



Global Trade and Value Chains in the Pandemic

APRIL 2022 (SPILLOVER) WEO CHAPTER 4

Tin Lang, Davide Malacrino, Adil Mohommad, Andrea Presbitero, Galen Sher with support from Shan Chen and Bryan Haiwen Zou

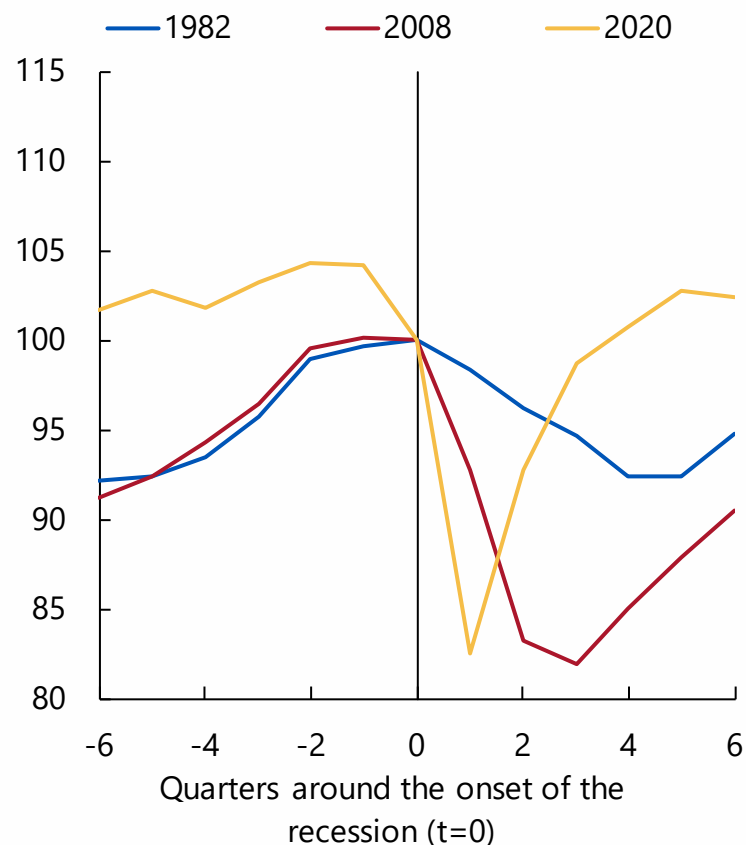
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Trade Through the COVID-19 Pandemic

Some basics facts

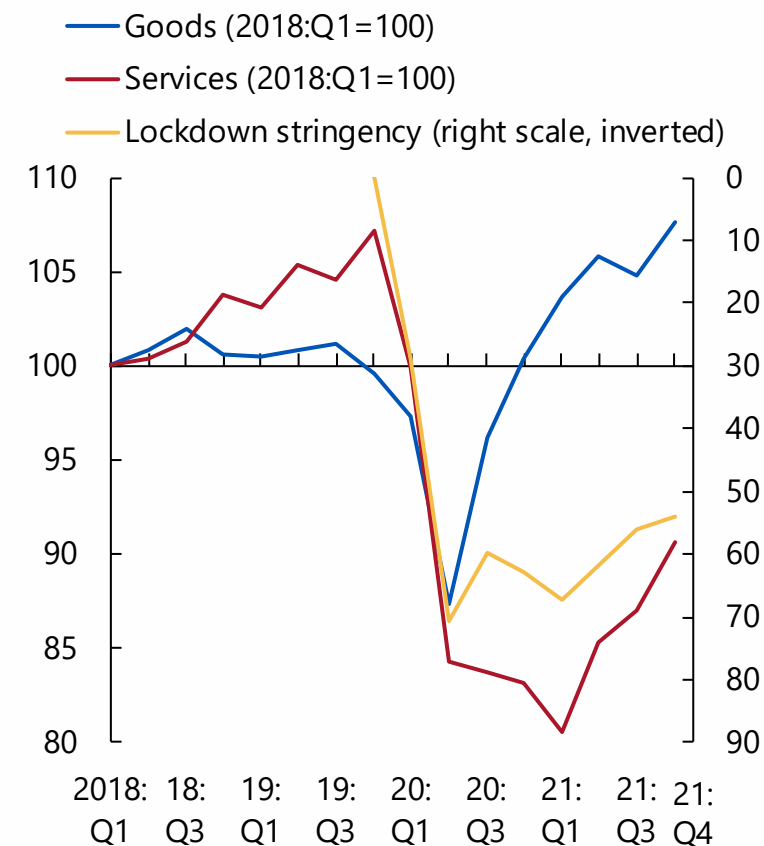
- Trade collapsed dramatically in 2020Q2 (-21 percent against 2019Q4)...
- ...But rebounded quickly compared with previous global recessions
- Yet, many dimensions of heterogeneity
 - Services vs Goods
 - GVC-intensive goods vs other goods

Trade Patterns around Global Recessions: Goods and Services Import Volume (Index)



Sources: Kose and others (2020); and IMF staff calculations.

Global Import Volume and Lockdown Stringency (Index)

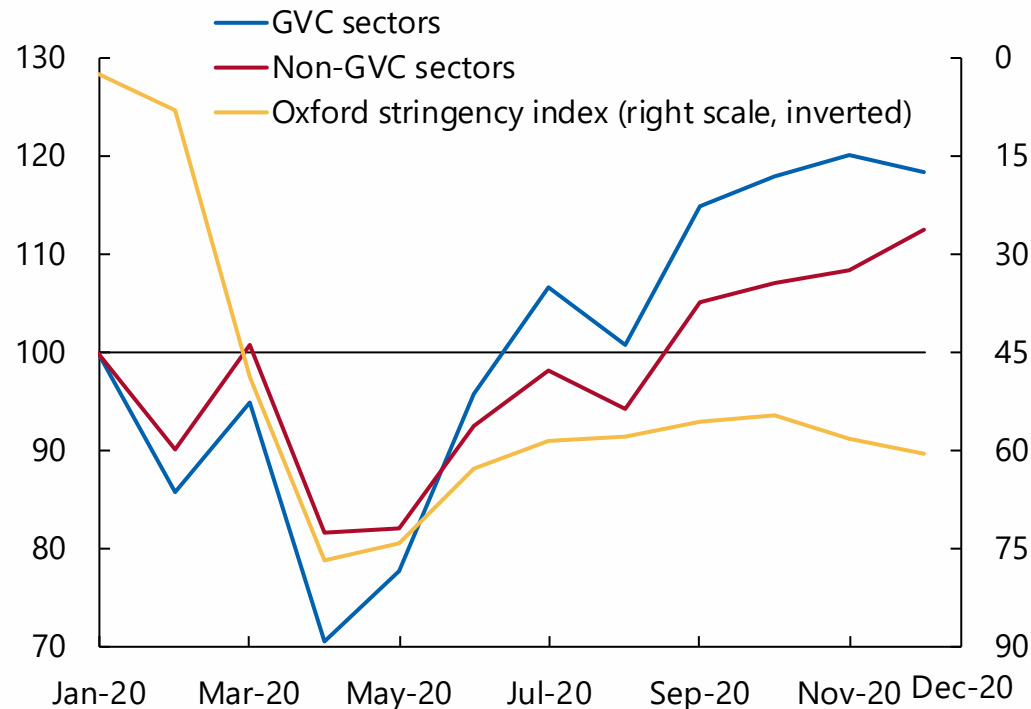


Sources: CPB World Trade Monitor; Hale and others (2021); and IMF staff calculations.

Large swing in GVC-intensive goods, but quick recovery

Trade in GVC-intensive industries was more volatile than trade in other industries

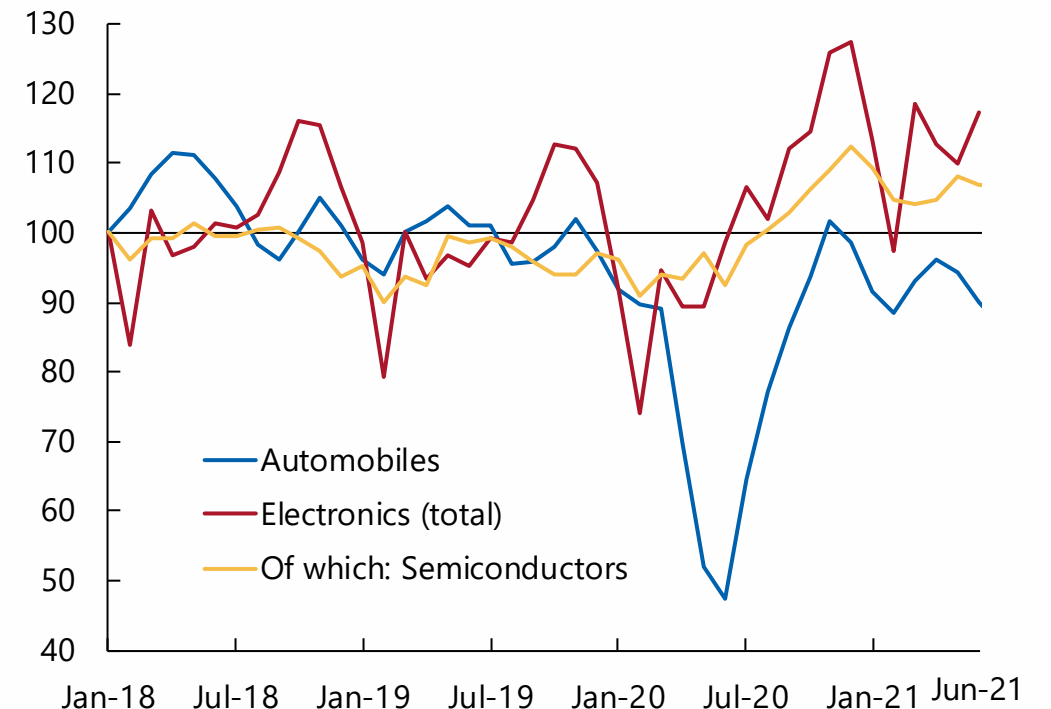
Volatility of Trade in GVC-Intensive Industries versus Non-GVC-Intensive Industries Early in the Pandemic (Index)



Sources: Hale and other (2021); Trade Data Monitor; and IMF staff calculations.

The quick recovery occurred in some GVC-intensive goods but not for others

Trade in Automobiles and Semiconductors (Index, January 2018 = 100)



Sources: Trade Data Monitor; and IMF staff calculations.

Chapter Structure

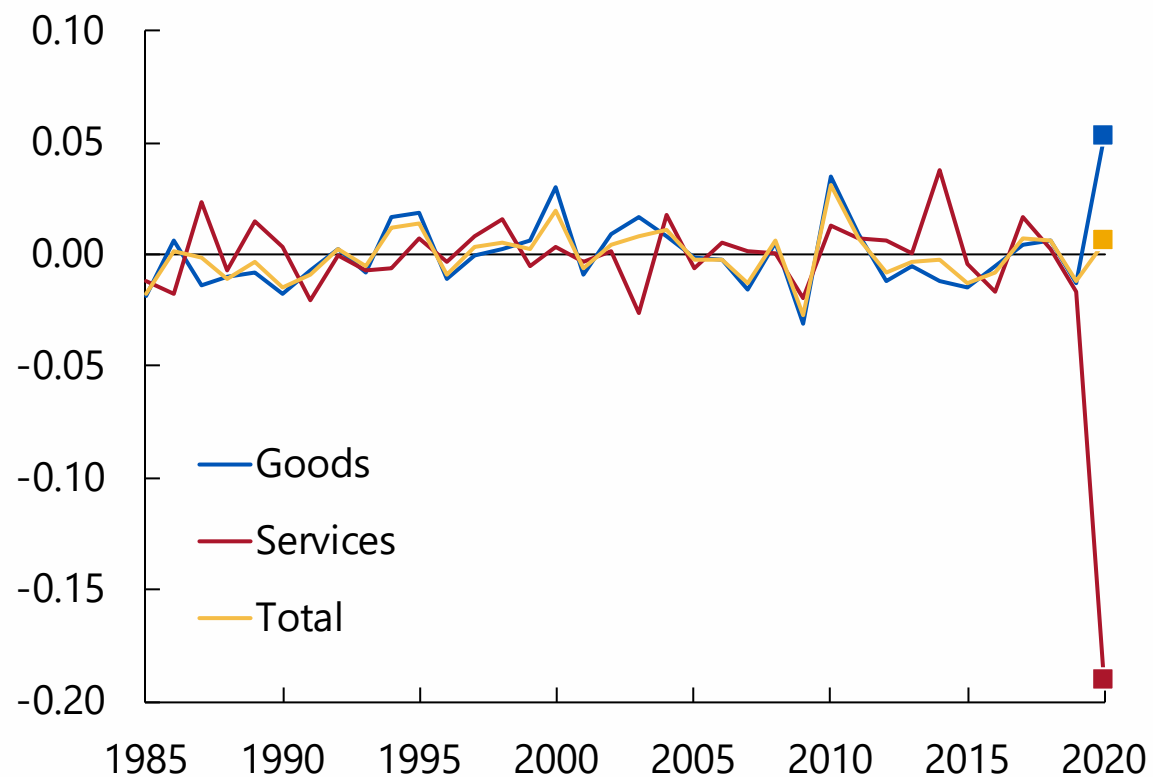
Combine empirics and model-based analysis to inform policy

- 1. Q: Can demand factors explain fully the observed trade patterns?**
 - Import-demand model and analysis of unexplained components of import growth
- 2. Q: Did the pandemic response affect trade via international spillovers?**
 - Empirical analysis of bilateral trade flows to isolate spillovers
- 3. Q: Were Global Value Chains (GVCs) able to adjust?**
 - Track GVC developments using trade data
- 4. Q: How can GVCs be made more resilient?**
 - Analysis of trade linkages and response to supply shocks (multi-sector/multi-country model)

1. The pandemic had an important role in determining trade patterns

Average Forecast Errors of the Growth in Imports from the Import Demand Model

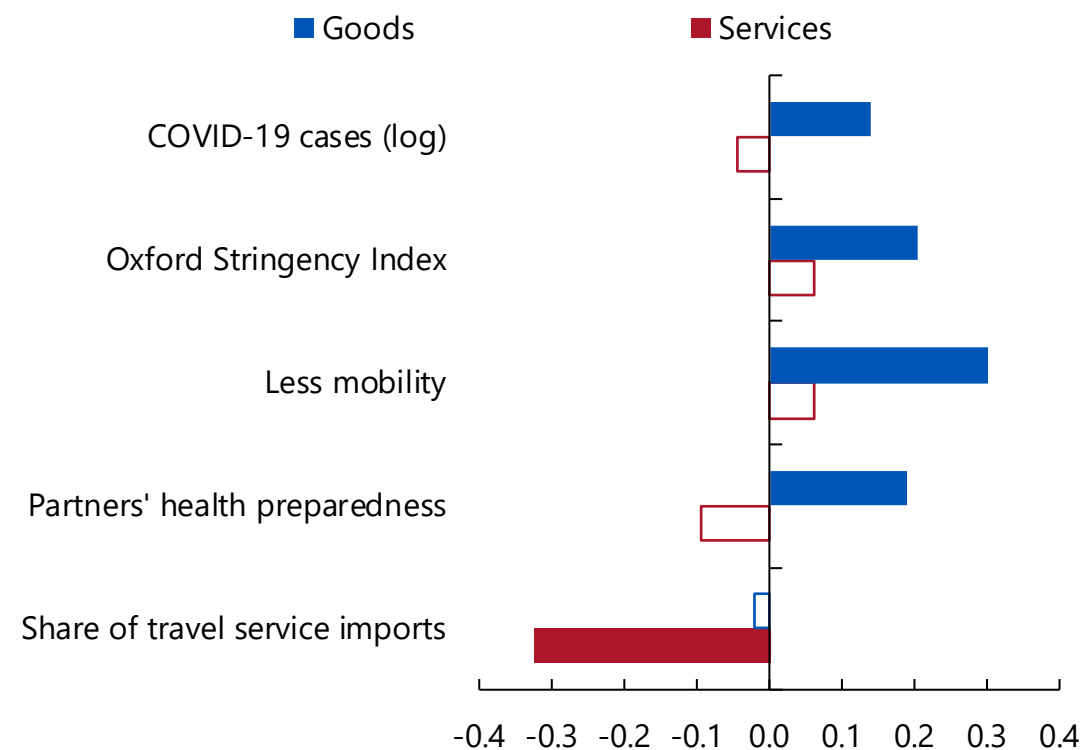
(Percentage points)



Sources: Eora Global Supply Chain Database; IMF, *Balance of Payment Statistics*; and IMF staff estimates.

Factors Associated with the Demand Model's Forecast Errors in 2020

(Standard deviation, unless noted otherwise)

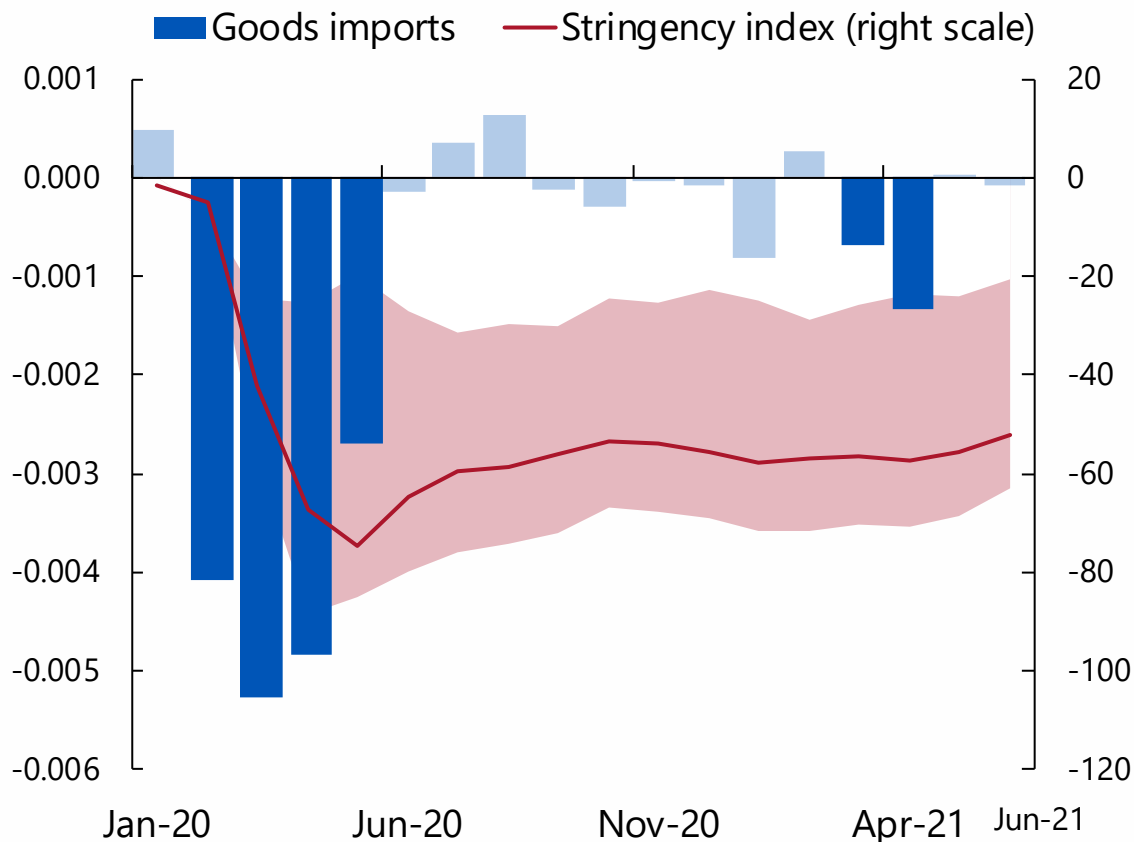


Sources: Global Health Security Index; Google, Community Mobility Database; Hale and others (2021); Our World in Data; World Trade Organization; and IMF staff calculations.

2. Lockdown policies had substantial—but unintended—international spillovers

The Spillover Effect of Trade Partner Containment Policies Faded over Time

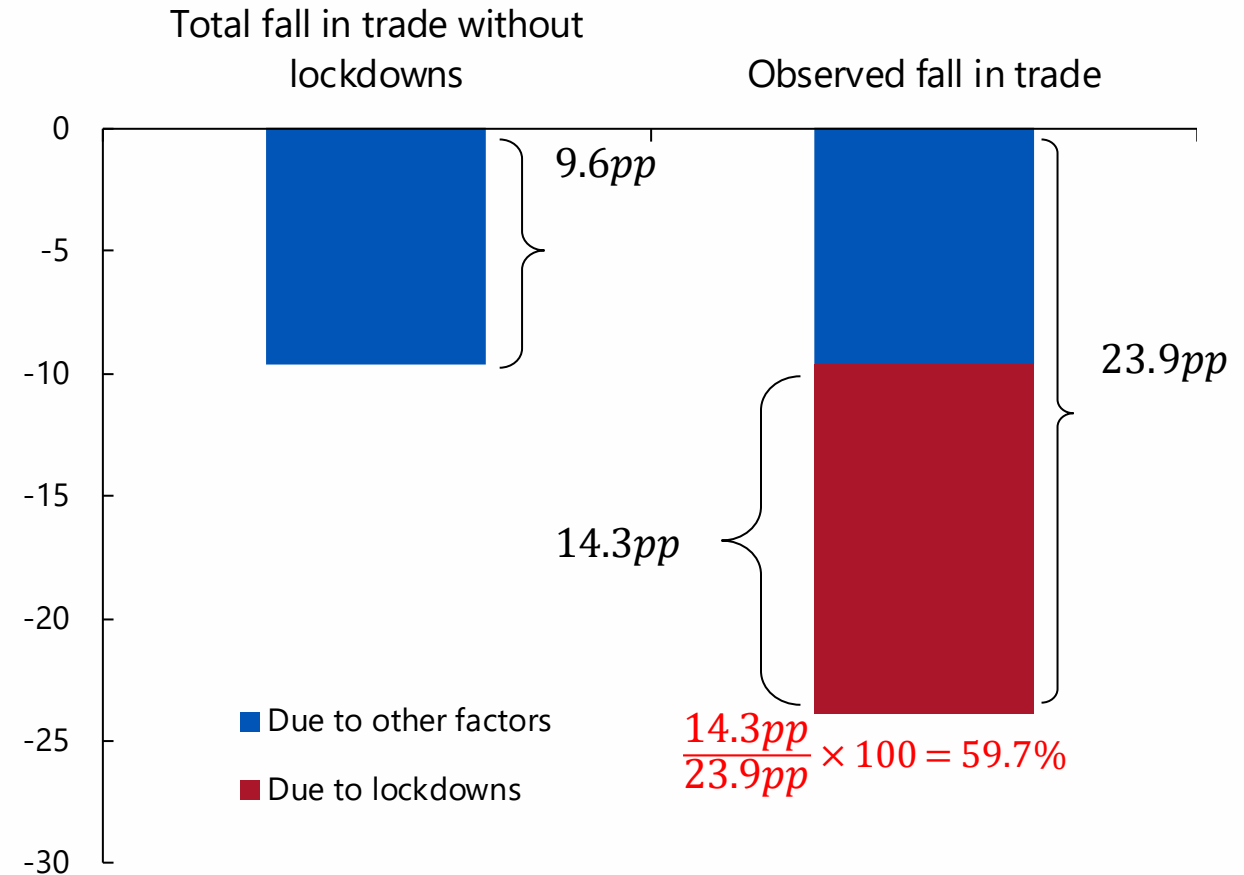
(Index)



Sources: Hale and others (2021); Trade Data Monitor, and IMF staff calculations.

Lockdowns accounted for 60% of the observed decline in Trade from Jan 2020 to May 2020

(Percentage point)



Sources: Hale and others (2021); Trade Data Monitor, and IMF staff calculations.

3. GVCs adapted well to the shock

Change in Regions' Market Shares of GVC-related products

(Percentage points, unless noted otherwise)

1. 2020:H2 vs 2019

Importer regions	Rest of the World	-1.0	-0.8	1.8	0.0
	Asia	-0.8	-0.8	1.3	0.3
	Europe	-0.9	-1.9	4.6	-1.9
	North America	-2.4	-1.4	2.3	1.5
		North America	Europe	Asia	Rest of the World
		Exporter regions			

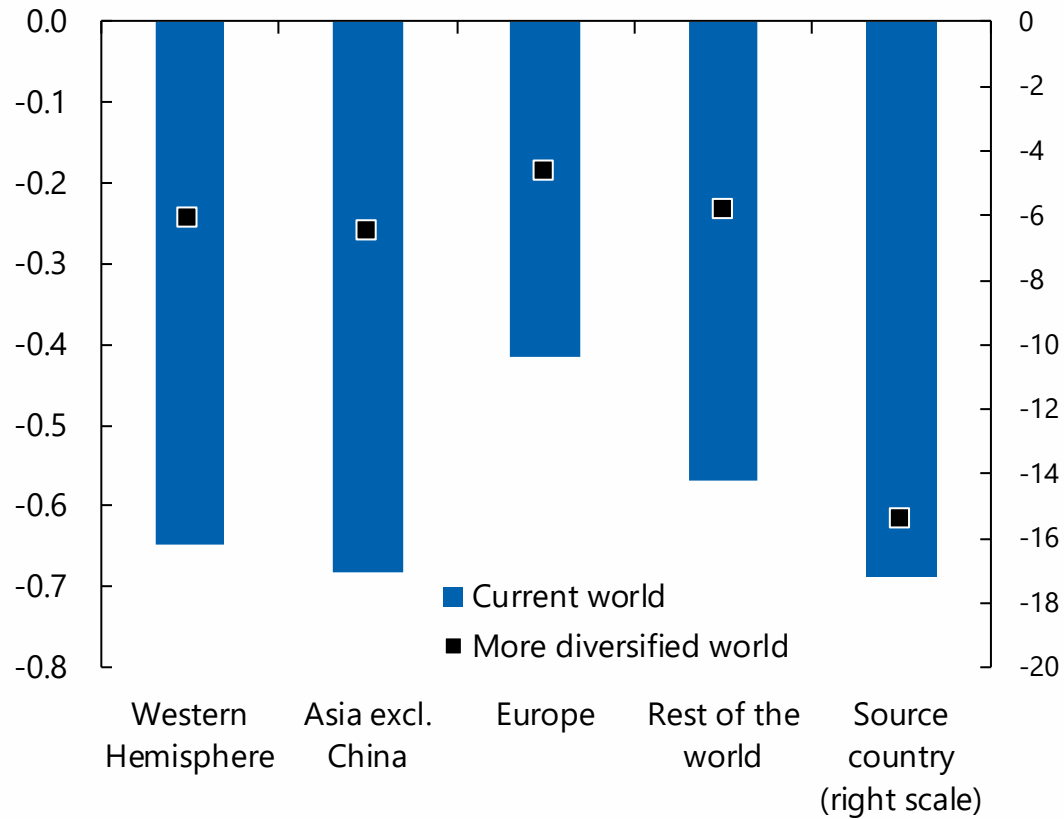
2. 2021:H1 vs 2019

Importer regions	Rest of the World	-0.6	-1.7	2.1	0.2
	Asia	-0.6	-0.6	1.1	0.1
	Europe	-0.5	-2.3	3.1	-0.4
	North America	-3.2	-0.8	0.6	3.4
		North America	Europe	Asia	Rest of the World
		Exporter regions			

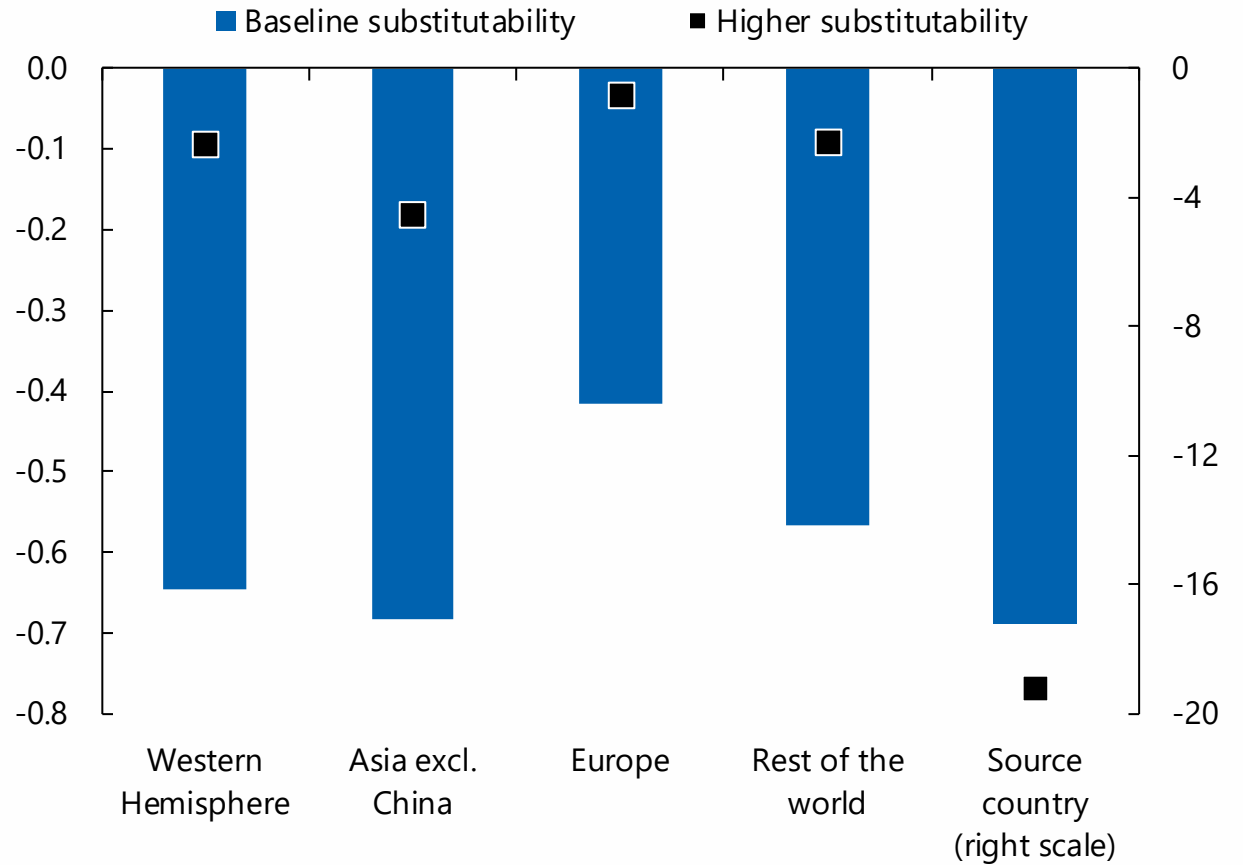
Sources: Trade Data Monitor, reported import flows, GVC-related products; and IMF staff calculations.

4. Diversification and substitutability in input sourcing can enhance GVC resilience

Gains from Diversification Following a Supply Disruption in a Large Supplier Country
(Percent)



Gains from Substitutability Following a Supply Disruption in a Large Supplier Country
(Percent)



Source: IMF staff calculations. Note: The figure shows GDP declines in response to a 25 percent labor supply contraction in a country that is a large global supplier of intermediates

Source: IMF staff calculations.

Policies

1. Vaccinate widely across countries:

- a) Domestic benefits plus reduced costs from minimizing spillovers from supply disruptions in partner countries

2. Enhance infrastructure (digital and physical):

- a) Digital infrastructure to strengthen teleworking capacity can smooth lockdown-type shocks
- b) Upgrade and modernize trade logistics infrastructure including ports

3. Closing information gaps:

- a) Generate more information on supply chain networks, including through advancing digitalization of firms' document filings (e.g., tax returns)
- b) Use such information to conduct stress-testing exercises to identify weaknesses

4. Reduce trade costs:

- a) Large scope to reduce nontariff barriers
- b) Minimize trade policy uncertainty providing open and stable rules-based trade policy regime to support diversification



World Economic Outlook April 2022

THANK YOU!



BACK UP SLIDES

Main Findings

- **The pandemic had an important role in determining trade patterns.**
 - Goods imports grew more, and services imports less, than predicted by model
 - “Excess” goods imports with more severe pandemic outbreaks/“Deficit” services imports where tourism imports mattered more.
- **Lockdown policies had substantial—but unintended—international spillovers**
 - Lockdowns in trading partners can account for 60% of observed decline in goods imports
 - Spillovers larger for GVC-intensive goods and downstream goods, but faded over time
- **GVCs adjusted well to the pandemic**
 - GVC-intensive goods imports fell more upon the shock, but rebounded quickly
 - Evolution of market shares across GVC-regions suggests GVCs were able to adapt
- **Diversification and substitutability in input sourcing can enhance GVC resilience**
 - “Home bias” in sourcing inputs suggests rooms to diversify input sourcing internationally
 - Greater diversification and substitutability lower economic volatility in response to shocks

Import Demand Model: the Covid-19 as an Outlier

$$\Delta \ln M_{i,t} = \alpha_i + \beta_{D,i} \Delta \ln D_{i,t} + \beta_{P,i} \Delta \ln P_{i,t} + \varepsilon_{i,t}$$

$\Delta \ln M_{i,t}$ is the change in real imports in country i in year t

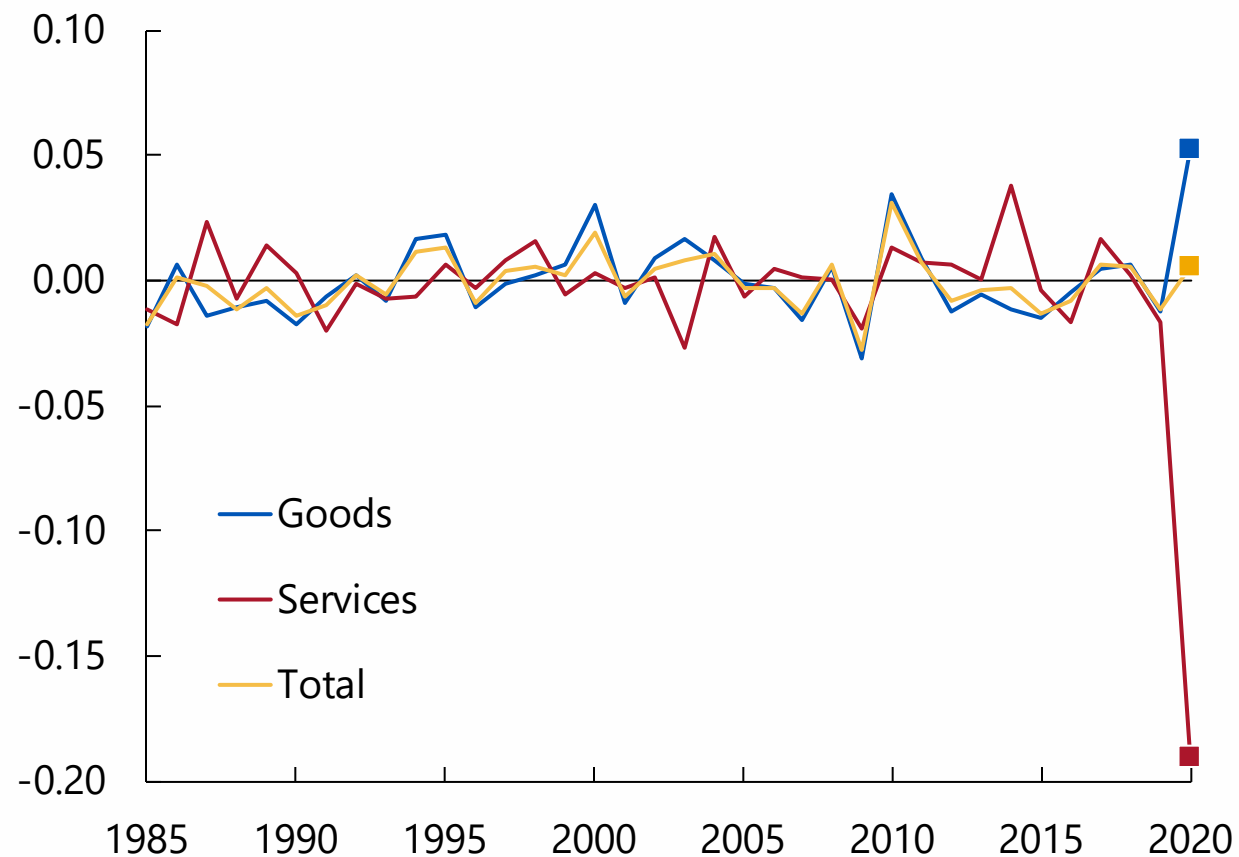
$\Delta \ln D_{i,t}$ is the change in import-intensity adjusted demand (Bussiere et al. 2013)

$\Delta \ln P_{i,t}$ is the change in relative price of import

Results from country-by-country estimation:

- Goods grew about 5 percentage points more than predicted
- Services grew 18 percentage points less
- Errors off-the chart compared to previous years
- Why?

Average Forecast Errors of the Growth in Imports from the Import Demand Model
(Percentage points)



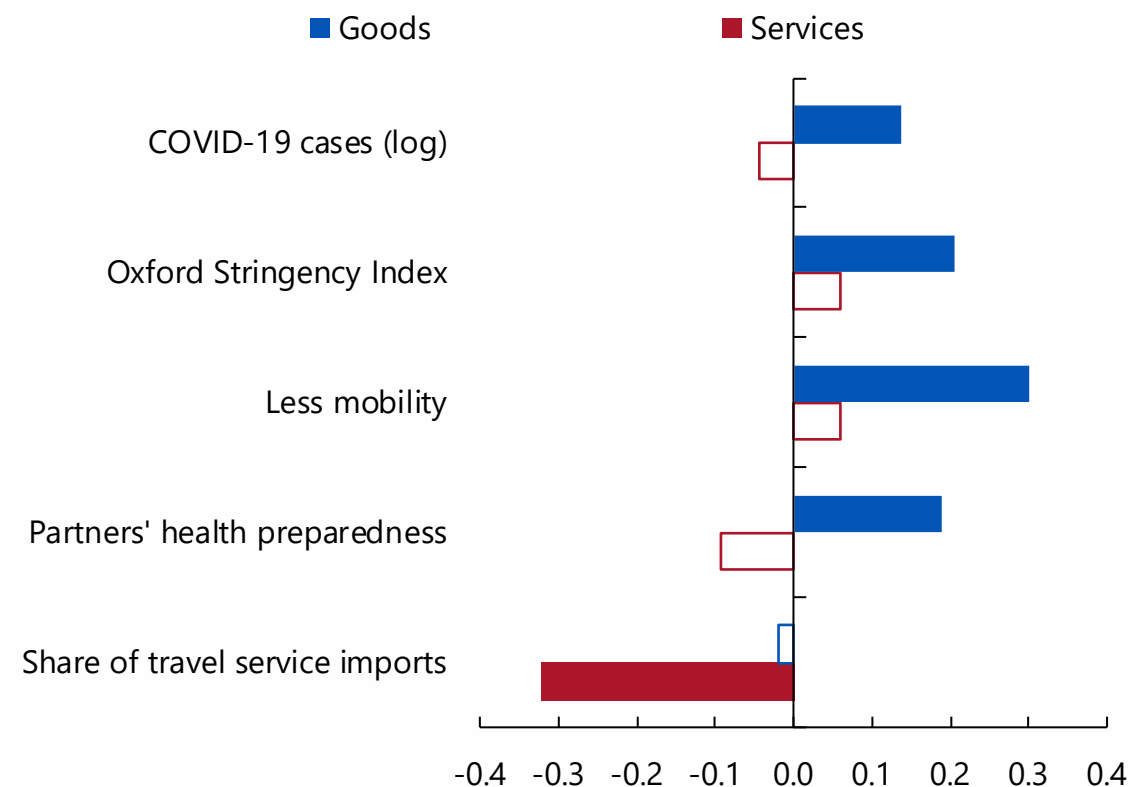
Sources: Eora Global Supply Chain Database; IMF, *Balance of Payment Statistics*; and IMF staff estimates.

Factors Specific to Covid Drove Trade Patterns

- **Domestic Covid-19 intensity** associated with “excess” goods imports
 - Transitory expenditure switching?
 - Persistent shift in preferences?
 - Constraints to domestic supply?
- Higher share of **travel** service imports associated with “deficit” in service imports
- Partners’ **health preparedness** associated with “excess” goods imports
 - Prima facie evidence of spillovers

Factors Associated with the Demand Model’s Forecast Errors in 2020

(Standard deviation, unless noted otherwise)



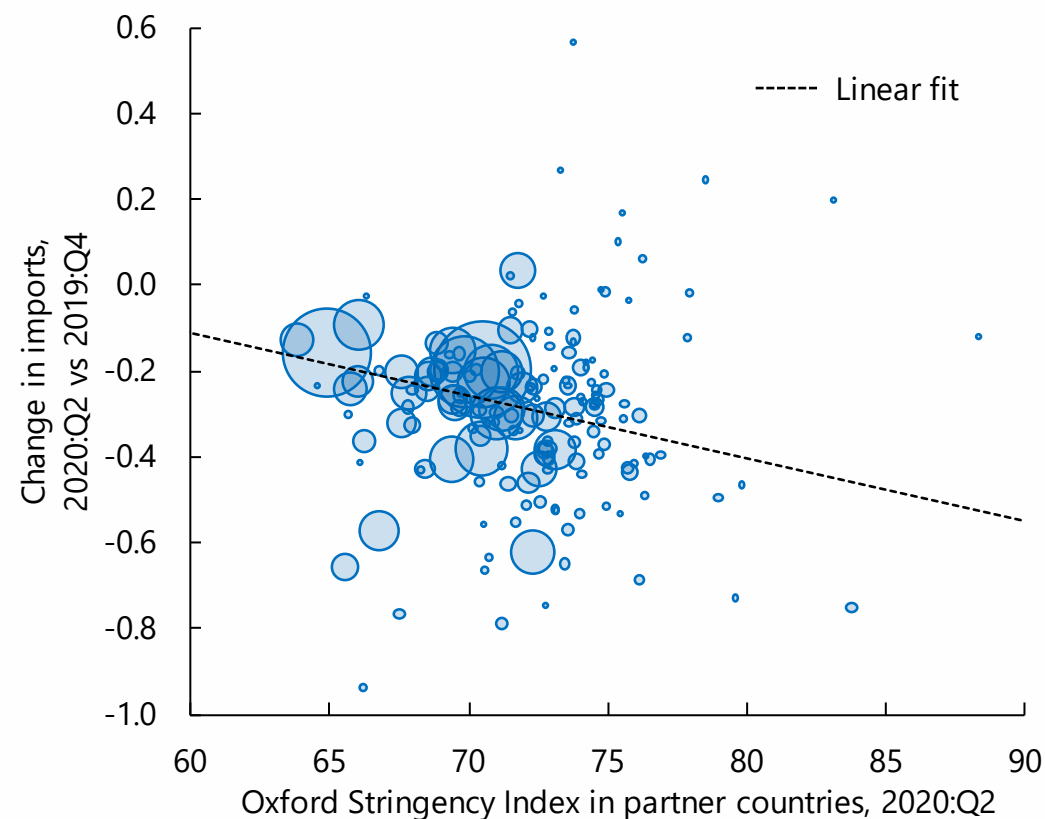
Sources: Global Health Security Index; Google, Community Mobility Database; Hale and others (2021); Our World in Data; World Trade Organization; and IMF staff calculations.

Spillovers from partner countries' policies

- The negative trade effect of lockdowns could spill over to partner countries, via a supply effect
- To better understand
 1. the drivers of supply disruptions and
 2. the potential effects of new waves of restrictions,we look at the effect of lockdown intensity in partner countries
- Comparing imports of a given product from countries that, at a given point in time, imposed different containment policies

Change in Imports and Partner Countries' Lockdown Stringency

(Percent; unless noted otherwise)



Sources: Hale and others (2021); IMF, *Direction of Trade Statistics*; and IMF staff calculations.

Isolating supply with a gravity model

Model:

$$M_{m,e,i,t} = g(\beta \text{Stringency Index}_{e,t} + \delta \text{Controls}_{m,e,t} + \alpha_{m,e,i} + \gamma_{m,i,t}, \varepsilon_{m,e,i,t})$$

- $M_{m,e,i,t}$ are bilateral imports in industry i by importer country m from exporter country e in month t
- $\text{Stringency Index}_{e,t}$ is a time-varying measure of lockdown intensity in the exporter country
- Country-pair-industry FEs ($\alpha_{m,e,i}$) control for difference in industry-specific trade flows between each pair m,e
- Importer-industry-time FEs ($\gamma_{m,i,t}$) absorb the role of unobserved factors (e.g., demand) in driving imports
- Controls include new trade restrictions and the number of COVID-19 cases and deaths per capita



β captures the spillover effect of lockdowns on imports via the supply channel

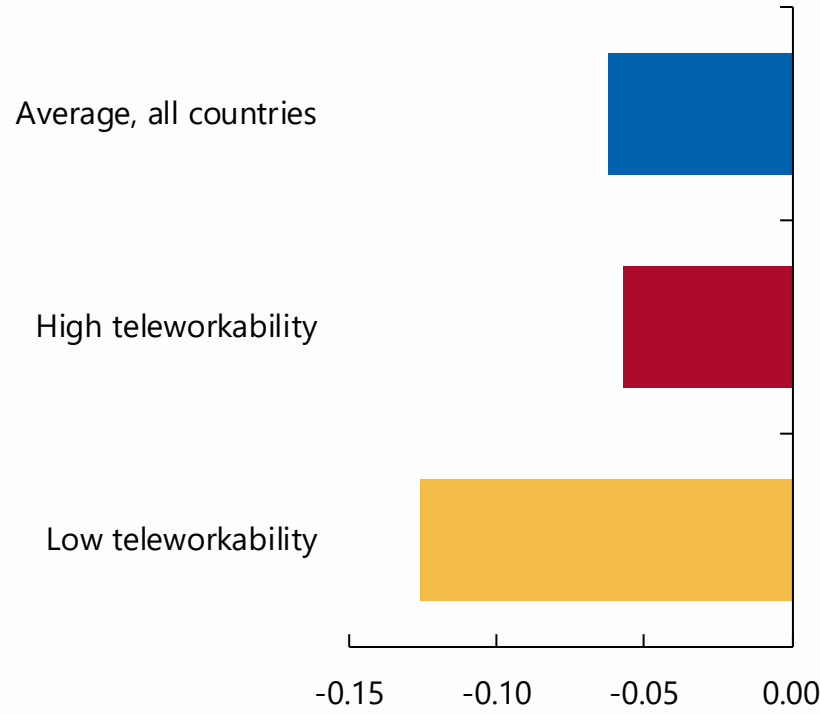
Data: monthly bilateral imports at the 6-digit level from TDM, aggregated across ~ 300 industries

Estimation: PPML (Santos Silva & Tenreyro 2006; Correia et al. 2019); cluster at exporter level

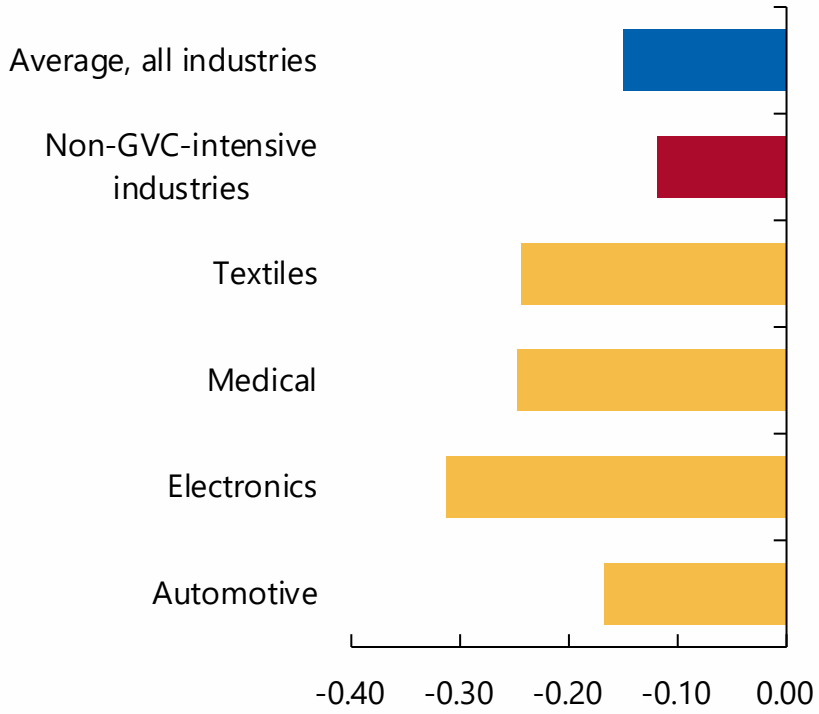
Larger spillovers in low-teleworkability countries, and in GVC-intensive and downstream industries

Semi-Elasticity of the Oxford Stringency Index

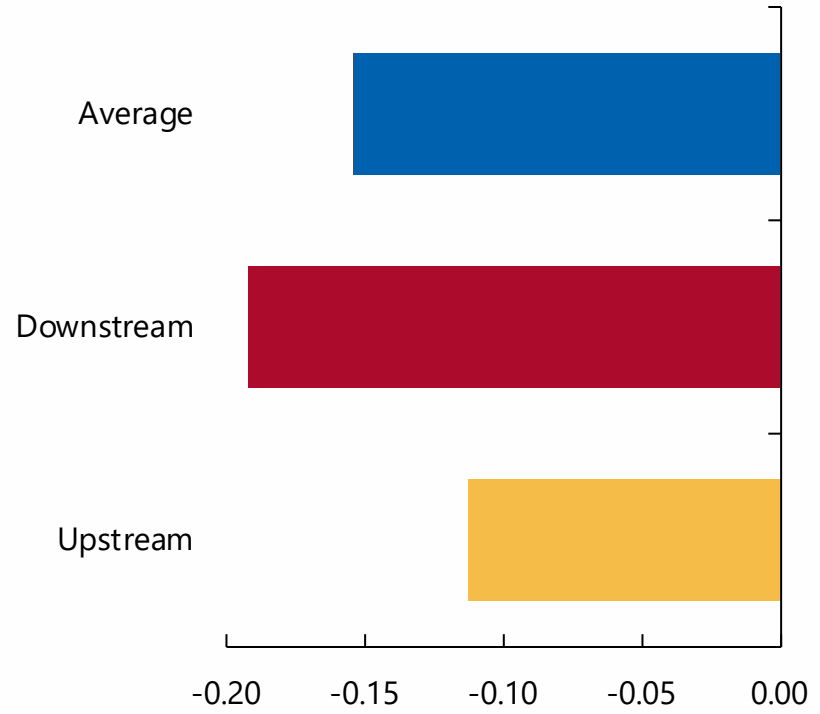
1. Teleworkability



2. Type of Industry



3. Upstreamness



Sources: Dingel and Neiman (2020); Hale and others; Trade Data Monitor (2021); and IMF staff calculations.
 Note: GVC = global value chain.

Yet, GVCs adapted well to the shock

- Asynchronous lockdowns: initial increase in Asia's market share partly unwound by mid-2021
- Suggests that countries adapted to the pandemic, permanent changes in the structure of GVCs are unlikely

Change in Regions' Market Shares of GVC-related products (Percentage points, unless noted otherwise)

1. 2020:H2 vs 2019

Importer regions	Rest of the World	-1.0	-0.8	1.8	0.0
	Asia	-0.8	-0.8	1.3	0.3
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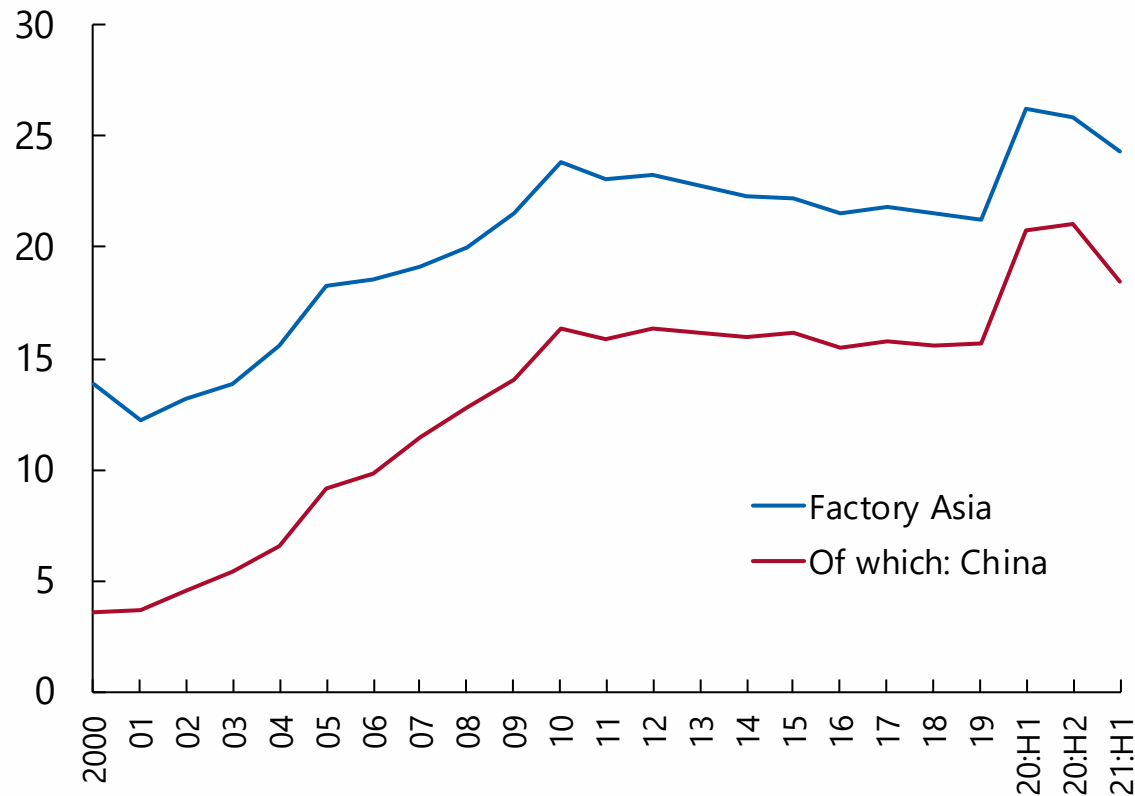
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Sources: Trade Data Monitor, reported import flows, GVC-related products; and IMF staff calculations.

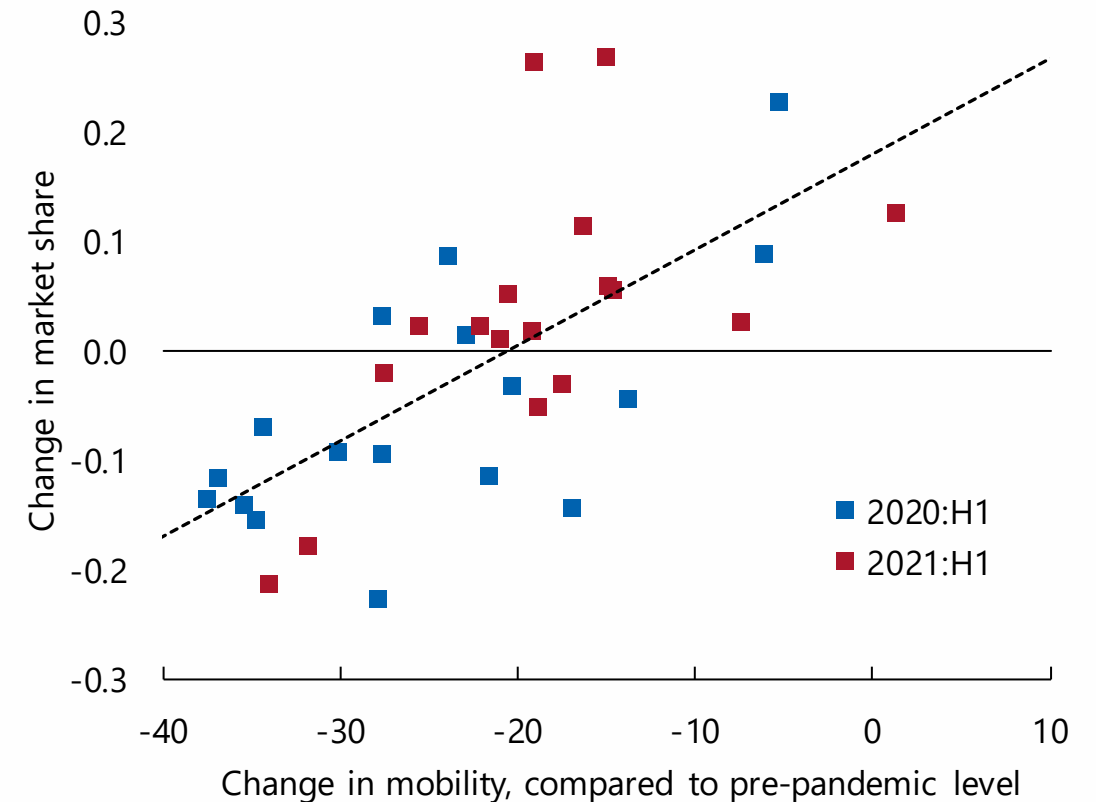
Changes in market shares, driven by China in Asia, have been associated with changes in mobility

Market Share with Respect to Europe
(Percent)



Sources: Trade Data Monitor, reported import flows, GVC-related products; and IMF staff calculations.

Change in Mobility and Market Shares in GVC-Related Exports (Percent)



Sources: Google, Community Mobility Reports; Trade Data Monitor; and IMF staff calculations. Note: The sample includes 18 countries observed over two periods (2020:H1 and 2021:H1).

Types of GVC resilience considered

Diversification:

Captures how equally intermediate inputs are sourced across countries, while holding fixed the sourcing across sectors.

More diversification means supplies are less likely to be disrupted. Establishing relationships in good times can also make switching possible in a crisis.

Substitutability:

Captures how easily one intermediate input can be substituted for another in production.

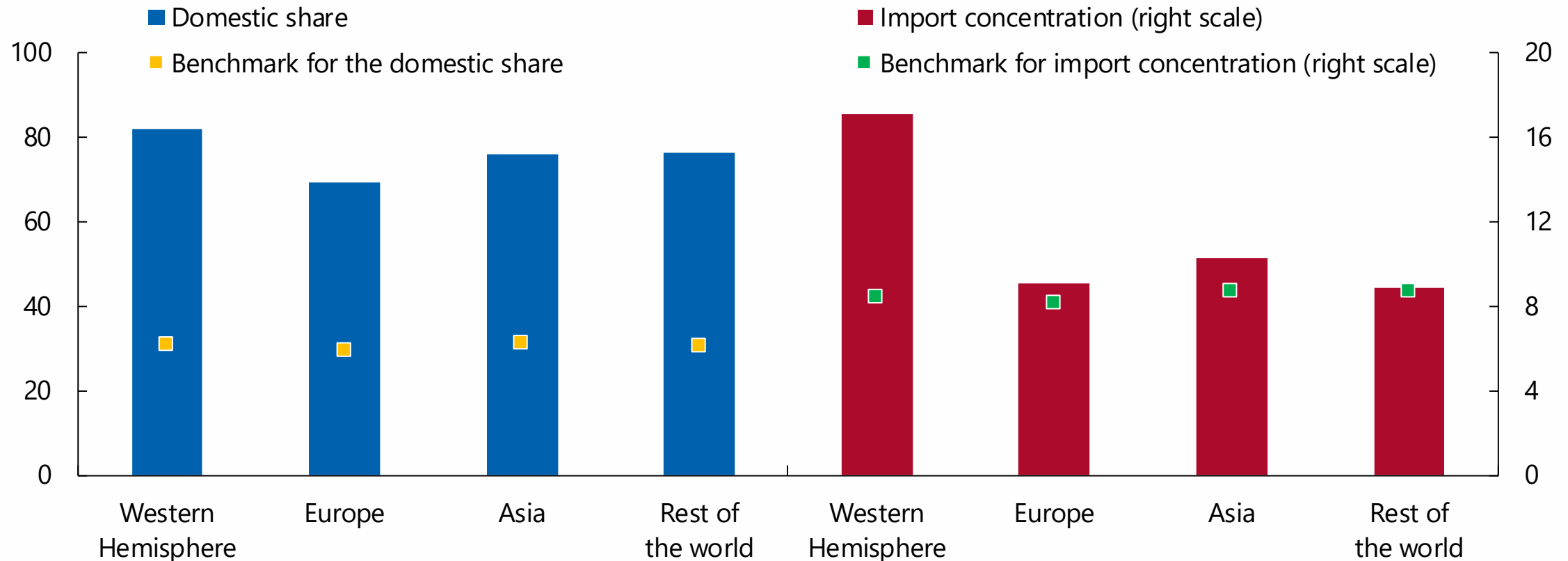
Examples: Reducing the number of unique semiconductor chips (GM) or writing software that works on different chips (Tesla).

Room for diversification

- Substantial room to diversify the sourcing of intermediate inputs away from domestic sources
- But little room to diversify across foreign countries

Room to Diversify the Sourcing of Intermediates

(Percent)

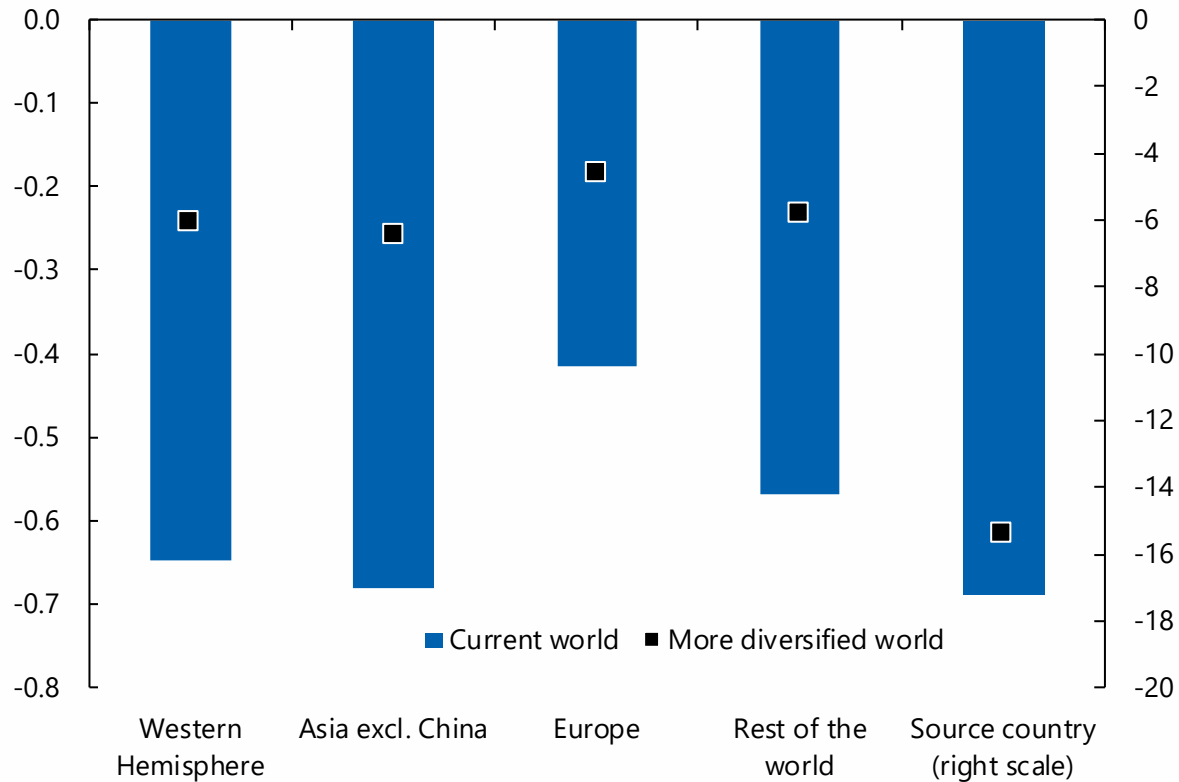


Sources: Organisation for Economic Co-operation and Development, Inter-Country Input-Output Tables; and IMF staff calculations

Diversification protects against shocks

Gains from Diversification Following a Supply Disruption in a Large Supplier Country

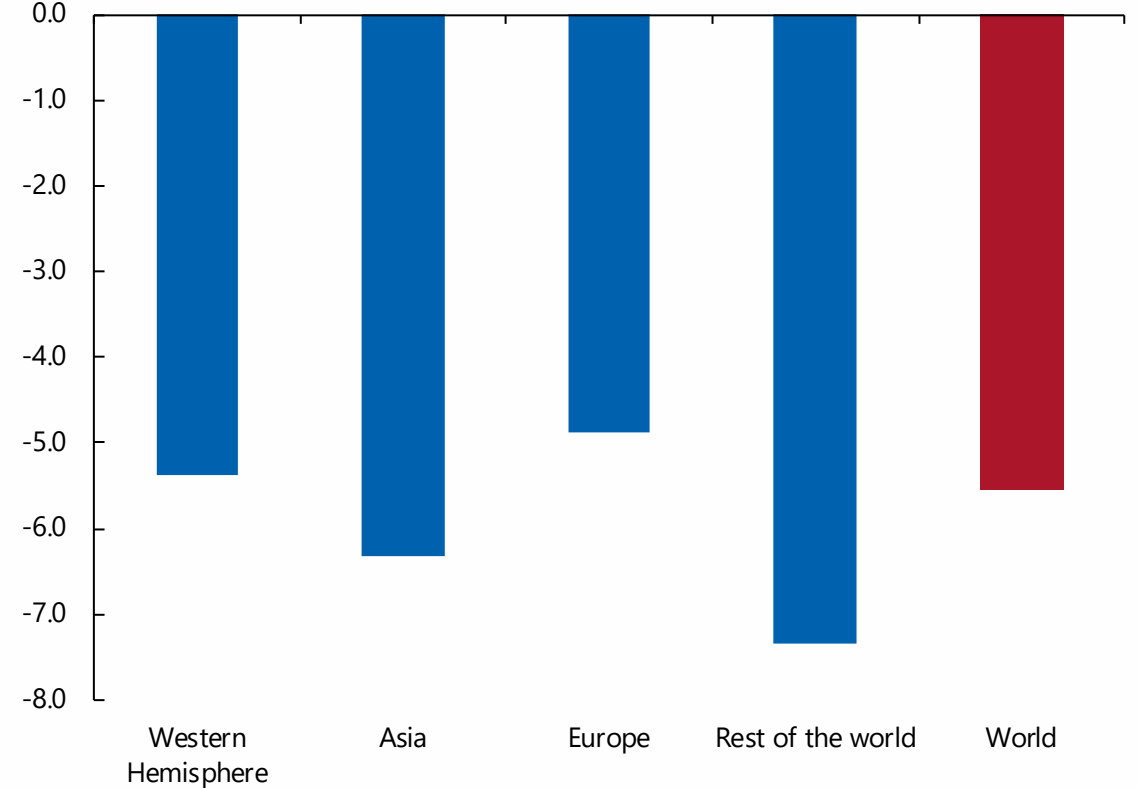
(Percent)



Note: The figure shows GDP declines in response to a 25 percent labor supply contraction in a country that is a large global supplier of intermediates

Gains from Diversification under Shocks to Total Factor Productivity

(Percent)

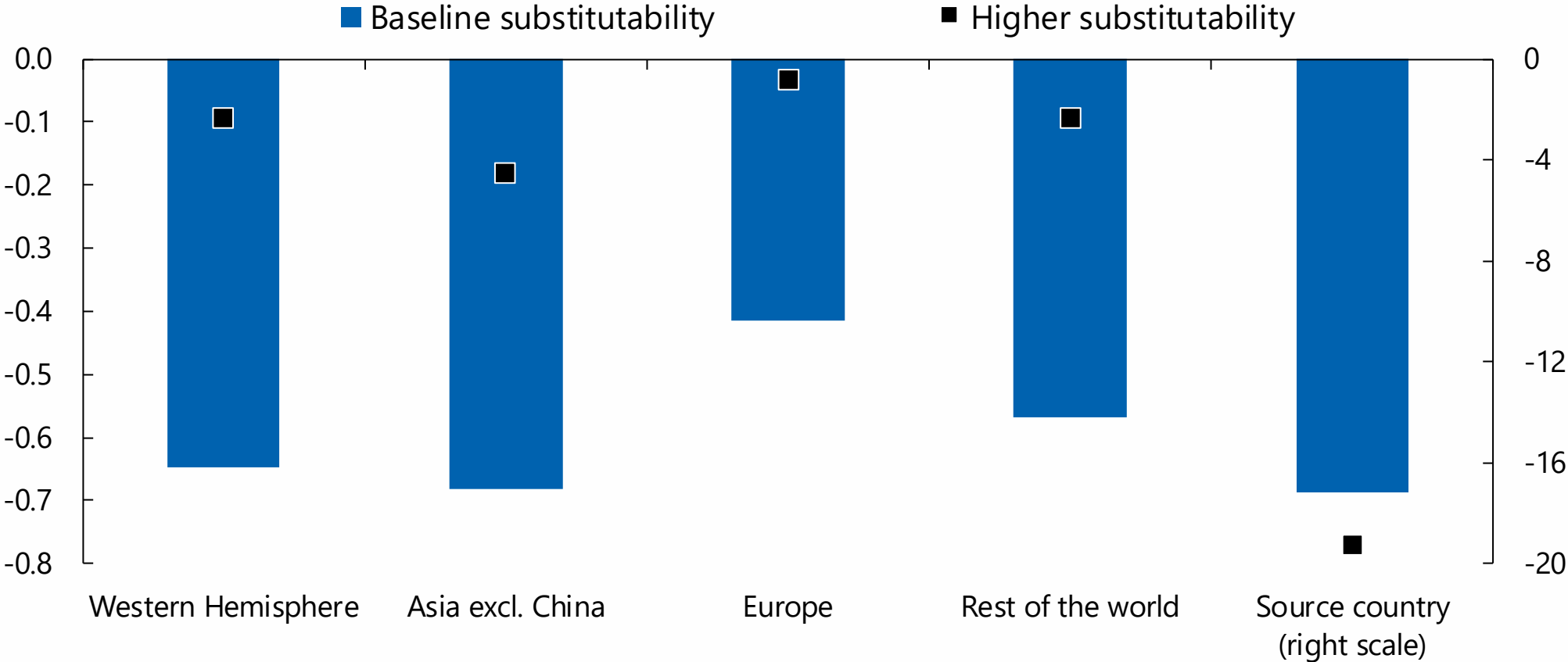


Note: The bars show simple averages within each region of the percentage reduction in volatility.

Source: IMF staff calculations.

Higher substitutability brings benefits and costs

Gains from Substitutability Following a Supply Disruption in a Large Supplier Country
(Percent)

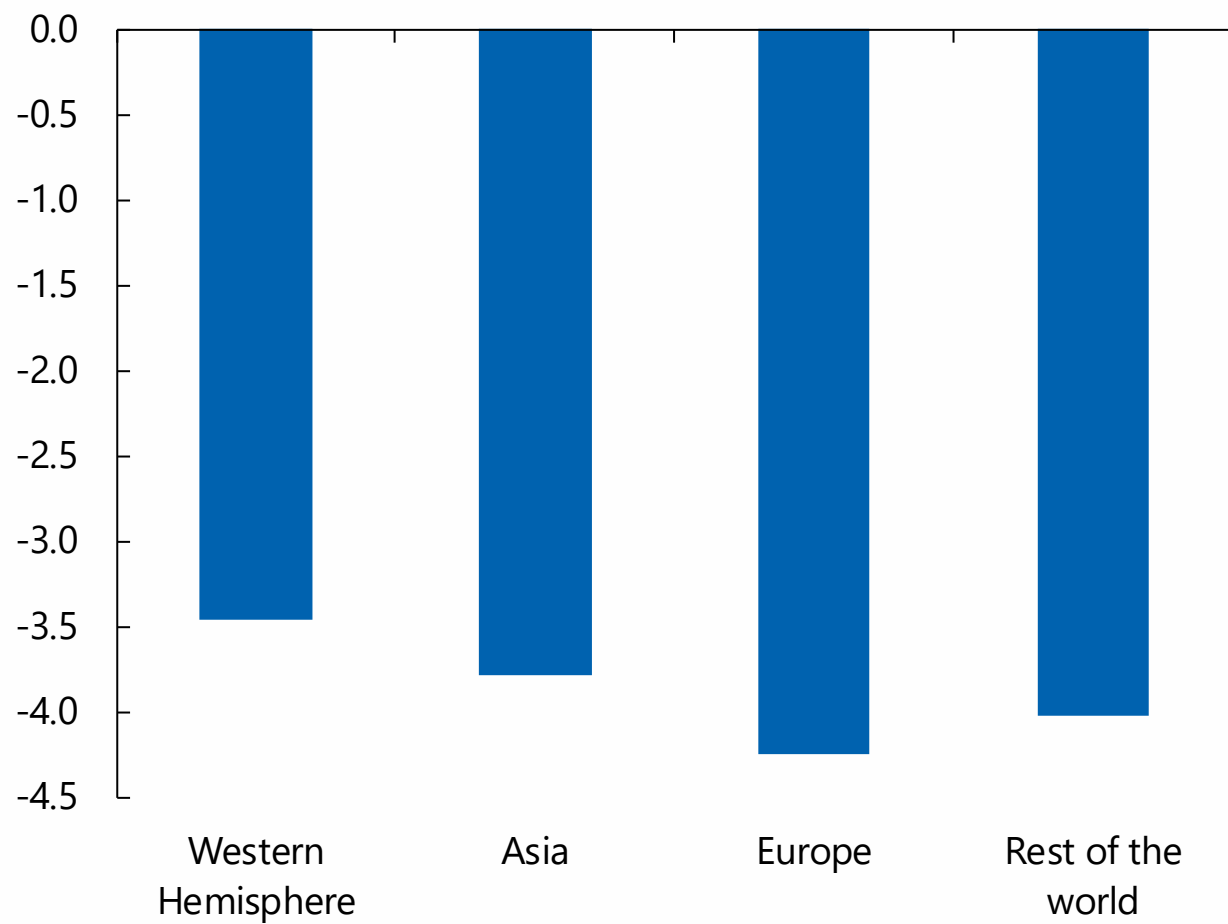


Source: IMF staff calculations.

Lower trade costs increase diversification

Lower Concentration from Lower Trade Costs

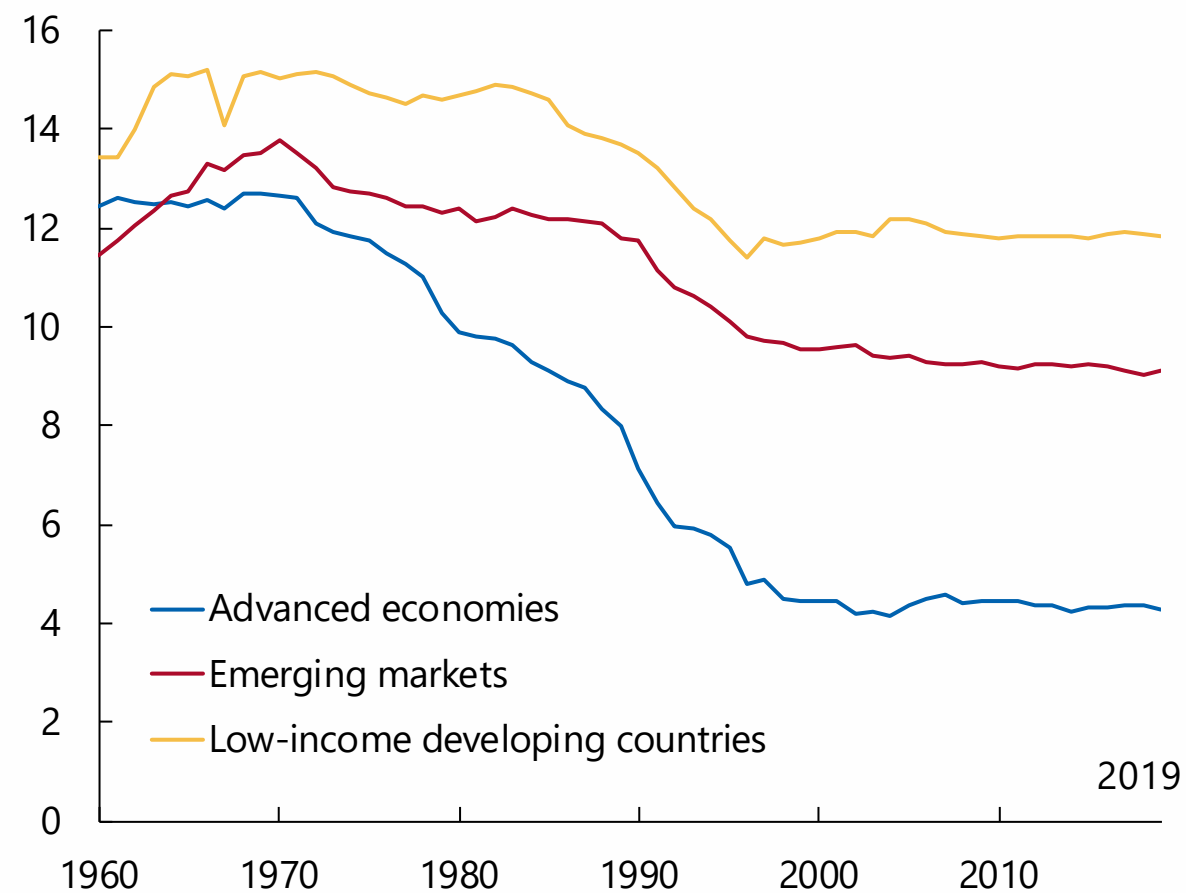
(Percentage point change in Herfindahl index)



Source: IMF staff calculations

Nontariff Barriers Index

(Simple average)



Source: : Estefania-Flores and others (2022).

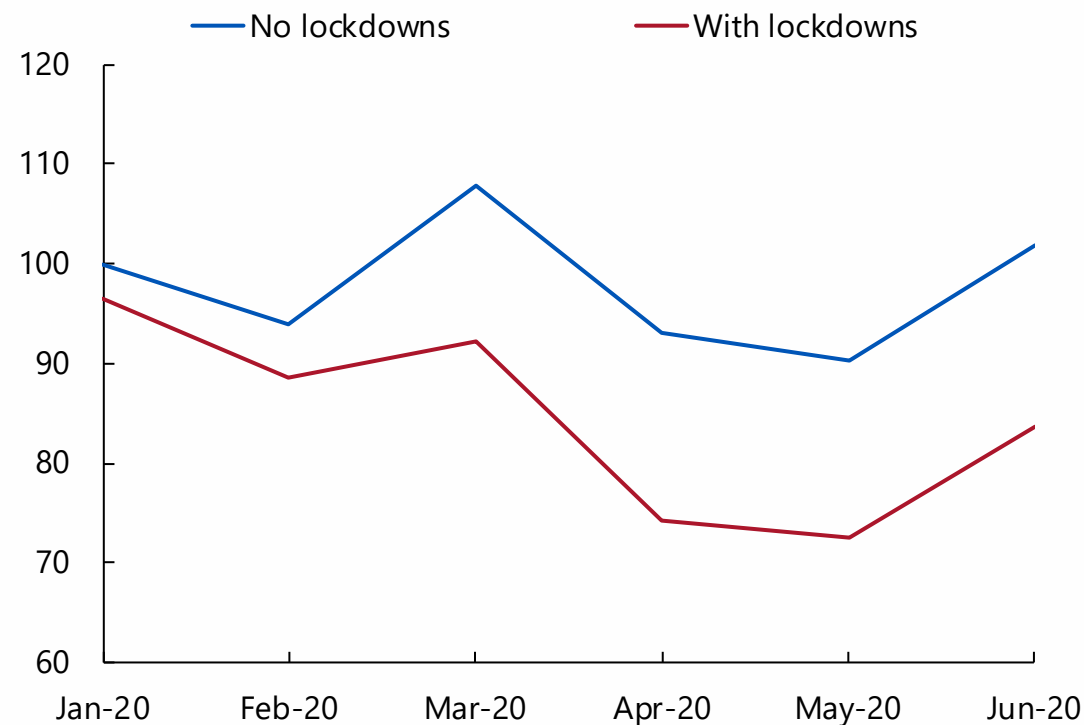
Negative spillover effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Stringency index	-0.00141*** (0.000)	-0.00149*** (0.000)	-0.00183*** (0.000)	-0.00160*** (0.000)	-0.00182*** (0.000)	-0.00234*** (0.001)	
Covid cases per million, lagged			0.00002 (0.000)		0.00002 (0.000)		
Covid deaths per million, lagged			-0.00056 (0.001)		-0.00051 (0.001)		
Number of new export restrictions				0.01631 (0.011)	0.00917 (0.010)		
Number of removed export restrictions				-0.00299 (0.002)	-0.00199 (0.002)		
Stringency index x Upstreamness						0.00039* (0.000)	0.00057*** (0.000)
Observations	23,594,169	23,531,808	21,787,468	23,531,808	21,787,468	23,531,808	23,531,808
Exporter-importer-industry FE	Y	Y	Y	Y	Y	Y	Y
Importer-month FE	Y	-	-	-	-	-	-
Importer-industry-month FE	N	Y	Y	Y	Y	Y	Y
Exporter-month FE	N	N	N	N	N	N	Y

Fall in trade: observed and predicted with no lockdowns

Spillover Effect of Lockdowns

(Percent of predicted value with no lockdowns in Jan 2020)



Sources: Hale and others (2021); Trade Data Monitor; and IMF staff calculations.

Note: The chart plots the evolution of good imports under a counterfactual without any containment policy in place in trade partner countries. The counterfactual of no lockdown (green line) is obtained using the results reported in Table A2.1 (column 6) and imposing a value of zero for the Stringency index over the entire period. The red line plots the actual evolution of imports (in the same sample) in percent of the value with no lockdown in January 2020.

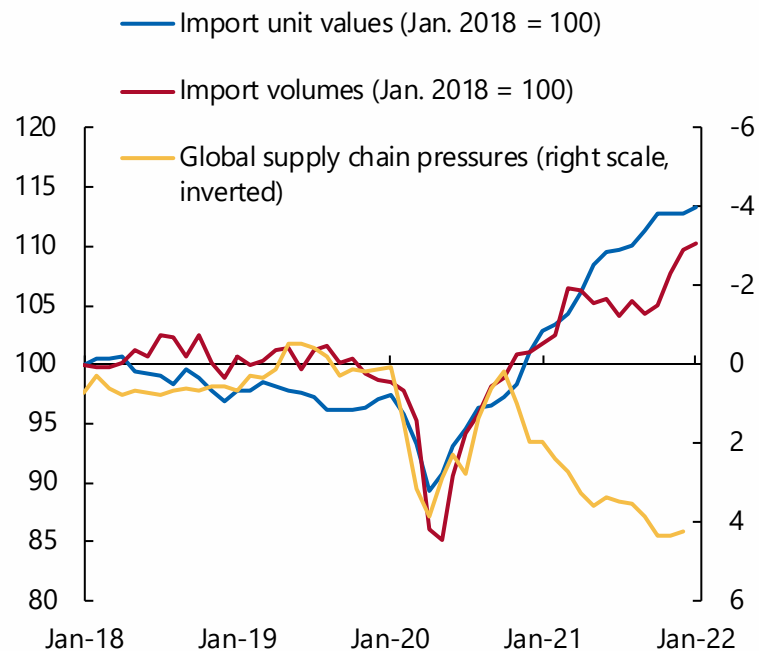
Supply chain disruptions persist in some sectors

The recovery in trade continued, even as supply chain pressures resumed in late 2020

The pressures have large real effects on firm inventories, production, and sales

Trade tensions and domestic shocks constrained the recovery in the automotive sector, despite strong demand

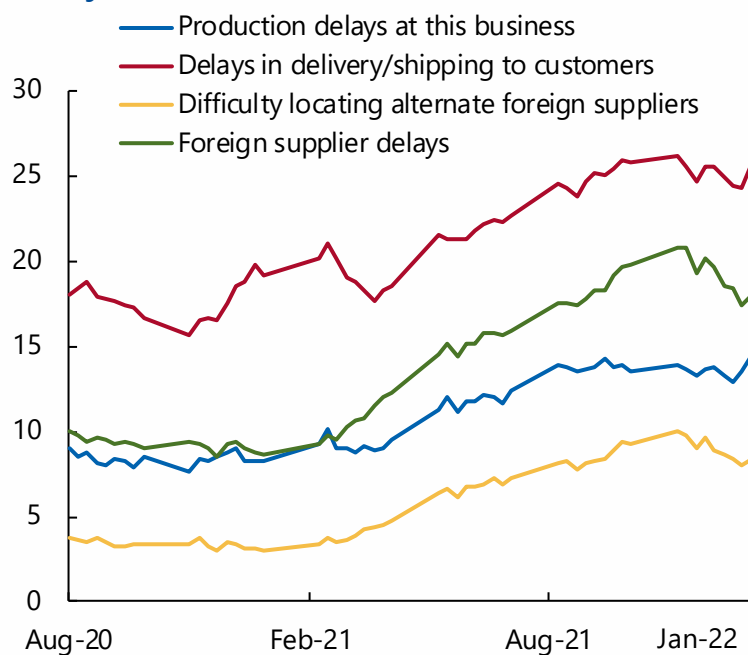
Global Goods Trade and Supply Chain Pressures (Index)



Sources: Benigno and others (2022); CPB World Trade Monitor; and IMF staff calculations.

Note: The index of global supply chain pressures is a composite measure of several variables combining cross-border transportation costs with country-level supply chain measures on delays, backlogs, and inventories from manufacturing surveys.

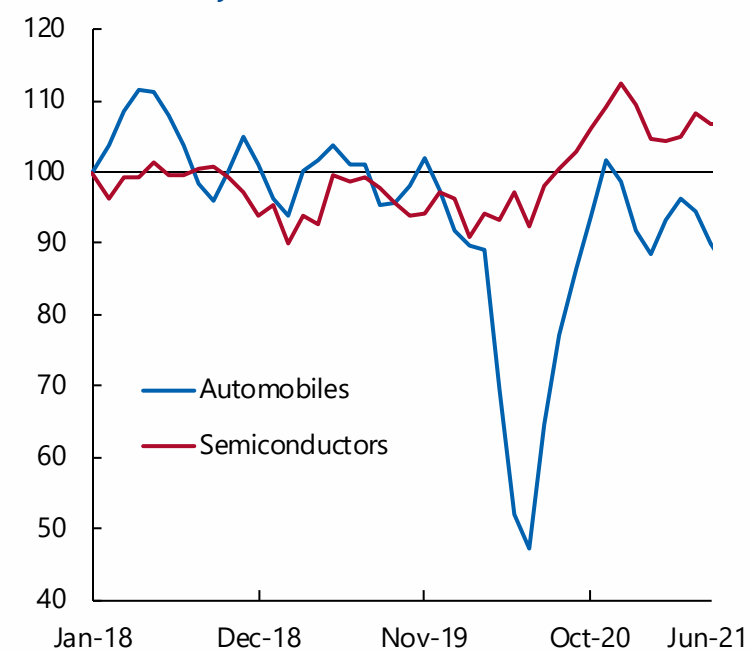
Foreign Suppliers, Production, and Delivery Delays in the United States (Percent)



Sources: United States Census Bureau, *Small Business Pulse Survey*; and IMF staff calculations.

Note: Data are as of January 20, 2022.

Trade in Automobiles and Semiconductors (Index, January 2018 = 100)

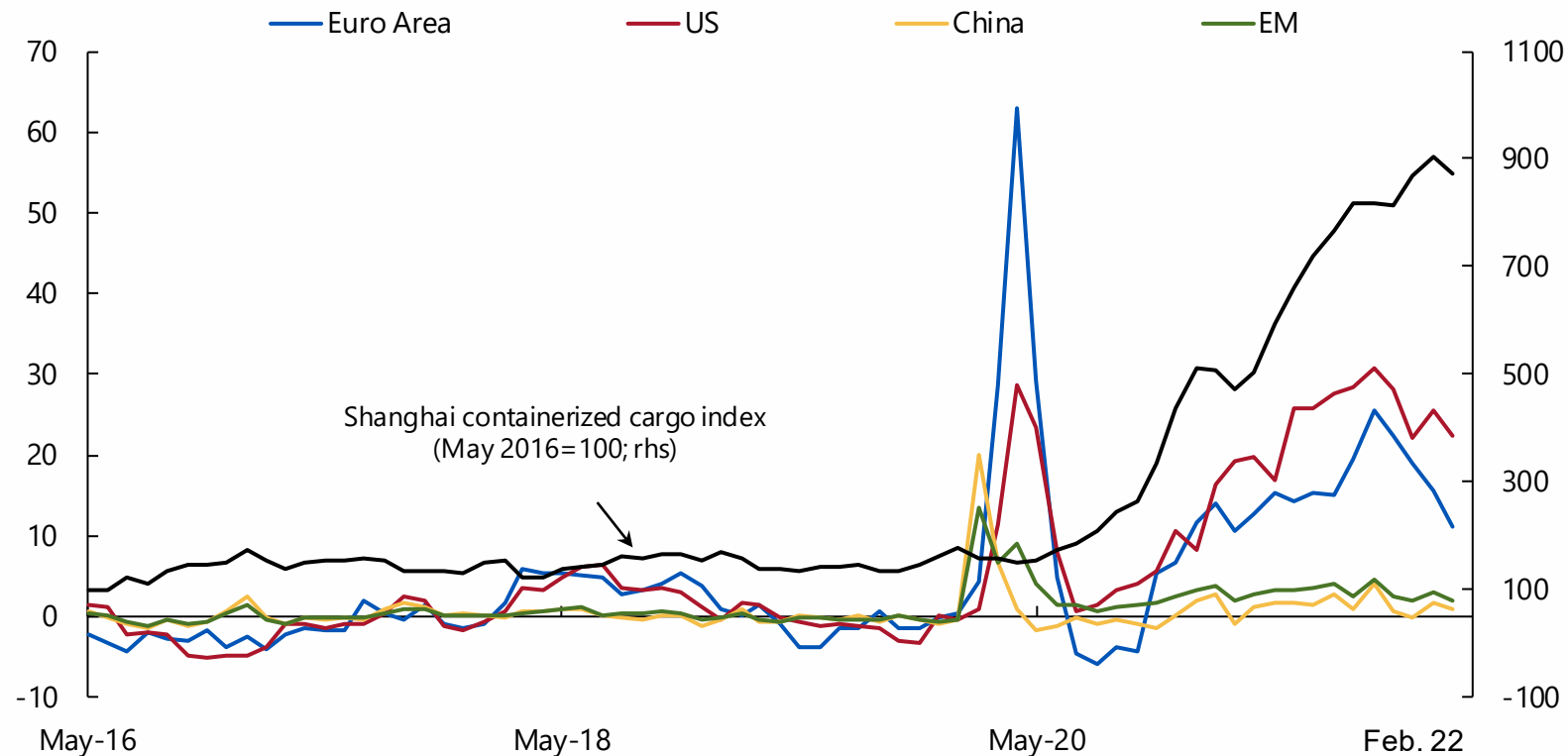


Sources: Trade Data Monitor; and IMF staff calculations.

Note: "Automobiles" comprise HS 6-digit codes for manufactured intermediate inputs and final goods (vehicles). "Semiconductors" comprise HS 6-digit codes 854150 and 854190.

Other measures of supply chain disruptions

Supply chain disruptions (index)



Sources: The Baltic Exchange; Haver Analytics; and IMF staff calculations.

Note: Supply chain disruptions are calculated as the difference between the supply delivery times sub-index in the PMI and a counterfactual, cyclical measure of supply delivery times based on the manufacturing output sub-index in the PMI.

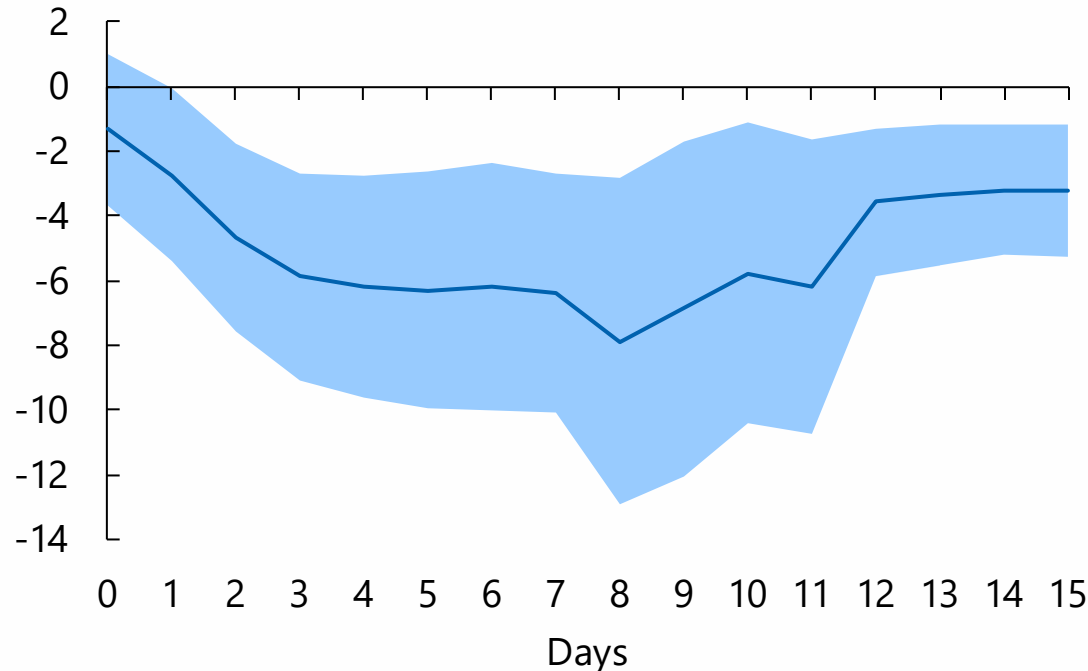
Shipping data confirms that trade adapted well to the pandemic

Exporter lockdowns have a large and statistically significant impact on bilateral trade volumes

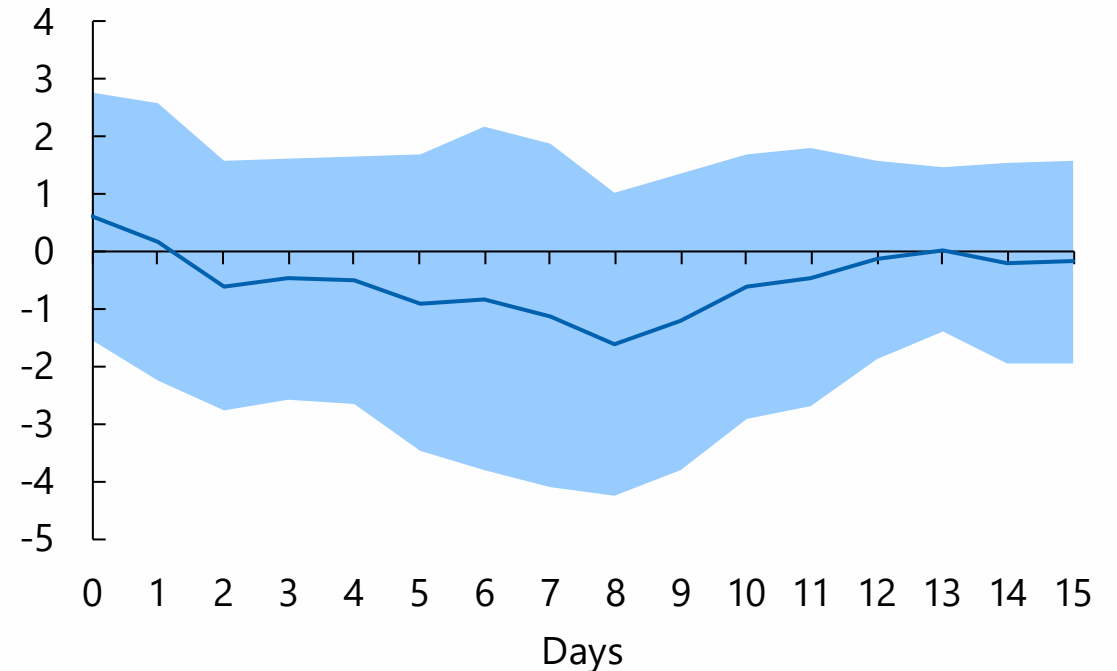
But they have no statistically significant effect on trade volumes in 2021

Response of Bilateral Import Growth to Exporter Lockdowns (Percent)

1. Full sample



2. 2021 sample



Source: IMF staff estimates based on Cerdeiro and others(2020). Automatic Identification System data collected by Marine Traffic.
Note: The blue shaded area indicates 95 percent confidence bands; robust standard errors.

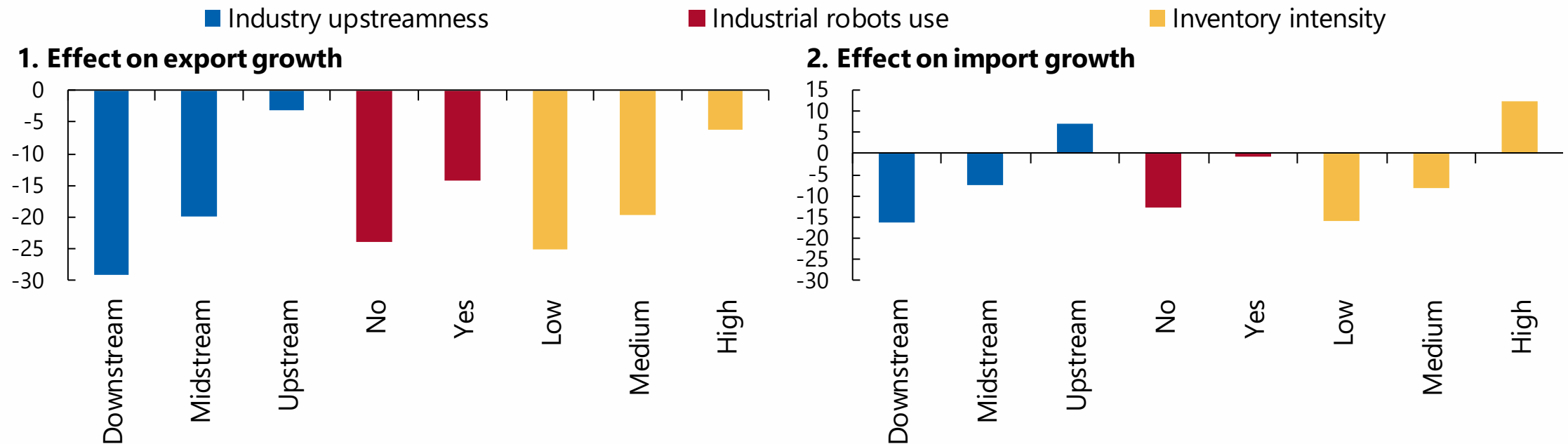
Value chain position, automation and inventory management modulated the firm level response to the pandemic shock

Upstream, more automated and firms with more inventories were more resilient to the shock in terms of their exports

Similar patterns held in terms of input demand

Impact of Supply Chain Upstreamness, Automation, and Inventories on Trade Adjustment

(Percent)



Sources: Antras and others (2012); French Customs data; Hale and others (2021); and IMF Staff Calculations.

Note: Each bar corresponds to the average effect for a given group of firms derived from the regression of firms' exports and imports on COVID-19 lockdown intensity and COVID-19 deaths in trade partner countries interacted with the industry's upstreamness index, median ratio of inventories to sales, and firm's use of industrial robots. Downstream industries are closest to the final consumer, whereas upstream and midstream industries specialize predominantly in production of intermediate inputs.

Impact of the Ukraine War: Trade Channels

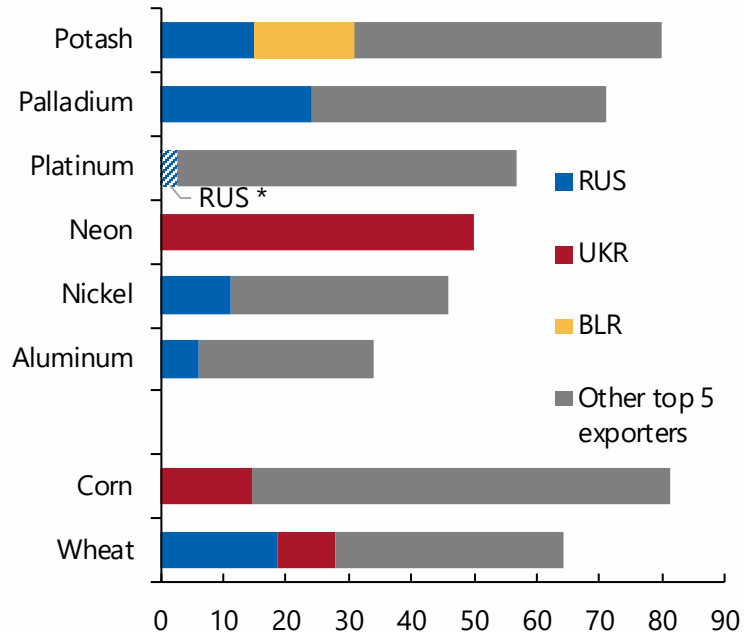
Russia, Ukraine, and Belarus are important producers of critical commodities

Prolonged disruptions carry significant risks, as reflected in Ukraine's and Russia's high level of participation in GVCs

Prices of critical metals and grains are at record highs with upside risks to food prices.

Share in Global Exports

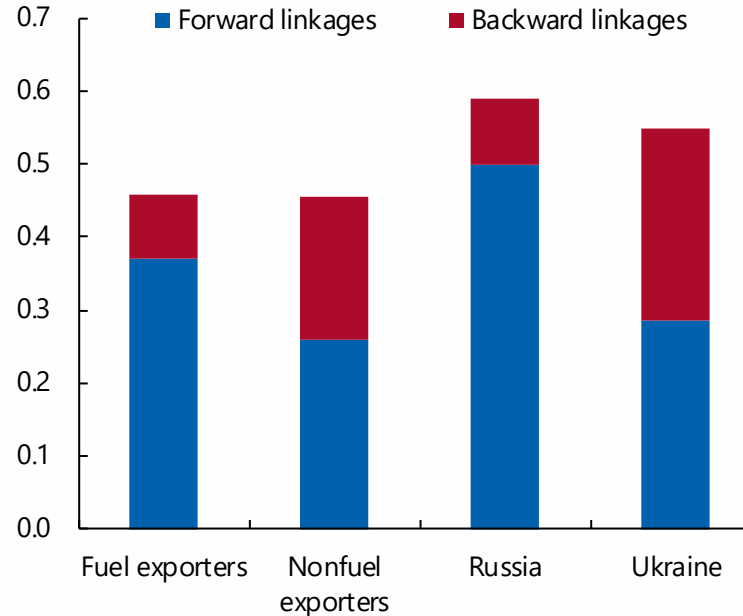
(Percent)



Sources: FAOSTAT; UN Comtrade; IMF staff calculations.
 Note: Share of metals exports by value. Russia is the 10th largest exporter of platinum. Data availability for neon exporters is limited. Share of agricultural exports by weight.

GVC Participation, 2018

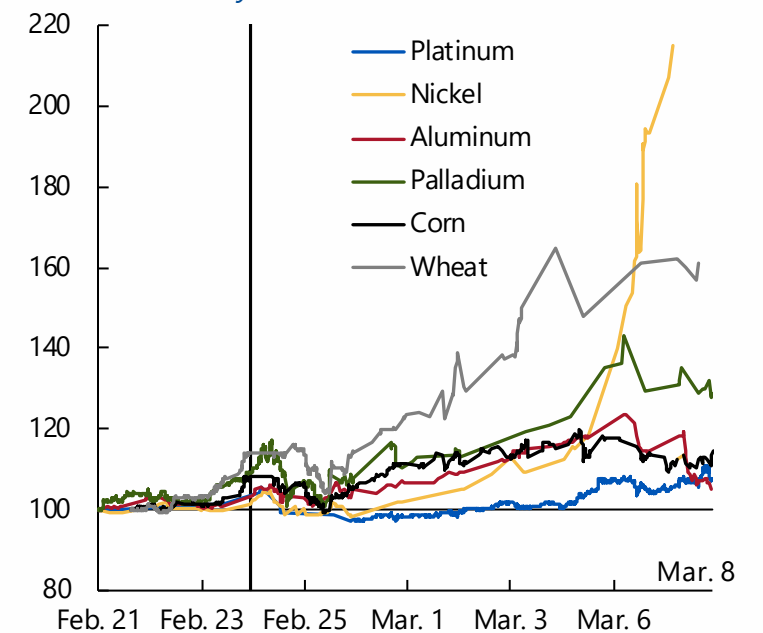
(Share of exports)



Sources: UNCTAD-Eora Global Value Chain (GVC) database and IMF staff calculations.
 Note: GVC participation is the sum of backward and forward linkages. The former measure imported intermediate inputs that are used to generate output for exports. The latter measure exports of intermediate goods that are used as inputs for the production of exports of other countries. See Casella and other (2019) for methodological details

Commodity Prices

(Index, February 2021 = 100)



Source: Bloomberg.
 Note: Front-month contracts. Last data point is March 8 at 1:40 p.m. Vertical line = February 24, 2022 (Invasion).