Exploring Globalization with Cosmopolitics

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1. Introduction

The global economy underwent a big transformation over the last years, due to the great increase of international trade. According to World Bank and OECD national accounts data, the World export propensity, i.e. the percentage ratio of exports to the gross domestic product (GPD) has grown constantly since the mid '80s until 2008, when a maximum of 31% was reached. Despite the critical phases after 2008, in 2020 the estimated world export propensity was 26.5%, i.e. more than one fourth of total global production is exported. International production, trade and investments are increasingly entangled in the global value chains (GVCs): different production and distribution processes can be located across different countries, providing economic advantages (Surugiu and Surugiu 2015). While the interdependence between countries' economies, stemming from the GVC, increases the level of efficiency, it poses risks of instability affecting the whole production and trade system when local crises arise. This is even more true for crises on a larger scale, like the COVID-19 pandemic (Lin and Zhang 2020) or the Russian-Ukrainian conflict.

The GVC causes the transmission of shocks which can drastically disrupt the supply chains of some products, a risk that became evident in several phases of the pandemic when medical products flow was interrupted (Verschuur et al. 2021). To prevent this risk, policy makers should engage in new trade agreements to avoid disruption in products supply (Barlow et al. 2021). To this aim it would be useful to support government's decision makers with new policy tools, which can give hints about how to "re-localize" GVCs, identify key potential sources of shock exposure in GVCs and assess different policy scenarios, in terms of both economic efficiency and stability (OECD 2021).

Within this framework it is extremely important for policy makers to have appropriate tools to analyze qualitatively and quantitatively the evolving structure of GVC. A suitable tool should exploit sound quality statistical trade data, as provided by official statistics, allow dynamic multidimensional analysis, and provide a high-level, interactive, easy-to-use visualization of relevant information.

The presented dashboard was developed by Istat in the framework of the Big Data Hackathon, and it enables a general analysis of the effects of any local crisis on global world trade by both social network tools and time series analysis.

2. Network analysis on international trade data

We built an integrated tool, which can provide dynamic views and interactive analysis of GVC across European and extra-European countries. The tool is based on the online available "Monthly COMEXT Data", containing all the international trades in import and export (except for trades between extra-European countries). The tool is a dashboard providing interactive views of graphs of international trade relations, in the framework of social network analysis (De Benedictis et al. 2013). Countries in the COMEXT dataset are represented as graph nodes connected to each other by arrows, edges of the graph (Wasserman and Faust 1994) that represent the traded value of products (in Euros) exchanged between the two countries in a considered time period (Figure1). The graphical visualization is useful to have qualitative information about countries holding a central role in the structure and countries serving as bridges between different areas of the network. Those insights are

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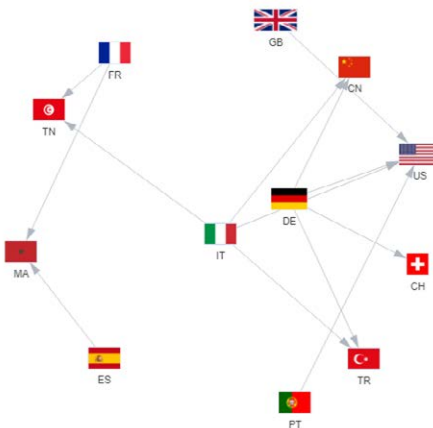
Fig. 1 Social network of Textile products trade in January 2020

then quantified by the centrality measures that characterize the graph and each country in the network:

- *Product spread*: a global measure corresponding to the Graph density, representing the ratio between the number of edges in a graph and the maximum number of edges that the graph can contain.
- *Vulnerability*: a local measure corresponding to (1 - the indegree centrality) for each country vertex, where the indegree centrality is a normalized measure for the number of in-coming links. The vulnerability conveys the message that a country receiving a product from several countries is less dependent on singles countries for the product supply.
- *Export strength*: a local measure corresponding to the country outdegree centrality, a normalized measure for the number of out-going links.
- *Hubness*: a local measure corresponding to the closeness centrality for each country.

The tool is interactive, so the user can focus on graphs of specific products supply chain (same classification as COMEXT dataset), on import views or export views, on specific periods of time, on a percentage of the total trade flow, by selecting filters values.

Fig.1 shows an example of the social network representing 30% of the global export of Textile Yarn, Fabrics, Made up Articles and Related Product, in January 2020.

Moreover, starting from a specific supply chain graph, the tool provides the possibility to remove chosen links, both globally and for selected mode of transports, and re-compute graph indicators corresponding to the new graph configuration. This feature allows to determine if a specific trade disruption would increase country import vulnerability, or which exporting country would take advantage by increasing its export strength in the new configuration. This allows to perform scenario analysis, and to foresee if a critical trade disruption would make an importing country particularly dependent by specific geo-political areas.

3. Analysis insights and results

The dashboard allows the user to follow the evolution in time of a trade network, by comparing graphs associated to different time periods. It can enable to spot changes in the role played by different countries in the network of relations, allowing to detect countries playing central roles; it can give information on market contraction or expansion; it allows to detect isolated clusters or countries more vulnerable to products supply disruption; it allows to perform analysis of scenario and to evaluate the effect of political and economic agreements and strategies.

In the following we show an example of evolution analysis, comparing graphs of international trades

of all the products for the same period in different years. We consider the second trimester (T2) of 2021 (see Fig.2) and the second trimester (T2) of 2022 (see Fig.3)

Fig. 2 Social network of all products trade of the second trimester 2021 (T2).

The measure of Product spread (graph density) indicates the percentage of existing trading relations between countries among all the possible ones (it's not a measure of traded amounts). The product spread of all products decreased from 0.10 in T2-2021 graph to 0.087 in T2-2022 graph, meaning that some relevant commercial links between countries ceased. One possible cause could be the Russian-Ukrainian conflict.

4. Data sources

Data sources on international trade in goods used by the presented dashboard consist in EU official statistics data produced by the 27 Member States according to harmonized methodologies based on EU statistical regulations and available in the Eurostat COMEXT database, freely accessible at http://epp.eurostat.ec.europa.eu/newxtweb/. They provide trade data in monetary value and physical quantities at maximum granularity in time resolution (monthly frequency), traded product characteristics, trade partner countries, mode of transport and nature of the transaction.

Fig. 3 Social network of all products trade of the second trimester 2022 (T2).

5. Conclusions

The GVC presents risks of instability for international commercial trades, so assessing the country exposure to potential shocks and crises by monitoring the time evolution of indicators such as country vulnerability can be very important. The proposed interactive dashboard can be a valuable tool to support policy makers in the decision making process relative to economic strategies. It provides views, measures, and filters to analyze the structure of trading relations between countries, its evolution in times and its relevant features. It allows to perform scenario analysis, by acting on the graphs and evaluating the effects of actions on the trade structure.

The Dashboard is available at the following link: https://www.terra.statlab.it

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