



33th Annual EAEPE Conference

“Recovery from the Covid-19 Pandemic: Re-thinking the role of the State towards safe, cohesive, sustainable, and innovative economies”

Parthenon University of Naples, Italy, 2-4 September, 2021

Insights from Complexity Economics for building economic resilience: the case of global value chains



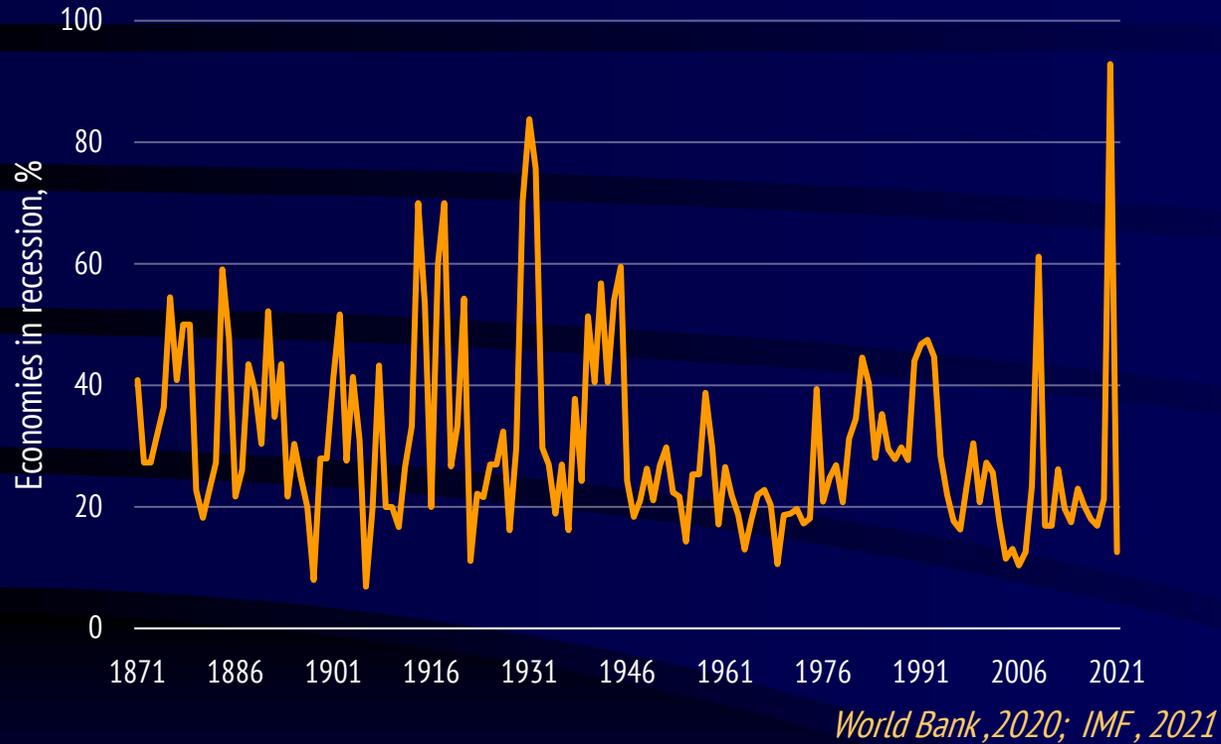
**Nataliya Smorodinskaya,
Institute of Economics,
Russian Academy of Sciences**

Special session

“A Window of opportunity for Heterodox Economics amidst the financial and health crises”

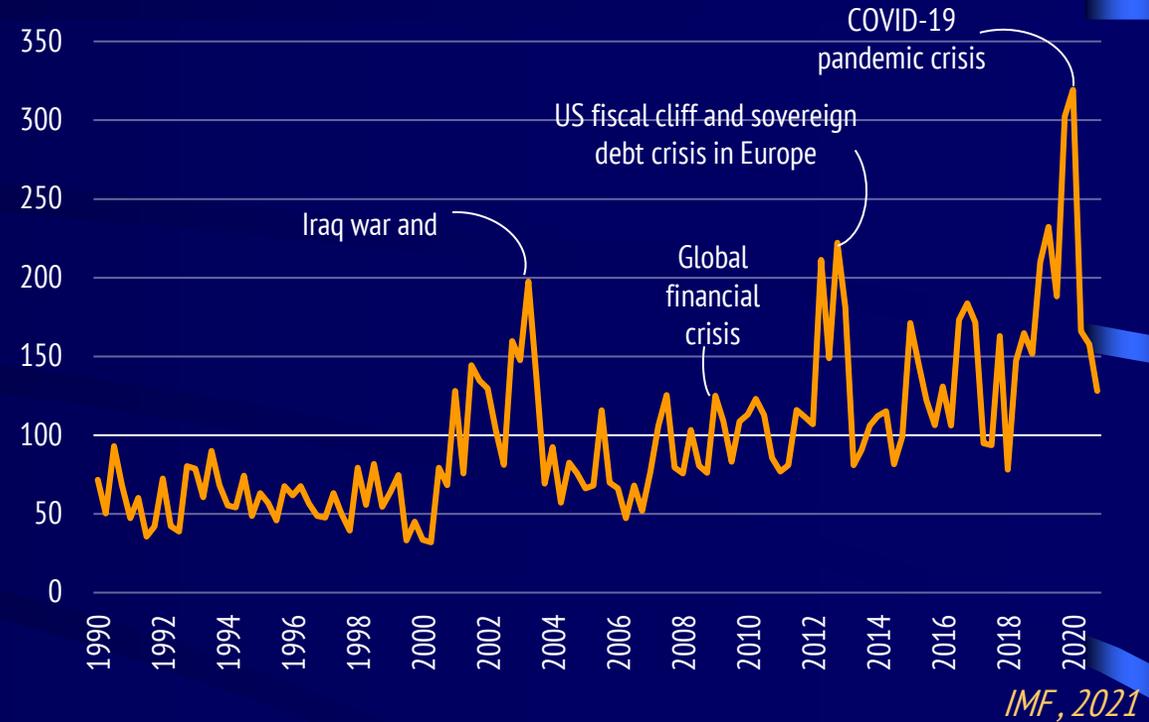
The 2020 global recession was the first shock-induced crisis typical for the interconnected world of networks and for the complexity of production through global value chains (GVCs)

Share of economies in downfall during global recessions, 1871-2021, %



World Uncertainty Index, 1990-2020

Index, long-term average = 100



Unlike in the times of previous pandemics, local downfalls can now immediately diffuse globally through GVCs.

- Last year's recession had **a record level of synchronism** (90% of economies ran negative growth rates) and the resulting **record deepness** (- 3.6% ac. to IMF) among peacetime global recessions for the last 150 years (*Barro et al., 2020*). It caused **a record upsurge of uncertainty** in world markets (more two times higher than during the Great recession of 2008).

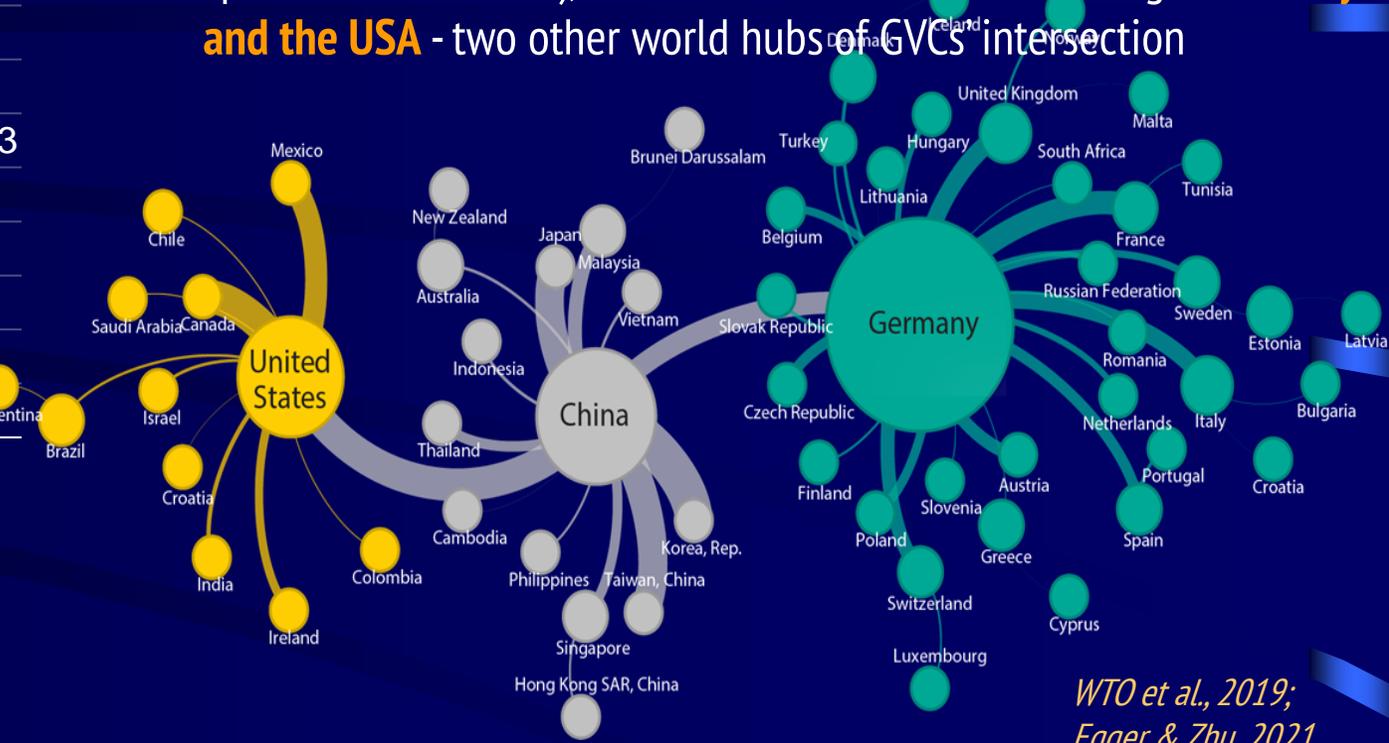
Value-added trade through GVCs, accounting for a half of world trade (or \$ 10 trill per year, ac. to MGI), has become **a key channel for dissemination of supply disruptions and the resulting production downfalls from a country to country** (Ivanov & Dolgui, 2021).

Trade through GVCs before the pandemic shock (% of total trade)



ADB MRIO 2021, authors' calculations

Transmission of shocks started from **China** (far before the global spread of lockdowns), and then was exacerbated through **Germany and the USA** - two other world hubs of GVCs intersection



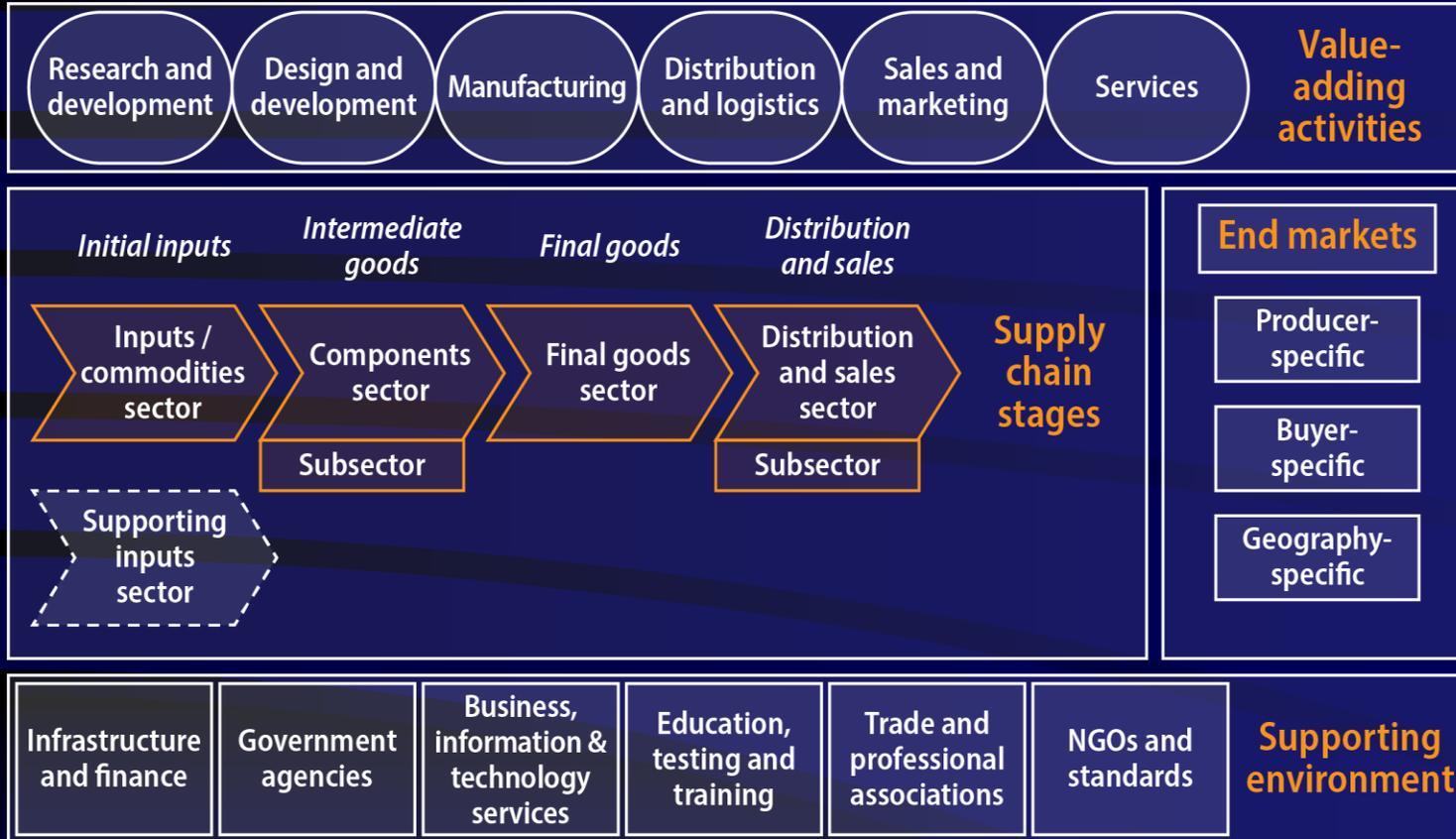
WTO et al., 2019;
Egger & Zhu, 2021

The pandemic crisis revealed that **increased interconnectedness of economies as GVCs' partners** can put them at destabilizing risks in case of a sudden fall in deliveries from just a single country, particularly from China.

- Academic and public circles on both sides of Atlantic started a sharp debate: **do risks of shock transmissions through GVCs outweigh benefits of countries' participation in them? And how to lessen the overdependence of countries on supplies from China?** (OECD, 2021)

Under lockdowns of 2020, disruptions in GVCs came from **the collapse of just-in time supplies**, involving the majority of economies

GVC as a dynamic multi-structural system: a typical organizational model



Supply chains (stages of inter-firm trade in intermediates) are a key structural component of a GVC

➤ A small firm-level supply disruption can propagate downstream from a stage to a stage, and amplify throughout the GVC, resulting in **devastating impacts on its aggregate performance** (sales, output, total profit, market share, stock returns). This is called **domino, or ripple effect** (Ivanov et al, 2019)

Ripple effect of supply disruptions can generate disruptions in all GVC structural components, undermining its network architecture and VA production process. **The longer this effect lasts, the larger are structural disruptions**, up to a complete breakdown of the whole GVC system (Ivanov et al., 2019)

Adapted from Frederick, 2019

- Due to multiple supply interdependences, any disruption at the level of an individual GVC firm or its partners in other GVCs (earthquake, delay in shipment, fire at a factory, working strike, cyberattack, etc.) can lead to cascading output losses across industries and economies
- **Ripple effects can spread worldwide in a similar fashion as information diffusion, or bank failures, or biological epidemics** (Minas et al., 2019), while interdependencies among thousands of supplier and sub-supplier firms get transformed into cross-country interdependencies

Share of industrial output produced by countries in the rows due to importing intermediate goods from countries in the columns, % (2015)

	North America			Europe							Asia-Pacific region										
	US	CA	MX	DE	GB	FR	IT	ES	TR	NL	CH	CN	JP	KR	TW	AU	ID	BR	RU	IN	
North America	US	1.6	1.6	1.0								6.5	1.2	1.0							
	CA	14.1	1.4	1.2	0.5							7.2	1.2	2.2	0.5						
	MX	15.5		1.7		0.6	0.6					14.3	2.3	2.6	1.1			0.6		0.7	
Europe	DE	1.6			1.0	2.0	1.9	1.1	0.6	1.3	1.0	4.6	0.9	0.6					0.8		
	GB	2.6	0.5		2.9	1.6	1.2	1.0	0.6	1.0		4.8	0.6	0.6						0.6	
	FR	2.4			5.7	1.2	2.3	1.9		0.8	0.6	4.1	0.6							0.5	
	IT	1.1			4.9	0.8	2.3	1.6	0.8	0.8	0.6	4.6		0.7						1.2	0.6
	ES	1.2			4.5	1.2	3.3	2.3		0.6	0.8	4.6	0.6	0.6							0.6
	TR	1.1			2.1	0.6	0.8	1.2	0.8			5.0		1.3						2.0	1.0
	NL	1.8			5.0	1.2	1.2	0.9	0.7			3.7	0.7								0.9
	CH	2.4			8.2	1.6	1.9	3.1	1.1	0.6	0.7	5.2	0.9								0.5
Asia-Pacific Region	CN	1.5		0.9									1.9	3.0	1.9						
	JP	1.4		0.7							6.3		1.2	0.6							
	KR	2.9		1.8		0.5					16.4	4.4		1.8					0.6	0.6	
	TW	2.7		1.3							13.8	6.4	3.4				0.8		0.6	0.6	
	AU	1.8		1.0							7.1	2.2	1.5	0.5							
	ID	0.9		0.5							7.4	2.1	1.9	0.7							0.6
	BR	2.2		1.0							4.6	0.5	0.6							0.6	
	RU	1.0		1.9		0.8					5.7	0.8	0.8								
	IN	2.1		0.9	0.5						7.2	0.9	1.5	0.5						0.7	

Baldwin & Freeman, 2020 (OECD ICIO data base)

What can we learn from **the matrix of cross-country interdependences** through various GVCs in manufacturing?

- All major economies are interconnected either as immediate suppliers or indirectly as sub-suppliers (*foundation for globally rippling disruptions in case of a shock in one country*)
- There are **three macro-regional network “factories”** in the world, where countries’ supply interdependences are the most dense (in North America, in Europe and in APR)
- **US (the hub of NA factory)** depends also on supplies from Germany (the hub of Europe) and most strongly, from China (the hub of APR). Similar dependences are typical for Canada and Mexico. **Germany and other countries in Europe** seriously depend on US and also most strongly, on China. The same dependence on US, Germany and especially on China is typical for **Brasilia, Russia and Indonesia**.
- **China is really the world's industrial workshop:** its products based on supplies of components from 5 other countries (USA, Germany, Japan, Korea and Taiwan), dominate in intermediate imports of all major economies. So, shutdowns of Chinese firms at the start of 2020 really stroke the entire world manufacturing and associated sectors.
- Moreover, considering cross-country dependencies in NA and Europe, **any production shock in one of 3 hubs, as well as in Japan or Korea, can lead to output falls in all leading world economies.**

According to forecasts, in the coming decades, the world will face more intense and cascading global shocks (*diseases, climate change disasters, disruptions from new technologies, financial crises*) (Peterson Institute IE, 2021).

- **building a resilience capacity to cope with shocks** becomes not just a strategic imperative but also a key competitive advantage for all types of economies and businesses.

The concept of economic resilience

- derives from systems sciences and complexity theory, particularly, from complexity economics that views economies as **complex adaptive systems (CAS)** able to demonstrate **a dynamic sustainability** in a constantly changing environment (Arthur, 2021).
- a key property of CAS is **agility**, and resilience is a manifestation of it in concern with **radical uncertainty** (Sreedevi & Saranga, 2017)

According to OECD description, **resilience** is the ability of a complex system to flexibly recombine its elements and resources for keeping on at a dynamic equilibrium in response to sudden disturbances. **A system is considered resilient if it is able to absorb unpredictable shocks and quickly recover after them** (OECD & SIDA, 2017)

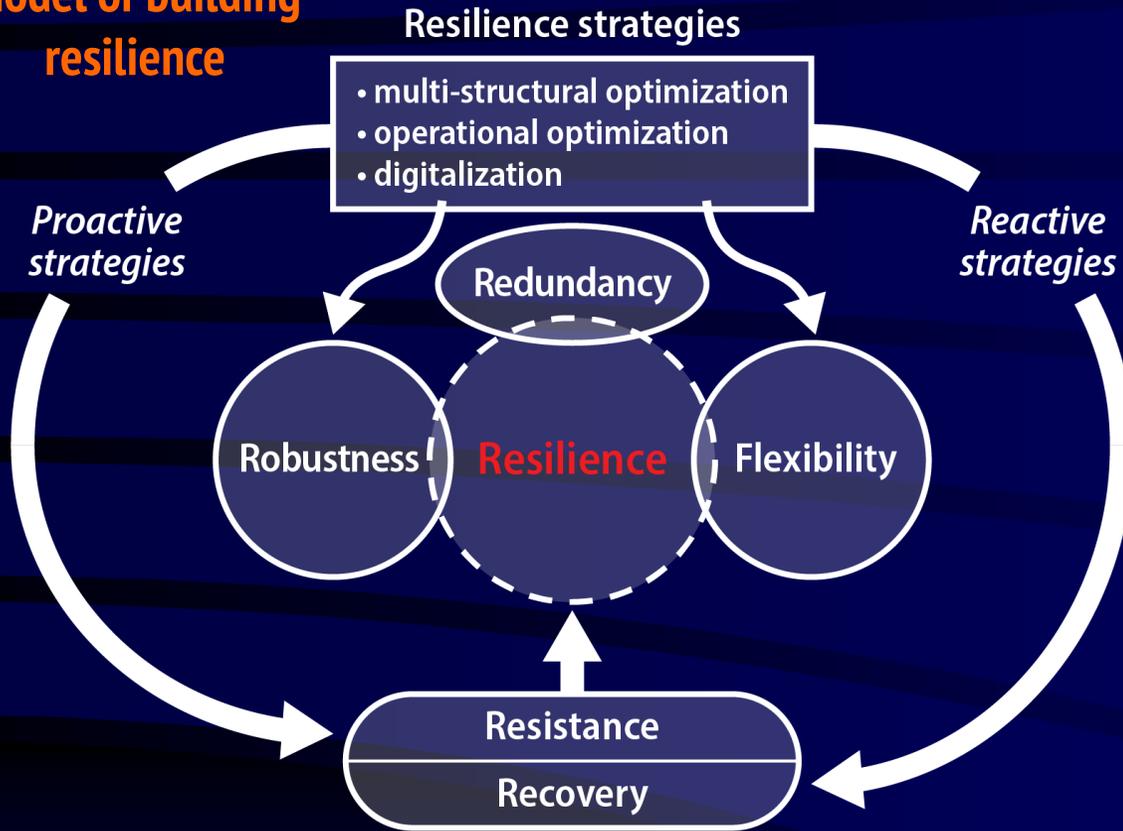
- *in terms of growth model*, resilience implies maintaining effective performance under uncertainty due to **capacity for a continual innovation** (accounting for that, the EU new industrial policy for 2020s aims to foster transition of member-states to innovation-driven growth)
- *in terms of growth policy*, firms and countries now need to revise their neoclassical perceptions of systems' sustainability, with refocusing their strategic priorities **from maximizing current profits to ensuring long-lasting resilience** (OECD, 2021). Traditional cost saving measures, including just-in-time supplies, are no guarantee from sudden losses in the world of the 2020s.

A key practical implication

- The post-pandemic recovery of economies and their adaptation to future shocks will depend on **resilience efforts of not just national governments but also of large multinationals (MNEs) that organize GVCs**

Since 2020, leading MNEs started to eliminate revealed weaknesses in GVCs' architecture and enhance their resilience to shocks

Model of building resilience



Adapted from
Dolgui, Ivanov, Sokolov 2018
with insights from complexity theory and latest empirical findings

A resilient system must be typically **robust** enough (structurally stable) to safely absorb shocks, and simultaneously, **flexible** enough to self-adapt to post-shock changes through recombination of its elements and resources.

➤ Reaching a dynamic balance between robustness and flexibility requires **building redundancy** – some surplus assets and reserve facilities that could be activated in case of a shock for a maneuver

In the new risk management of global firms, resilience is about **establishing control over possible ripple effects**, which encompasses **two stages of activities** (plan A and plan B) **in developing the GVC:**

- ✓ **proactive activities** (*before disruptions*) are meant to prevent or constrain possible ripple effects, increase the GVC robustness and flexibility, and ultimately **ensure its resistance to possible shocks**
- ✓ **reactive activities** (*if ripple disruptions still occur*) are meant to mobilize the earlier built redundancy assets and flexibility capacities of the system to lessen its financial losses from disruptions and **to ensure its quick after-shock recovery**

Ivanov et al. (eds) *Handbook on Ripple Effects*, 2019

➤ Upon reviewing recent economic and business literature on GVCs, we have grouped the post-pandemic resilience strategies of global companies in three complementary areas (*Smorodinskaya & Katukov, 2021*)

Post-pandemic strategies of leading MNEs for enhancing GVCs' resilience: **three complementary directions**

I. Restructuring the architecture and supplier networks of GVCs

1. **Diversification of suppliers and relocation of GVCs' links** (a key instrument)

- **Multi-sourcing** – expanding geography and number of suppliers, up to dual and multiple input sourcing, in each GVC link
 - **Nearshoring** – switching from long-distance offshoring to closer locations
 - **Partial re-shoring** – returning some offshore links to the country of origin (especially from China). **No mass reshoring across industries is expected**
- To diversify risks, reducing dependence of GVC firms on just one or two suppliers or locations (*especially, the overdependence on China*)
 - To reduce length of supply chains and, hence, the geography of ripple effects
 - To localize production in some 'strategic sectors' (*like pharmaceuticals*) and bring production of some goods (*like clothes*) closer to end markets

2. **Regionalization of GVCs** - further switching from globally dispersed GVCs to their more compact, macro-regional configurations

- To improve control over ripple effects, restraining diffusion of disruptions within the borders of macro-regions

3. **Smart-sourcing** - moving manufacturing GVC links to innovation clusters worldwide, while domestic R&D links, offshore to developing economies

- To build such GVC configurations that ensure a continual innovation process across the entire chain and, hence, its dynamic sustainability

II. Improving the production process in GVCs

1. **Building redundancy** (*extra inventory, reserve production capacities, duplicate supply sources*) in all or key GVC's links

- To increase agility of GVCs in recombining their facilities for shock resistance and for post-shock adaptation to changed environment

2. **Reducing operational costs and increasing flexibility** at all stages of production through applying advanced ICT-based technologies

- To support the GVC total productivity under sudden shocks and to compensate for expensive investment in redundancy

III. Digital transformation of GVCs (a key trend of the 2020s)

- **Adoption of latest ICT** (*big data analytics, advanced trace & tracking systems, Blockchain, cyber-physical systems, 3D printing*) that provide real-time data coordination and transparency of supply flows, while reducing both production costs and supply disruption risks

- To trace roots of disruptions and radically improve control over their propagation, while moving over time to **a new generation of digital GVCs with low sensitivity to shocks** (*due to delivering services with data on manufacturing intermediate goods rather than goods as such*)

Despite the collapse of the just-in-time supply system and a severe global recession of 2020, **fears of a large-scale de-globalization and of countries' withdrawal from GVCs turned to be false.**

Not just empirical evidence but also numerous econometrical findings confirm that **advantages of distributed production through GVCs outweigh the associated risks of increased interdependences:**

- ✓ *World bank (2020):* value-added trade in intermediate goods better supports economic growth than traditional trade in final goods
 - ✓ *OECD (2020, 2021):* over-localization of production do not give more security to economies but rather make them less efficient in terms of growth and less able to cushion shocks through international trade
 - ✓ *Boston Consulting group (2021):* the idea of technological "self-sufficiency" of nations will impose enormous additional costs upon economies, while sharply raising the price of final products (f.e., in semiconductor industry, by 35-65%)
 - ✓ *Bank of England (2021):* shocks can come from any location, not just from China. So, policies to reshore production only increase volatility in the given economy, as they concentrate disruption risks in one domain instead of diversifying risks among many locations
 - ✓ *Kiel IWE, Germany (2020):* **GVCs are more likely to cushion the crisis impacts of sudden shocks than to amplify them.** If the pandemic shock happened under traditional trade and in the absence of GVCs, then a number of large economies, including Germany, could face an even greater drop in GDP.
- Resilience strategies of MNEs will rather give a new impulse to globalization, **redirecting it to a less turbulent and a better arranged stage** as compared with its previous phases since early 1990s.

Globalization of the 2020s, marked in literature ‘re-globalization’ (*Gereffi 2020*), may open **a window of new development prospects for a large number of lagging economies** (*World Bank 2020*)

- Diversification of suppliers and reallocation of GVCs’ links will **change the global industrial landscape**: in the next 5 years, up to a quarter of the world production facilities for manufactured goods may be moved to other jurisdictions (*MGI 2020*). So, according to EBRD, **many developing economies will get a chance to find a new export niche in GVCs**, squeezing positions of China as a dominant supplier of cheap intermediates (*Javorcik, 2020*). And **China’s role** in GVCs will increasingly shift to a vast and growing end market for final goods (*World Bank, 2020*).
- Transition of GVCs to more compact configurations (*through regionalization, nearshoring or partial reshoring*) will **amplify economic integration within world macro-regions** (far beyond Europe and South-East Asia), which may **refine specialization of their member-countries, while lending new economic value to some locations**.
- Digitalization of GVCs will **amplify servicification of production**: the emergence of new GVCs in service sectors is expected to increasingly outpace their appearance in manufacturing (*WTO, 2019*). This will open **new export opportunities for those transition economies that are actively developing ICT-sector and digital services at home** (like Russia, f.e.).

However, **these objective chances can not be realized automatically** (*World Bank 2020; OECD 2021*)

- **All nations** should avoid trade conflicts (like US-China trade war) and keep their markets open
- **Developing economies** need to improve their business climate and ecological standards, as well as to liberalize their trade and investment regulations, especially in digital services.

Thank you for your attention!



smorodinskaya@gmail.com