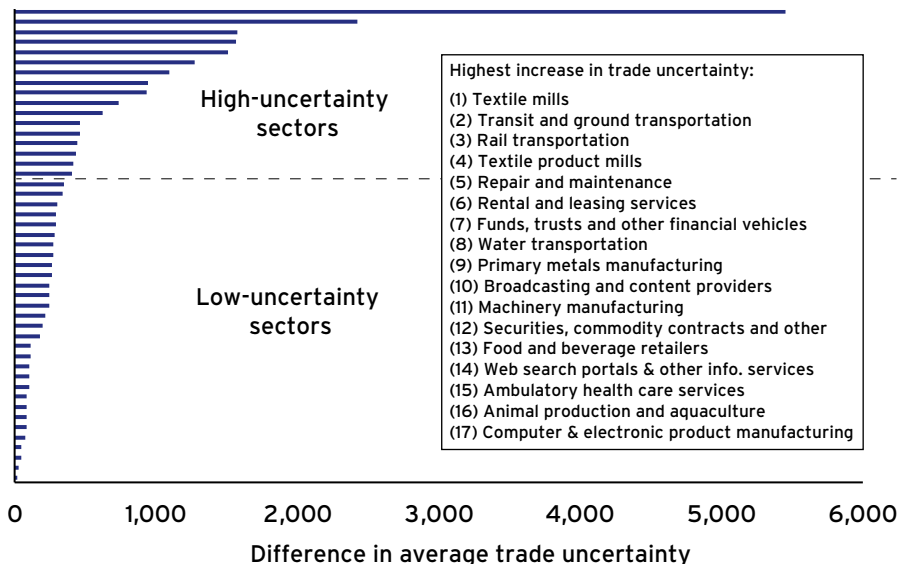
Note: The figure depicts the average change in trade uncertainty between 2016-2017 and 2018-2019 by 3-digit NAICS sector for sectors that experienced an increase in trade uncertainty. The text box lists high-uncertainty sectors (above the 75th percentile of the distribution, shown as horizontal dash line). The units of measurement for "Difference in average trade uncertainty" is the frequency (number) of mentions of synonyms for risk or uncertainty, divided by the length of the transcript, and multiplied by 1,000.

Sources: FR Y-14Q, Hassan, Hollander, van Lent and Tahoun (2019, 2020a); Hassan, Hollander, van Lent, Schwedeler and Tahoun (2020b).

Figure 2 shows the ranking of sectors with an increase in average uncertainty between 2016–2017 and 2018–2019. We define high-uncertainty sectors as those sectors above the 75th percentile of this measure's distribution. These sectors include several manufacturing and transportation industries, consistent with some of these sectors being targeted for trade tariffs during the trade war, actually receiving tariffs, or being closely integrated with tariffs-hit sectors in the production network. All other sectors are defined as low-uncertainty sectors.

In the second step, we aggregate this information at the bank level using information on banks' loan shares to firms across sectors, measured before the trade war.

We develop a statistical model to tests the relation between banks' exposure to uncertainty and a wide range of lending outcomes. Specifically, we compare the lending decisions of banks with different degrees of exposure to trade uncertainty between the period before the trade war (2016–2017) and during the trade war (2018–2019). This comparison is conducted for each firm that borrows from at least two banks so as to control for changes in lending outcomes potentially driven by adjustments in firms' demand for credit (Khwaja and Mian 2008). We examine both the full sample of bank borrowers as well as the sub-sample of firms in low-uncertainty sectors to look for potential spillover effects. The model accounts for numerous factors that may have affected banks' lending decisions during the sample period, such as bank and firm characteristics or changes in the macroeconomic environment affecting all firms at once.

We obtain three sets of results. First, we show that banks with higher exposure to trade uncertainty tend to contract lending relative to other banks. Importantly, exposed banks curtail credit not only to borrowers in high-uncertainty sectors, but also to those borrowers that are not directly exposed to an increase in trade uncertainty (that is, they are in low-uncertainty sectors). Thus, a rise in uncertainty has spillover effects on borrowers that are not the source of the uncertainty shock—a form of amplification. Banks' reaction to uncertainty manifests in ways that describe both the external and internal margins of lending. We show that exposed banks are less likely to grant new loans and, for approved loans, they reduce loan volumes, charge higher spreads and require more collateral.

Second, we find that banks react to an increase in uncertainty by adopting lending practices that suggest a 'wait-and-see' attitude. Specifically, exposed banks reduce the maturities of loans they originate, which increases the frequency with which they assess the creditworthiness of borrowers, and are more likely to originate loans that can be called back on short notice (so-called demandable loans). Moreover, exposed banks respond to higher uncertainty by raising the internally assessed probabilities of default for their borrowers, a forward-looking indicator of loan defaults and writedowns. We also find that exposed banks pare back risky exposures by rebalancing their portfolios away from those borrowers that are most likely to be impacted negatively by trade developments, including firms that are less protected by changes in tariffs and firms that are more

reliant on imported intermediate goods, and thus likely to experience an increase in input costs. Finally, our results are consistent with financial constraints playing an important role in banks' portfolio adjustment to higher uncertainty. Specifically, we find that exposed banks with lower capital levels are even more cautious in their lending than other banks, and that banks facing higher uncertainty reallocate their assets away from risky commercial lending and toward relatively safer assets such as securities.

The third key set of results describes the consequences of exposed banks' credit contraction for the real sector. We show that several performance metrics are relatively worse for those firms that borrow predominantly from more exposed banks, and are thus exposed to higher uncertainty through their lenders. These exposed firms exhibit lower debt growth, capital expenditures and overall asset growth during the trade war compared to less exposed firms. The adverse effects of the credit contraction are stronger for the exposed firms that are privately held and more likely to depend on bank credit (as opposed to publicly listed firms that are more likely to obtain financing in public debt markets). We conclude that bank-dependent firms are unable to substitute for reduced bank lending with alternative sources of external finance during times of high uncertainty.

The credit supply contraction documented above has a material adverse effect on exposed firms' real outcomes. The main point estimates for the full sample imply that a one standard deviation increase in bank exposure to trade uncertainty is associated with a 2.6 percentage point decline in credit growth (compared to 0% median loan growth for the sample) and an increase in loan spreads by 6.5 basis points during the trade war (compared to a 185 basis point median loan spread for the sample). Spillover effects to low-uncertainty firms have similar magnitudes: a 2.8 percentage point contraction in loan growth and a 7.1 basis point rise in loan spreads. A one standard deviation increase in bank exposure to trade uncertainty cuts the probability of new loan origination by 0.5% (compared to the share of new loan originations of 5%). Turning to the real effects of the credit contraction, a one standard deviation increase in firms' exposure to trade uncertainty through their relationship with exposed banks reduces the growth rate of the firms' total debt, investment and assets in 2018–2019 by 2.4, 2.7 and 2.7 percentage points, respectively.

CONCLUSION

Our research shows that international trade uncertainty affects US banks' credit supply along several dimensions. Exploiting the spike in uncertainty during the 2018–2019 trade war, we find that the banks with higher loan exposure to firms in sectors facing a greater increase in trade uncertainty curtailed credit to firms in those sectors as well as to firms not directly affected by trade uncertainty. Banks reacted to greater uncertainty by tightening credit supply along multiple margins (including loan acceptance rates, loan volumes, spreads, and collateral requirements), by assessing their borrowers as riskier,

and by shortening the maturities of their loans. The evidence is consistent with wait-and-see behaviour that echoes the nonfinancial firms' decisions to postpone 'irreversible' investment in the face of uncertainty shocks. Furthermore, lower-capital banks contract lending relatively more, suggesting a financial frictions channel is present as well. Our findings demonstrate that policy uncertainty can have significant contractionary real economic effects through a tightening of lending conditions in the banking sector. They also suggest that general equilibrium analyses of the macroeconomic impacts of trade wars should account for the 'endogenous' contractionary effects through the financial system which occur on top of any direct effects from trade policies and surrounding uncertainty on the real economy.

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CHAPTER 10

Geopolitics and financial fragmentation: Implications for macro-financial stability[1]

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International Monetary Fund

INTRODUCTION

Concerns about global economic and financial fragmentation have intensified in recent years amid rising geopolitical tensions, strained ties between the United States and China, and Russia's invasion of Ukraine (Aiyar et al. 2023, Aiyar and Ilyina 2023a, 2023b, 2023c). Financial fragmentation could have important implications for global financial stability by affecting cross-border investment, international payment systems, and asset prices.

Geopolitical factors may already be influencing the global financial landscape. Investors generally allocate a smaller share of capital to recipient countries with more distant foreign policy outlooks to their country of origin (Figure 1, panel a).[2] In addition, restrictions on cross-border capital flows have increased in recent years (Figure 1, panel b), with apparent implications for international capital allocation. For example, after Russia's invasion of Ukraine and the subsequent sanctions imposed by the United States and the European Union, cross-border banking and portfolio debt flows to Russia and its allies (countries that rejected the motion in the United Nations in March 2022 to condemn Russia's war on Ukraine) have reversed sharply, with allocations falling by about 20% and 60% relative to prewar levels, respectively (Figure 1, panels c and d).

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1   This chapter is based on Chapter 3 of the April 2023 IMF Global Financial Stability Report (IMF 2023), co-authored by Mario Catalán (co-lead), Max-Sebastian Dovì, Salih Fendoglu, Oksana Khadarina, Junghwan Mok, Tatsushi Okuda, Hamid Reza Tabarraei, Tomohiro Tsuruga (co-lead), and Mustafa Yenice, under the guidance of Fabio Natalucci and Mahvash Qureshi. The views expressed here are those of the authors and should not be attributed to the International Monetary Fund, its Executive Board, or its management.
2   The similarity in foreign policy outlook is captured by the agreement in voting behavior of the investor and recipient countries in the UN General Assembly; see details below and in IMF (2023, Online Annex 3.2).

**FIGURE 1   GEOPOLITICAL TENSIONS AND GLOBAL FINANCIAL FRAGMENTATION**

Investing countries tend to allocate smaller shares of cross-border investment and bank credit to countries with less agreement on foreign policy issues.

a) Cross-border investment, 2009-21 (percentage points; relative to world portfolio)

Bilateral financial sanctions have increased in recent years.
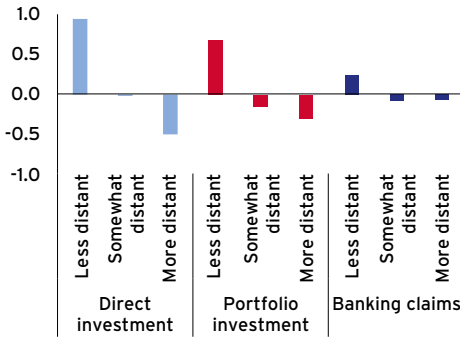
b) Number of countries subject to financial sanctions, 2010-22
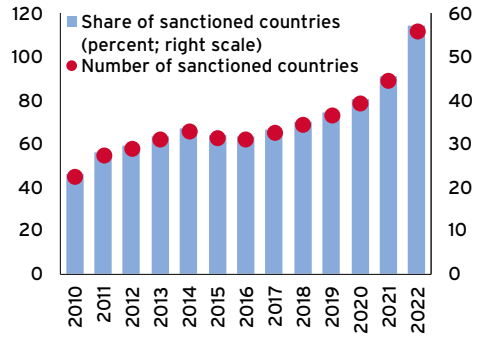
Since Russia's invasion of Ukraine, the country has suffered a sharp decline in cross-border banking flows.

c) Cross-border banking flows (cumulative 2022:H1 percent of prewar cross-border banking claims)

A rise in tensions could imply a sizable portfolio flow reversal out of recipient countries.
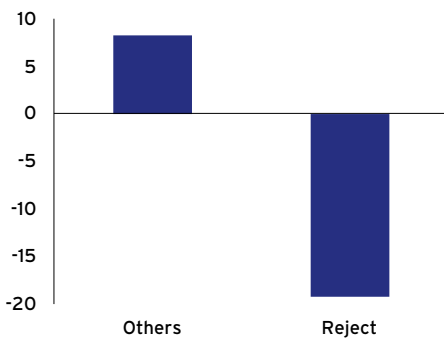
d) Cross-border portfolio debt flows (cumulative 2022:March–November; percent of prewar portfolio debt allocation)
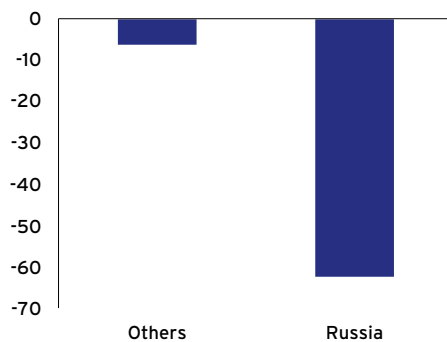
Sources: Bank for International Settlements, Locational Banking Statistics; FinFlows; Global Financial Sanctions Database; Institute of International Finance, Capital Flows Tracker; IMF, Coordinated Portfolio Investment Survey; IMF, Coordinated Direct Investment Survey; and IMF staff calculations.

Note: Panel a shows the average share of bilateral cross-border financial assets allocated to a recipient country by a source country, in excess of the total cross-border financial assets allocated to the recipient country by all source countries. The latter adjustment is made to account for the different economic sizes of recipient countries. The averages are taken over the indicated years for different ranges of the bilateral foreign policy distance measure, with less, somewhat, and more distant indicating country-pairs in the bottom, middle, and top third of the sample distribution of the distance measure. Panel b indicates the number of countries subject to financial sanctions (dots) and the share of sanctioned countries (bars) in the sample; the sharp increase in the number of sanctioned countries in 2022 reflects the financial sanctions imposed by Russia on the European Union. Panel c shows the sum of cross-border banking flows over the first and second quarters of 2022 to countries that "rejected" the motion to condemn Russia's invasion of Ukraine (including Belarus, Eritrea, North Korea, Russia, and Syria) in the UN General Assembly meeting of March 2, 2022, and all others that did not reject the motion (that is, those that were "absent" or voted "abstain" and "accept" on the motion; excluding Ukraine), in percent of total cross-border claims of these groups in the fourth quarter of 2021. Panel d indicates the sum of portfolio debt flows to Russia and all other countries (excluding Ukraine) that did not vote to reject the motion after the onset of the war (March through November 2022) in percent of their prewar (February 2022) portfolio debt allocation.

In this chapter, we lay out a simple conceptual framework and use a broad sample of advanced economies and emerging market and developing economies over the past two decades to empirically analyse three key questions. First, do geopolitical factors influence the cross-border allocation of capital? Second, do geopolitical shocks, and the financial fragmentation driven by those shocks, affect macro-financial stability as proxied by the profitability, solvency, and lending behaviour of banks? And third, does financial fragmentation make countries more vulnerable to adverse shocks by reducing their international risk diversification opportunities?[3] Our analysis primarily relies on a commonly used measure of 'geopolitical distance' between countries obtained from Häge (2011), which reflects the divergence in countries' voting behaviour in the UN General Assembly.[4]

CONCEPTUAL FRAMEWORK

Geopolitical tensions could lead to financial instability through two key channels that are likely to feed off one another (Figure 2).

The first is directly through a *financial* channel. Imposition of financial restrictions, increased uncertainty, and cross-border credit and investment outflows triggered by an escalation of tensions could increase banks' debt rollover risks and funding costs. They could also drive-up interest rates on government bonds, reducing the values of banks' assets and adding to their funding costs.

The effects of the financial channel on financial stability could be exacerbated through a real channel. The impact of disruptions to supply chains and commodity markets on domestic growth and inflation could exacerbate banks' market and credit losses, further reducing their profitability and capitalisation. The stress is likely to diminish the risk-taking capacity of banks, prompting them to cut lending, further weighing on economic growth.

In addition, financial fragmentation induced by geopolitical tensions could increase the volatility of capital flows in the longer term by limiting international risk diversification. The higher volatility of capital flows could, in turn, lead to greater volatility in domestic financial markets, making financial systems more susceptible to shocks and prone to crisis.

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3   See IMF 2023 (Online Annex 3.1) for the list of countries in the sample. The exact sample composition varies across analyses based on data availability.

4   This measure corresponds to the 'S' measure in Signorino and Ritter (1999) and calculates the distance metric as the sum of squared deviations of countries' votes cast in the UN General Assembly. The sensitivity of the results is examined using alternative measures based on UN voting behaviour, as well as other proxies, such as bilateral financial sanctions and arms trade. The various geopolitical measures are strongly positively correlated. For example, the correlation between the geopolitical distance measures obtained from Häge (2011) and Bailey et al. (2017) range from 0.6 to 0.9. Similarly, the likelihood of financial sanctions being imposed on countries that are more geopolitically distant is significantly higher. See IMF 2023 (Online Annex 3.2) for further details.

FIGURE 2   KEY TRANSMISSION CHANNELS OF GEOPOLITICAL TENSIONS TO MACRO-FINANCIAL INSTABILITY
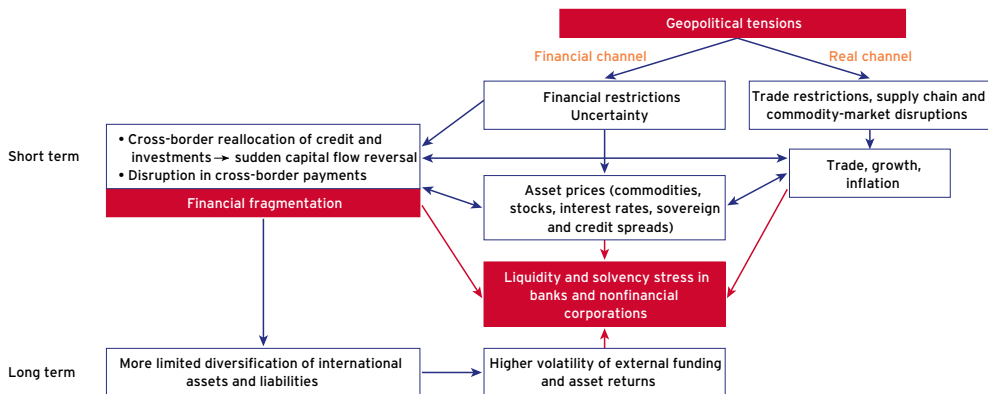
Source: IMF staff.

Note: The figure shows the two key transmission channels, financial and real, through which geopolitical tensions could contribute to financial fragmentation and exacerbate macro-financial stability risks. In addition to these channels, macro-financial stability could also be affected if geopolitical tensions increase cybersecurity risks, compliance, legal and reputational risks for entities, risks associated with money laundering and financing of terrorism, or climate-related risks because of lack of international coordination to mitigate climate change.

DO GEOPOLITICAL FACTORS INFLUENCE THE CROSS-BORDER ALLOCATION OF CAPITAL?

We estimate a gravity model of *bilateral* cross-border financial relationships (Portes and Rey 2005) augmented to incorporate geopolitical distance. The results show that source countries tend to allocate significantly less capital to recipient countries with which they have less agreement on foreign policy issues.

Controlling for a range of country-specific and bilateral factors, an increase of one standard deviation in geopolitical distance between a source and a recipient country – equivalent to the divergence in the voting behaviour of the United States and China in the United Nations since 2016 – is associated with a reduction in bilateral cross-border allocation of portfolio investment and bank claims by about 15% (Figure 3, panel a).[5] Investment funds' cross-border portfolio allocations are more sensitive to similar changes in geopolitical distance, with investments declining by more than 20%. These impacts are conditional on several recipient country characteristics – specifically, cross-border allocations are less sensitive to changes in geopolitical tensions for countries that are more financially developed, or hold larger stocks of international reserves or net foreign assets (Figure 3, panels b and c).

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5   The dependent variable is (log) portfolio share of a recipient country in a source country's cross-border portfolio investment or banking claims. To disentangle the role of geopolitical factors in bilateral cross-border investment, the model controls for common global factors (such as global investor risk sentiment and financial conditions) and macroeconomic and structural characteristics of countries by including source-country-time and recipient-country-time fixed effects. It also controls for other bilateral factors that may affect investor allocation decisions such as geographical distance and cultural and linguistic ties between the two countries. See IMF (2023, Online Annex 3.4) for further details and results.

FIGURE 3   EFFECT OF GEOPOLITICAL TENSIONS ON CROSS-BORDER CAPITAL ALLOCATION

Greater geopolitical distance is associated with reduced cross-border banking and portfolio allocation by source to recipient countries.

Countries with larger stocks of net foreign assets and international reserves, and with more developed financial systems, are less sensitive to geopolitical shocks. Buffers mitigate the effects on cross-border banking...

a) Change in cross-border capital allocation (percent)

b) Change in cross-border allocation of banking claims (percent)

...and portfolio allocation.

c) Change in cross-border capital allocation (percent)

Sources: Bank for International Settlements, Locational Statistics by Residence (restricted version); EPFR Global; FinFlows; IMF, Coordinated Portfolio Investment Survey; IMF, Coordinated Direct Investment Survey; and IMF staff calculations.
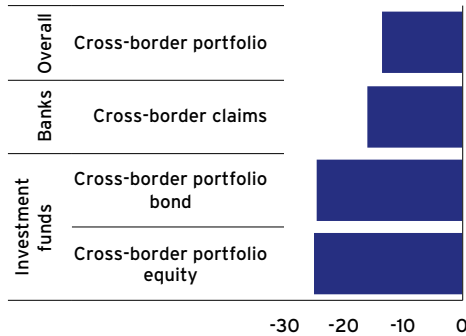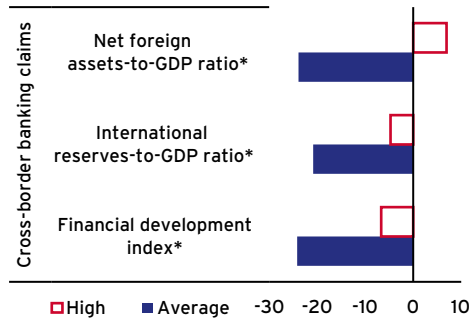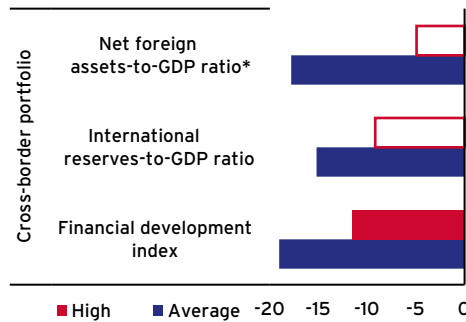
Note: Panel a shows the estimated average percent change in portfolio share of a recipient country in a source country's cross-border portfolio investment or banking claims in response to a one-standard-deviation increase in bilateral geopolitical distance within a year. The results for "Banks" exclude international financial centres identified as those in Damgaard and Elkjaer (2017). Panels b and c also show estimated responses to a one-standard-deviation increase in bilateral geopolitical distance within a year. "High" stands for the estimated impact for countries with the macroeconomic indicator above the 75th percentile of the distribution in the sample, whereas "Average" stands for those below the 75th percentile. See IMF 2023 (Online Annex 3.4) for further details of the results reported here. Solid-filled bars indicate statistical significance at the 10 percent or lower level; unfilled bars indicate lack of statistical significance at the 10 percent level. An asterisk next to a country characteristic (e.g. "Net foreign-assets-to-GDP ratio") indicates that the difference between the estimated impacts for "High" and "Average" is statistically significant at the 10% or lower level.

We perform additional analysis based on aggregate capital flows and confirm that rising geopolitical tensions could cause abrupt reversals of capital flows. The effect is particularly pronounced for emerging market economies, with an increase of one standard deviation

in geopolitical distance with a country's financial partners being, on average, associated with a decline in net capital flows of about 3% of GDP, compared to about 2% of GDP for advanced economies (Figure 4, panel a).[6] For these economies, a large portion of the total effect on net capital flows corresponds to a decline in portfolio flows (Figure 4, panel b).

FIGURE 4   EFFECT OF GEOPOLITICAL TENSIONS ON AGGREGATE CAPITAL FLOWS
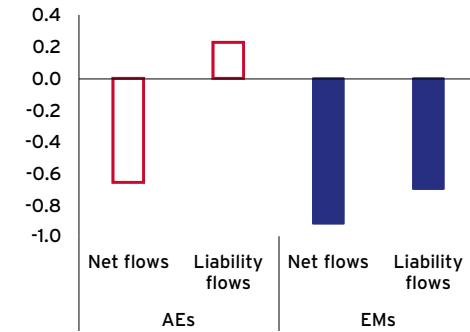
An increase in geopolitical distance could lead to a significant decline in capital flows...

...with the effect being most pronounced for portfolio flows in emerging market economies

a) Net capital flows to GDP (percentage points)
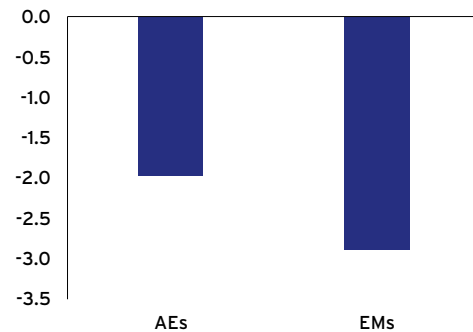
b) Portfolio flows to GDP (percentage points)

Source: IMF, Balance of Payment Statistics; and IMF staff calculations.

Note: The bars represent the percentage point change in total net capital flows to GDP in response to a one standard deviation increase in geopolitical distance with a country's financial partners. Geopolitical distance for each recipient country is the financial exposure-weighted average of geopolitical distances with source countries, where financial exposure is computed as the share of portfolio and direct investment liabilities to a source country. Solid-filled bars indicate statistical significance at the 10 percent or lower level; unfilled bars indicate lack of statistical significance at the 10 percent level. See IMF 2023 (Online Annex 3.5) for further details on the empirical analysis and results. AE = advanced economy; EM = emerging market economy.

DO GEOPOLITICAL SHOCKS AND FINANCIAL FRAGMENTATION AFFECT FINANCIAL STABILITY?

We estimate panel regression models based on global bank-level data to assess the effects of changes in a country's (weighted-average) geopolitical distance to foreign lenders on banks' funding costs, profitability, and real loan growth.[7] The results indicate that an increase in geopolitical distance between a country and its financial partners could significantly increase domestic banks' funding costs, reduce their profitability, and prompt them to contract lending to the real economy (Figure 5, panels a-c).

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6   To study the relationship between geopolitical tensions and aggregate capital flows, a panel regression analysis is performed using a weighted-average measure of bilateral geopolitical distance (foreign policy disagreement based on UN voting), where the weights are shares of foreign portfolio and direct investment liabilities in relation to partner countries. See IMF (2023, Online Annex 3.5) for further details on the estimation.

7   The data are comprised of annual unconsolidated financial statements of more than 5,000 banks from 52 advanced economies and emerging market and developing economies. The regressions control for relevant bank-level characteristics, macroeconomic fundamentals, and time effects. All regressors are lagged one period to mitigate potential endogeneity concerns. See IMF (2023, Online Annex 3.6) for more details on the estimation methodology and results.

FIGURE 5   BANKS' PERFORMANCE AND AN INCREASE IN GEOPOLITICAL TENSIONS

After an increase in geopolitical distance to foreign lenders, especially in emerging market and developing economies, domestic banks experience higher funding costs...

a) Effect on cost of funding (percentage points)

■ At mean geopolitical distance
■ At high geopolitical distance

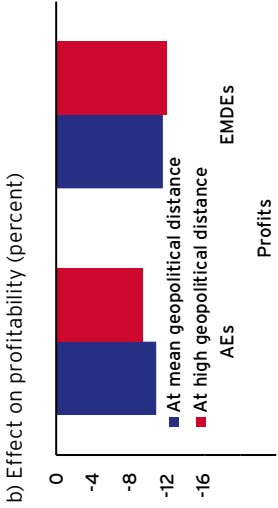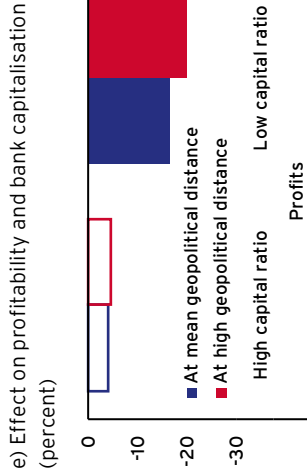AEs   EMDEs

Cost of funding

...as well as lower profitability...

b) Effect on profitability (percent)

■ At mean geopolitical distance
■ At high geopolitical distance

AEs   EMDEs

Profits

...and in response, contract lending to the domestic economy.

c) Effect on lending (percent)

■ At mean geopolitical distance
■ At high geopolitical distance

AEs   EMDEs

Real loans

Banks with lower capital ratios experience a greater increase in borrowing costs than better capitalised banks...

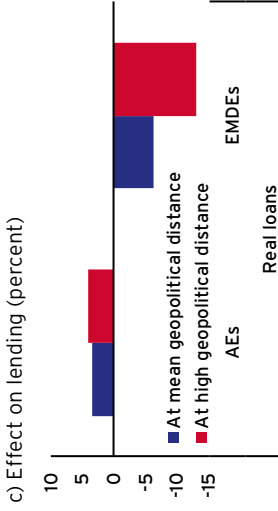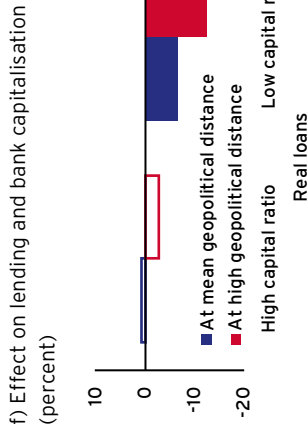d) Effect on cost of funding and bank capitalisation (percentage points)

■ At mean geopolitical distance
■ At high geopolitical distance

High capital ratio   Low capital ratio

Cost of funding

...and a larger decline in profitability...

e) Effect on profitability and bank capitalisation (percent)

■ At mean geopolitical distance
■ At high geopolitical distance

High capital ratio   Low capital ratio

Profits

...as well as in lending.

f) Effect on lending and bank capitalisation (percent)

■ At mean geopolitical distance
■ At high geopolitical distance

High capital ratio   Low capital ratio

Real loans

Source: IMF staff calculations.
Note: Panels a–c show the effect on domestic bank outcome variables when a country experiences a one standard deviation increase in geopolitical distance to foreign lenders. The outcome variables are (1) total interest expenses-to-total interest-bearing liabilities, (2) (log) operating profits-to-total assets, and (3) (log) real outstanding gross loans (gross loans in local currency divided by the domestic consumer price index). To capture potential nonlinearities in the relationships between geopolitical distance and bank performance indicators, the regressions include an interaction term of geopolitical distance with a dummy variable equal to one when the distance is "high" (above the 75th percentile of the distribution of geopolitical distance for the specific sample) and zero when the distance is "low." Panels d–f report results for banks with different levels of capital ratios, based on panel data models estimated for banks in EMDEs only. "High capital ratio" corresponds to banks with equity-to-total assets ratios above the 75th percentile of the equity-to-total assets ratios of banks in a given country in a given year. The model further includes a large set of bank- and country-specific macro variables, as well as bank- and year-fixed effects. See IMF (2023, Online Annex 3.6) for further details. Solid-filled bars indicate statistical significance at the 10 percent or lower level; unfilled bars indicate lack of statistical significance at the 10 percent level. AE = advanced economy; EMDE = emerging market and developing economy.

These effects are notably larger for emerging market and developing economies, underscoring their greater vulnerability and limited capacity to absorb such shocks. The results also show some nonlinearity in the effect of geopolitical tensions, such that the overall effect – in particular, for banks' lending – tends to be larger when tensions with foreign lenders are already elevated.[8]

In general, well-capitalised banks are less affected by geopolitical shocks than those that hold less capital. Separating the effect of geopolitical shocks on banks with high capital ratios (that is, those with capital ratios in the top 25th percentile of the specific country-year distribution) versus other banks, the results for emerging market and developing economies show that the latter experience a much larger increase in borrowing costs, decline in profits, and reduction in lending than the former (Figure 5, panels d–f).[9] This suggests that building bank capital buffers should be considered an effective way to mitigate the transmission of geopolitical shocks to the real economy through credit provision.

DOES FINANCIAL FRAGMENTATION EXACERBATE MACRO-FINANCIAL VOLATILITY?

Financial fragmentation driven by an escalation of geopolitical tensions can limit international risk diversification opportunities for countries and increase the volatility of key macro-financial variables. We quantify the potential loss of diversification benefits under financial fragmentation using a two-country, open-economy model with trade in stocks and bonds, developed by Coeurdacier et al. (2010) to explain the 'equity home bias' puzzle in G7 economies.[10]

We simulate the model for each G7 economy under four scenarios characterised by different degrees of fragmentation. In the 'full integration' scenario, G7 economies trade with the rest of the world (comprised of a sample of 53 countries). Under the 'moderate' and 'extreme' fragmentation scenarios, G7 economies are unable to engage in financial transactions with countries whose geopolitical distances from the G7 economies exceed the top 25th and 50th percentiles of the sample distribution, respectively. Finally, in the 'autarkic' scenario, G7 economies are financially self-sufficient.

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8   The nonlinearity is captured by including an interaction term between the (lagged) geopolitical distance measure and a dummy variable which takes the value one if this distance is greater than the 75th percentile of the distribution of geopolitical distance for the specific sample.

9   In addition to higher interest expenses, a deterioration in bond valuations and credit quality of loan portfolios could also undermine the profitability of banks, including through a "sovereign-bank nexus" (IMF 2022). Completely disentangling the financial channel from the real channel would be feasible if more granular data were available. Such data could allow to fully absorb credit demand effects or exploit within-country bank-level variation in geopolitical distance to foreign lenders.

10 The model generates plausible macro-financial dynamics after total factor productivity and investment-specific technology shocks. In the model, households can obtain international diversification benefits by investing in foreign equity because of imperfectly correlated total factor productivity and investment efficiency shocks across economies. Home bias arises because wage income and dividends from domestic equity investments are imperfectly correlated, providing some opportunity for risk diversification domestically. For further details, see IMF (2023, Online Annex 3.7).
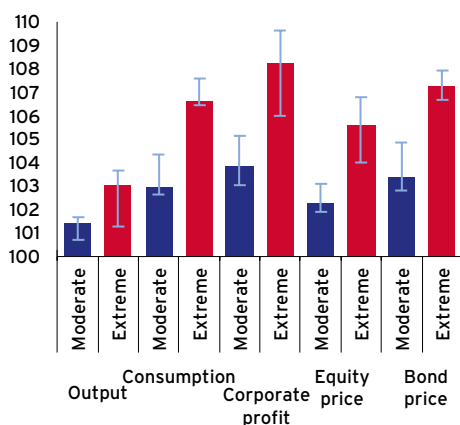
The results indicate that under the moderate and extreme fragmentation scenarios, the median volatility of output increases by 1 and 3 percentage points, respectively, relative to the full integration scenario, while the median volatility of (real) consumption, corporate profits, equity and bond prices increases between 2 and 8 percentage points (Figure 6, panel a).

These increases in volatility imply a significant loss of diversification benefits (Figure 6, panel b).[11] 'Moderate' fragmentation implies that about 20% of the diversification benefits from financial integration would be lost, while 40–50% of those benefits would be lost under the 'extreme' fragmentation scenario.

FIGURE 6 MACRO-FINANCIAL VOLATILITY AND LOSS OF DIVERSIFICATION BENEFITS IN THE G7 ECONOMIES UNDER FRAGMENTATION

Macro-financial volatility could increase under fragmentation relative to full integration...

...and the loss of diversification benefits could be substantial

a) Increase in macro-financial volatility (full integration = 100)

b) Loss of diversification benefit under fragmentation (percent relative to the loss under autarky)
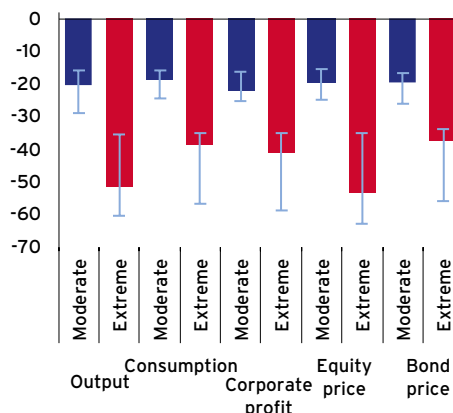
Source: IMF staff calculations.

Note: Bars in panel a show the median volatility (standard deviation) of (real) output, consumption, corporate profits, and equity and bond prices in the home country under two fragmentation scenarios – "moderate" ("extreme") – where the home country does not financially trade with countries to which the bilateral geopolitical distance measure lies in the top 25th (50th) percentile of the sample distribution, respectively. Whiskers indicate the interquartile range of the effect across the Group of Seven economies. Panel b shows the loss of diversification benefit under fragmentation, quantified as the difference in volatility for each variable under fragmentation relative to an autarkic scenario. See IMF 2023 (Online Annex 3.7) for further details of the modelling exercise.

11 To quantify this loss, the increase in the volatility of output, consumption, corporate profits, and stock and bond prices under fragmentation is compared with the increase in the volatility of these variables under the autarky scenario, and the ratio of the changes in volatilities is defined as the diversification benefit.

CONCLUSIONS AND POLICY RECOMMENDATIONS

Rising geopolitical tensions can lead to financial fragmentation through cross-border capital reallocation. They can also increase banks' funding costs, reduce their profitability, and prompt them to contract lending, with potentially adverse effects on economic activity. Emerging market and developing economies are more vulnerable to adverse geopolitical shocks than advanced economies. However, countries can mitigate geopolitical risks by holding adequate international reserves and by promoting financial development, while banks can mitigate them by holding larger capital buffers. The analysis also shows that if geopolitical tensions persist, the long-term costs associated with reduced cross-border risk diversification in the form of broader macro-financial volatility could be substantial.

How to curb risks:

- Supervisors, regulators, and financial institutions should be aware of the risks to financial stability stemming from a potential rise in geopolitical tensions and commit to identify, quantify, manage, and mitigate these threats. A better understanding and monitoring of the interactions between geopolitical risks and more traditional ones related to credit, interest rate, market, liquidity, and operations could help prevent a potentially destabilising fallout from geopolitical events. To develop actionable guidelines for supervisors, policymakers should adopt a systematic approach that employs stress testing and scenario analysis to assess and quantify transmission channels of geopolitical shocks to financial institutions.

- In response to rising geopolitical risks, economies reliant on external financing should ensure an adequate level of international reserves, as well as capital and liquidity buffers at financial institutions.

- Policymakers should strengthen crisis preparedness and management frameworks to deal with potential financial instability arising from heightened geopolitical tensions. Cooperative arrangements between different national authorities should continue to help ensure effective management and containment of international financial crises, including through development of effective resolution mechanisms for financial institutions that operate in multiple jurisdictions.

- The global financial safety net must be reinforced through mutual assistance agreements between countries. These would include regional safety nets, currency swaps, or fiscal mechanisms – and precautionary credit lines from international financial institutions.

- In the face of geopolitical risks, efforts by international regulatory and standard-setting bodies, such as the Financial Stability Board and the Basel Committee on Banking Supervision, should continue to promote common financial regulations and standards to prevent an increase in financial fragmentation.

Ultimately, policymakers should be aware that imposing financial restrictions for national security reasons could have unintended consequences for global macro-financial stability. Given the significant risks to global macro-financial stability, multilateral efforts should be strengthened to reduce geopolitical tensions and economic and financial fragmentation.

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CHAPTER 11

Comments on geopolitics and financial fragmentation[1]

Brad Setser

Council on Foreign Relations

I want to thank the IMF for inviting me to be a discussant on financial fragmentation – especially as I have been known on occasion to be a bit provocative.

The conference organisers invited discussants to discuss the broader issue – in this case, financial fragmentation driven by geopolitics – as well as the specific papers.

I will thus start with a few general observations before offering my reaction to the two papers presented here.

The IMF has highlighted the potential cost of financial fragmentation – namely, reduced opportunities for helpful diversification of risk across borders (Catalán et al. 2023a). It also has highlighted the risk of what might be called a 'fragmentation' shock – namely, the sudden imposition of financial sanctions or other events that freeze or reduce cross border financial ties.

Of course, one obvious way to reduce the risk of a fragmentation shock is to pre-emptively reduce financial ties between geopolitical rivals, forgoing the gains such as they are from diversification across geopolitical blocs for greater financial stability.

Neither of the papers focuses on financial sanctions per se, or looks at the impact of recent cases where significant sanctions have been imposed. But it is striking to me that the freeze imposed in 2022 on most of the external assets (and liabilities) of two of the three largest Russian banks (Sberbank and VTB) didn't have more of a direct market impact. I suspect the reason for that modest impact is in part that legacy of the 2014–2015 sanctions, which forced a significant but largely orderly deleveraging of the Russian banking system and economy by denying many large Russian banks and government owned firms access to new external financing. The total external debt of Russia's banks and state firms dropped by over $100 billion between 2014 and 2021.

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1   This discussion relates to the papers as presented at the IMF conference rather than the respective chapters in this eBook.

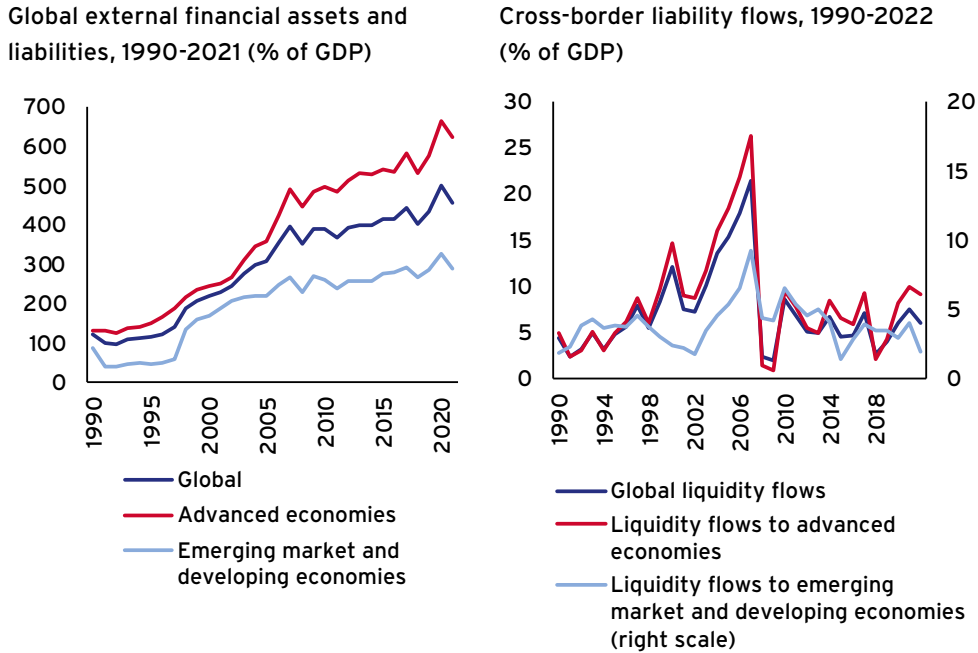**FIGURE 1   RUSSIA: EXTERNAL DEBT, SELECT LINE ITEMS (US$ BILLIONS)**
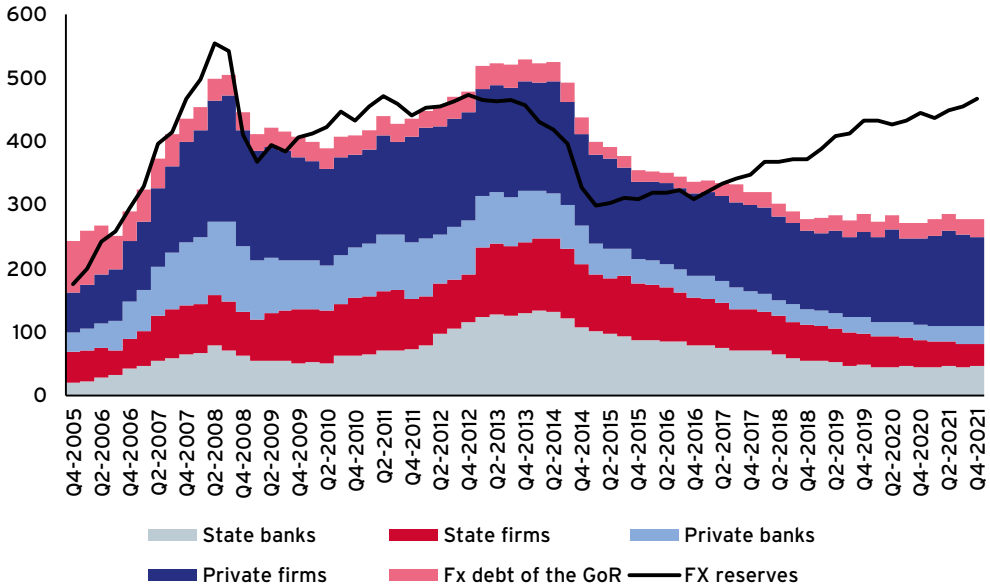
Source: Central Bank of Russia (accessed via HAVER).

Was that unhealthy fragmentation? Or did it help insulate many large global banks from the impact of the 2022 sanctions? Figuring out how to balance the economic cost from the lost opportunities to diversify into Russian state-backed credit (in this case) against the gain to financial stability from limiting financial exposure to entities likely to be subject to potential future sanctions and other geopolitical shocks is sure to be an important issue going forward – but also isn't really a topic addressed by either of the two papers.

The discussion of the benefits of financial integration also needs to be balanced by a recognition that there isn't a general consensus that more cross-border financial integration is always better. The IMF itself recognises a distinction between capital flow management, which the Fund now recognises can serve a prudential purpose, and trade flow management, which it generally criticises. Prior to the global financial crisis then Federal Reserve Chair Alan Greenspan extolled how increasing financial flows were helping to diversify the risks associated with US mortgage lending globally (Greenspan 2003), and how it was finally breaking down the traditional linkage between national savings and national investments – allowing for more dispersion in global current account positions. In its surveillance of the US economy before the global financial crisis, the IMF echoed Greenspan and talked about how the securitisation had diversified the risk from the US housing boom, and thus protected the stability of the core of the US financial system (IMF 2007).

With hindsight though the acceleration in most measures of global financial integration in the years prior to the global financial crisis was a sign of building risk, not a sign of robust global diversification (Setser 2018, 2019a).

FIGURE 2 FINANCIAL FLOWS SOARED IN THE RUNUP TO THE GLOBAL FINANCIAL CRISIS

Global external financial assets and liabilities, 1990-2021 (% of GDP)

Cross-border liability flows, 1990-2022 (% of GDP)

Source: Catalán et al. (2023).

The IMF doesn't generally welcome large and increasing current account deficits on the grounds that the country is offering global investors greater opportunities for risk diversification. Measures of global financial integration can also be heavily influenced by lax regulation and increased leverage among systemically important banks and broker-dealers.

The surge in financial integration prior to the global financial crisis was also, in my view, a byproduct of the strain that the enormous acceleration in reserve accumulation from 2002 to 2007 placed on the global financial and trading system. Mapping reserve accumulation to safe assets which then were in truly short supply meant private investors had to take on more risk – and of course the rise in cross-border bank flows was clearly a sign that regulators had fallen asleep while balance sheet risks increased in large global banks. Cross-border assets – global financial integration – increased without a commensurate increase in their loss-absorbing equity base. With global financial integration, more isn't in fact always better.

It should go without saying that cross-border financial flows are also heavily influenced – and distorted – by considerations of tax. The large reduction in FDI flows globally noted in one of the previous panels was in fact – as an excellent speech by ECB Chief Economist Philip Lane explained in 2020 – a result of the initial effort to reduce global tax competition (Lane 2020). That effort led to a significant unwinding of shell companies in the Netherlands and Luxembourg, which had an enormous impact on measured

FDI in the euro area (Di Nino 2019). The swing was so big that it also impacted the global data. In the United States, steps to limit so-called inversions (reverse takeovers of US companies by Irish headquartered companies to shift the companies' global tax residence) reduced measured FDI inflows as well. Globally, something like half of all FDI touches a low-tax jurisdiction (Lane and Milesi-Ferretti 2017) – and there is absolutely no correlation between a country's economic weight in the global economy and its share of the global profit of US multinational companies (Setser 2019b). All the flows into and out of centres of tax avoidance raise measures of financial integration. It isn't an accident that the Caribbean and Ireland punch enormously above their weight here. I would hope that others agree that is not actually a good thing.

These is consequently cause for caution – not all financial integration is necessarily healthy, not all forms of quote unquote fragmentation is bad. Stronger measures on global tax cooperation, for example, should be welcomed even if they lead to a reduction in the large share of cross border flows that are motivated by tax avoidance. The Economics 101 view that nation states restrict cross border flows unnecessarily and thus eliminating restrictions on those flows raises global efficiency isn't all that apparent in the actual data, given the concentration of flows through centres of corporate tax avoidance.

The two papers presented at this conference differ enormously. The paper by Correa et al. is a carefully constructed to make a narrow but empirically well supported claim. The paper by Catalán et al. (2023b), by contrast, has a sweeping scope. It both attempts to quantify how geopolitical distance can reduce financial integration, and to provide a conceptual framework for thinking about the cost of fragmentation and the risk of fragmentation shocks.

The central claim of Correa et al. (2023) is that the US banking system amplified the shock from the imposition of the Trump tariffs by pulling back on its trade finance to companies with more trade exposure. The study itself is very convincing.

I am certainly not someone with the skill set needed to comment on the econometric identification techniques, but they appeared to very carefully done. I have no doubt that its basic conclusion holds and holds robustly.

The study also demonstrates just how valuable it can be to have access to central bank supervisory data.

I have two general comments on the paper.

The finding about the impact of not just tariffs but of trade uncertainty may be influenced by a sample period dominated by President Trump. President Trump in a sense weaponised trade uncertainty as part of making trade policy by tweet. Threats to withdraw from a number of trade pacts were deployed to prompt countries to renegotiate existing agreements. In that context, it isn't surprising that bank risk-management

committees assessed their own exposure to companies that were especially exposed to the risk of tariffs. Uncertainty was a feature, not a bug, of Trump's world view; he hoped to generate concessions from countries wanting certainty.

The second observation is that the paper is perhaps more trade than about finance. The basic insight is that the financial sector amplifies the direct impact of tariffs. The paper doesn't have much to say on sanctions, for example, or even on why China continues to run large global surpluses even in the face of the US tariffs. There is an obvious question in the trade data – namely, how the extension of the supply chains needed to route Chinese parts through Vietnamese assembly was financed – that the paper doesn't directly answer. The paper's answer is "not by US banks that report data to the Fed", but that doesn't explain how the growth in Southeast Asia's trade was financed.

FIGURE 3   US IMPORTS FROM SELECT ASIAN ECONOMIES, TRAILING 12-MONTH SUMS (US$ BILLIONS)
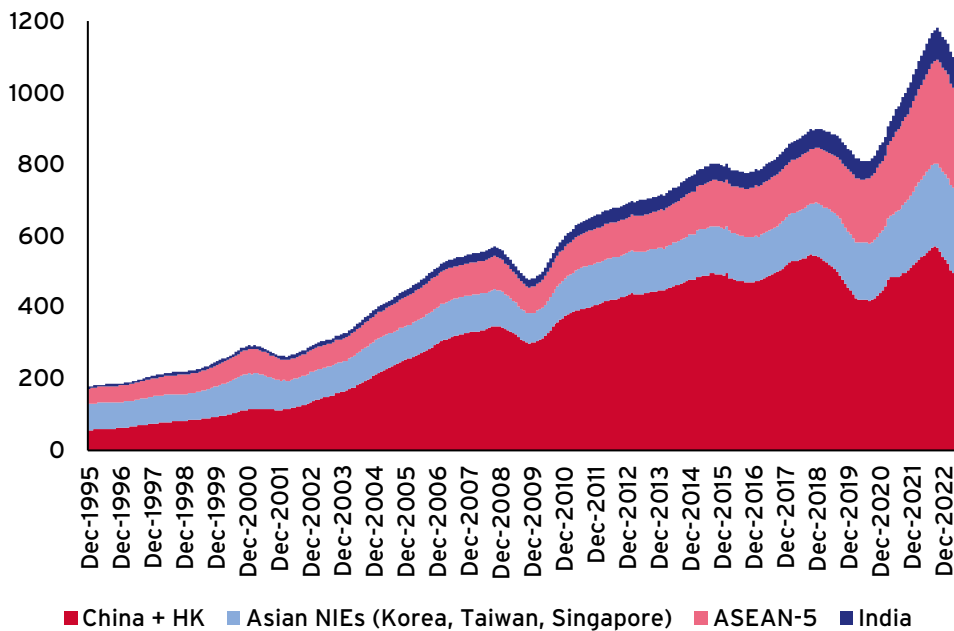
Source: US Bureau of Economic Analysis (BEA).

Catalán et al. (2023b) is analytically ambitious. It finds that countries that differ along important political dimensions that are identified in the political science literature (UN voting, arms trade) systematically have fewer cross-border financial ties. Those empirical relationships allow the authors to estimate the impact of a fragmentation shock – defined as the expected financial disintegration that would follow from a large increase in geopolitical difference. A one standard deviation increase in voting distance in the UN leads for example to a 15% reduction in financial flows. Fragmentation shocks, unsurprisingly, generate risks to the banking system that warrant larger buffers for

internationally exposed banks. The paper also argues, drawing on the finance literature that has found benefits from financial diversification across the advanced economies, that there are costs to financial fragmentation, not just to fragmentation shocks.

All the individual parts of the paper are well done. But I wasn't convinced by the paper's argument, largely because it doesn't offer a convincing explanation of how a world of increased geoeconomic fragmentation is still marked by large net flows of capital across geopolitical blocs. Each individual component of the paper illustrates a stylised fact that works in isolation, but the sum of the components in a sense just doesn't quite add up.

The argument that rising geoeconomic tension should result in financial fragmentation is intuitively obvious. It just isn't clearly true in a deep sense right now: the surpluses of China, Russia and the Gulf autocracies collectively have to finance countries on the other side of the most salient of the world's geopolitical divide. China and Russia are clearly geopolitical rivals of the big deficit countries. The Middle East is complicated – the big oil surplus countries in the Gulf Cooperation Council will score highly on measures of political alignment with the United States that focus on military ties, but not on measures that focus on UN votes or similarity of political systems. But given the scale of the combined surplus of Russia, China and the Gulf, it is clear that the global balance of payments requires large, almost historically unprecedented, flows of funds across geopolitical blocs.

Of course, the net financial flow needed to balance the global current account doesn't appear simply or obviously in data sets that look at bilateral financial flows between different countries.

Yet nowhere in Catalán et al. (2023b) is there any recognition of the cross-bloc financial flows implied by the current pattern of global current account imbalances, or an examination of how the massive 2022 surplus of the oil-exporting autocracies and China financed the current account deficits of the United States, the United Kingdom, India and Turkey (Setser 2022).

Of course, it isn't hard to find a geopolitically motivated flow from the Gulf and Russia to Turkey, so that particular deficit doesn't pose a global mystery. India financed its deficit by selling reserves, so that too is an easy puzzle to solve. But the Chinese and Russian surplus is simply too big not to have helped finance in part the deficits of the United States and the United Kingdom, no matter how uncomfortable that is for all the parties involved. Logically, there has to be a net flow of funds between geopolitical rivals even if that flow is masked in the measured data (the big buyers of US Treasuries these days are the United Kingdom and the Caribbean). The risks from that flow, which we can infer from global adding up constraints, isn't explained by the empirical work in the paper.

FIGURE 4   **GLOBAL BALANCE OF PAYMENTS, SELECT ECONOMIES, TRAILING FOUR-QUARTER SUMS (US$ BILLIONS)**
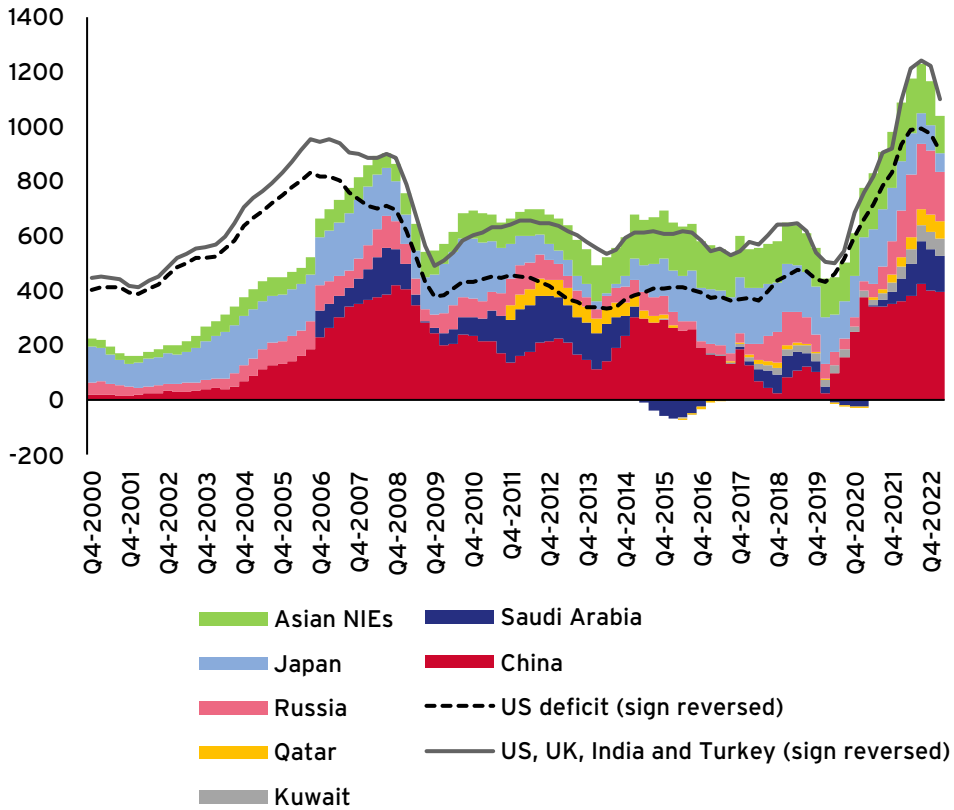
Source: IMF balance of payments quarterly and national sources, accessed via HAVER.

There are several reasons for this gap. Much of the empirical work used in Catalán et al. (2023b) focuses on private portfolio flows, so it misses the uphill flow done through reserves. Historically that has been important – the Chinese, Russian and Saudi reserve managers have invested their reserves across geopolitical fault lines for a very long time. Now reserve growth is very low, but there are large flows from sovereign funds and state banks (Setser 2022, *The Economist* 2023). The fact that the global net flow of finance is at odds with global geopolitics does though point to what is probably as big a risk as financial fragmentation – namely, growing financial opacity. The simple reality is that no one really can track the chain of financial transactions that allow Chinese and Russian surpluses to ultimately finance deficits in the United States and the United Kingdom.

FIGURE 5   CHINA, RUSSIA AND SAUDI ARABIA: RESERVE GROWTH VERSUS THE CURRENT ACCOUNT, TRAILING FOUR-QUARTER SUMS (US$ BILLIONS)
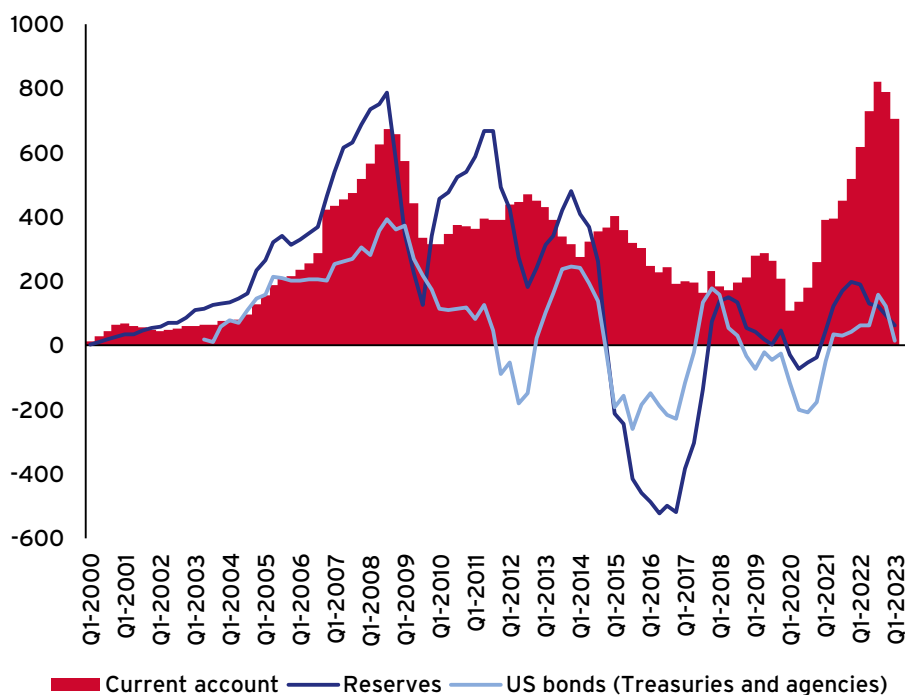
Source: National sources and author's calculations.

I also wonder to what extent the empirical gains from financial diversification – which come from studies that focus on diversification among the advanced economies – are simply a function of the fact that, for most countries, a more diversified portfolio has meant increased exposure to US markets. For all the talk of global financial integration, the cross-border flow of portfolio debt has been concentrated and has largely flowed to a single borrower (as the IMF's examination of the global stock imbalance in the External Sector Report has made clear). Over the last 15 years, the dollar has rallied and US equities have outperformed global equities, so a global flow into the United States meant a correlation for most countries between diversification and returns. For Americans at least, there actually haven't been comparable gains from holding a diversified international portfolio – American investors actually would have done far better staying at home.

Studies focused on the gains from financial integration among economically similar, politically aligned advanced economies also don't address what to me is the biggest looming question – namely, the balance of risks associated with further financial integration between the United States and Europe and China.

Broadly speaking, any analysis of patterns of capital flows will find that foreign investors are underweight in Chinese assets (especially fixed income assets; equities are complicated by holdings of Caribbean companies with an equity like claim on Chinese firms) and that private Chinese investors are underweight in foreign assets of all kinds. A great financial interchange offers a large opportunity to raise cross-border diversification. But such diversification across blocs would also create larger risks of a disruptive geopolitical shock. The lesson of Russia, broadly speaking, was that the risks of holding assets in a geopolitical rival are very real.

I at least was not convinced by Catalán et al.'s analysis, which only tangentially addressed this question by drawing on empirical work that focuses on the advanced economies, to change my view that rapid financial account liberalisation by China absent deep political and economic reforms would generate more economic and political risks than benefits.

With an unbalanced domestic economy marked by exceptionally high savings and potentially significant unrealised losses in the state financial sector, the risks that poorly sequenced liberalisation could result in a domestic financial crisis that complicates the needed financial rehabilitation of China's real estate sector and the finances of its local governments are high. There would equally be risks that large outflows from China could result in larger trade imbalances, and what could be viewed as an increase in integration would result in greater not less economic and political friction across geopolitical blocs.

CONCLUSION

The paper by Correa et al. convincingly demonstrates that banks can amplify the impact of a tariff shock. The paper by Catalán et al. on geopolitics and financial fragmentation provides a demonstration of how measures of political distance can be incorporated into analysis of cross-border flows. It also raises a set of topics that warrant much more debate, even if I personally remain unconvinced that the main goal of economic policy should be promoting measures of global financial integration. With hindsight, the 'peak' of financial integration across borders back in 2006 and 2007 should have been viewed as a global risk factor, not a cause for celebration. The underlying distortions in the global economy that can lead to an unhealthy rather than a healthy rise in measures of global financial integration have not, in my judgement, fully disappeared over the last 15 years.

I thank the IMF for inviting me to participate in this conference. I look forward to future work on the geopolitics of finance, especially to any work that will help pierce the financial opacity that clearly has accompanied geopolitical fragmentation and that has complicated analysis of the net flow of global capital implied by persistent large current account imbalances.

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SECTION 5
GLOBAL VALUE CHAINS AND FDI

CHAPTER 12

Geopolitics and the cost of FDI fragmentation[1]

Shekhar Aiyar,[a] JaeBin Ahn,[a] Ashique Habib,[a] Davide Malacrino,[b] Dirk Muir[a] and Andrea F. Presbitero[ac]

[a]International Monetary Fund; [b]European Central Bank; [c]CEPR

As geopolitical tensions rise and pandemic-related supply chain disruptions gradually dissipate, the costs, benefits and risks of geoeconomic fragmentation have come to occupy centre stage of the policy debate (Aiyar and Ilyina 2023). US Treasury Secretary Janet Yellen argued in April 2022 that firms should move towards the friend-shoring of supply chains (Yellen 2022). More recently, the European Commission proposed the Net Zero Industry Act[2] to counter the subsidies embedded the US Inflation Reduction Act. And China's Ministry of Commerce announced that gallium and germanium – two metals used in chipmaking and communications equipment – will be subject to export restrictions in order to safeguard national security.[3] While the bulk of the incipient literature on the potential economic effects of geoeconomic fragmentation has focused on the risk of disrupted trade flows, less attention has been paid to foreign direct investment (FDI). But with companies and policymakers increasingly looking at strategies to 'de-risk' supply chains by moving production home or to trusted countries (Attinasi et al. 2023; see also the contribution by Javorcik et al. in this eBook), understanding how the dynamics of FDI might be affected by geopolitical developments is crucial.

THE RECENT INTERPLAY BETWEEN GEOPOLITICS AND FDI

While the slowdown in globalisation is a broad-based but nuanced phenomenon dating back at least to the global financial crisis (Irwin 2020, Antràs 2021, Baldwin 2022a, 2022b, Cernat 2022), a prominent decline in global FDI is occurring against the backdrop of increasing firm-level anxiety about geopolitical tensions. Figure 1 documents a sharp – and so far unabated – spike in firms' interest in reshoring and friend-shoring (measured using textual analysis of companies' earning call reports). Moreover, as shown in a chapter of the April 2023 World Economic Outlook (IMF 2023), the interest in reshoring

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1   The views expressed here are those of the authors and should not be attributed to the International Monetary Fund, its Executive Board, or its management.
2   https://single-market-economy.ec.europa.eu/publications/net-zero-industry-act_en
3   https://global.chinadaily.com.cn/a/202307/03/WS64a2bdb3a310bf8a75d6cf97.html

has been increasing especially sharply among large, profitable and knowledge-intensive firms, suggesting that current host economies may incur large costs from a potential wave of reshoring.

FIGURE 1   RISING GEOPOLITICAL TENSIONS AND FDI FRAGMENTATION (INDEX; FREQUENCY OF MENTIONS OF RESHORING ON RIGHT SCALE)

Recent years have seen increasing geopolitical risk and companies' interest in reshoring and friend-shoring.
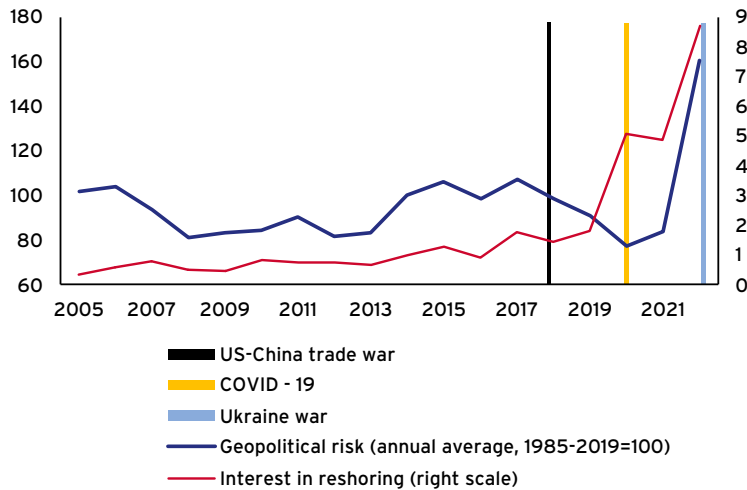
Sources: Bailey et al. (2017); Hassan et al. (2019); NL Analytics; IMF staff calculations

Note: The interest in reshoring measures the frequency of mentions of reshoring, friend-shoring, or near-shoring in firms' earning calls.

EARLY EVIDENCE OF FDI FRAGMENTATION

Looking at investment-level greenfield FDI data from 2015 up to the first quarter of 2023 reveals early signs of FDI fragmentation. FDI flows have been characterised by divergent patterns across host countries, particularly in *strategic* sectors (like semiconductors) on which policymakers may place greater weight due to national and economic security interests. For instance, the flow of strategic FDI to Asian countries started to decline in 2019 and has recovered only mildly in recent quarters (Figure 2). For China, the decline continues.

Focusing on the post-pandemic period, FDI declined by almost 20% in Q2 2020 – Q4 2022, relative to the post-global financial crisis but pre-pandemic average. But this decline has been extremely uneven across host regions, with the emergence of relative winners (e.g. Europe) and losers (e.g. China). Looking into specific cases reinforces the impression that geopolitical forces have been playing a role in this process. For instance, among major Asian and European recipients of US FDI, some of the relative winners (e.g. Canada and Korea) are politically closer to the United States than the relative losers (e.g. China and Vietnam).

FIGURE 2   FDI FRAGMENTATION IN STRATEGIC SECTORS (NUMBER OF INVESTMENTS, FOUR-QUARTER MOVING AVERAGE, 2019:Q4 = 100)

Foreign direct investment flows to different regions are diverging, with China losing market share.
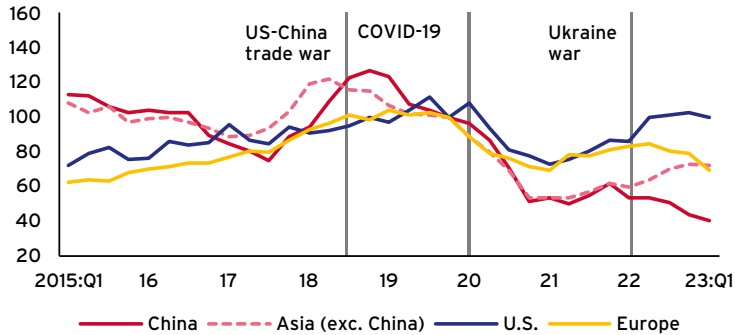
Sources: fDi Markets and IMF staff calculations.

Note: Vertical lines indicate the start of the US-China trade war, the start of the Covid-19 pandemic and the start of the Ukraine war.

THE CONNECTION BETWEEN GEOECONOMIC FRAGMENTATION AND FDI

Various exercises suggest that, over the last decade, the share of FDI flows among geopolitically aligned economies has been rising. To gauge *prima facie* evidence of the increasing role played by geopolitical distance in determining FDI, countries are divided into five blocks based on their geopolitical distance from the United States.[4] This reveals that the share of FDI taking place between countries that belong to the same group has been increasing over time from about 40% between 2003 and 2010 to more than 50% in 2021. Moreover, the extent of geopolitical proximity appears to matter more than geographical proximity, and its importance has been increasing more steeply in recent years (Figure 3).

The suggestive evidence above is confirmed more formally by a set of empirical gravity model equations, which flexibly control for confounding country-time characteristics that embody other push and pull factors (such as the business cycle and political risk in both source and destination countries). The estimates from the gravity models show that the role of geopolitical alignment for bilateral FDI flows is significant and economically relevant, particularly for emerging market and developing economies. In our baseline specification, an increase in the ideal point distance from the first to the third quartile of its distribution (approximately equivalent to moving from the geopolitical distance between France and the United Kingdom to that between France and India) is associated with a decline in FDI between countries of about 17%. This average result is stronger when emerging market and developing economies are either a source or a host country. Moreover, since 2018, coincident with increasing trade tensions between China and the

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4   The adopted measure of geopolitical distance between countries is the 'ideal point distance' proposed by Bailey et al. (2017), based on similarity of voting patterns at the United Nations General Assembly.

United States, geopolitical factors have become more relevant to FDI flows. Consistent with the idea that geopolitics matters more for sectors that are deemed strategic, the analysis suggests that these factors are more important for FDI in strategic sectors, such as pharma and semiconductors.

FIGURE 3   FDI BETWEEN GEOGRAPHICALLY AND GEOPOLITICALLY CLOSE COUNTRIES (PERCENT)

The importance of geopolitical distance for foreign direct investment has increased.
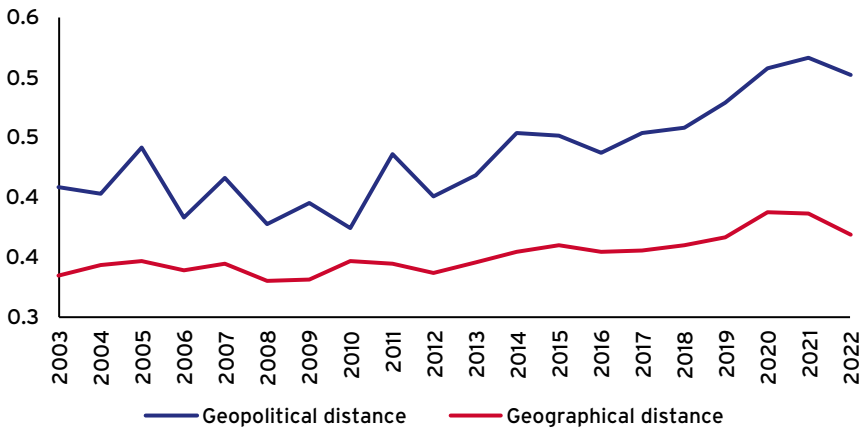
Sources: Bailey et al. (2017); Centre d'etudes prospectives et d'informations internationals, Gravity database, fDi Markets; IMF staff calculations.

Note: Figure shows the annual share of total FDI between country pairs that are similarly distant (i.e. in the same quintile of distance distribution), geopolitically and geographically, from the United States.

VULNERABILITY TO FDI FRAGMENTATION: A NEW INDEX

To obtain a sense of how vulnerable the FDI hosted in different countries may be to fragmentation pressures, we construct an index of countries' exposure to GEF risks by considering countries' inward FDI geopolitical exposure, their global market power, and the strategic content of their investment stock.

The index comprises three calculations. First, the geopolitical component of the index is built by multiplying the share of investment from each source country by the geopolitical distance between the host and the source. Second, the market power of a host economy is assessed by counting the FDI sectors in which the country is among the top ten exporters in that sector. Such sectors are treated as only 'partially vulnerable', as opposed to the other 'fully vulnerable' sectors. Though most economies show low levels of protection arising from market power, some large economies (e.g. China, Germany, the United States) do enjoy substantial protection, being large exporters in many sectors. Third, the strategic content of the investment stock is computed as the share of inward FDI in strategic sectors.

Aggregating the constructed measures, the index of vulnerability to FDI fragmentation (Figure 4) shows that emerging market and developing economies (EMDEs) are more vulnerable than advanced economies, although there is large variation in the distribution of the index and some overlap between advanced and emerging market economies. In part this is because EMDEs rely to a greater extent on flows from more geopolitically distant countries.

FIGURE 4   VULNERABILITY INDEX

Emerging market and developing economies tend to be more vulnerable to relocation of foreign direct investment than advanced economies.
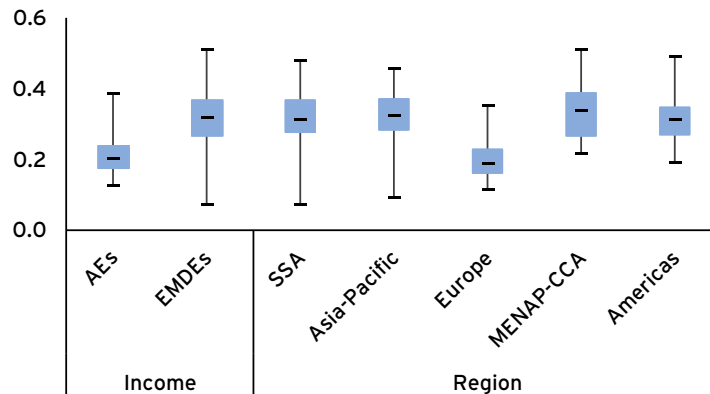
Sources: Atlantic Council; Bailey et al. (2017); fDi Markets; NL Analytics; Trade Data Monitor; and IMF staff calculations.

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.

MODELLING THE COSTS OF FDI FRAGMENTATION

Technological progress and subsequent productivity growth induced by FDI has historically been one of the critical drivers of economic growth. Our cross-country firm-level estimation results reaffirm that the entry of multinational corporations in foreign countries indeed brings positive productivity spillovers to domestic firms. In advanced economies, the main channel is through positive within-industry spillovers, with domestic firms reacting to fiercer competition from multinational corporations by becoming more productive. By contrast, in EMDEs, the positive spillovers accrue to domestic suppliers (i.e. 'upstream' firms), which benefit from greater local demand for components and the technological spur provided by engaging with a more exacting and sophisticated customer. Of course, these results suggest that fragmentation of cross-border investment flows could involve the loss of such benefits, thereby hampering capital formation and technological diffusion.

To better quantify the potential costs of FDI fragmentation and their distribution across countries, we employ a multi-region dynamic stochastic general equilibrium (DSGE) model, where fragmentation is modelled as a permanent rise in investment barriers between opposing geopolitical blocs centred on the two largest economies (China and the United States).[5]

While the scenarios examined are intended to be illustrative, they indicate that FDI fragmentation could substantially reduce global output level, by about 2% in the long term (Figure 5). Moreover, output losses are likely to be unevenly distributed. This is particularly concerning as EMDEs stand to lose the most due to their heavy reliance on FDI for capital formation and productivity gains from the transfer of better technologies.

FIGURE 5   IMPACT OF INVESTMENT FLOW BARRIERS ON GDP (PERCENT DEVIATION FROM NO-FRAGMENTATION SCENARIO)

Fragmentation could lower global output by up to 2 percent.

■ Barriers to Investment ■ Productivity losses ● Medium-term total
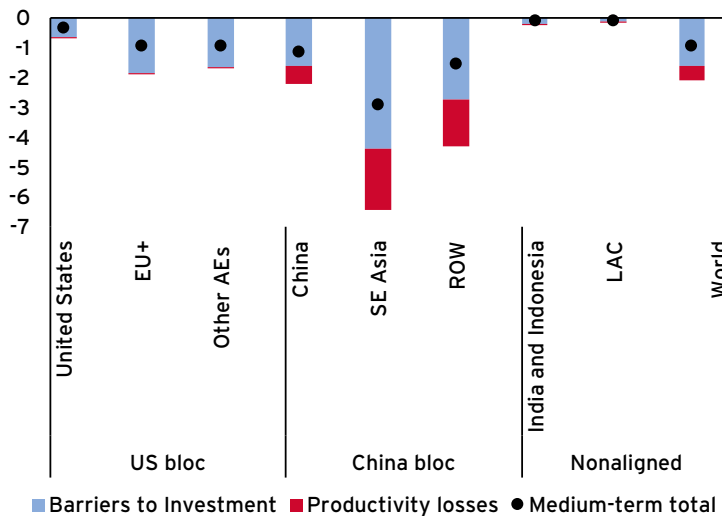
Source: IMF staff calculations.

Note: Baseline fragmentation scenario represents a 50% 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.

Although there may be relative winners from investment flow diversion – such as those 'non-aligned' countries that remain open to different geopolitical blocs – the gains are likely to be partly offset by adverse effects from lower external demand. Moreover, Figure 5 shows results for a baseline scenario with perfect certainty. If investors worry that non-aligned economies may be forced to choose between one bloc or the other in future,

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5   Relative distances from either the US or China, based on the latest ideal point distance data, are used to assign regions to geopolitical blocs aligned with either the US or China, or as nonaligned.

uncertainty regarding their alignment could restrict their ability to attract investment, further eroding gains from diversion. Accounting for such uncertainty reduces inflows to non-aligned countries from both blocs, amplifying the output losses of these countries and bringing them to levels close to the global average.

Alternative alignment choices highlight their significant impact on outcomes. For example, a world in which the European Union remains non-aligned entails lower costs for both itself and the China bloc economies. However, the European Union might face heavy costs if such a policy approach significantly raises the possibility of barriers between itself and the United States – due to greater uncertainty about its future alignment.

Finally, the model clearly shows that the blocs' incentive to attract emerging market and developing economies (for instance, through favourable trade and investment treatment or fiscal measures to encourage friend-shoring to target economies) might give non-aligned regions some bargaining power, but could also generate the type of damaging uncertainty that reduces investment.

LESSONS FOR POLICY

Many policymakers have recently argued that reconfigured supply chains could potentially strengthen national security and help maintain a technological advantage over geopolitical rivals. But there are also potentially large economic costs to reshoring or friend-shoring of FDI, as the results discussed in this chapter show. The estimated economic costs from FDI fragmentation provide a rationale for a robust defence of global integration, at a time when the case for inward-looking policies is gaining voice, especially among major economies.

Policymakers will need to carefully balance the strategic motivations behind reshoring and friend-shoring against economic costs to the countries themselves and to third parties. At the same time, the current rules-based multilateral system must adapt to the changing world economy and should be complemented with credible 'guardrails' to mitigate global spillovers, especially to the most vulnerable countries (Aiyar et al. 2023).

Finally, noting that policy uncertainty amplifies losses from fragmentation, especially for non-aligned countries, effort should be devoted to minimising such uncertainty. Improving information sharing through multilateral dialogue would support this goal. In particular, the development of a framework for international consultations – for instance, on the use of subsidies to provide incentives for reshoring or friend-shoring of FDI – could help identify unintended consequences and promote transparency on policy options.

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CHAPTER 13

US-China decoupling: Rhetoric and reality[1]

Caroline Freund,ᵃ Aaditya Mattoo,ᵇ Alen Mulabdicᵇ and Michele Rutaᶜ
ᵃUC San Diego; ᵇWorld Bank; ᶜInternational Monetary Fund

In the wake of US-China tensions, the supposed phenomena of reshoring, nearshoring and deglobalisation are dominating the news. Google search trends show all three terms experiencing high levels of search activity since 2020 (Figure 1). The economic consequences of deglobalisation are a growing concern for policymakers (Aiyar et al. 2023) and economists have begun to estimate the economic costs for the world economy of different breakup scenarios (Bolhuis et al. 2023, Cerdeiro et al. 2021, Goes and Bekkers 2022, IMF 2023).

FIGURE 1 **SEARCHES FOR "NEARSHORING", "DEGLOBALISATION" AND "RESHORING"**
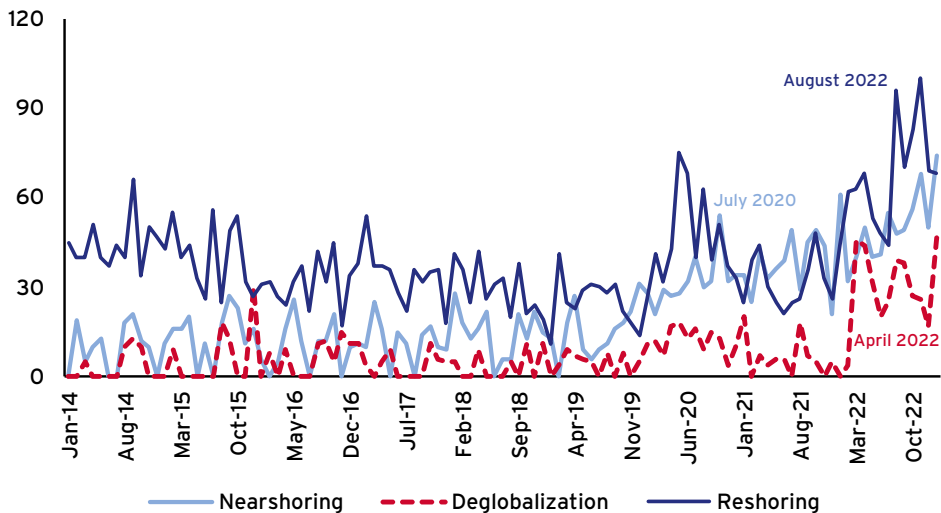
Deglobalisation appears to be everywhere except in the (aggregate) trade statistics. Goods trade was at an all-time high in 2022, after years of slow growth. US imports in 2022 were close to pre-COVID levels, providing little support for the notion of reshoring.

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1   The views expressed in this chapter are those of the authors and do not necessarily represent the views of the institutions they work for.

Even if we focus just on US-China bilateral trade relations, US merchandise imports from China in 2022 were more than 30% higher than levels in 2017, despite the tensions and the tit-for-tat tariffs imposed during the Trump administration.

In a recent paper (Freund et al. 2023), we investigate this disconnect between rhetoric and reality, focusing on the trade effects of the US-China trade war in 2018 and 2019.[2] In that period, US imposed tariffs on over 60% of imports from China, mostly at the 25% level (Bown 2023). We use granular trade and trade policy data from the United States between 2017 and 2022 (i.e. pre- and post-trade war) and show that underneath the aggregate trends discussed above, trade and global supply chains are indeed responding to policy. US-China decoupling may be starting to take shape, but a close look at the data shows that this process may be unfolding in unexpected ways.

FIVE LITTLE-KNOWN FACTS ON US-CHINA DECOUPLING

Let us start with a set of stylised facts illustrating how US trade policy is affecting trade and global supply chains.

- *First, US-China decoupling is happening as China's share in US imports started declining in 2018* (Figure 2). China's share in US imports fell from 21.6% to 16.3% between 2017 and 2022 and is now back at the level it was in 2007, before the global financial crisis. For strategic goods (i.e. the products the US government lists as Advanced Technology Products), this decline was dramatic, from 36.8% in 2017 to 23.1% in 2022 – a decline of over 13 percentage points.

FIGURE 2   CHINA'S SHARE OF US IMPORTS
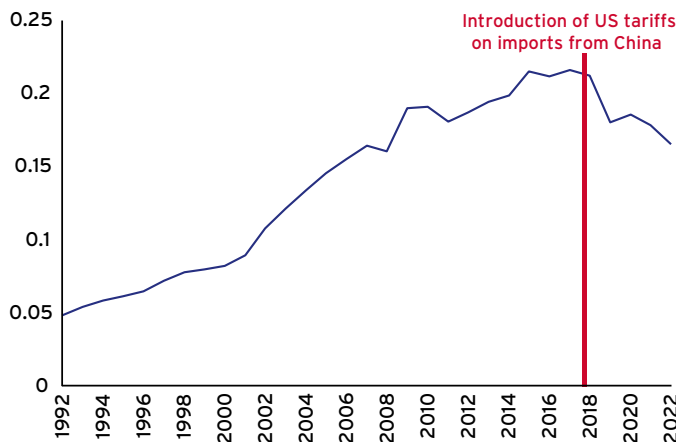
2   A growing body of literature studies the US-China trade war. Amiti et al. (2019), Fajgelbaum et al. (2020), Cavallo et al. (2021) and Flaaen et al. (2020) find that US consumers and importers have borne the brunt of the tariffs through higher prices. Handley et al. (2020), Flaaen and Pierce (2019), Amiti et al. (2019) and Fajgelbaum et al. (2020) find that the tariffs reduced US export growth, employment, and real income in China and US. Finally, Fajgelbaum et al. (2023) examine the impact of the US-China trade war on exports by third countries, finding that they largely increased exports to the US and to the rest of the world in response to the tariffs.

- *Second, the decline in China's share in US imports was concentrated in tariffed goods* (Figure 3). In 2022, US imports from China in tariffed goods were 12.5% lower than in 2017, while imports from the rest of the world surged in those same products. No similar pattern can be detected in the products that were not hit by the tariffs, where the change in imports from China does not appear significantly different from the change in imports from the rest of the world. The sizeable reduction in China's share in tariffed products and the increase in overall US imports together suggest that tariffs have induced importers to turn to new sources of supply.

FIGURE 3   CHANGES IN US IMPORTS, TARIFFED AND NON-TARIFFED GOODS, 2017-2022
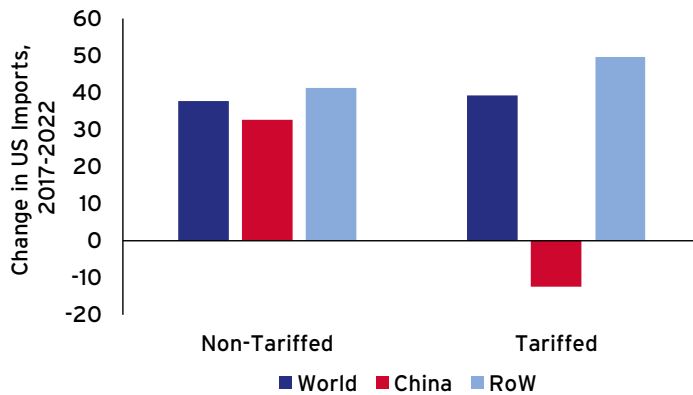
- *Third, certain countries have more prominently replaced China in the US market* (Figure 4). The figure shows prima facie evidence on the reshuffling of the top US trade partners from 2017 to 2022. Focusing on the overall shares, the countries with the biggest gains in market share were Vietnam (1.9 percentage points), Taiwan (1 percentage point), Canada (0.75 percentage points), Mexico (0.64 percentage points), India (0.57 percentage points) and Korea (0.53 percentage points). These six countries more than account for China's 5.3 percentage point decline.[3] For strategic goods, Vietnam and Taiwan appear to have gained the largest market share in the US over the period.

3   The combined gain of these set of countries does not mean that these countries are the main or only beneficiaries, as they might be increasing their market share in products that China does not export or for reasons unrelated to China. It also overlooks small countries that may have gained significantly in niche products, but whose overall market share is small.

FIGURE 4   IN US IMPORTS BY PARTNER COUNTRY, 2017-2022
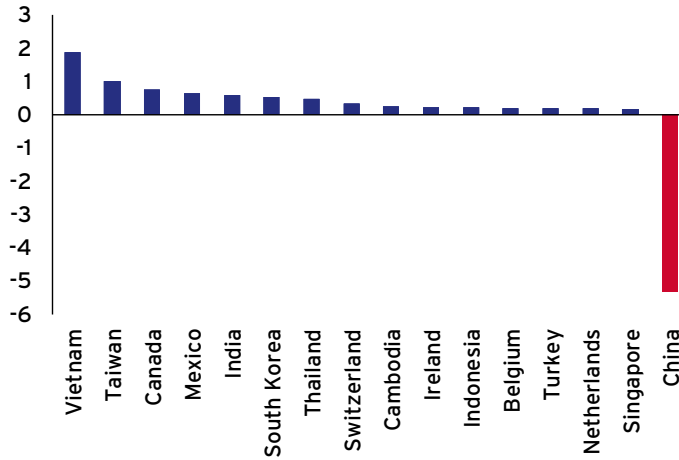
- *Fourth, this reshuffling in US imports was not associated with an increase in diversification of US import sources* (Figure 5). The average Herfindahl-Hirschman Indexes (HHI) across products and time show little variation. Tariffed goods generally have a more diversified supplier base than non-tariffed goods (suggesting that limited diversification may not have been a key reason to impose the tariffs). But for both tariffed and non-tariffed products, HHIs have only marginally declined over the period, indicating that import diversification has remained fairly stable regardless of the imposition of the tariffs.

FIGURE 5   AVERAGE HERFINDAHL INDEXES, TARIFFED AND NON-TARIFFED GOODS, 2017-2022
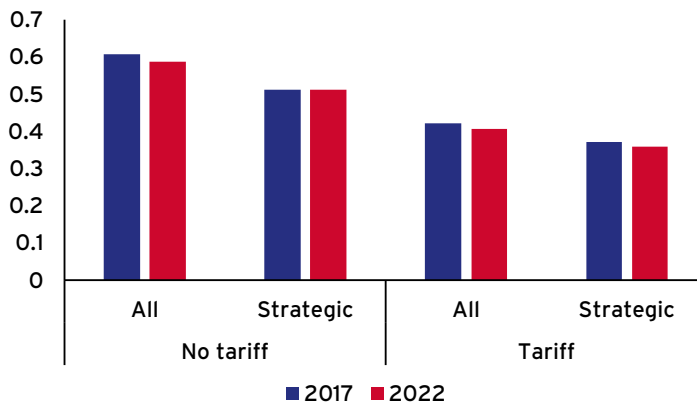
- *Fifth, countries that exported more to the US also increased their linkages with China* (Figure 6). While China is being replaced by other exporters in the US market, the prima facie evidence points to the fact that US dependence on China may still be an issue. The figure shows that for electronics, the industry that contributed most to decoupling and which contains many strategic products, countries that increased exports to the United States also increased imports from China in the sector. This high correlation suggests that linkages with China turn out to be especially important for those replacing China in the US market. Put differently, to displace China on the export side, countries have embraced industry-wide supply chains with China.

FIGURE 6   TRADE IN ELECTRONICS (HS85): CHANGES IN EXPORTS TO THE UNITED STATES AND IMPORTS FROM CHINA
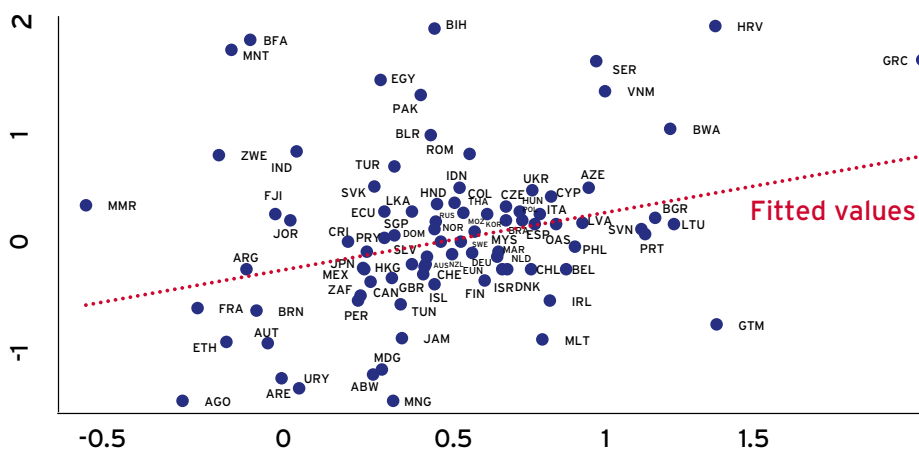
TARIFFS ARE CAUSING DECOUPLING, BUT ARE NOT ENDING DEPENDENCE ON CHINA

In our recent work, we investigate these issues exploiting 10-digit import data at the country level from US Customs for 2017 and 2022. The analysis relies on a simple identification strategy. First, we focus on differences between trade in tariffed and non-tariffed goods, controlling for product and market characteristics. Second, we examine the country characteristics that are associated with replacing China, especially in strategic sectors. Apart from the change in imports from China, we also investigate whether the tariffs led to a diversification of imports, reshoring, nearshoring or friendshoring.

We find that the tariffs led to a decline in imports from China and stimulated export growth in other countries. But US import diversification of tariffed goods, or of goods with declining import shares from China, did not increase markedly. Given that overall

imports in these products grew at rates similar to those of other goods, there is also little evidence that the United States re-shored production. When we focus on strategic industries, defined as the eleven 2-digit sectors where the US government's list of Advanced Technology Products reside, we find the impact of US tariffs on imports from China is higher. Though there is weak evidence of an increase in import diversification, there is no robust evidence of re-shoring even for these products.

Finally, we investigate which countries picked up the slack as US imports moved away from China. We perform a difference-in-differences analysis, comparing shifts in trade patterns of products where the import share of China fell markedly with the shifts in other products, while controlling for exporter and product specific time-varying shocks. We find that countries with revealed comparative advantage in a product improved their market share. We find evidence that countries that saw faster export growth to the United States in strategic sectors also had more intense intra-industry trade with China in those same sectors. This finding is consistent with the view that the reshaping of US imports away from China in strategic sectors may not have reduced dependence on China as much as import numbers suggest. These countries also experienced faster import growth from China at the 6-digit level, which could reflect transshipment or additional supply chain effects. Other (non-strategic) goods conformed more to the predictions of a gravity model, flowing to large, developing countries that could offer competitive wages.

CONCLUSION

The evidence in our research highlights the tension between efficiency and decoupling. A full reshuffling of global supply chains is not only a long-term process, it is also costly and could only be induced by pronounced and prolonged government intervention. Moreover, decoupling in direct trade may only serve to deepen the indirect linkages between US and China through the industrial supply chains of their trade partners.

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CHAPTER 14

Discussion of geoeconomic fragmentation, global value chains, and foreign direct investment[1]

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This conference, the proceedings of which are contained in this CEPR eBook, has been convened at a time when globalisation is confronting its most severe test in at least half a century. While it seemed for several decades that ever-closer global integration was 'inevitable' (to quote the Marvel character Thanos), recent events – including the Brexit referendum, the escalation in US-China tariffs, and the trade restrictions seen during the Covid-19 pandemic – have made it amply clear that globalisation should not be taken for granted.

For global value chains, these recent events have cast doubt on the wisdom of the extensive cross-border sourcing and production arrangements that firms have come to rely on. Many of us will remember, for example, the shortages of essential goods in the early months of the Covid-19 pandemic, which triggered broad calls to make supply chains more resilient. Meanwhile, geopolitical tensions between the United States and China have stoked concerns that the United States' dependence on China-based suppliers constitutes a national security vulnerability. In response, political actors in key countries around the world have *de facto* called 'timeout' on a further embrace of global supply chains. The policy messaging has instead turned toward urging a reconsideration of sourcing partners, to 'reshore', 'nearshore', or 'friendshore' to better manage supply chain risk in the current fraught landscape. In the United States, this has been backed by the rollout of generous subsidies (read: industrial policies) to promote domestic capabilities in industries, such as semiconductors and electric vehicles, deemed to be of strategic importance.

Against this backdrop, the papers by Ahn et al. and Freund et al. take important dives into what the data are already telling us about how geoeconomic fragmentation is affecting global supply chains. At first glance, one may be left with the impression that current deglobalisation trends have so far been mild. After all, trade as a share of world GDP has been flat rather than falling in the past ten years (see Figure 4.1 in Ahn et al. 2023), while US imports from China have actually grown in level terms between 2017–2022

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1   This discussion relates to the papers as presented at the IMF conference rather than the respective chapters in this eBook.

(Freund et al. 2023). This is nowhere near the reversal witnessed during the last major deglobalisation episode – the inter-war period (1918-1939) – when world trade collapsed by two-thirds under the weight of protectionist policies (O'Rourke and Williamson 1999). Why then sound the early alarm on geoeconomic fragmentation?

The paper on "Geoeconomic fragmentation and foreign direct investment" by Ahn et al. cogently summarises what is at stake. At a basic level, it is important to remind ourselves of the static efficiency and welfare gains that countries would be turning their backs on by retreating from globalisation. The recent academic literature has developed powerful modelling tools that have enabled researchers to quantify the gains from trade liberalisation (Arkolakis et al. 2012), as well as the gains from openness to FDI and multinational production (Garetto 2013, Ramondo and Rodriguez-Clare 2013, Arkolakis et al. 2018). These gains are magnified in production settings with global value chains, where it is not just final goods that are traded across borders, but also intermediate inputs and goods-in-process (Caliendo and Parro 2015, Antràs and de Gortari 2020, Antràs and Chor 2022). From a more dynamic perspective, countries that are shut off from international trade and FDI lose out on potential technology transfers and productivity spillovers. These are often transmitted through supply chain links that facilitate engagement and learning from foreign companies (Javorcik 2003, Harrison and Rodriguez-Clare 2010, Alfaro-Ureña et al. 2022).

What is at stake goes beyond dollars and cents. Casting an eye back once again to history, the *raison d'etre* for the creation of the Bretton Woods institutions was precisely the recognition that multilateral cooperation across countries, including on economic matters, would be a crucial element for preserving peace as the world emerged from the embers of World War II. Put simply, economic integration raises the costs of conflict and war, and so should discourage a resort to military action. It is fitting then that the current early warning signals against geoeconomic fragmentation are being sounded by none other than the IMF.

Turning specifically to the analysis, the authors document several patterns in FDI flows that warrant attention. Most notably, greenfield FDI projects worldwide have been on the decline since the Global Financial Crisis of 2007–2009 (Figure 4.1). At the same time, outward FDI from the US has been directed increasingly to the United States' 'friends', such as Costa Rica, Canada and Korea, rather than to locations such as China and Hong Kong (Figure 4.6). Since multinational companies are estimated to be involved in some manner in up to 80% of global value chain transactions (UNCTAD 2013), these trends will surely have repercussions moving forward for supply chain trade. This does not bode well particularly for emerging and developing economies. The study's model-based assessments indicate that these economies are likely to suffer more in welfare terms than advanced economies, since they would lose access to knowledge transfers if the diffusion of technology were to be segmented along geopolitical lines.

Two comments for future work are worth raising, the first of which relates to the measurement of FDI. It is not straightforward to collect comprehensive information on cross-border direct investments, since there are no one-stop clearing-houses for these data in the manner that customs authorities serve as a natural repository of trade transaction records. This paper has opted to focus on greenfield investments as tracked by the fDi Markets database, which gathers this information from public announcements and news releases (among other sources). To be fair, this focus on greenfield FDI is not a bad starting point: decisions over the initiation of projects should in theory be particularly sensitive to shifts in geoeconomic risk, given the large sunk and fixed costs that need to be committed to set up a foreign affiliate or equip an overseas factory.

Having said that, information on exit decisions will surely become important over time if one is to gauge the full impact of geoeconomic fragmentation on FDI. As firms arrive at critical decision points where they need to consider whether (or not) to extend the life of an overseas affiliate, a climate of heightened geoeconomic risk may well tip more multinationals toward downsizing or outright divestment. This will present data hurdles: while firms and host countries are often willing to announce the commencement of new FDI projects, they might be less keen to be the public bearer of bad news. Systematic data on exits from FDI are thus inherently more difficult to gather. One might imagine that such a database would have to triangulate information from multiple sources, including news about factory shutdowns or the unwinding of foreign ownership stakes, as well as from continuous monitoring of multinational affiliates' output and employment in key economies around the world. A concerted effort to fill this data gap would go a long way towards building a more comprehensive picture of FDI trends in the current age of geoeconomic fragmentation.

A second comment relates to how we should think conceptually about countries' decisions over their geopolitical alignment. If current trends were to persist, one could imagine that many countries may be faced with an explicit foreign policy decision over which pole – the United States, China, or perhaps the European Union – they should align themselves to. These decisions are not going to be made in a vacuum. Instead, one could well expect that existing bilateral economic links, particularly long-term engagements such as is the nature of FDI, would influence this alignment decision. In more concrete terms, countries that already benefit from the presence of US multinationals may find it most natural to align themselves with the United States; on the other hand, countries that are part of the Belt and Road Initiative may naturally be more inclined toward China. There is thus an endogeneity issue to contend with, if we are seeking to establish a causal impact running from geoeconomic fragmentation to realised patterns of FDI. Toward this end, a potentially fruitful approach might be to exploit 'surprise' election results that lead to unanticipated changes or about-turns in countries' foreign policies, to study how such events might shake up the level and sources of FDI received by these countries.

Switching gears, the paper on "Is US trade policy reshaping global supply chains?" by Caroline Freund et al. studies the impact of geoeconomic fragmentation on supply chains from an international trade perspective. Armed with the latest product-level US trade data, the authors show that growth in US imports from China has slowed particularly for goods hit with US tariffs, and especially so for strategic goods. This has resulted in a marked drop in China's share in total US imports, from 22% in 2017 to 16% in 2022. This decline in China's importance as a source country has not been accompanied by significant signs of reshoring, nor has it brought about a greater diversification of import sources. Instead, the slack has been picked up by imports from alternative origins – namely, Vietnam, Taiwan, Canada, Mexico, and India – as corroborated by Fajgelbaum et al. (2023) and Grossman et al. (2023). A dramatic reshuffling in the composition of US imports is thus well and truly underway.

On this front though, a closer investigation is needed on the following: to what extent is the decline in the China import share being driven by the relocation of production out of China into third countries such as Vietnam and Mexico, rather than being due simply to a re-routing of trade flows with minimal value being added in the transit country? The reality is likely that both interpretations of the data are playing out in practice, but possibly for different categories of traded products. A more definitive answer will have to await the availability of data for this period on manufacturing production and employment in Vietnam and Mexico, as well as information on the composition of these countries' imports from China and exports to the United States. There are surely multiple papers to be written on this topic, to discern the true extent to which supply chain activity is shifting out of China.

Freund et al. conclude that while there has been some direct decoupling of US supply chains from China, the United States nevertheless remains indirectly coupled to China given the strong trade links between China and third countries such as Vietnam. From a policy perspective, this raises the thorny question whether it is at all feasible to pursue a goal of supply chain disentanglement from China, given that indirect imports are much more difficult to target with trade barriers. Moreover, the fact that companies appear now to be turning to supply chain options in third countries that were previously available but not favoured suggests that these shifts will ultimately create upward cost pressures for final goods in the United States. If so, more work is needed to understand how much of these additional costs are being passed on to American consumers and contributing to inflation. On a related note, if supply chains are indeed becoming more circuitous with added transit nodes, one has to wonder how much this will actually advance the goal of supply chain resilience.

To sum up, these two papers are important and timely efforts at sizing up how geoeconomic fragmentation is already impinging on established patterns of foreign direct investment and global supply chain activity. What is clear from the available data is that the world as it stands in mid-2023 is at the early stages of what could be dubbed a 'Great Reallocation' of economic activity: US outward FDI and supply chains have started shifting away from

China toward partner countries that are either geographically closer or geopolitically more aligned with the United States. While these trends are still nascent, they bear close and vigilant monitoring, to guard against the risks of even more severe fallout should this geoeconomic fragmentation persist and major world powers such as the United States and China become more economically disengaged from each other.

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Davin completed his A.B. in Economics *summa cum laude* from Harvard University in 2000. He also holds an A.M. in Statistics (2000) and a Ph.D. in Economics (2007) from Harvard.

SECTION 6
CONCLUDING REMARKS

CHAPTER 15

What's next for economic research on geoeconomic fragmentation?

Pierre-Olivier Gourinchas
International Monetary Fund

The contributions collected in this eBook succinctly summarise how a growing literature in international economics is trying to understand and quantify the channels though which geopolitical tensions and fragmentation could affect the global economy. In the following I will argue that, even if we are still far from a fragmented world, there is no scarcity of signs that we could go down the road of more fragmentation. Moving from the main takeaways discussed in the eBook, I will then elaborate on where I think the research efforts – both on the modelling and the empirical side – and policy priorities should be directed at.

The economic costs of geoeconomic fragmentation are difficult to understate. As discussed in several contributions in the eBook, estimates vary widely and are highly uncertain. But these costs can be very large for individual countries, with emerging and developing countries often hit the hardest, as they may be forced to align with a particular bloc from where they source most of their inputs and conduct most of their trade, and on which they rely financially, thereby losing out disproportionately on knowledge spillovers from alternative sources.

Yet, the risks of geoeconomic fragmentation seem to be at odds with aggregate statistics. Despite all the talk of deglobalisation, trade in recent years proved to be very resilient to multiple shocks (Sher et al. 2022) and the world economy is still highly integrated. Even when we look at trade between China and the United States, where the trade relationship is most tense, we still have that US imports from China in 2022 are over 30% higher than in 2017. Financial flows are still very integrated. For instance, even if the momentum has slowed since the global financial crisis, cross-border external positions expanded sharply since the 1990s. Also, portfolio investment from major economies into China were still on the rise in 2021 (IMF 2023a).

So, is it all 'scare tactics'? Not really. Although we are not yet in a fragmented world, we are observing important cracks in the system.

First, policies are changing. If we look at trade policy, the share of G20 imports that are affected by trade restrictive measures increased from around 2% in 2011 to close to 12% ten years later (IMF 2023b). More concerning is that the path we are embarking on can easily lead to unintended fragmentation. All 'policy signals' – trade policy, industrial policy, security policy – point in the same direction.

Second, when we look at the data more closely, we already see important changes. The US-China trade war is reshuffling trade patterns. Because of the tariffs, US imports from China of goods subject to the 2018-2019 tariffs were 12.5% lower in 2022 than in 2017, as shown by Freund et al. (2023). Similarly, our recent work at the IMF (IMF, 2023a, 2023c) documents early signs of fragmentation in capital flows, which are increasingly concentrated among geopolitically aligned countries.

How things will evolve is difficult to predict. Sanctions and trade barriers are difficult to enforce over the longer term. The impact is sharp at first because the elasticity of substitution is lower, but economies adapt; the experience of Europe dealing with Russian gas is a case in point.

Where do we go from here? In the remainder, I will highlight three areas where I believe researchers and policy makers should focus.

On the *modelling* side, the last decade witnessed a big wave of innovations in the international trade literature: quantitative structural trade models became a norm in both academic research and policy analysis – as attested by some contributions in the eBook. However, the frontier of these structural trade models mostly features static or long-run steady-state equilibria, and thus they are unable to offer insights on transitional dynamics. Likewise, although incorporating global input-output linkages into such quantitative models greatly improved our understanding of cross-country spillovers in the presence of global value chains (GVCs), the literature is only starting to fully account for the network structure of GVCs, which is critical to better identify the transmission mechanism from potential fragmentation (Antras and Chor 2022). By contrast, dynamic stochastic general equilibrium (DSGE) models developed in the open economy macroeconomics literature are well suited for explaining transitional dynamics, but the lack of granularity – often abstracting away from global input-output linkages – means that the inter-industry and cross-country spillover effects tend to be overlooked. In this sense, narrowing the gap between these two strands of literature is hard, but essential.

When considering estimates of the costs of fragmentation, it is important to keep in mind that most of these exercises should be taken with a grain of salt, as the models are often estimated in partial equilibrium, focusing on one (or a few) transmission channel(s) of fragmentation, while other relevant channels are shut down. These channels, however, do not operate in a vacuum and are likely to be connected. It is critical – but difficult – to understand how they interact, as they could trigger fragmentation along other dimensions and reinforce each other, leading to more adverse outcomes. More precisely, there are first-order effects of each individual channel of transmission and second-order

effects of the interaction of the various channels. Both are important but can hardly be captured by a model in practice. For instance, some of the estimated losses from trade fragmentation are likely to multiply once one takes into account reductions in labour flows and capital flows, and a deterioration in the provision of global public goods. Being able to incorporate first- and second-round effects in quantitative models will be essential to generate more realistic scenarios.

On the *empirical* front, closely monitoring early signs of fragmentation can critically help policymakers to understand the intended and unintended consequences of trade and industrial policies. For instance, while trade restrictions are indeed having a significant effect in reshaping global supply chains, these effects may be quite different from what these measures intend to achieve. US tariffs on China have reduced efficiency and increased prices in the United States (Fajgelbaum and Khandelwal 2022), but as shown in Freund et al. (2023), they have so far not helped to improve diversification of import sources – a stated goal of the measures. Learning from early evidence can contribute to improve policies.

Better and more convincing evidence can only come with access to more micro-level data. Transaction-level customs datasets merged with firm-level or bank-firm matched datasets have become increasingly available, enriching empirical evidence on the behaviour of exporters and importers. This in turn has helped improve calibration of quantitative models. Similarly, more granular data on capital flows are becoming available, but much more is needed.

When administrative data are not available (or accessible), alternative data (e.g. shipping data) and big micro-level data with high frequency indicators can greatly improve our capacity for real-time analytics. In this regard, let me highlight the 'data hub initiative' launched at the IMF to improve access to micro administrative data, which will also be able to contribute on this front.

Turning to *policies*, I would argue that the most significant change in recent times has been the growing activism on the policy front, including trade policy, industrial policy, and climate policy. This activism is justified in some cases, but also poses many challenges. Some of these policies generate strong negative spillovers, intended or not. There is a growing risk that these measures will lead to retaliation and further policy escalation. Policy uncertainty will further take a toll on the global economy by delaying investment decisions. Monitoring policies and assessing their (intended and unintended) economic implications and cross-border spillover effects is a priority, not only for policy work but also for research. Structural trade models can be used to assess the effects of different policy scenarios in an attempt to identify the policies that achieve intended domestic goals while minimising the disruption to trade partners.

But the goal of research and international institutions cannot be limited to monitoring policies and quantifying their effects. There is a need to find solutions to underlying problems. This is why the IMF, together with other international organisations, is calling

for stronger multilateral efforts to resist geoeconomic fragmentation (Aiyar et al. 2023). When multilateral efforts stall, open and non-discriminatory plurilateral initiatives could be a practical way forward. When countries opt for unilateral actions, credible 'guardrails' may be needed to mitigate global spillovers and protect the vulnerable. Part of our job is to use economic analysis to help identify policy solutions. For example, there is a long tradition of using game theory and mechanism design to study the efficiency of rules in trade agreements (Bagwell and Staiger 2016). This approach can be used to answer difficult questions, from the design of green subsidy schemes to guardrails on the use of export controls to achieve food or national security.

Overall, I think that the research presented at the IMF conference on Geoeconomic Fragmentation and summarised in this eBook has been extremely helpful in taking stock of what we know and shaping the direction of future research. But it is just a first step. One thing is clear: more work is needed. This is an exciting challenge, and I am sure new and insightful research will come soon.

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After decades of increasing global economic integration, the world is now facing the risk of fragmentation. Global cross-border flows of goods, services and capital have slowed down markedly after the global financial crisis, against the backdrop of increasing trade tensions between the US and China, and more generally a rise in populism and greater scepticism about the benefits of globalisation. Cross-border trade restrictions have risen sharply, industrial policies to favour domestic production are back in vogue, there is mounting evidence that trade flows are being reshuffled across countries, and foreign direct investment is increasingly clustered among geopolitically aligned countries.

The economic literature on 'geoeconomic fragmentation' is still in its infancy, but is evolving rapidly in line with the political salience of the topic. This eBook brings together several key papers presented at a conference organised in May 2023 at the International Monetary Fund, analysing different aspects of geoeconomic fragmentation. The papers are authored by a distinguished cast of academics and policy officials, and each paper is discussed by an independent expert. For the purposes of the eBook, each article is distilled to the essentials of the analysis, thus providing the reader with an easily accessible and broad-ranging review of the field.

The contributions in this volume consider the impact of a fractured global economy along many dimensions, including trade, financial flows, technology diffusion and global value chains. They underscore that costs from fragmentation can be very high, even if unintended, and that emerging and low-income countries stand to lose the most, because of their distance from the technological frontier. Fragmentation can also make it more difficult to provide cooperative solutions to inherently global problems, such as climate change and pandemics. Urgent action is therefore needed by politicians and policymakers to ensure that the benefits of many decades of global integration are not lost.