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Editorial

Disruption of global and regional supply-chains in the aftermath of Covid-19 pandemic. Analyses and forecasts

The impact of the Covid-19 pandemic on transport and logistics has been remarkable. In the passenger transport sector, travel habits and behaviours have abruptly changed also as a consequence of travel restrictions and lockdowns, and a long-term impact with a reshape of the overall mobility system is expected (Fazio et al., 2022). In the logistics and freight transport sector, the consequences are even more complex. One emblematic case is the huge rise of e-commerce purchases and of on-demand logistics, leading to new logistics scenarios especially for last-mile deliveries (Le Pira et al., 2021; Maltese et al., 2021).

If one looks at the wider picture of global supply chains, whereas they have always been characterized by high complexity and uncertainty (Corsini et al., 2022; Costinot et al., 2013), Covid-19 pandemic and its current globally troublesome aftermath have revealed supply chains (SC) full-scale vulnerabilities and have helped foster a debate on the mechanisms of new SC risk management (Baldwin & Freeman, 2021). The new complexity urges supply chains actors to map and visualize the hidden risks of SC extension and interdependencies.

Covid-19 is an extreme event that sets the stage for the age of "regression to the tail" (Flyvbjerg, 2020) in which risk management, differently from events measured against a normal distribution, should prompt decisions based on "tail events" requesting rapid mitigation actions according to the precautionary principle. Moreover, being a severe disruption caused by a simultaneous demand and supply shock, its effects have not remained localized and have engendered cascade impacts leading to often unforeseen "ripple effects" compounding the impact of the initial disruption (Dolgui & Ivanov, 2021).

As a "black swan" of unprecedented severity in terms of supply disruption, wars apart, Covid-19 provides the ideal testbed to assess circumstances, systems, organizations, routines and policies that could help assess and plan supply chain criteria of resilience in times of extreme adversity.

The aim of this Special Issue is to contribute to the current literature on the analysis of SC disruption effects from a perspective of extreme events. The vulnerability to which regional and global supply chains are subject under extreme events, like the Covid-19 pandemics, raises several concerns in terms of impacts on transport and logistics scenarios. First, it brings up the need for a risk identification to map out and assess the value chains of all major products. Second, it generates the need to assess organization’s and firm’s preparedness to deal with specific risk along the supply chain. Third, it stresses the need to have reliable metrics and statistics to deliver early warning systems to track top risks, to maximize the chances of mitigating, or at the very least limiting, the impact from their occurrence.

All papers in the Special Issue tackle SC disruption in the aftermath of the first Covid-19 wave and the subsequent lockdown of economies in several countries. The debate on SC during and after Covid-19 has often been steered towards the need to assure "resilience" beyond "robustness", the former indicating the ability to return to post-disruption operations and the latter affirming the capacity to guarantee operations during a crisis (Mirodout, 2020). Yet, the term resilience is not undisputed. It comprises at least two perspectives: one of engineering resilience, often looking at SC as a closed and engineered system and the other related to a socio-ecological view to resilience implying a complex and adaptive phenomenon (Wieland & Durach, 2021). The two views must be reconciled when attempting to understand and prepare for extreme disruptions. This special issue confirms that SC complexity entails several intertwining perspectives to allow a new risk management approach and new policy formulation for new global scenarios.

Overall, the insights of this special issue are related to these crucial aspects of supply chain disruption:

- Asymmetry of effects
- Pressure of supply chain stakeholders’ requirements in risk management
- Vulnerability from export interdependency
- Multiplier effect in regional economy
- Assessment of total cost for nearshoring strategies
- Need of Policy adjustment in transportation and energy sectors
- Resilience of the small business sector

This Issue comprises ten papers. A wide geographical coverage and a wealth of methodological approaches testify the theoretical complexity of SC mapping of vulnerabilities under extreme events (Fig. 1).

The papers in this issue help build evidence for the strategic management of SC during disruptive events from at least three perspectives. From a perspective of trade, distance and regional economy, the paper by Suriyan Jomthanachai, Wai-Peng Wong, Keng-Lin Soh, Chee-Peng Lim, A global trade supply chain vulnerability in Covid-19 pandemic: an assessment metric of risk and resilience-based efficiency of CoDEA method, shows that the vulnerability of global SC is dependent on the vulnerability of the export system of each country together with the inefficiencies of their import countries. As such, the authors recommend that a strategic selection of trade and SC partners is followed. The paper by Edwin Van Hassel, Thierry Vanselander, Kris Neyns, Hans Vendebo, Dominique Kindt, Stefan Kellens, Reconsidering nearshoring to avoid global crisis impacts: applications and calculation the total cost of ownership for specific scenarios illustrates that COVID-19 may be a trigger that will re-inforce the
| Title | Author | Focus | Methodology | Major outcomes and insights |
|-------|--------|-------|-------------|-----------------------------|
| A global trade supply chain vulnerability in Covid-19 pandemic: an assessment metric of risk and resilience-based efficiency of CoDEA method | Sunyian Jombornatech, Wai-Peng Wong, Keng-Lin Soh, Chee-Pang Lim | Global trade interconnectedness and vulnerability of supply chain systems | Extended network structure of Data Envelopment Analysis (DEA) | Trading partners with a lower risk and the ability to rapidly recover their import volume reflect their less vulnerable supply chains |
| Reconsidering nearshoring to avoid global crisis impacts: applications and calculation the total cost of ownership for specific scenarios | Edwin Van Hasselt, Thamy Varenius, Kris Neyens, Hans Vandeborre, Dominique Kindt, Stefan Kellens | A quantitative and qualitative framework to assess factors leading to nearshoring choices | Cost Case study (Belgium) | Total Cost of Ownership model and Qualitative panel of industry decision makers |
| Covid-19 and seaborne trade: the Italian perspective | Claudio Ferrari, Luca Pesko, Alessio Tai | Immediate impact on trade of Covid-19 first wave shocks | Analysis of Italian Customs Agency Database Fixed effects regression models | Trade and transport costs may be decisive as they determine also the lead time and hence the costs related to stocks. Qualitative decision factors do not always match economic outcomes. |
| The economic impact of Covid-19 pandemic in Sardinia | S. Delfi, I.P. Caesar, R. Pretaroli, C. Socci | A comprehensive macroeconomic framework for assessing the economic and social impact of policies (lockdown) with direct and indirect effects | A computable general equilibrium (CGE) model calibrated on a Social Accounting Matrix (SAM) | Activities most affected by lockdown account overall for 32% of the drop in production. Tourism mostly affected in terms of economic contraction and loss of value added. Sharp decline in compensation of employees and income. Reduction in tax revenue. Public administration and households mostly hit in terms of disposable income. |
| How Covid-19 affected green-fuel supply chain? A performance analysis of Brazilian ethanol sector | Paulo Noeca Alves Junior, Isotília Costa mela, Rodrigo de Morais Santos, Fernando Vinicius da Rocha, Jose Victorica Caixeta Filho | Pandemic’s effects on ethanol industries of 15 ethanol producing Brazilian states | Data Envelopment Analysis as a basis to analyse the relative efficiency of decision-making Units (DMU) | Importance of national public policies to the agribusiness and include such as Renov energy program in Brazil and other low food commodity pricing incentives |
| Flows of goods to the shock of Covid-19 and toll-free highway policy: evidence from logistics data in China | Da Fang, Yan Guo | Negative impacts of Covid-19 on logistics Case study (China) | Analysis of a logistic business platform covering more than 1.8 million trucks and 336 pre-toll-level regions | The pandemic led to an average daily drop of 0.67% in road freight volume and an increase of 0.48% in road freight rate compared to non-pandemic period. |
| Significance of digital technology in manufacturing sectors: examination of key factors during Covid-19 | Biswajit Mohapatra, Sudhanta Tripathy, Deepak Singh, Rajendra Nath | Factors that influence revenue generation in industries during and after shocks | Selection of 12 key factors through critical literature review and Structuring Modelling of 15 experts from Academia and industry | Technologies such as AI, IoT and Big data lead a centralised decision making to make supply chains more efficient contrary to prior knowledge that factors most needed are time to recovery and time to restore. |
| Issues and analysis of critical success factors for the sustainable initiatives in the supply chains during Covid-19 pandemic outbreak in India: a case study | Soni Rajan, K. Mathiyazhagan, Vernika Agarwal, K. Bivikumar, Vikas Kumar, Andrea Appolloni | Stakeholders' requirements and critical success factors for sustainable supply chains under extreme events | Hybrid quality function deployment, best-worst methodology based on literature review and panel of experts. | Managerial implications in terms of critical success factors. Lead factors are: social distancing, emergency logistical systems, emergency backup facilities. |
| Enablers of resilience in the healthcare supply chain: a case study of US healthcare industry during COVID-19 pandemic | Christos Zamiera, Viamali Ullah, Hosain A, Gerd Jarrard | Assessment of the characteristics of a resilient healthcare supply chain Case study (USA) | Multicriteria decision making with 12 indicators based on literature review. Survey with panel of healthcare experts Weights analysis index and rank reversal method | Guidelines to medical supply chain during a long-term crisis. Broad backup storage, closer collaboration between Government and healthcare sector, increase information sharing all along the chain. |
| Small business survival and covid-19: an exploratory analysis of carriers | Larry C. Guenther, Shane Denlow, Anita Isabell Rynarzewski | Small businesses in the truck industry with cash flow problems caused by Covid-19 shocks | Case study (USA) | Two-case study (two trucking firms) Comparison with national transportation database | Power imbalances can occur in the supply chain when certain parties act opportunistically. More volatility among these businesses than the national index. Both small businesses utilized their entrepreneurial orientation (EO) by taking forward-looking actions to reduce their risk exposure and avoid failure. They also utilized resources according to resource orchestration theory by reconfiguring their resource portfolio to lower their cost structures viaselected layoffs. |

Fig. 1. Overview of the papers included in this special issue.
nearsourcing process. Accordingly, SC sectoral specialisation of a country is critical, since different characteristics will play a different role depending on the sector. Furthermore, transport costs typically do not have the biggest share in total supply costs, but may be decisive as they determine also the lead time and hence the costs related to stocks. The impact of Covid-19 shocks on national and regional economies is the subject respectively of the paper by Claudio Ferrari, Luca Persico, Alessio Tei, Covid-19 and seawborn trade: the Italian perspective and the paper by S. Deriu, I.P. Cassar, R. Pretaroli, C. Socci, The economic impact of Covid-19 pandemic in Sardinia. The first highlights the impact on the Italian national port logistic sector and acknowledges that this impact has not been consistently distributed neither spatially nor temporally and future recovery actions should take these asymmetries into consideration so to allow a faster bouncing back effect and customised tools for the different sectors. The latter confirms that the economic impact of Covid-19 crisis exacerbated in the territories where the economy mostly depends on tourism activities, which continue to suffer a decrease despite the interruption of containment measures.

From a perspective of national policies, the paper by Paulo Nocera Alves Junior, Isotília Costa melo, Rodrigo de Moraes Santos, Fernando Vincius da Rocha, Jose Vicente Caixeta-Filho How Covid-19 affected green-fuel supply chain? A performance analysis of brazilian ethanol sector recommends the implementation of public policies to support fossil-fuel substitution programs, mainly, by assisting state mills to become environmentally certified to take advantage of income opportunities available in the carbon credit trading market. The paper by Da Fang, Yan Guo Flows of goods to the shock of Covid-19 and toll-free highway policy: evidence from logistics data in China shows that policies aimed at the logistic sector such as the Chinese toll-free policy is an effective short-term policy to hedge the negative shock of the pandemic on the logistic industry, stimulating resumption of production. The paper by Biswajit Mohapatra, Sushanta Tripathy, Deepak Singhal, Rajandini Saha Significance of digital technology in manufacturing sectors: examination of key factors during Covid-19 is a reminder of the importance of coordinated policies to help the digital transition in the manufacturing sector also as an enabling factor against adverse conditions of the market.

From a perspective of risk management and firms’ resilience, the paper by Sonu Rajak, K. Mathiyazhagan, Vernika Agarwal, K. Sivakumar, Vikas Kumar, Andrea Apolloni Issues and analysis of critical success factors for the sustainable initiatives in the supply chains during Covid-19 pandemic outbreak in India: a case study shows that a major challenge is to address this disruption risk and bring sustainability to SC. The paper also highlights that ‘Social distancing’, ‘Emergency logistics systems’ and ‘Emergency backup facilities’ are the top three critical factors that should be implemented first by the organizations to accelerate the sustainability initiative during and after the pandemic outbreak. The paper by Christian Zamiela, Niamat Ullah Ibne Hossain, Raed Jaradat Enablers of resilience in the healthcare supply chain: a case study of US healthcare industry during COVID-19 pandemic illustrates that the best way to combat disruptions in the healthcare SC due to large-scale pandemics is to share information quickly, reduce reliance on the design of the supply chain, and track the usage of necessary medical supplies. Finally, the paper by Larry C. Giunipero, Diane Denslow, Ania Rynarzewska, Small business survival and covid-19: an exploratory analysis of carriers shows that Power imbalances can occur in the SC when certain parties act opportunistically. These imbalances are analyzed through theories of Resource Dependence, Resource Orchestration, and Entrepreneurial Orientation (EO). Small businesses that utilize their EO by taking forward-looking actions reduce their risk exposure and avoid failure.

The focus of this issue on the immediate aftermath of an extreme event of SC disruption provides methodological tools and perspectives to analyse the first impact of a severe crisis. Under an uncertain global scenario, more research is needed to further understand how SC could be strategically re-designed and supported to guarantee their long-term structural resilience. Some questions for future research may address the role of regional economies to generate resilient strategies, the role of technology for SC visibility, the role of policy for risk mitigation.

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