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Globalization

By
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# Globalization, shipping and trade
## October 17th, 2024

**The Globalization Chair workshop on October 17th presented five studies on globalization that use AIS (Automatic Identification System) data. The research focused on how trade network configurations shape the impact of political changes and economic shocks. The results revealed that the ability to redirect trade between different modes of transport (air, road and sea), between different points in the network and between carriers plays a crucial role in determining the spread of disruption and its ultimate economic impact at global and local levels.**

The first presentation by Yuan Tian (University of Nottingham), entitled "Unpacking Global Shocks" (co-authored with Alejandro G. Graziano), revealed several key insights about supply chain disruptions during the COVID-19 pandemic. This research examined COVID-19's impact on Colombian imports from 2018 to 2021 by decomposing local supply and demand shocks. The study leveraged comprehensive datasets combining subnational human mobility data (from sources like Facebook and Baidu), detailed trade flow information (including prices, quantities, and transport costs), and container ship port calls. The analysis showed that COVID-related mobility disruptions in Colombia (the importing country) led to reduced import quantities but had no significant effect on prices. However, local disruptions in supplier cities and seaports on the way both increased import prices and reduced quantities. Analysis of shipping data revealed that reduced mobility at export ports resulted in extended ship waiting times and elevated freight costs. The findings indicate that local disruptions during the pandemic primarily manifested as a negative supply shock, while residual structural factors acted as a positive demand shock, with the resulting excess import demand contributing to domestic inflation.

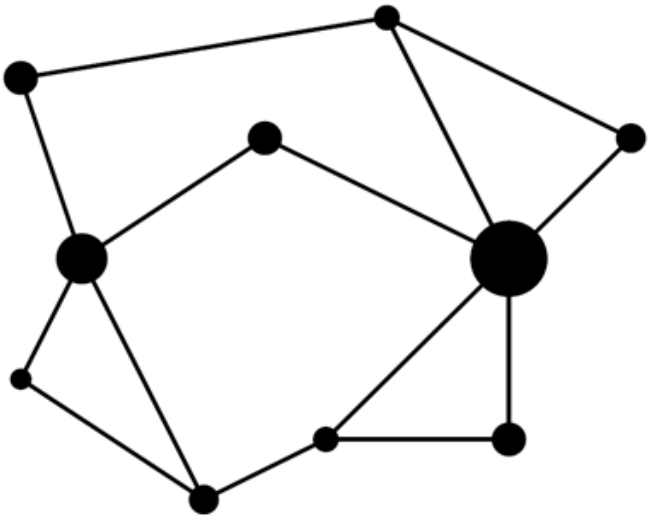
The research also provided robust evidence supporting supply chain diversification strategies. Cities with diverse supplier networks demonstrated greater resilience to pandemic-related disruptions, supported by elasticity calculations across exporter locations–a crucial metric for assessing supply chain resilience. Products with multiple supplier options exhibited higher substitution elasticity, empirically demonstrating that supply chain diversification enhances shock absorption capacity.

These findings have significant implications for supply chain management, suggesting that maintaining multiple supplier relationships substantially improves resilience to global disruptions.

The second presentation by Barthélémy Bonadio (NYU Abu Dhabi), entitled "Ports vs. Roads: Infrastructure, Market Access and Regional Outcomes," examined the comparative impact of port and road infrastructure improvements on market access and welfare in India. The research addressed the optimal allocation of infrastructure investment budgets between ports and roads to maximize trade and social welfare. A key finding was that while most Indian exporters (80%) utilize a single port for their exports, they rarely choose the nearest one, likely due to significant variations in port efficiency and challenges in land accessibility.

Looking at the transport network representation in *Figure 1*, it seems desirable to concentrate investment on major central nodes of the network, as capacity constraints at these points can create significant bottlenecks. Similarly, improving access routes to these central hubs should be prioritized. Conversely, investments in peripheral nodes and their connecting routes are likely to yield more limited benefits.

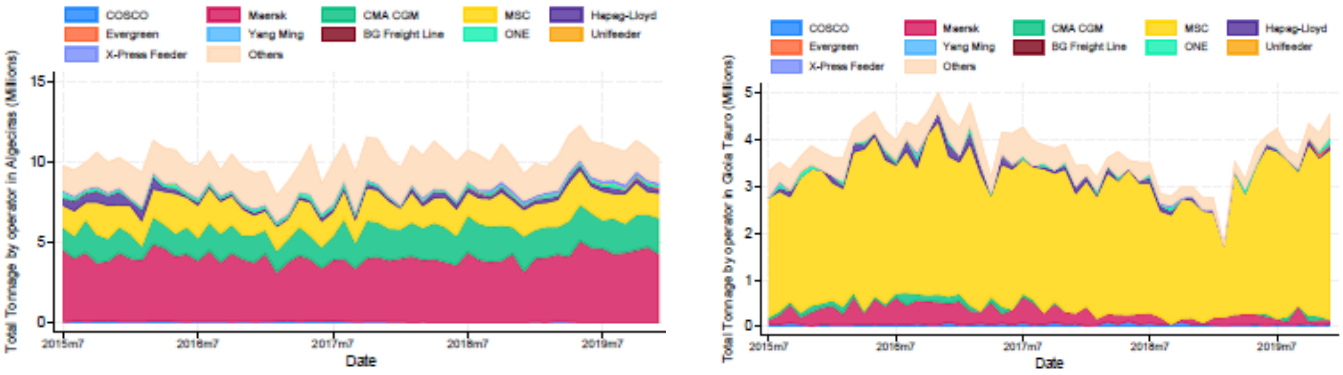
*Figure 1.*
Shipping network representation



The impact of port expansion investments on export costs will also depend on how exporters redistribute their shipments from other ports due to capacity constraints. To quantify this relationship, the study employed a discrete choice model analyzing port selection patterns among Indian exporters, using transaction data from approximately 15,000 firms between 2015 and 2019. The elasticity of port choice is estimated at around 15. It indicates substantial firm sensitivity to port costs, notably being at least twice the magnitude of standard trade elasticity in response to transport costs. Counterfactual analyses suggest that port investments yield greater welfare benefits than road investments in India, though the study emphasizes the complementary nature of port and road infrastructure, advocating for coordinated investment strategies.

Pamina Koenig (PSE, University of Paris 1 Panthéon-Sorbonne) presented "China, Ports and Trade" (co-authored with Sandra Poncet and Mathieu Sanch-Maritan), examining the trade implications of COSCO's 2016 acquisition of the Port of Piraeus. Analysis of Automatic Identification System (AIS) data revealed significant variations in maritime transport networks across operators. Shipping lines use ports in proportions far removed from their overall market share, often establishing dominant hubs while bypassing major ports altogether. *Figure 2* illustrates this but showcasing the dominance of Maersk in Algericas and that of MSC in Gioia Tauro.

*Figure 2.*
Shipping network representation

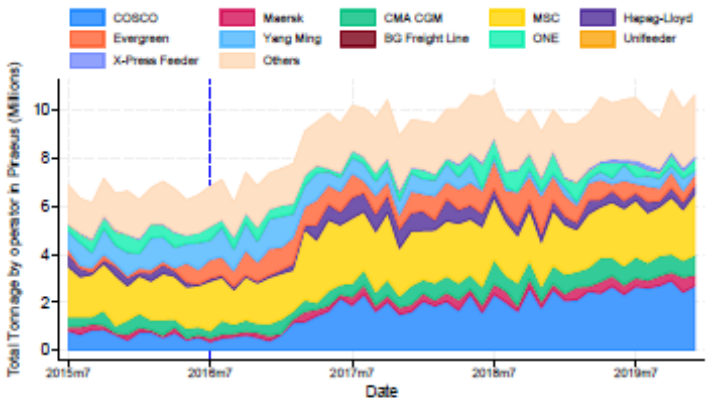



Port of Algericas
**Maersk** dominates

Port of Gioia Tauro
**MSC** dominates

Consequently, port investments and resulting cost reductions have operator-specific impacts rather than network-wide effects. The study utilizes AIS data, maritime operator information, and bilateral trade data from 2012-2020 to investigate the repercussions from the expansion of Piraeus which is visible in *Figure 3*. Total traffic increased significantly after the port was privatised in 2016, particularly traffic operated by the port's new owner, COSCO.

*Figure 3.*
Specific presence of operators in the port of Piraeus (AIS data)




Port of Piraeus
**Cosco** rises

Reduced-form gravity equation estimates first show that country pairs whose shortest COSCO shipping route traversed Piraeus before privatization experienced an 18% increase in trade post-acquisition. Notably, no trade changes were observed for country pairs where Piraeus lay on other shipping lines' shortest routes. This disparity suggests that efficiency gains from port modernization in Piraeus primarily benefited COSCO's network. A structural gravity model further quantified these effects and explored scenarios including regional operator exclusion, highlighting the importance of considering both inter-port and inter-operator traffic substitution in cost reduction analyses.

The work by Julian Hinz (Bielefel University, Kiel Institute) also is based on a structural gravity model. The paper entitled "Shipping Routes and Trade Shocks" and co-authored with Carsten Brockhaus investigates the resilience of the global container shipping network to disruptions such as route closures. The study uses Automatic Identification System (AIS) data to map the network and develops a structural gravity model to estimate the effects of route closures on trade flows. The model includes three components of transportation costs: first nature, local congestion and global capacity (common effect). Disruptions to shipping routes (involving detours or queues) affect trade not only because they increase shipping rates, but also because they lead to supply constraints due to the mobilisation of existing vessels for longer periods on the disrupted route. The authors plan to use this model to explore counterfactual scenarios, such as the closure of the Red Sea and a trade war between the United States and China. The preliminary results of the study, based on random port deletion simulations, indicate a relatively small impact on the robustness of the maritime transport network. One outstanding problem is that, unlike the literature which focuses on continuous variations in trade costs, the removal of a port is a binary event which does not appear to be amenable to iceberg transport cost modelling.

The last presentation is by Simon Ray (CMA CGM) and is entitled "Relevant research questions from a shipping practitioner's perspective, e.g. carbon emissions and container volumes in the long run". The first part of the presentation underlines the importance of the increase in capacity (increase in the number of ships and their size) achieved by the maritime operators. Capacity has kept pace with the demand for trade so that the evolution of maritime traffic (measured in twenty-foot equivalent unit) reflects mostly demand for shipping trade and is not constrained by supply. Because of overcapacity in maritime transport, the (low) marginal cost prevails for pricing and sea transport has met the growth in demand for international trade up to 2020 and has facilitated adjustment to the various disruptions. The second part of the presentation discusses the potential impact of carbon pricing, in particular the EU Emissions Trading Scheme (ETS), on maritime and air trade volumes. The study uses a quantitative methodology that incorporates commodity unit values, shipping distances, freight rates, working capital and emission intensities to estimate the changes in transport costs induced by a carbon tax. Quantifications are based on a bilateral dataset covering 42 countries and 1,200 products, with projections to 2030. The study reveals that a carbon tax of USD 100/tonne could lead to a 2.5% reduction in maritime transport volumes. The impact, however, is heterogeneous, varying according to transport mode, sector and country. Low-value products and long-distance trade are particularly vulnerable to the effects of carbon pricing. Sectoral analysis reveals that wood and oilseeds are the sectors most affected by carbon pricing in maritime transport, while the furniture industry is the most affected in air freight. The United States and Brazil are identified as the most vulnerable exporting countries, while China is relatively unaffected as far as shipping is

concerned. This work highlights the need to take into account yet another substitution effect following a change in cost, this time between sea and air transport.

The various presentations highlighted the need to take account of dynamic and general equilibrium effects and to model the way in which a shock propagates through the different transport networks (different modes of transport and different carriers), which are complementary but also substitutable for one another. They demonstrate the importance of reliably estimating the different elasticities that govern the reallocation of traffic and trade between these different parts and operators of the overall network.

## References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