



IMF RESEARCH

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perspectives



**SUPPLY CHAINS,
INTERRUPTED.**

**PERFECT STORM:
COVID-19, Trade Wars,
and Natural Disasters**



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IMF RESEARCH *perspectives*

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NOTE FROM THE GUEST EDITOR

Have prices at your local barbershop increased recently? Have you waited longer than usual for your holiday gifts to arrive? What do a container ship stuck outside the port of Los Angeles, US, and a plant closure in Ningbo, China, following a COVID-19 outbreak have to do with this? The answer is global supply chains. Recurring lockdown orders and the inability of the global transportation system to cope with the booming demand for consumer goods in some parts of the world have resulted in major disruptions in global supply chains during the pandemic. These supply chain disruptions have [largely contributed to rising inflation pressures](#) reverberating through virtually all aspects of our local economies.

The Fall/Winter 2021–22 issue underscores the degree of interconnectedness of the world economic system and how diverse shocks transmit through global supply chains. In the context of the pandemic, research featured in this issue tracks the transmission of supply chain disruptions triggered by the COVID-19 lockdowns and explains why trade networks are so difficult to disentangle. The pandemic is not the only reminder of the role of global supply chains, as demonstrated by the articles on the cross-border spillovers of technology wars and natural disasters.

The overarching message from these articles is clear: there is a need for international cooperation to deal with the consequences of these shocks—whether it is ending the [COVID-19 pandemic](#) or [mitigating climate change](#).

~Mariya Brussevich

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INTERVIEW WITH DENIZ IGAN

Former Editor-in-Chief of
IMF Research Perspectives



About Deniz

Let's start with the basics. How did you choose economics as a profession? Growing up in Turkey, I had an early encounter with certain macro-economic concepts. Chronic high inflation was a defining feature, and even seven-year-olds understood how quickly the purchasing power of their weekly allowance dwindled. I would hear my parents—who are teachers, not economists—discuss the current account deficit during dinner. Soon enough, the economics section had become my favorite part of the newspaper, and I wanted to understand how the Turkish economy worked and why it appeared to be so different from the advanced economies.

... and more specifically, what attracted you to economic policy institutions? First, the IMF and most recently the BIS (Bank for International Settlements). The natural question to me after trying to understand an economic or social phenomenon is: Can we make it better and how? Along with my increasing awareness of inflation and

the current account deficit came some familiarity with the IMF. Turkey had a series of IMF programs, and visits by the IMF team would be in the headlines. As a PhD student at Princeton, I had the opportunity to attend a talk by Kalpana Kochhar, the former HR Director of the IMF. Her description of life as an economist at the IMF—the opportunity to apply insights from research to challenges faced by the member countries and the constant learning from each challenge—was instrumental for me to apply to the [Economist Program](#). I particularly enjoy the sharing of experiences and knowledge among policymakers, which the BIS offers as a place for central bank governors to regularly meet and discuss the current issues they are facing.

IMF RP work

How did the idea of *IMF Research Perspectives* (RP) come about? How does it differ from its predecessor? Good research is important, but it is equally important to get the message out in an accessible way. The vehicle we had, the *IMF Research Bulletin*, featured rather technical



Istanbul, Turkey

summaries and felt too formal. So, in 2018, with co-editor Chris Papageorgiou, we set out to revamp it to present the more approachable, more human side of IMF research and of IMF researchers. We transformed what used to be the Q&A feature into a complete interview. We added more research summaries to give the readers a better sense of what IMF research has to offer on recent topical issues. We changed the design to make the reading experience more enjoyable and reaching out to the contributors easier. And, of course, we changed the name from Bulletin to Perspectives, which more accurately reflects the new approach focused on sharing views and encouraging interaction. Of course, such an undertaking would not have been possible without the support of Maury Obstfeld (who was the Chief Economist at the time) and without a dedicated group of individuals: the guest editors, the contributors, and the marvelous design team.

What were the most rewarding aspects of being a co-editor of the IMF RP? Put in the simplest way: the people. Being a part of the IMF RP team helped me get to know not only other economists but also design and communications professionals that I may not have had a chance to meet and work with otherwise. I was impressed with the creativity and the camaraderie in every step of the way, and built relationships that will last a long time. Equally important has been the recognition from outside the Fund, and I do not mean the newspapers or blogs picking up on a piece we had published but individuals—young researchers from central banks and economics students in universities—reaching

out to express their appreciation of how we covered an issue or to get in touch with an IMF economist whose research they wanted to learn more about. Sparking a conversation is what we had wanted to accomplish.

How do you envision this publication moving forward? The strength of IMF RP is the whole institution behind it, from the editorial and design teams to the contributors to the leadership, whose support remains essential. As times change, so will this publication. For example, there will perhaps be more interviews in the form of podcasts. What I trust will not change is commitment to conduct and disseminate state-of-the-art, policy-relevant research to foster further discussion for better policymaking around the world in the most accessible, inclusive way possible.

Current issue theme

Your research often revolves around [macro-financial linkages](#) and [real estate markets](#).

During the global financial crisis (GFC), the interconnectedness of banks played a major role in the international transmission of the shock—the theme of this issue. How is the COVID-19 crisis different? A key difference has been the resilience of financial systems around the world. This reflects both the nature of the shock and the important policy work done over the past decade. The GFC started with a downturn in house prices—following years of exuberance—and the associated losses in the lending institutions, while COVID-19 was truly what economists call an exogenous shock—unexpected and unrelated to the prevailing economic dynamics. It did not happen because banks were overextended, which could have sent them into a tailspin as negative feedback between collateral values, credit, and economic activity took hold. Equally important is the fact that financial regulation has been reformed since the last crisis: closer monitoring and supervision helped increase the resilience of the system, and macroprudential frameworks provided buffers for financial institutions to absorb the shock.

The real estate shock we experienced during the COVID-19 crisis is also considerably different from the GFC. How do you see it playing out



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going forward? What we have seen so far in real estate markets is quite fascinating, and the full picture is still to emerge. House prices in many countries [soared](#), unlike the pattern we would normally observe at times of low economic activity. On the commercial real estate side, the sharp drop in segments like office buildings and hotels turned out to be short-lived. Some of the drivers of this acceleration in house price increases are specific to the pandemic: remote work and more time spent at home generated demand for more space, which coincided with disruptions on the supply side. Other drivers are more traditional: incomes remained stable thanks to massive fiscal support deployed, while financial conditions eased with both monetary policy and macroprudential regulations being relaxed. As policy support is withdrawn, some moderation is to be expected. We need to also see what the post-pandemic normal will be, whether there will be a return to office and travel, or a more fundamental shift in terms of how we utilize space for commercial and residential purposes.

Climate change

You have recently published a working paper in the area of [climate change](#). Can you describe the main findings of your research and your future plans for work in this important area? [Carbon taxes](#)

cushioned by transfers to vulnerable households are widely viewed as the most effective way to contain emissions, but such policies face political headwinds. In the absence of sufficient support for carbon taxes, a more sustainable approach to finance—one that incorporates environmental, social, and governance (ESG) considerations—could be part of the way forward to address climate change. However, our analysis suggests that ESG

scores tend to reflect what firms say they (will) do, not what they actually do, to contain their carbon footprints and do not capture differences across firms in their contributions to climate change. Even if sustainable investors succeeded in driving large improvements in firms' ESG performance, this would buy the global community only two more years to act relative to a business-as-usual scenario.

So, while potentially helpful, ESG investing is only one tool in what should be a larger toolbox deployed by governments and the private sector to reduce greenhouse gas emissions. That brings us to what is next to explore. Having done some research on [political influence and policymaking](#), I am very interested in better understanding the political economy of climate legislation.

Life after the IMF

How do you expect your work at BIS is going to be different from the IMF?

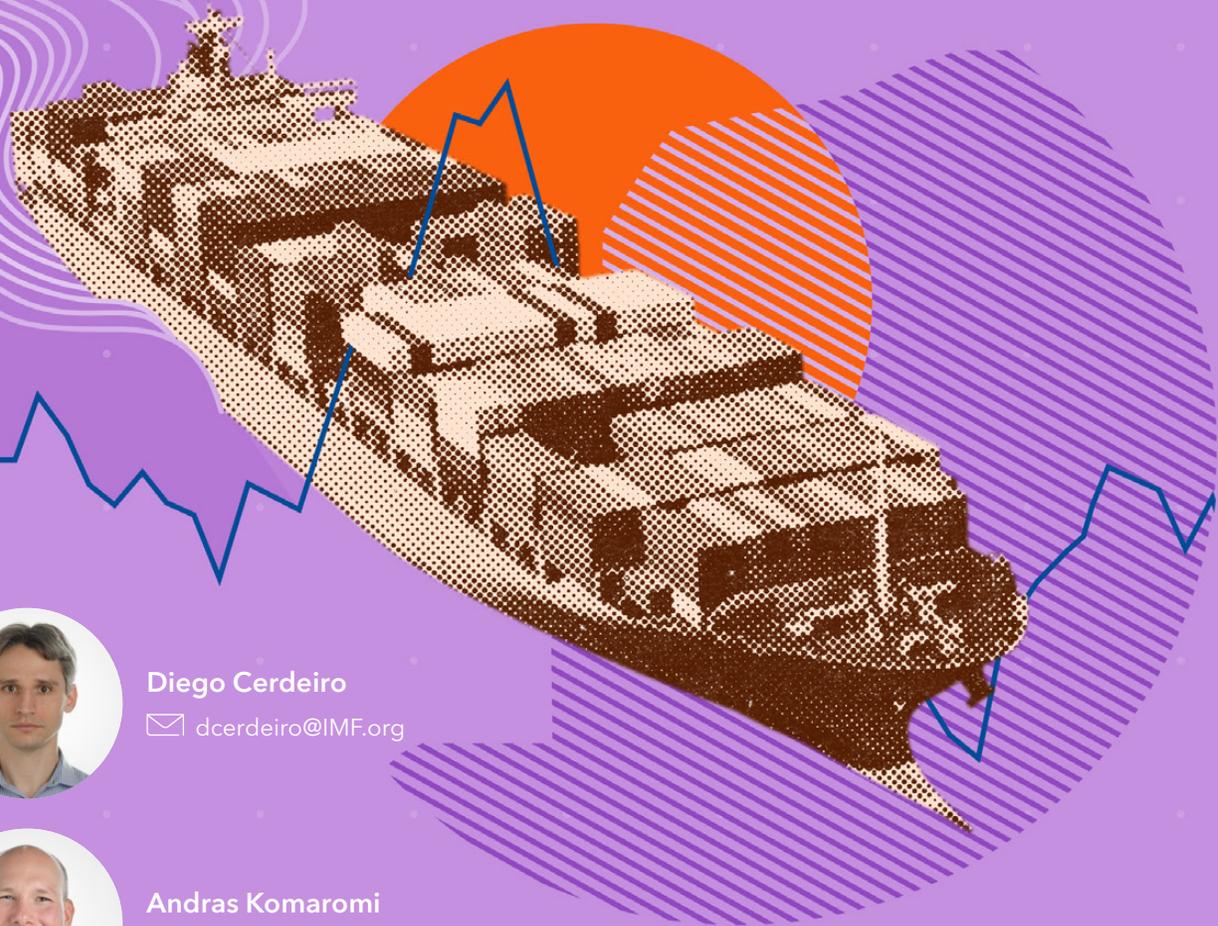
Given both organizations share a common goal of enhancing knowledge exchange among policymakers, I expect to continue doing research on current policy issues. And the two organizations collaborate on many levels, for instance, in [organizing conferences](#) on issues related to international monetary and financial stability. So I expect many aspects of my work to remain similar, but to hear more German on a daily basis (BIS is located in Basel).

What will you miss the most about the IMF?

The people. I have had the privilege to work in great teams, building relationships and making friends along the way. Each one of them will be sorely missed. My hope is that our transition to a more virtual world will help a little, and I will continue to get the latest news from the IMF RP!

Disentangling SUPPLY AND DEMAND

in Global Trade during the Pandemic



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In the early days of the pandemic, before the current upswing in trade was ushered in by both extraordinary policy support and an unprecedented [shift in consumption patterns](#), trade suffered a drop that was [not for the faint of heart](#).

As the free fall of trade coincided with the period of [the Great Lockdown](#), some observers concluded that global value chains were not reliable and that a greater degree of self-sufficiency [would foster resilience](#).

Conceptually, the reshoring argument appears at best incomplete, as sourcing from different countries also means that no single country lockdown (including at home) [could disrupt all production](#). Empirically, however, it is an interesting and open question how much lockdowns contributed to declining trade flows. In tandem with the strict containment measures that led to restrictions on economic activity across all continents, demand *also* dissipated on the back of increased risk aversion, revised income expectations, and fear of the disease. An age-old question in economics resurfaced: Were the observed changes in trade volumes driven mostly by supply or demand effects?

In our [paper](#) on lockdown spillovers during the pandemic, we separate the supply and demand channels and trace the effects of lockdown-related supply-side disruptions through the trade network.

A high-frequency data set built from radio signals

High-frequency data are key to tracking *daily* changes in lockdowns across the globe. Likewise, we estimate that more than 90 percent of international trade voyages take place in a period of less than 30 days. That is, both the lockdown shocks *and* their transmission around the world take place at a frequency that standard sources for bilateral trade data, which are reported at a monthly frequency, are unable to capture.

To address this issue, we rely on a [unique data set](#) of daily bilateral trade volumes estimated via tracking virtually all cargo ships in the world. Much like airplanes and their transponders, for navigational safety purposes cargo ships around the world are required to carry a device commonly known as AIS (Automatic Identification System). These devices periodically emit signals that are captured by satellites and—when ships are near land—by terrestrial stations. These radio signals include information on ships' positions, speed, and draft, among other variables. The high-frequency data that we use is constructed by transforming these AIS messages into voyage-level trade volume estimates through the use of various machine-learning techniques.

Identification strategy and geography-induced variation

We focus our analysis on the earlier period of the pandemic, namely the first half of 2020, as this was the time when worldwide lockdowns were the most stringent.

A country's imports during the pandemic are affected by the lockdowns imposed by the country's trading partners that supply these goods. We thus propose and construct a measure of *lockdown exposure* to trace the effects of these supply-side disruptions. The lockdown exposure of a country is a weighted average of daily indices of [lockdown stringency](#) for each of its trading partners. The weights account for the intensity of the bilateral trade linkages, while the suppliers' lockdown measures are lagged according to the delivery times between the importing country and its partner.

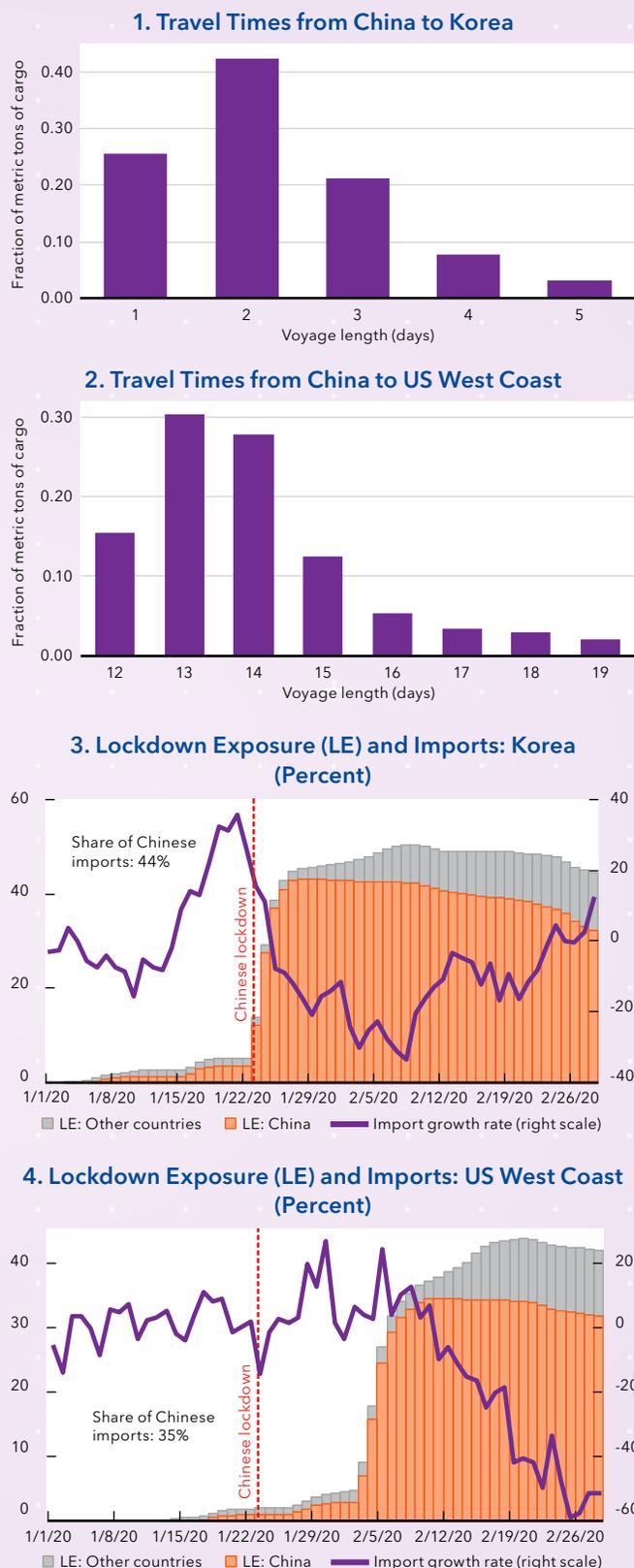
The high-frequency nature of the data yields multiple sources of variation that allow identification of the causal effect. In particular, the variation in our data results not only from different timing of lockdown measures (often referred to as "shifts" in the academic literature on shift-share design) and different import weights across countries (the "shares"), but also from the geography-induced lags in the transmission of lockdowns between countries.

Figure 1 illustrates our identification strategy. Because China was among the first countries to impose lockdown restrictions, a visual analysis of its initial effects is less likely to be affected by confounding factors, and therefore more amenable to a simple illustration. The top two panels in Figure 1 show the distribution of travel times before the pandemic in our bilateral seaborne trade data set from China to Korea (Figure 1, panel 1) and from China to the US West Coast (Figure 1, panel 2). With most trips taking between one and three days, the lockdowns imposed by China on January 23 (Figure 1, panels 3 and 4) very soon raised our measure of lockdown exposure for Korea. Korean import growth fell significantly in the wake of this sudden increase in the country's lockdown exposure. A similar pattern is observed for the US West Coast, but with a longer time lag, as geography implies that it took longer for this shock to reach the United States than it took to reach Korea. Overall import growth also fell significantly in the United States as the strict containment measures imposed by China on January 23 kicked in the region's lockdown exposure. Of course, these are only two countries in our sample, and even in these simple examples there are various possible confounding factors. To claim identification, we develop a rigorous shift-share regression design with appropriate control variables.

The effect of lockdowns: Strong but short-lived

Our empirical analysis finds very strong but short-lived trade spillovers from supply disruptions due to lockdowns. Our preferred estimate over the entire sample implies that in a hypothetical case, in which all suppliers in a country went from no lockdown to full lockdown, the country's seaborne import growth would drop more than 20 percentage points. This estimated spillover effect, however, is especially large and statistically significant in the early stages of the crisis, implying a 10 percent reduction in our measure of global seaborne trade during February–March 2020, with China's lockdowns contributing about 4 percentage points (Figure 2, panel 1).

Figure 1. Lockdown Exposure and Import Growth: Korea and the United States

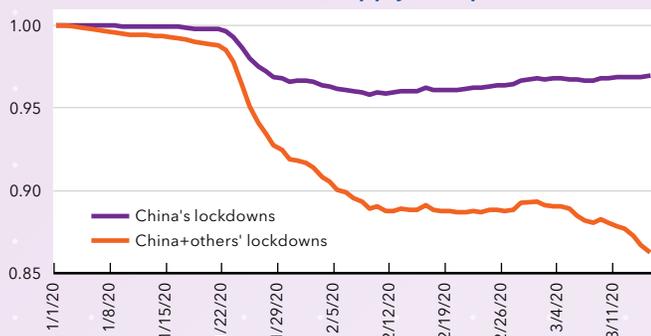


Source: Authors' calculations using Automatic Identification System data collected by MarineTraffic.

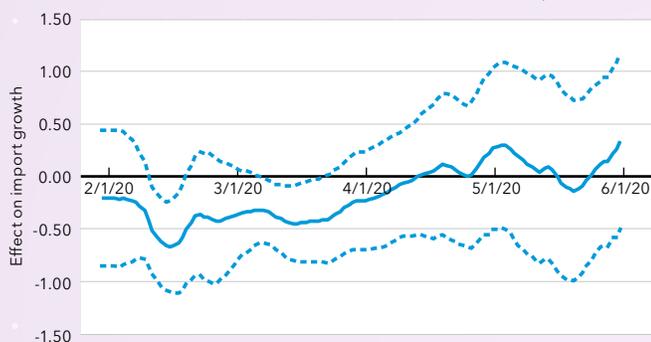
Note: Panels 1 and 2 show the distribution of travel times from China to Korea and the US West Coast, respectively. Our lockdown exposure variable captures these geography-induced lags, which affect the timing of import disruptions—as shown in panels 3 and 4.

Figure 2. Strong Initial Effect of Lockdowns, but Vanishing Significance by the end of March 2020

1. Ratio of Actual vs Counterfactual World Trade (counterfactual with no lockdown-induced supply disruptions)



2. Estimated coefficient on lockdown exposure (60-day rolling sample: t-30 to t+29, clustered standard errors)



Source: Authors' calculations using Automatic Identification System data collected by MarineTraffic.

Note: Our estimates imply a 10 percent reduction in global seaborne trade during February-March 2020 due to lockdowns, as shown in panel 1. However, the estimated effect of lockdowns becomes statistically insignificant starting in April 2020, as shown in panel 2, and suggests, in all, that the effect of lockdowns on global supply chains was strong but short-lived.

What could explain the vanishing lockdown spillovers in our empirical estimates (Figure 2, panel 2)? Shift-share designs like ours assume that some frictions prevent quick reallocation after the shock. (In our case, this would mean a swift reshuffling of trade flows from countries with strict lockdowns to countries with fewer restrictions.) Consequently, in practice, shift-share regressions test a joint hypothesis: the presence of frictions (for example, supplier relationships that take time to build) and the effect of the shock. The finding of an effect in the earlier part of our sample means that the frictions are large enough to trump any possible reallocation. Conversely, the absence of a statistically significant effect toward the later part of our sample could be either because supply chains reconfigured or because the lockdowns imposed during that later period no longer had an effect on trade flows.

Either way, the evidence suggests that already in the second quarter of the pandemic demand was in the driver's seat of international trade.

Concluding remarks

Our work confirms that lockdowns and supply disruptions did play a significant role in the trade collapse—at least at the beginning of the crisis. Countries that historically had stronger trade links with and were closer to countries under heavy lockdowns experienced larger and faster contraction in their imports. We also find some evidence for indirect downstream spillovers from lockdowns through global supply chains, as higher lockdown exposure of a country's trading partners is also associated with lower import growth.

However, these spillover effects were present only during the first two to three months of the pandemic. After that, demand effects likely dominated the evolution of global trade. In all, the short-lived trade effect of lockdowns despite the unprecedented scale of the shock should give pause for careful consideration of the benefits of creating costly redundancies in, or outright reshoring of, global supply chains.

DIGITAL DECOUPLING *and the* URGENT NEED *for* INTERNATIONAL COOPERATION



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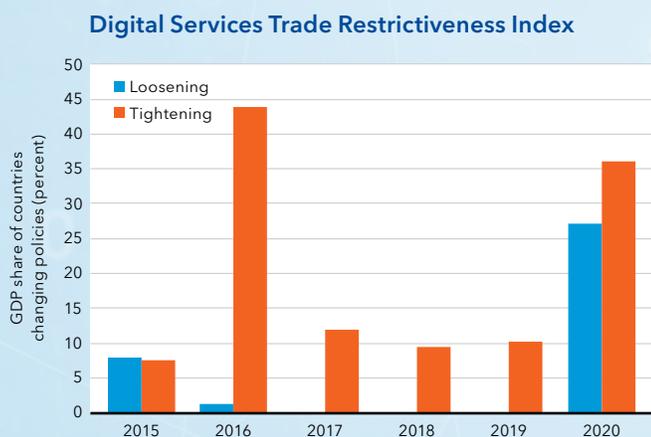
Since World War II, no economy has come close to challenging the overall technological and economic dominance of the United States—until China.

The former Soviet Union challenged the United States mainly on military and space technology. Other economies competed in selected sectors or were US allies. China is the first to compete on a similar scale, and across a broad swath of new technologies, while not being part of the US security blanket. This has raised new issues for the globally integrated trading and financial system.

The race between the United States and China to dominate the technologies of the future has already led to import and export bans of semiconductors, 5G network technologies, social media platforms, and data-based security applications across multiple countries. Over the past five years, new trade restrictions in digital services have dominated liberalization efforts (Figure 1).

Figure 1. A Digital Trade Wall

Trade-restrictive measures on digital services have outstripped trade liberalization in recent years.



Sources: Organisation for Economic Co-operation and Development (OECD); and authors' calculations.

Note: the sample comprises OECD countries and eight large non-OECD countries.

With the COVID-19 pandemic accelerating the digitalization of the economy, there was some welcome liberalization in 2020, but restrictions increased in other places. Countries have imposed

restrictions on financial market access of foreign technology firms, as well as on foreign access for domestic firms.

These restrictions have raised fears about technology wars becoming the new trade wars, leading to a decoupling, or splintering, of global supply chains with adverse consequences for many.

Classical economics teaches us that escalating trade barriers generally lower economic well-being in all countries involved, as they prevent efficient specialization and limit the variety of goods available.

But in the digital era, economies of scale and scope mean that global technological leadership is highly prized, bestowing outsized profits and the ability to set standards. The IMF's [World Economic Outlook](#) has shown that a small fraction of highly productive and innovative firms has gained dominance and enjoyed large profits over the past two decades, a particularly acute phenomenon in the digital sector.

The digital economy does not conform to traditional borders and intellectual property protections. It makes it possible to reach seamlessly across the world to collect information, learn from others, and make decisions, enhancing economic efficiency. But it also can allow malevolent actors to cross borders and steal, copy, manipulate, or destroy. In cyberspace, there are thus far no effective domestic norms or public institutions for enforcing security, such as "e-police" or an "e-justice system," and no international mechanisms for de-escalation and maintaining peace. Digitalization and connectivity have sped up the diffusion of knowledge while simultaneously spawning new security threats.

A new global tech order

The interconnections of the digital era blur traditional distinctions between economic and security issues. Economic policy tools, such as trade and industrial policies, are increasingly being employed for security and geopolitical goals.

We are then confronted with a new set of questions. When, if ever, does restricting digital trade make sense for an individual country? How does this affect other countries, and how should they respond? What policies and institutions can deter conflict?

In a recent [IMF working paper](#), we show that some of the standard answers no longer apply in the digital era. Once the key features of digital sectors are considered—large market power driven by scale economies, technology flows, and security risks—import and export bans, which we associate with technological and economic decoupling, can be rationalized from the point of view of an individual country. However, these bans come at an enormous cost for the rest of the world.

In our analysis, the key motivation for banning technology *imports*—if a country hosts a potentially viable substitute—is to repatriate monopoly profits that would otherwise accrue to foreign firms. The presence of cybersecurity vulnerabilities only increases the attraction of banning imports of foreign technology. However, banning imports could halt inflows of technological knowledge and may be desirable only for a country with sufficiently advanced technological capacity and know-how. While trade economists have long [pointed out](#) that banning imports may be beneficial in sectors involving monopoly rents, the increase in market power observed across the digital economy accentuates the motive to do so.

Our novel finding, however, is that banning *exports* can also be beneficial for an individual country in the digital economy. The explanation lies in the dynamics of technological competition between countries. A technological challenger can successfully displace a leader as the global producer and capture monopoly rents, as a result of international technology diffusion and domestic scale economies. To forestall such an outcome and reduce the associated cybersecurity vulnerabilities, the leader in a certain technology may seek to ban its exports.

Imposing trade bans could lead to retaliation. An import ban might help a technological power gain an advantage in global markets, although a competitor might also reciprocate the ban, leading to a worse outcome for both countries. In many cases, the anticipation of such reciprocity can act as a powerful deterrent.

Unlike import bans, however, export bans cannot be deterred with retaliation via trade policies. A technology leader would impose them irrespective

of the challenger's response. Hence, they could be harder to defuse in a world of decentralized international competition.

Such bans may benefit an individual country relative to the free trade outcome. But they cut off other countries from access to digital technologies and may lead to inefficient decoupling, making the rest of the world unambiguously worse off. Costs are amplified when allies follow suit.

Avenues for cooperation

International technology transfers are a major source of productivity growth and income convergence across countries, especially for less advanced regions. Digital technologies developed abroad have been crucial to mitigate the economic effects of the pandemic, and an intensification of the technological decoupling between superpowers would aggravate the supply-side shortages, restraining the recovery.

Countries caught in the middle of the competition between the United States and China should therefore spearhead multilateral solutions and work actively with both technological competitors to set up cooperative frameworks in several areas. Cooperation can start in specific areas to build confidence and trust, and gradually grow to encompass thornier issues. Recent success on international corporate income tax reform is promising in that regard.

Securing intellectual property rights benefits all innovators. Minimum enforced standards would reduce concerns about misuse, forced transfers, or theft and thus diminish the incentives for a technological leader to impose export bans.

Clear, transparent, and uniform rules are also needed on the interaction between the public and the private sectors. Governments' partnerships with domestic cyber technology firms purportedly for national security purposes, including surveillance, should be clearly ring-fenced.

The advent of the internet has facilitated an explosion in cross-border online crime. Strengthening cybersecurity and bringing cybercriminals to account would involve developing the necessary

national and international tools, norms, and organizational structures and capabilities. Concerns over misuse by governments need to be addressed.

Facilitating foreign ownership and control of monopolistic digital goods firms would also broaden the sharing of rents, align incentives for better global outcomes, and discourage trade conflict. Open financial or capital accounts to permit such ownership, governance arrangements to facilitate control, upholding foreign property rights, and narrowly circumscribing areas subject to national security arguments would be prerequisites.

Regarding regulatory policy, if consideration is given to breaking up large domestic technology firms to reduce their monopoly profits or otherwise regulating prices, this ideally should be done in concert across nations. The absence of a concerted effort could reduce the incentives for any country to pursue action in this area, as it could risk falling behind in the race for technology and markets.

The challenge of international cooperation against a backdrop of mistrust and competition has led to calls for a new Bretton Woods moment for the digital age. Just as Bretton Woods brought nations toward a new monetary order in the wake of two world wars, rampant protectionism, and the Great Depression, international cooperation on digital matters could similarly seek consensus on broad principles and common institutions to resolve problems, such as in the areas outlined above, and help create a predictable and open framework for international trade.

If, however, the monopoly rents on offer remain large and cyber warfare is seen as the key arena for security conflicts in the future, there will be strong domestic resistance to collaboration. In this case, continued tech conflict, with the risk of a global rupture and its associated adverse spillovers, looms large. That is why it is critically important for multi-lateral coalitions of like-minded reformers to step forward and undertake sustained and concrete action to build trust and create new opportunities for all in the digital age.



CROSS- BORDER SPILLOVERS OF **NATURAL DISASTERS** THROUGH **SUPPLY CHAIN LINKAGES**



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Large disasters, such as storms and floods, can cause significant disruptions to economic activities, by shutting down factories, paralyzing transportation systems, and destroying the wealth of households.

The COVID-19 pandemic is a recent reminder about the disruptive power of these disasters: the public health disaster has forced many countries around the world to lock down cities, halt industrial production, and urgently reorganize economic resources to save lives.

These negative effects of disasters are not only confined to the local economy but can be felt beyond country borders. With today's highly complex and interconnected global supply chain, it is estimated that disruptions to supply due to COVID-19 lockdowns [reduced global seaborne trade by 10 percent](#) between February and March 2020. Similar examples are abundant. The severe flood in Thailand in 2011, which claimed hundreds of lives, affected millions locally and effectively put a halt to automobile parts production in the country. As a result, Japanese carmakers that used Thailand as a key supplier in Southeast Asia reportedly had to [pause their car production and sales globally](#).

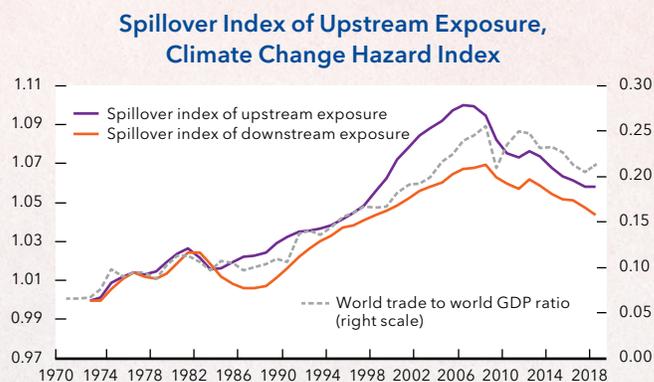
The cross-border implications of disasters through the global supply chain deserve in-depth analysis to inform policy, especially in the age of climate change, when climate-related disasters are set to rise in frequency and intensity. Are climate disasters propagated through international trade linkages? How are sectors in foreign countries affected? How does that change our thinking about macro-financial policies related to climate change?

Global spillover index of climate shock exposures

Global supply chains redistribute the exposures to climate change risk across countries. Industries in inland countries are no longer entirely shielded from the risk of sea-level rise if they are interconnected with other vulnerable countries through the supply chain. To capture this risk, a [recent IMF working paper](#) constructs a spillover index

using the inverse of the standard deviation of climate disaster exposures through upstream and downstream trade in the cross-country sample. The spillover index across countries increased between the 1970s and late 2000s before a slight decline after the global financial crisis (Figure 1). This indicates that, over the past several decades, country-level exposures to climate change risk have spread out more across countries, mainly thanks to the rise in globalization. Understanding these cross-country risk exposures is therefore an important aspect in evaluating climate-related risks and in financing climate change adaptation and mitigation.

Figure 1. Global Spillover Index of Climate Shock Exposures



Source: IMF staff calculations.

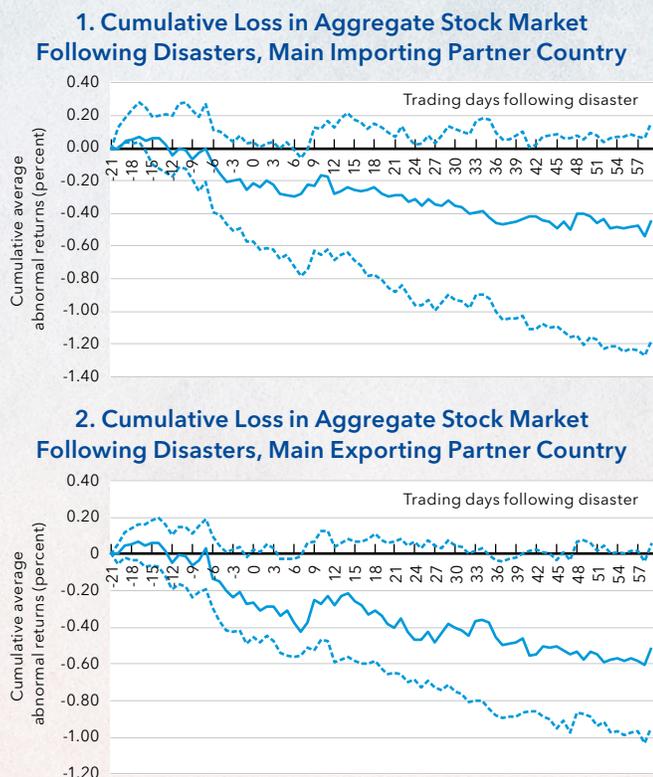
Note: This figure plots the spillover indices of upstream and downstream climate shock exposures. The spillover index is defined as the inverse of the standard deviation of climate disaster exposures through upstream and downstream trade in the cross-country sample. The spillover indices increased between the 1970s and late 2000s before a slight decline after the global financial crisis.

Cross-border spillover effects on equity markets from natural disasters

Combining bilateral trade data between countries and historical data on climate disasters, we use an event study approach to measure the cross-border spillovers of climate disasters. Climate disasters, such as heat waves, floods, and storms, lower the stock market valuation of major trade partners, both upstream due to disruption to demand and downstream due to disruption to supply. On average, a climate disaster lowers the aggregate stock market valuation by 0.5 percent in the main importing partner and by 0.4 percent in the main exporting partner of the country that is directly hit by the disaster (Figure 2). For the average country,

this amounts to a monetary loss of \$6.1 billion from the average disaster in the upstream countries and \$6.6 billion from the average disaster in the downstream countries. These magnitudes are comparable to the effects of climate disasters on the domestic valuation loss.

Figure 2. Cross-Border Spillover Effects of Climate Disasters on the Aggregate Equity Market

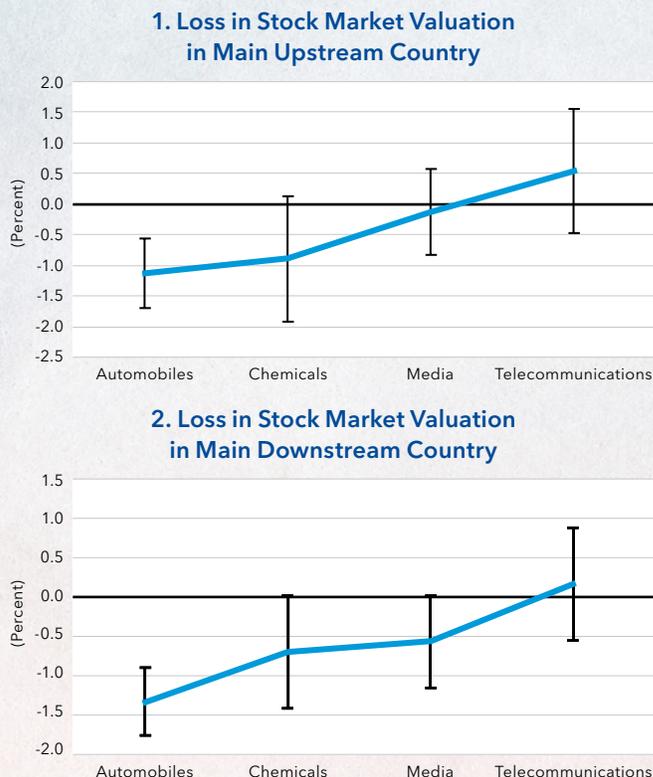


Sources: EM-DAT; Refinitiv Datastream; and IMF staff calculations.
 Note: The figure plots the cumulative average abnormal returns of the aggregate equity market in the main exporting and importing partner countries on trading days around a climate disaster. On average, a climate disaster lowers the aggregate stock market valuation by 0.5 percent in the main importing partner and by 0.4 percent in the main exporting partner of the country that is directly hit by the disaster. Dashed lines represent 95 percent confidence intervals.

The spillover effect is heterogeneous across sectors. This is, perhaps, not surprising as some sectors are more heavily involved in the global supply chain than other sectors. For example, the automobile sector, a tradables sector that depends on foreign supply and demand, on average loses 1.3 percent from an upstream disaster and about 1.2 percent from a downstream disaster (Figure 3). This translates to roughly \$564 million from the average upstream disaster and \$480 million from the average downstream disaster in monetary terms. On the contrary, most non-tradables sectors,

such as media and telecommunications, do not respond significantly to foreign climate disasters. These results suggest that the international trade network is an important channel for the cross-border propagation of climate disasters.

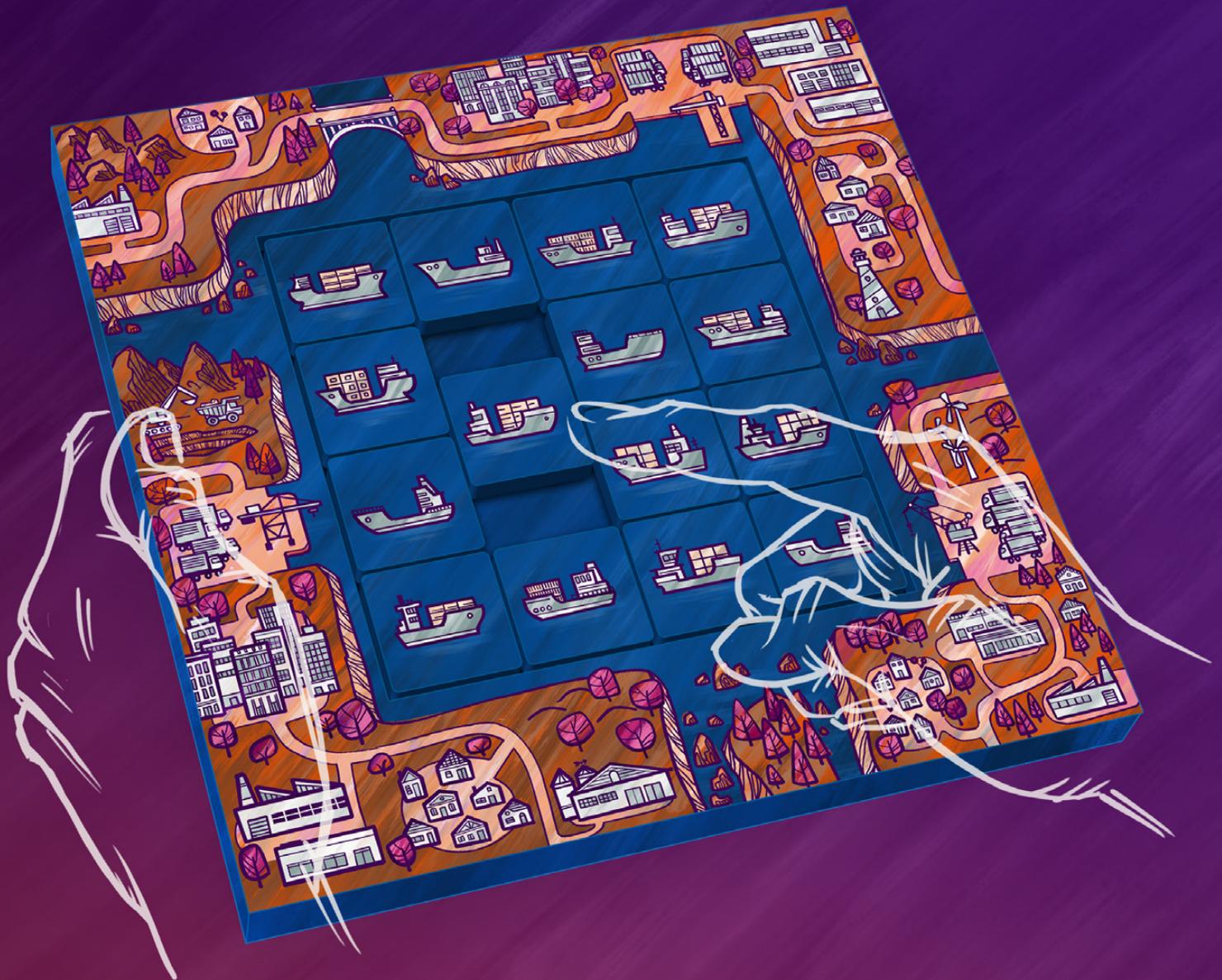
Figure 3. Cross-Border Spillover Effects of Climate Disasters on the Equity Valuation of Tradables and Non-Tradables Sectors



Sources: EM-DAT; Refinitiv Datastream; and IMF staff calculations.
 Note: The figure plots the cumulative average abnormal returns as well as the 95 percent confidence intervals for several sectors in the main exporting and importing partner countries after a climate disaster. Tradables sectors such as the automobile sector on average lose from upstream and downstream disasters; non-tradables sectors such as media and telecommunications do not respond significantly to foreign climate disasters.

Concluding remarks

The COVID-19 crisis has reminded us that, in today’s interconnected world, a shock in one country can propagate to other countries through supply chain linkages. One of the key lessons we have learned during the COVID-19 pandemic is the importance of collective action across countries for building resilience. Investments in climate adaptation infrastructure and supply chains today not only increase domestic resilience against future climate shocks but also strengthen the financial stability and economic ties of all trade partners sharing the same network.



How Does Trade Adjust to Global Disruptions?

THE ROLE OF SUPPLY CHAIN HABITS



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The latest global recession, caused by the outbreak of COVID-19, is in many ways unlike other global recessions over the past seven decades.

Nevertheless, they share a few key patterns. First, [global trade flows declined more than output](#), which was most vividly observed during the “[Great Trade Collapse](#)” of 2008–09. Second, trade declined in [a remarkably synchronized fashion across the world](#). Third, recoveries differed across country groups.

The volume of world goods exports fell 7.2 percent in 2020 (Figure 1), [plunging 15 percent year over year in the second quarter of 2020](#)—that is, following the first wave of the COVID-19 outbreak. The drop in trade is once again larger than the decline in world GDP, set at 3.6 percent for 2020, with a [dip of 9.8 percent in the second quarter of 2020](#). This shock was indeed global, but the aftermath has been mixed—the [IMF](#) calculates 12.8 and 6.2 percent declines in export volumes for 2020 in the United States and European Union, respectively. Asia and, especially, China were an exception, with export volumes increasing by almost 1 and 4 percent, respectively. A significant, albeit diverse, rebound in global trade occurred

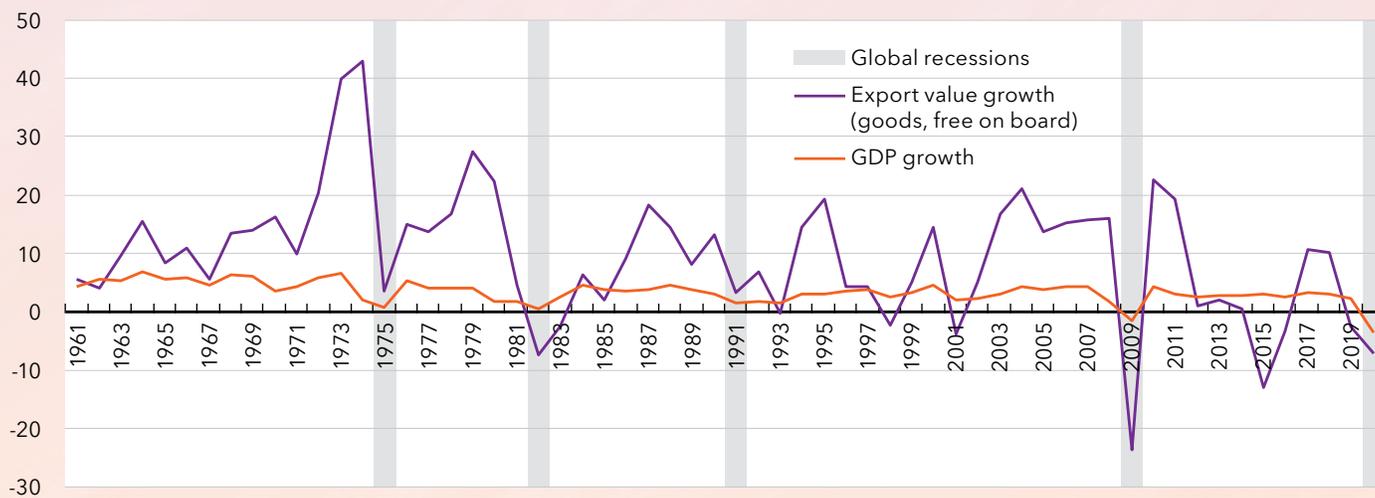
in the first quarter of 2021 and was [forecast by the World Trade Organization to reach 8 percent in 2021](#), but future outcomes remain uncertain given the slower than expected rollout of vaccinations in some countries, inequitable access to the vaccines, and the impact of virus variants.

By definition, global shocks affect economies worldwide because of production spillovers that reach far beyond the site of the initial disruption, in particular through cross-country supply chains, thereby limiting the mechanisms that would otherwise function to diversify these risks. Given the above evidence and the uncertain environment we are facing, it is important to understand and predict why and by how much the value of international trade flows adjusts as a result of a global shock; that is, how persistent it is and why some countries can weather a time of crisis better than others.

A new study of trade persistence, supply habits, heterogeneity, and global shocks

The above stylized facts suggest relatively low trade persistence in response to global shocks and an inherent heterogeneity of impacts and adjustments. By contrast, much of the modern trade literature predicts that the value of trade flows adjusts either [immediately](#), without any transitional dynamics, or [too slowly](#), thereby contradicting the data.

Figure 1. World Trade Flow Growth and GDP Growth (Percent)



Source: Authors’ calculations based on data from the World Bank and IMF Direction of Trade Statistics database.

Note: The figure depicts the growth in the value of exports of goods and GDP growth during 1961–2020 for the global economy. The shaded areas represent the years of global recessions as in [Kose and others \(2020\)](#).

[A recent study](#) labels this discrepancy the “excess trade persistence puzzle.” It argues that history does matter when it comes to predicting changes in trade value, but not as much as the trade literature previously indicated. The more countries trade with one another, the more likely they are to develop habits of importing certain popular brands of final goods from each other. And the exporting firms may find themselves tied to contractual obligations on the supply chains, unwilling or unable to break them in the face of shocks. To explain trade persistence, we therefore must account for the strength of global value chains; that is, the share of intermediate imports in home production.

To understand the mechanisms behind trade persistence, the study presents a tractable model, which embodies the global supply chain network. The new theory, called “habits in supply chains,” establishes a link between past and current exports that implicitly prevents firms from immediate assembly, dismantling, or swapping of offshore suppliers in response to shocks. The model generates trade flow persistence specific to each country pair, which depends on their intensity of supply habits. Cross-country differences in habit intensity in turn create differences in the propensity to

trade at the aggregate level, which result in empirically relevant country-specific trade imbalances and heterogeneous transmission of shocks into trade flows.

The theory is then mapped to the data, covering 39 advanced and emerging market economies during 1950–2014. The habit approach produces the most accurate data fit, not only during [global recessions](#) but also during “normal times.”

The average cross-sectional trade persistence coefficient from the derived dynamic gravity model is estimated to be 0.35. This means that past values matter for current trade flows, but with an intensity that is somewhere between the estimates in the existing literature—where the persistence is either zero and the past does not play a role or very high, at about 0.9, and the past matters a lot.

This results in a different transition path and size of the long-term effect of a shock, defined as the cumulative effect of the shock over time. For instance, if the short-term effect of a shock in the aggregate trade balance on bilateral trade flows is close to 1 it implies that a 1 percent change in the aggregate trade balance results in a 1 percent change in bilateral trade flows.

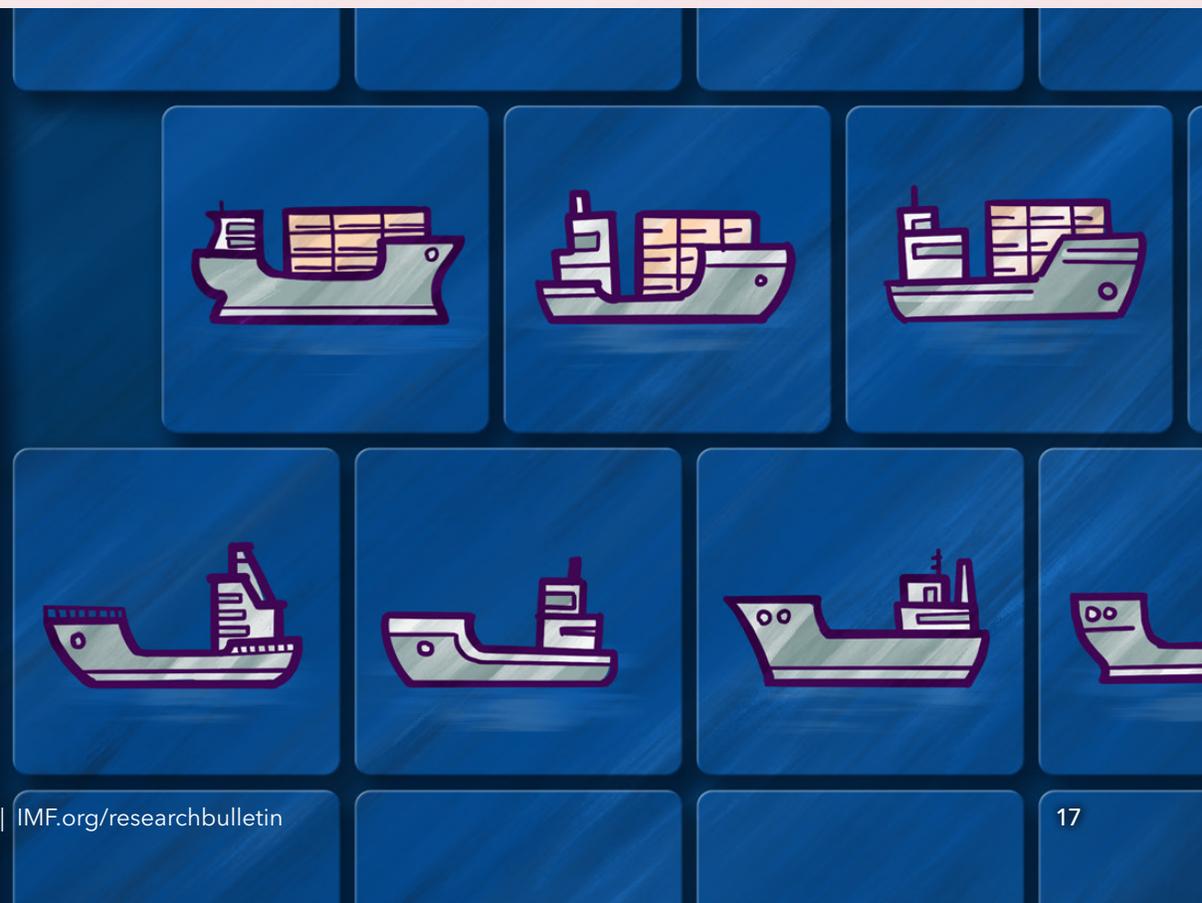
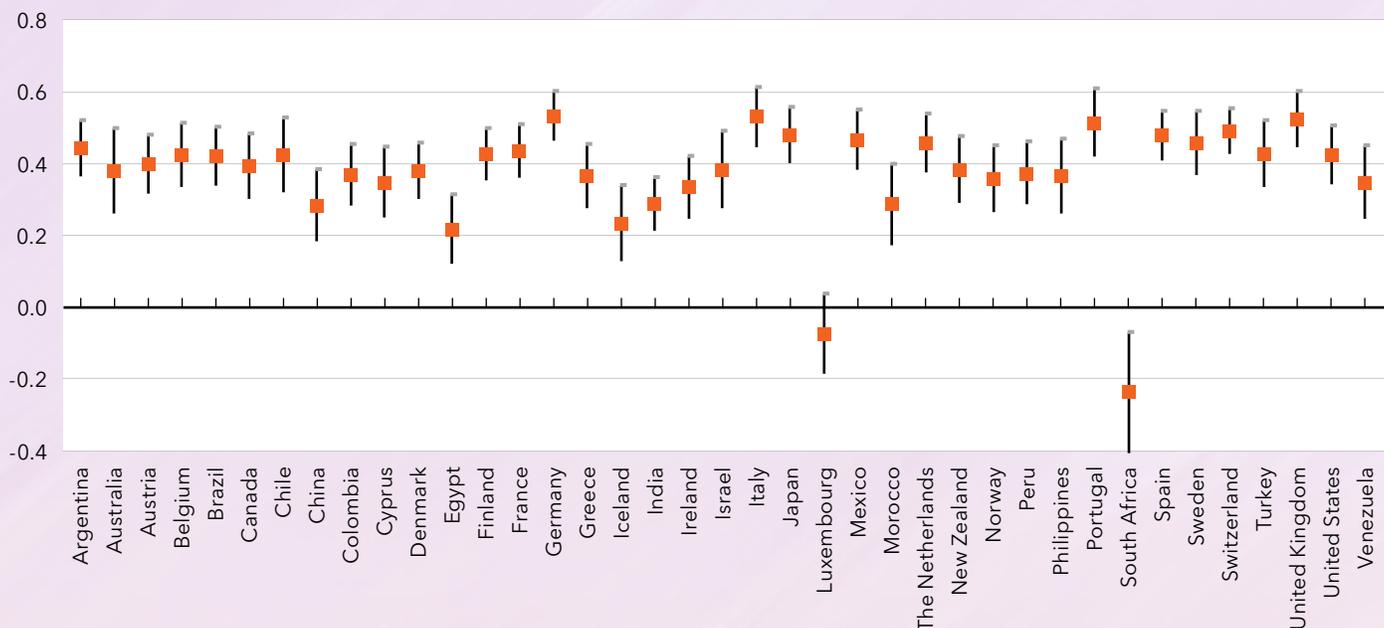


Figure 2. Trade Persistence across Countries



Source: [Comunale, Dainauskas, and Lastauskas \(2021\)](#).

Note: The trade persistence coefficients are on the y-axis with 95 percent confidence bands.

However, over the long term, the effect rises to only 1.5, and the overall adjustment takes just a few years. In a model with zero trade persistence, however, the short- and long-term effects coincide, and the impact is instantaneous. On the contrary, models with much higher persistence coefficients predict decades of adjustment after a shock (for example, persistence of 0.9 implies a 10 percent cumulative long-term effect on bilateral exports because of a 1 percent shock in the aggregate trade balance).

The model is also able to identify heterogeneity in these outcomes—that is, beneath the average lie widespread cross-country differences in trade persistence, with values ranging between 0.2 and 0.5 (Figure 2), leading to different transition paths and long-term effects of shocks.

The importance of supply chains and distance
What drives the cross-country differences in trade persistence?

Countries exporting goods that are predominantly independent of offshore supply chains are generally most exposed to trade disruptions compared with those that rely on intermediate goods from abroad to make their final products. Hence, if a country is dependent on intermediate imports from a diverse set of offshore suppliers,

its trade flows may actually be smoother over time than if it relies solely on domestic or weakly internationally integrated technology.

Geography also matters. While global value chains are a source of strength in the face of global shocks, long-distance trade appears to be a sign of weakness, as it results in more trade volatility. This means that bilateral trade flows are more resilient to local and global shocks between countries that source their intermediate goods from a regionally diversified set of suppliers.

Consequently, looking at how economies integrated their supply chains with trade partners in the past can help predict future trade flow adjustments, especially at a time of global crisis, but also during normal times. This finding can be helpful for policymakers in predicting, and possibly avoiding, large swings in trade when facing global events, such as the COVID-19 pandemic. Countries that are more integrated in supply chains and have more regionally diversified suppliers tend to perform better and have more stable trade flows. Therefore, building resilience through participation and geographic diversification in supply chains is a key ingredient to ensure less disruptive trade adjustments.



TOWARD AN INCLUSIVE AND RESILIENT RECOVERY

22nd Jacques Polak

Annual Research Conference

The IMF Research Department held the 22nd Jacques Polak Annual Research Conference on November 4-5, 2021.

The event was held virtually, with engaging discussions focused on ways to move [“Toward an Inclusive and Resilient Recovery.”](#)

It covered the analytical insights and policies necessary to strengthen the recovery and make it more equitable. It included academic sessions on vaccines, fiscal policy, the distributional impacts of the pandemic, supply chains, and mitigation policies.

Pierre-Olivier Gourinchas delivered the Mundell-Fleming Lecture, where he provided a perspective on the development of international macroeconomics over the past 20 years and proposed a new role for the IMF as an elastic provider of global liquidity.

Gita Gopinath and Raghuram Rajan had a stimulating conversation on the global outlook, the response of monetary policy to the current inflation pressures, and asset valuations.

Martin Wolf, Silvana Tenreyro, and Nicholas Bloom discussed the impact of the pandemic on uncertainty and policies to restore confidence.



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