International Trade Resilience and the Covid-19 Pandemic

Abstract

The Covid-19 pandemic represents a low-probability, high-impact systemic risk that has severely disrupted international trade, reshaping the patterns of globalization. Drawing from the concept of supply chain resilience, which involves both the ability of a system to withstand an impact (*robustness*) and recover from it (*responsiveness*), we investigate country-level trade resilience during the 1st wave of the pandemic. By employing Fuzzy-set Qualitative Comparative Analysis (fsQCA), we identify configurations of country-level factors, i.e., country profiles, based on their effectiveness in engendering trade resilience. These factors include social and economic globalization, logistics performance, healthcare preparedness, national government response, and income level. The results show how these factors coalesced to strengthen (or weaken) international trade resilience, contributing to a holistic understanding of the impact of the pandemic on international trade. The findings inform the post-Covid-19 debate on international trade, with implications for managers and policymakers.

Keywords

Resilience, Covid-19 Pandemic, International trade, Fuzzy-set Qualitative Comparative Analysis, Globalization, Logistics

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1. Introduction

The Covid-19 pandemic is one of the most profound crises of our time. The socio-economic impact of the crisis has been devastating, and repercussions will continue to unfold in years to come. Undoubtedly, the loss of life has been the most poignant consequence of the pandemic, but the economic impact has also been overwhelming. Several articles have suggested that Covid-19 will end globalization altogether (The Economist, 2020; Yip, 2021), while others argue that it will at least alter its course (Altman, 2020). What is clear is that while globalization has brought many benefits to the world's economy, it has also exposed nations, firms, and individuals to systemic supply chain risks (Goldin & Mariathasan, 2015; Scheibe & Blackhurst, 2018). This type of risk relates to events that can cause a widespread and sustained shortage of a product or service with no alternatives or substitutes available (Sheffi & Lynn, 2014). The Covid-19 crisis is an extreme example of such a risk, which appears to have forced globalization into retreat.

It is perhaps not surprising that highly globalized countries like the UK, Italy, France, and the USA, were hit fast and hard (Ahluwalia, 2020). The economic and social connections that engendered globalization have also reinforced interdependencies that enabled the spread of the virus (Mas-Coma et al., 2020). In response, many countries closed their borders, and uncooperative behavior emerged as governments competed to secure access to scarce resources, such as personal protective equipment (PPE), ventilators, and vaccines (Chowdhury et al., 2020; New York Times, 2020). This jockeying for position has caused additional ripple effects across global supply chains. While the level of globalization might have had a detrimental effect in the early days of the pandemic, many highly globalized countries also have substantial resources, trade links, logistics capabilities, and healthcare infrastructure that may have helped them achieve a swift recovery (New York Times, 2020).

Countries have followed different paths in response to the pandemic. Some, such as China, imposed strict regional restrictions; others, like Sweden, adopted a more laissez-faire approach, yet others, like the UK, changed track several times through the crisis (IMF, 2021; Mayer & Lewis, 2020; Reuters, 2021). It is still unclear which path will be more effective in the long run. Thus, we need an evidence-based approach to understand the most effective ways to deal with systemic risks, such as the Covid-19 pandemic.

Considerable research has focused on the resilience of firms (e.g., Ambulkar et al. 2015; Parker & Ameen, 2018; Dormady et al., 2019) and supply chains (e.g., Blackhurst et al., 2011; Melnyk et al. 2014; Sheffi, 2005; Zsidisin & Wagner, 2010). Similarly, researchers have investigated economic resilience at a country level (e.g., Rose & Liao 2005; Rose, 2007; Xie et al., 2018). However, research into the resilience of the international trading system in which firms, supply chains, and countries operate, has been lacking. This gap is surprising given that in today's globalized economy, international trade resilience appears to be intricately linked to the resilience of countries, supply chains, and firms.

Countries exchange goods and services through imports and exports within the international trading system. In this context, we define international trade resilience as "*the ability of a country to both resist disruptions to international trade and recover after disruptions occur"* (cf. Melnyk et al., 2014: 36). This definition is helpful because it captures two distinctive aspects of resilience: the ability to resist a disruption; and the ability to recover from it. In this research, we explore the role of different country-level factors in both aspects of resilience: *robustness* to withstand the initial impact and *responsiveness* to facilitate the recovery in the context of international trade during the Covid-19 pandemic. Specifically, we aim to address the following research question:

What configurations of factors led to trade resilience amidst the Covid-19 pandemic?

To address this question, we employ Fuzzy-set Qualitative Comparative Analysis (fsQCA), an analytic technique that uses Boolean algebra and fuzzy set theory to address causal complexity (Beynon et al., 2016; Fiss, 2011; Rihoux & Ragin, 2008; Woodside, 2014). We follow inductive logic to evaluate the role of different country-level factors (e.g., globalization, logistics capabilities, income level, healthcare infrastructure, and national government response), and configurations thereof, in eliciting trade resilience. To this end, we build a unique dataset after combining secondary data from several sources, including the World Bank, World Trade Organization (WTO), the Swiss Economic Institute, and the Johns Hopkins University (JHU). The research focuses on the first wave of the pandemic (March-July 2020). While most countries have suffered multiple waves to date, we argue that the first wave was truly unpredictable and unprecedented, and provides a unique context for examining international trade resilience.

We inductively derive configurations of factors leading to international trade resilience, laying the foundations for a midrange theory (Eisenhardt & Bourgeois, 1988; Hoffman & Ocasio, 2001; Crilly, 2011; Criaighead, Ketchen, & Cheng, 2016) of this phenomenon in the context of the Covid-19 pandemic. Midrange theorizing involves context-specific conceptualizations and thus provides theoretically grounded insights applicable to a specific empirical context (Craighead et al., 2016). Moreover, midrange theories proved narratives of causal processes and the conditions under which those processes generate outcomes (Russo, Pellathy & Omar, 2021). These characteristics make midrange theorizing a suitable approach to investigate international trade resilience during the pandemic.

We contribute to the literature in several ways. Firstly, we show that no single factor is necessary or sufficient for trade resilience during a disruption of this scale; rather, it is complex combinations of (high or low levels of) those factors that strengthen or weaken resilience. Secondly, we help explain why some countries remained comparatively trade resilient during the first wave of the pandemic, while others did not. Finally, we complement studies of resilience at a firm, dyad, and network level, by adopting a macro-level perspective, using the country as the unit of analysis. This macro-perspective provides a contextual explanation for the resilience of firms and supply chains operating across borders.

2. Literature Review

The Covid-19 pandemic has caused ripple effects across every aspect of human life (Verma & Gustafsson, 2020), upending the business environment and decimating international trade (Verbeke & Yuan, 2020). This Covid-19 phenomenon is characterized by complexity and uncertainty, influencing (and being influenced by) government policies, health systems, firm behavior, and individual behaviors and decisions (Bratianu, 2020; Pappas & Glyptou, 2021). Some authors have used the label ‘chaordic’, emphasizing the chaotically-ordered character of the phenomenon (Pappas, 2021). While the complexity and uncertainty of the Covid-19 pandemic have affected the business environment globally, these effects have not been homogeneous across countries. Some countries suffered dramatically in terms of trade, while others remained relatively resilient to the disruption. It is this resilience, in the face of a highly complex and uncertain environment, that we investigate in this research.

Resilience is a construct that can be applied at multiple levels. From a personal (micro) level (e.g., Luthar et al., 2000), through to large scale (macro) systems like economies (e.g., Rose 2007; Rose & Liao, 2005), and societies (e.g., Cacioppo, Reis, & Zautra, 2011), researchers have tried to understand what makes a system resilient. While there are differences in the conceptualization of resilience at various levels, they all refer to a system's ability to contend with a disruption.

Researchers have distinguished two distinctive sets of capabilities of a resilient system (Melnyk et al., 2014; Välikangas, 2010; Weiland & Wallenburg, 2013). On the one hand, a resilient system can withstand a disruption. Researchers have referred to this capability as *robustness,* defined as *the ability of a system to maintain its function despite internal or external disruptions* (Bode et al., 2014). On the other hand, a resilient system also needs to respond after a disruption and *return to its original state or move to a new, more desirable state* (Christopher & Peck, 2004); this is the system's *responsiveness*. Robustness and responsiveness are interdependent, but as Melnyk et al. (2014) argue, they can sometimes trade-off against each other, so an increase in robustness could undermine responsiveness and *vice versa*. For this reason, it is crucial to investigate how different factors affect both robustness and responsiveness.

In this research, we evaluate key factors that can influence both the robustness and responsiveness of the international trade system and the countries that exchange goods and services within the system. In the next subsection, we discuss different factors that might influence a country's ability to participate in international trade, affecting global supply chains and the firms within them.

2.1. Globalization and resilience

Over the past decades, global supply chains have expanded in line with increasing levels of globalization, leading to higher interconnectedness and interdependence among firms (Blackhurst et al., 2005; Christopher & Holweg, 2011). While the interdependence has enhanced supply chain efficiency with practices of lean manufacturing, concurrent engineering, and "just-in-time" deliveries (Soni & Jain, 2011), it has also introduced supply chain vulnerabilities (World Economic Forum, 2019).

The Covid-19 pandemic prompted an unprecedented global stock-out of highly demanded life-saving medical equipment and PPE (Burki, 2020). The crisis has highlighted the vulnerability of interdependent economies and subsequent risks to supply chains. For example, approximately 97% of antibiotics used in the United States are imported from China

(MSCI, 2020), while 40-50% of generic drugs come from India, with nearly 70% of those drugs' active pharmaceutical ingredients (APIs) originating from China (CNBC, 2020). In turn, Chinese manufacturers of ventilators experienced critical production delays due to shut-downs of European sub-suppliers' production units. While the Covid-19 pandemic highlighted the vulnerability of healthcare supply chains, many other sectors experienced the flip side of globalization, with global demand plummeting.

Globalization was initially driven by relocating subsidiaries or by outsourcing to foreign suppliers. As globalized business models matured, companies gradually offshored more critical business processes through integrated networks of interdependent subsidiaries and suppliers (Contractor et al., 2010). This process of globalization has, in turn, increased the impact of potential disruptions (Christopher et al., 2011) since countries have become increasingly dependent upon each other for goods and services. However, globalization is a multi-dimensional construct. In the DHL Global Connectedness Index, economic indicators of globalization (trade and capital flows) showed steady growth until the 2008-09 global financial crisis and have since fluctuated below their pre-crisis peaks. In contrast, the social aspects of globalization (information and people flows) have been setting new records (Steven & Philip, 2020). In the context of a pandemic involving human-to-human contagion, this broad view of globalization is a key country-level factor for determining vulnerability and exposure. As the WEF Global Risk Report (2006: 4), "the vulnerabilities of our interconnected global system would intensify the human and economic impact" (of a pandemic).

2.2. Logistics performance and resilience

The performance of a country's logistics and transport system is central to international trade (Martí, Puertas, & García, 2014; Ekici, Kabak, & Ülengin, 2016) and the smooth functioning of global supply chains (Closs & Mollenkopf, 2004). Various aspects contribute to logistics performance at a country level, including the quality of trade and transport infrastructure (e.g., ports, roads, airports), the efficiency of customs (ease and speed of clearance), and the level of technology adoption. In turn, these factors can influence the economic outcomes of a country or region (Kurth et al., 2020) and the performance of all supply chains in and out of a country (Arvis et al., 2008; Closs & Mollenkopf, 2004). Thus, in the face of a global disruption, weak logistics infrastructure and competencies can undermine a country's robustness in terms of international trade.

A country's logistics infrastructure can be vulnerable to disasters, including a pandemic (Goldin & Mariathasan, 2015). A survey of port authorities and operators worldwide investigating the impact of Covid-19 indicates that many ports have been affected by changes in demand, capacity constraints, labor shortages, and delays caused by changes to procedures (Notteboom & Pallis, 2020). Moreover, bottlenecks can emerge because of the limited flexibility of logistics. For instance, the lack of temperature-controlled infrastructure in some countries has been highlighted as a barrier to vaccine distribution (Wight, 2020). Conversely, a strong logistics system at a country level can also help in recovery, allowing to bring products to the right places at the right time.

The pandemic has caused instability in supply and demand, causing pressure on logistics systems, causing shortages (e.g., PPE, ventilators) (Shih, 2020; Tatelbaum, 2020). As Notteboom & Pallis (2020:3) assert, "*port demand is a derived demand*," and thus, changes to demand and supply of products directly impact activity levels at ports. This dependent demand argument can be extended to all elements of a national logistics system, including roads, airports, customs offices, and individual logistics providers. Consequently, a country's resilience to a crisis will likely be affected by the ability of its logistics system to cope with swings in supply and demand.

2.3. Income level, healthcare preparedness, and resilience

The concept of healthcare preparedness has gained special attention in the context of the Covid-19 pandemic, as governments were forced to lock down economies to reduce case numbers and subsequent hospitalizations, trying to avoid the collapse of overwhelmed healthcare systems. The preventive measures of governments, and the associated economic trade-offs, highlight the linkage between the preparedness of healthcare infrastructure and economic activity (Jovanović et al., 2020). The pandemic effectively stress-tested the capabilities of national healthcare systems, which partly determined the scope and depth of lockdown periods and other preventive measures. In the same vein, a well-prepared healthcare system can support a quicker recovery through, for example, more effective testing and vaccination rollouts (Hale et al., 2020b).

Another important factor determining a country's level of trading activity is its financial ability to withstand extended lockdowns (Chowdhury et al., 2020). This can take the form of national relief packages, access to credit for businesses, or the ability to draw upon higher levels of personal savings. Wealthier countries are also better positioned to secure access to critical resources, such as PPE, medical equipment, and vaccines. For many low-income economies, the crisis revealed that without either political influence or spending power, securing access to scarce global healthcare production capabilities was almost impossible. Due to the lack of equity in access to affordable healthcare products, the pandemic, therefore, had a disproportionate impact across countries (New York Times, 2020). On this basis, a country's financial strength is considered a key factor in enabling international trade resilience.

2.4. National response and resilience

National governments responded to the Covid-19 pandemic using different approaches, such as containment measures (e.g., lockdowns, workplace closures, and travel bans), health measures (testing, contact tracing, vaccines), economic measures (e.g., income and debt support, workforce retention), and social measures (e.g., strengthening social dialogue) (Hale et al., 2020a; ILO, 2021). As the pandemic unfolded in different countries, the scope and stringency of these measures adapted, to balance healthcare, economic, and social outcomes.

The biggest challenge for countries is that trade-offs exist between desirable outcomes. Lockdowns and travel bans, for example, have been effective in containing the spread of the virus and allowed healthcare systems to cope, particularly for nations like New Zealand, Vietnam, and Taiwan (Frieden, 2021). Similarly, in China, strict local lockdowns have kept the virus at bay (Reuters, 2021). However, containment measures can also have a crushing economic impact. The effects of these measures labeled 'great lockdowns' have been compared to the great depression (Gopinath, 2020). Undoubtedly this has affected employment, income, and the supply and demand for many products, undermining international trade.

Countries like South Korea have implemented a complex combination of targeted lockdowns, extensive testing, border closures, quarantines, contact tracing, and economic relief packages to balance the various impacts of the pandemic (Frieden, 2021; IMF, 2021). Yet other countries, most notably Sweden, have kept schools and businesses open and even discouraged the use of face masks (IMF, 2021; Vogel, 2020). While this approach has economic benefits and probably buoyed Sweden's economic outcomes in the early stages of the pandemic, it appears to have significant shortcomings related to healthcare outcomes, which may undermine the country's recovery (Vogel, 2020).

While it is too early to say which countries and policies have been most effective, ultimately, all countries are connected in the global trading system. Hence, even if some managed to contain the virus and limit its toll on human lives, it is unlikely that their trade volumes have remained unaffected. Hence, it is vital to understand how the stringency and scope of government responses have affected international trade in different countries.

2.5. A neo-configurational approach to country-level trade resilience

Given the complexity of the Covid-19 pandemic, the diversity of impacts on different countries, the varying levels of preparedness for it, and the multitude of approaches followed to counter it, the role of each theorized condition should not be considered in isolation. Instead, they should be thought of as fundamental parts of complex constellations, or country 'profiles,' as part of which the role of each dimension will be dependent on the role of others. As such, the Covid-19 pandemic calls for configurational approaches that allow researchers to investigate the complex interactions of various conditions (Pappas & Glyptou, 2021)

In this research, we argue that some of the configurations of the theorized conditions will be more effective in ensuring robustness and fostering the responsiveness of international trade, and our aim is to identify them. A neo-configurational lens (Fiss, 2007; Misangyi et al., 2016; Woodside, 2013), premised on conjunction (i.e., trade resilience results from the interdependence of country-level factors), equifinality (i.e., different configurations might be equally effective in eliciting trade resilience), and asymmetry (i.e., a factor may play a crucially positive role as part of one configuration but might be irrelevant in another) is well-suited to tackle the complexity of the phenomenon. With respect to the set of 'tenets,' codified by Woodside (2014) and adopted in several business research publications (e.g., Olya & Altinay, 2016; Pappas, 2021), we expect that:

- There is *no* country-level factor that is singlehandedly sufficient for the presence of trade resilience (Tenet 1).

- Rather, there is (more than one) configuration of consistently sufficient (but *not* necessary) factors for the presence of trade resilience (Tenet 2 & 3 - the recipe and equifinality principles).
- The sufficient configurations for the negation of the outcome (i.e., absence of resilience) will not be mirror opposites of the configurations sufficient for the presence of trade resilience (Tenet 4 - the causal asymmetry principle).
- Both the presence *and* the absence of a factor can contribute to the presence of trade resilience as part of different recipes, depending on the presence or absence of other factors in those recipes (Tenet 5).
- No configuration of factors leading to trade resilience will be relevant for all trade-resilient countries (i.e., coverage < 1.00 for any single configuration – Tenet 6), while there might be countries with high membership in a sufficient configuration that do not exhibit trade resilience (i.e., deviant cases – Tenet 7).

3. Methodology

The damage caused by the Covid-19 pandemic on global trade has no precedent, precluding the application of traditional theories of risk and resilience. In this research, we decided to adopt an inductive approach to develop a midrange theory of the phenomenon of trade resilience under exceptional circumstances. Specifically, we follow a bottom-up strategy for midrange theorizing, where the driving force for theory development is the data (Craighead et al., 2016). This strategy is considered appropriate for exploratory research as it relies extensively on induction to identify patterns in the data (Craighead et al., 2016). As a result, we use the extant literature not to formulate hypotheses but to motivate the selection of possible conditions that, conjunctively, might foster trade resilience. We then follow previous inductive research of configurational nature (e.g., Beynon et al., 2016; Crilly, 2011; Pajunen, 2008; Park, Fiss & El Sawy, 2020; Woodside, 2014), by applying fsQCA for data analysis.

FsQCA has rapidly established itself as a valuable and systematic approach to comparative social inquiry due to its ability to address causal complexity. The use of set theory and Boolean algebra enables the conceptualization of a case as a complex combination of theoretical attributes and the identification of attributes (and configurations thereof) that are necessary and/or sufficient for an outcome (Misangyi et al., 2016; Ragin & Rubinson, 2009). Furthermore, the calibration stage allows for the incorporation of substantive knowledge to capture variation across cases that is relevant to the particular research question and defined sets (Ragin, 2008); while the organization of cases (based on their shared set-membership scores) into a Truth Table reveals the commonalities across them and facilitates counterfactual analysis, i.e., a conscious examination of whether an unobserved configuration would lead to the outcome if it was empirically present (Ragin & Sonnett, 2004; Soda & Furnari, 2012). The subsequent algorithmic minimization process leads to a set of three theoretically meaningful solutions (*complex*, *parsimonious*, *intermediate*) that, at the same time, remain 'true' to the data (for a general introduction and step-by-step exposition of fsQCA, see Schneider & Wagemann, 2012).

We follow the growing number of fsQCA applications in business research that use the country as the unit of analysis (Estevão, Lopes, Penela, & Soares, 2020; Piñeiro-Chousa, Vizcaíno-González, & Caby, 2019; Tekic & Tekic, 2021) and seek to identify configurations of factors that might have helped countries achieve trade resilience over the first wave of the COVID-19 pandemic (March-July 2020).

3.1. Data, sample, and measures

Country-level data from various sources were combined into a unique dataset. First, monthly data (01/2019 – 11/2020) of total merchandise imports and exports for 74 economies was downloaded from the World Trade Organization's database inventory (WTO, 2021). *Trade resilience* of a country in a given month is measured by adding exports and imports (scaled with the country's 2019 GDP) and taking the Year-on-Year (YoY) monthly percentage (%) change. For example, the measure takes a positive (negative) value for a country that saw an increase (decrease) in trade volume in March 2020 compared to March 2019. The average YoY monthly % change of our sample ranges from -10.15% (June) to -29.14% (April). The largest value observed for an individual country is 21.36% (Ireland in March) and the smallest -62.63% (Bolivia in April).

Logistics performance is measured through the Logistics Performance Index (LPI) developed by the World Bank (Arvis et al., 2018). The index is a weighted average of six indicators (Customs, infrastructure, service quality, international shipments, tracking and tracing, and timeliness), ranging from a minimum of 1 to a maximum of 5. Based on the quintiles of the distribution of the LPI, Arvis et al. (2018) classify countries into 'logistics-unfriendly,' 'partial performers,' 'consistent performers,' and 'logistics-friendly.'

Healthcare preparedness is measured through the Global Health Security (GHS) index, which was developed in 2019 by the Nuclear Threat Initiative and the Johns Hopkins University (NTI & JHU, 2019), in collaboration with The Economist Intelligence Unit (EIU). The index is designed to assess a country's capability to prevent and mitigate epidemics and pandemics and takes values from 1 to 100. Each country is assessed using 140 questions organized across six categories, and the overall GHS Index score is a weighted sum of all these. The weights were determined by a panel of international experts. Based on the results, countries were classified into 'most prepared,' 'more prepared,' and 'least prepared.'

Economic and *Social Globalization* are measured through the respective overall indexes developed by the Swiss Economic Institute (KOF) of ETH Zurich (Gygli et al., 2019). Economic Globalization has two sub-domains: trade and financial; while Social Globalization has three: interpersonal contact, information flows, and cultural proximity. Various *de facto* and *de jure* indicators for each sub-domain are statistically weighted to form the overall indexes, which take values from 1 to 100.

Government response is measured through the index developed by the University of Oxford (Hale et al., 2020b), which systematically tracks the wide range of policies that governments have taken during the pandemic. It takes values from 1 to 100 and is based on 18 standard indicators that capture (predominantly) health, containment, and economic support measures.

Gross National Income (GNI) per capita in 2019 (in current US dollars) is used to measure a country's *income level*. Data was downloaded from the World Bank data repository (The World Bank, 2019).

To account for the magnitude of the pandemic-induced disruption and the fact that countries were asymmetrically and asynchronously affected by the pandemic's first wave, we consider the Covid-19 related deaths per 100,000 inhabitants per month as an additional condition. Monthly data of cases and deaths is continuously gathered by JHU and was sourced through Oxford's government response tracker website. We use deaths rather than cases due to the renowned inconsistencies of testing regimes across countries and to the fact that countries introduced mass testing at different points in time. As such, using case numbers would have introduced intractable biases both across countries and across months.

Of the 74 countries with monthly trade data (i.e., the outcome), four have missing values in at least one of the remaining variables (i.e., conditions), so our final sample size is reduced to 70. The list of countries in the sample is included in Appendix C.

3.2. Measure calibration

FsQCA requires the calibration of the raw measures into fuzzy sets using meaningful thresholds. In this way, every case is assigned a score (ranging from 0 to 1) to denote the degree of its membership in the defined sets (see Ragin, 2008). Descriptive statistics for the original measures are presented in Table 1, their pairwise correlations are in Table 2, and all the details specific to the calibration can be found in Table 3. As seen in columns 4-5 (and endnotes), where available, we use external, theoretically derived thresholds developed by experts and/or used in past research (Greckhamer et al., 2018). It is worth noting that even though our final sample is limited to the 70 countries that have full data availability, to calibrate the conditions and outcome for which no external information exists to assist calibration, we used all available data of their respective measures. In conjunction with the theoretically (based on expert knowledge) and time-sensitive, empirically driven qualitative anchors (see Table 3), this decision increases the study's external validity by introducing information and knowledge 'external' to the final, limited sample. The calibration of the time-varying measures (trade resilience, government response, number of deaths) every month, based on their respective distribution, also accounts for possible qualitative changes in the series (e.g., structural breaks) and trends (see Flaherty, 2019).

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3.3. Analytical steps

Following convention (Dusa, 2019; Schneider & Wagemann, 2012), we first test whether any of the conditions can be considered necessary for the outcome or its negation. As such, we apply a consistency threshold of 0.9 and a relevance threshold of 0.6. No condition (or any disjunction thereof) in any month passes both thresholds, but the presence of high-income can be considered ‘trivially’ necessary for trade performance in every month, with a consistency score of >0.9 and a relevance score of <0.31. In July only, both social and economic globalization surpass the consistency threshold and come close to be considered relevant (scores of 0.445 and 0.582, respectively). These results suggest that as the first wave dissipates, high trade performance is almost impossible for a country that is not high-income and globalized. For the negation of trade performance, no condition comes close to be considered necessary.

The main analysis consists of identifying configurations that are sufficient for the presence and absence of trade resilience, while no single factor is, by itself, sufficient for either outcome (confirming Woodside’s 1st Tenet). Each month is analyzed separately (i.e., one Truth Table per month), following Aversa, Furnari, and Haefliger’s (2015) approach to accounting for time in fsQCA. The results are synthesized in Section 4. We apply the Enhanced Standard Analysis (ESA) of Schneider and Wagemann (2012) using the QCA package in R (Dusa, 2019). This means that contradictory simplifying assumptions and simultaneous subset relationships are identified and removed from the Truth Table before generating the parsimonious and intermediate solutions. When it comes to the inclusion/exclusion of empirically observed configurations, as a rule of thumb, we apply a consistency threshold above the conventional 0.80 mark and a frequency threshold of 1. In this way, we seek to include a reasonable number of countries that could be considered to exhibit the outcome (trade resilience or its negation). These details are presented in Tables 4 and 5 in the next section. In the few instances where more than one (parsimonious or intermediate) solution exists, only the one with the highest consistency score is presented. The existence of multiple sufficient configurations (whose consistency scores are always <1.00) for both the presence and the absence of trade resilience for every single month indicates support for Woodside’s (2014) Tenets 2,3, and 6.

3.4. Robustness tests

We probe these decisions in a series of robustness tests, and all Truth Tables of the sufficiency analysis for the presence of the outcome are included in Appendix A for transparency purposes. In short, we experimented with alternative consistency thresholds and alternative calibration schemes for the outcome and selected conditions. The results (in Appendix B) reinforce our confidence in the validity of the findings from the baseline analyses, as discussed in the following section.

4. Results and Discussion

The main results come from the analysis of sufficiency for the presence and the absence of trade performance. In this section, we present both sets of results.

4.1. Analysis of sufficiency for the presence of the outcome

The parsimonious and intermediate solutions for each month are presented in Table 4. The latter includes additional details such as consistency/coverage scores, typical cases, and directional expectations. At first glance, the stand-out observation is that, even though the absence of 'strong government response' (~GOV) was not formally necessary for the outcome in any month, it emerges as a core condition in all but two sufficient configurations (a 'false necessary' condition – see Schneider & Wagemann, 2012). This suggests that maintaining an environment conducive to trade is paramount; countries in which governments did not impose many restrictions and emphasized business continuity (or swift recovery), possibly at the expense of human lives, managed to be relatively more robust and responsive.

Crucially though, the absence of a strong government response (~GOV) should *not* be interpreted in isolation since it was, almost invariably, accompanied by both high national income (GNI) and a prepared healthcare system (GHS). This means that countries that followed a lax containment approach (~GOV) exhibited resilience only due to their relatively high-income levels (and available resources) and their high levels of preparedness for a pandemic. The presence of GHS in all but two configurations is telling; healthcare infrastructure is crucial for maintaining economic activity and international trade during a crisis of this magnitude.

It should also be noted that in most instances, ~GOV is accompanied by the absence of deaths (~DEATHS) and *never* with its presence. This suggests that one of the following mechanisms might be at play. It could be that some countries might have been 'lucky' in terms of timing; for example, Brazil and Mexico in March had not yet entered their first wave. Alternatively, governments might have adopted a strict approach in earlier months, mitigating the magnitude of the wave considerably, and only in later periods relaxed many restrictions (i.e., ~GOV) contributing to recovery (e.g., New Zealand and Australia). Finally, it might be that some countries took selective actions to contain the health crisis (hence ~DEATHS) but did not restrict international trade (e.g., China). As such, a closer examination of the role of the encompassed indicators of the Oxford government response index warrants further research.

When it comes to logistics performance (LPI) and globalization (ECOG and SOCG), it is their presence that (in conjunction with other factors) leads to trade resilience. In the rare instances where the absence of either of these conditions is part of a sufficient configuration (confirming Tenet 5), the presence of the others seems to compensate for its role. This suggests that high levels of globalization and strong logistics infrastructure might, in instances, act as substitutes for each other in eliciting trade resilience. For example, in March, Uruguay and Belarus were deemed 'robust' despite their low LPI score; their high levels of social and economic globalization compensated for it, conjunctively leading to high trade performance. Conversely, Indonesia appears in a couple of configurations, despite its low levels of globalization (but high LPI score).

It is also important to note that 'High Income' (GNI) appears in all intermediate solution configurations. Although this is encouraging news for advanced economies, it paints a pessimistic picture regarding the chances of lower-income countries in achieving trade resilience during international disruptions of this magnitude.

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4.2. Analysis of sufficiency for the absence of the outcome

The analysis for the negation of the outcome identified various, qualitatively different configurations associated with the absence of trade performance (Table 5) that are not mirror opposites of the configurations in Table 4 (confirming Tenet 4). Overwhelmingly though, not having prepared for a health crisis (~GHS) and a weak logistics infrastructure (~LPI) hampered countries' chances to withstand and recover from the COVID-19 pandemic. This also holds for the two types of globalization, and in the odd case where either is present, solid logistics infrastructure is absent (~LPI). As expected, a strong government response to prevent the spread of the pandemic or belatedly to mitigate the damage (i.e., GOV*DEATHS) undermines trade resilience.

The fact that there are many different 'recipes' for trade underperformance is a cautionary note. However, it might also suggest that influential factors capturing commonalities across countries have not been considered here. Nevertheless, this does not undermine the critical role of preparedness in healthcare and logistics for tackling global health crises.

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4.3 Country profiles and trade resilience

The results presented in the previous sub-sections suggest a complex picture of how international trade resilience in different countries was tested by the first wave of the pandemic. In this section, we synthesize the emerging patterns. To do so, we abstract from the month-by-month configurational findings to advance a classification of countries into high-order 'profiles' that share similar characteristics over time. The profiles discussed below draw from both sets of analyses (presence and absence of the outcome) and inevitably leave out several countries that do not readily 'fit' in them. However, this abstraction comprises an initial attempt to tell a high-level 'story' of trade resilience during an unprecedented global disruption.

- ***Robust and responsive***: This profile includes high-income (GNI), globalized (SOCG and ECOG), well-prepared (GHS) countries with strong logistics infrastructure (LPI) that exhibited trade resilience (especially responsiveness in later months). Most importantly though, they appear to have avoided heavy fatalities (~DEATHS). While various countries come in and out of this configuration, countries such as New Zealand (NZL), South Korea (KOR), Iceland (ISL), and Norway (NOR) appear consistently from May onwards (i.e., after the global 'peak' of the first wave). These countries adopted a strict approach in earlier months (especially March), mitigating the magnitude of the wave considerably. This allowed them to relax many restrictions in later months (~GOV), contributing (alongside infrastructural factors) towards their recovery in May (IMF, 2021).
- ***Stringent but fragile:*** This profile involves countries that enforced a strong response (GOV), but weak healthcare and logistics infrastructures (~GHS and ~LPI) acted as barriers to trade resilience. The exemplar case in this profile is Ukraine, which consistently appears in the non-resilient set (Table 5) across all months except June. Indeed, Ukraine's response was very stringent, involving bans on international travel and restrictions covering most establishments, including those involving physical interaction with clients (IMF, 2021).

This profile reveals the adverse side effects of overly stringent measures in the absence of robust healthcare infrastructure and logistics capabilities.

- ***Laissez-faire***. In four out of the five months, Sweden (SWE) exhibited trade resilience. Sweden shows high national income (GNI), strong logistics (LPI) and healthcare systems (GHS), and solid globalization, both socially (SOCG) and economically (ECOG). However, the distinctive condition is a relatively lax government response (~GOV), which allowed businesses to remain open, propping-up the economy and supporting imports and exports. It is important to note that while Sweden maintained trade robustness and responsiveness during the first wave, high mortality rates ensued (JHU, 2021). That is a hefty price to pay for trade resilience.
- ***Procrastinators:*** This profile covers relatively less globalized economies (~SOCG or ~ECOG), but with strong healthcare (GHS) and logistics (LPI) infrastructure, which combined with a lax early government response (~GOV) enabled trade robustness. However, despite signs of robustness in the early months, their international trade performance eventually collapsed. The negative impact was so severe that countries moved from "fully-in" the set of resilient countries in the early months of the analysis to (almost) "fully out" in later months, consequently featuring in both Table 4 and 5. This profile includes Brazil (BRA) and Indonesia (IDN). In both countries, the lack of stringent government response (~GOV) in the pandemic's early days helped robustness as business remained open. However, as infections and deaths climbed, governments were forced to adopt a more stringent response (GOV) and suffered economically as a result. In the case of Brazil, they also suffered significantly from fatalities (JHU, 2021).
- ***Early victims*****:** This profile includes globalized European countries such as Belgium (BEL), Portugal (PRT), France (FRA), Netherlands (NLD), and Italy (ITA) that were hit fast and hard, both in fatalities and trade. Despite their wealth and solid infrastructure, these

countries were severely hit in March and April 2020, at a point where there was little understanding of the virus and limited supplies of protective and testing equipment. This led to a heavy loss of life and very stringent government responses (IMF, 2021), which undermined their trade robustness. Although the trade performance of some countries (e.g., France, Netherlands) recovered in later months (i.e., responsive), of others it did not (e.g., Portugal, Italy).

- ***Late victims*:** This profile includes countries that were lucky to be hit later than the bulk of the European countries; hence they did not suffer the international trade effects of the pandemic in the early days. However, as the virus spread and fatalities rose (DEATHS), they were forced to impose severe restrictions on economic activity (GOV), hampering their trade resilience. This profile includes Argentina (ARG), Colombia (COL), South Africa (ZAF), and to a lesser extent Russia (RUS) and the United States (USA).
- ***Never had a chance:*** This profile includes low-income (~GNI) countries that exhibited a lack of resilience during most periods. Due to suffering from many weaknesses, such as fragile healthcare (~GHS), limited globalization (~ECOG & ~SOCG), and poor logistics (~LPI), it would have been extremely hard for them to withstand and/or swiftly recover from a global disruption of this scale. This profile includes countries in Africa (e.g., Morocco, Tunisia, Egypt), Central America (e.g., Guatemala, El Salvador), and South America (e.g., Bolivia, Paraguay, Peru).

5. Conclusions, implications, and further research

Most firms participate directly or indirectly in global supply chains and are embedded in the broader international trade system (Goldin & Mariathasan, 2015). They must abide by international trade rules, use the infrastructure available in the countries where they operate or source from, and rely on suppliers and customers in those countries. As a result, every practitioner, whether in the private or public sector, should be interested in the factors underpinning the resilience of the international trade system (Goldin & Mariathasan, 2015). The macro perspective adopted in this research extends the scope of most supply chain resilience studies, which focus on dyads or networks, and provides a broader explanation for resilience. The findings are relevant to those making sourcing decisions, who are currently reviewing their global supply chain structure and risk exposure in light of the Covid-19 pandemic and preparing for the next crisis. This research can guide the restructuring process by providing insights into the complex relationships between globalization, healthcare infrastructure, logistics capabilities, and international trade. For instance, managers making global sourcing decisions can use this information to create supplier portfolios in different countries with different risk profiles to better manage the overall disruption exposure.

While the Covid-19 pandemic has raised concerns regarding supply chain vulnerability, especially across strategic sectors, and prompted discussions of possible reshoring and nearshoring, this work increases the understanding of specific country-level vulnerabilities (The Economist, 2020; Yip, 2021; Altman, 2020). This allows for a more targeted management of risk and the associated factors that contribute to the resilience of the international trading system. The findings allow for a balanced and informed approach to mitigation and subsequent policy interventions.

This research identifies a set of equifinal configurations of macro-level, country-specific factors that foster (or hamper) international trade resilience. While it is the conjunctive effect of these factors that leads to a positive or negative outcome, some insights with respect to each factor's role are salient: globalization (economic and social), logistics and healthcare preparedness, and high-income levels, played an overwhelmingly positive role in eliciting trade resilience. On the other hand, a strong government response, and a high number of deaths, had a largely negative effect, demonstrating that balancing and reconciling health-related and economic outcomes is a challenging task.

This study offers a more nuanced understanding of a causally complex, 'chaordic' phenomenon, laying the foundation of a midrange theory of international trade resilience. The adopted neo-configurational lens allowed us to explore the relevance of several causal factors (i.e., social and economic globalization, logistics performance, healthcare preparedness, national government response, and income level) and offer several plausible explanations for how these factors can promote (or suppress) international trade resilience. This contribution provides the rudiments of a midrange theory of international trade resilience. We hope our approach motivates future studies considering the extent of globalization and the strength of national logistics systems, and their influence on the robustness and responsiveness of international trade. We invite researchers to continue this theorization process by developing and testing hypotheses based on our findings.

The study also offers significant implications for policymakers, particularly those who focus on international trade policy, since it highlights the importance of key factors that can strengthen the resilience of export economies and hence guide host government investment priorities in support of national economic development strategies. As the Covid-19 crisis has been a major setback for global development targets in most countries, with a particularly negative socio-economic impact on vulnerable groups (New York Times, 2020), the findings emphasize a direct linkage between a resilient international trading system, equitable access to health care, and protection of livelihoods. Thereby, the development of a strong healthcare capability and an effective and efficient logistics infrastructure become integral components of a credible and resilient export-oriented national development strategy.

Furthermore, policymakers involved in designing national preparedness strategies for future pandemics or similar health-related systemic risks might also find this work useful. Drawing from the findings, they can review the factors affecting trade resilience and seek to improve their forecasts of the probability of disruptions emanating from specific sourcing locations. Based on the country profiles encompassing national income, globalization levels, and existing infrastructure capabilities, appropriate mitigation strategies can be developed.

In addition, the insight that lower-income countries lacked the needed trade robustness and responsiveness during an international trade disruption of this scale will need to inform global initiatives to ensure more equitable access to health-related resources in future pandemics. An example is the ongoing COVAX initiative[1], which aims to secure COVID-19 vaccines for 92 low- and middle-income countries at the same time as wealthier nations. Such initiatives will need to be mainstreamed into future global pandemic response frameworks.

This research has some limitations. Firstly, we made an informed decision to limit the analysis to the first wave of the pandemic, and we were constrained by the limited availability of trade data during an unfolding crisis. However, we believe that we have provided a blueprint for research, and as more data becomes available, it will be possible to study subsequent waves of the pandemic. Secondly, the use of secondary data and the chosen analytic technique limited the scope of factors included in the analysis. We acknowledge that other factors, such as national culture, geography, and even regional variations, might have influenced country-level trade resilience during the COVID-19 pandemic. In fact, the relatively low consistency and coverage scores of some solutions point towards this. Thirdly, the cross-country, multi-period lens adopted in this work prevents a detailed examination of each country's COVID-19 'story', especially of countries that did not achieve trade resilience despite exhibiting the 'desired' characteristics (i.e., deviant cases – see Tenet 7 of Woodside, 2014). Fourthly, the absence of external, agreed, qualitative thresholds for some of our measures might have slightly compromised the validity of our calibration scheme. However, we have examined the sensitivity of the results to alternative schemes in our robustness tests. We encourage

[1] https://www.gavi.org/vaccineswork/covax-explained

researchers to build on our findings, using different datasets and both qualitative and quantitative methods, to further our understanding of resilience in the context of large-scale, global disruptions.

The COVID-19 crisis has likely touched the lives of every person on earth. The impact of the loss of life and the changes to human interaction and economic activity will stay with us for generations. It is thus vital to understand the factors in our global economy that have allowed such a devastating impact, the benefits and costs of resilience, and the solutions that can enable a swift recovery. Armed with this understanding, we can start preparing for future crises.

References

Ahluwalia, S. (2020). Italy surpasses the 1 million COVID mar, joins top 10 worst-hit countries: Reuters tally, *Reuters*, https://www.reuters.com/article/us-health-coronavirus-italy-tally/italy-surpasses-the-1-million-covid-mark-joins-top-10-worst-hit-countries-reuters-tally-idUSKBN27R2C1. Accessed 05/21/21

Altman, S.A. (2020). Will COVID-19 Have a Lasting Impact on Globalization? *Harvard Business Review*, May 20th. Available from: https://hbr.org/2020/05/will-COVID-19-have-a-lasting-impact-on-globalization. Accessed 02/05/21.

Ambulkar, S., Blackhurst, J. & Grawe, S. (2015). Firm's resilience to supply chain disruptions: Scale development and empirical examination. *Journal of Operations Management*, *33*, 111-122.

Arvis, J.-F., Ojala, L., Wiederer, C., Shepherd, B., Raj, A., Dairabayeva, K., & Kiiski, T. (2018). *Connecting to Compete 2018: Trade Logistics in the Global Economy*. Washington, DC: World Bank.

Aversa, P., Furnari, S., & Haefliger, S. (2015). Business model configurations and performance: A qualitative comparative analysis in Formula One racing, 2005-2013. *Industrial and Corporate Change*, 24(3), 655–676.

Beynon, M.J., Jones, P. & Pickernell, D., 2016. Country-based comparison analysis using fsQCA investigating entrepreneurial attitudes and activity. *Journal of Business Research*, 69(4), 1271-1276.

Blackhurst, J., Craighead, C. W., Elkins, D., & Handfield, R. B. (2005). An empirically derived agenda of critical research issues for managing supply-chain disruptions. *International Journal of Production Research*, 43(19), 4067–4081.

Blackhurst, J., Dunn, K. S., & Craighead, C. W. (2011). An Empirically Derived Framework of Global Supply Resiliency. *Journal of Business Logistics*, 32 (4), 374-391.

Bratianu, C. (2020). Toward understanding the complexity of the COVID-19 crisis: a grounded theory approach, *Management & Marketing. Challenges for the Knowledge Society*, 15(Special Issue), 410-423.

Burki, T. (2020). Global shortage of personal protective equipment. *The Lancet*. Infectious Diseases, 20(7), 785–786.

Chowdhury, R., Luhar, S., Khan, N., Choudhury, S. R., Matin, I., & Franco, O. H. (2020). Long-term strategies to control COVID-19 in low and middle-income countries: an options overview of community-based, non-pharmacological interventions. *European Journal of Epidemiology*, 35(8), 743–748.

Christopher, M. & Peck, H. (2004). Building the Resilient Supply Chain. *The International Journal of Logistics Management* 15 (2), 1-14.

Christopher, M. & Holweg, M. (2011). “Supply Chain 2.0”: Managing supply chains in the era of turbulence. *International Journal of Physical Distribution and Logistics Management*, 41(1), 63–82.

Christopher, M., Mena, C., Khan, O., & Yurt, O. (2011). Approaches to Managing Global Sourcing Risk. *Supply Chain Management: An International Journal* 16 (2), 67–81.

Closs, D.J. & Mollenkopf, D.A. (2004). A global supply chain framework. *Industrial Marketing Management*, *33*(1), 37-44.

CNBC. (2020). Fears of US drug shortages grow as India locks down to curb the coronavirus. Retrieved from https://www.cnbc.com/2020/03/24/us-drug-shortage-fears-grow-as-india-locks-down-due-to-the-coronavirus.html, accessed 05/31/2021

Craighead, C. W., Ketchen Jr, D. J., & Cheng, L. (2016). "Goldilocks" Theorizing in Supply Chain Research: Balancing Scientific and Practical Utility via Middle-Range Theory. *Transportation Journal*, 55(3), 241-257.

Crilly, D. (2011). Predicting stakeholder orientation in the multinational enterprise: A mid-range theory. *Journal of International Business Studies*, 42(5), 694-717.

Dormady, N., Roa-Henriquez, A. & Rose, A. (2019). Economic resilience of the firm: A production theory approach. *International Journal of Production Economics*, 208, 446-460.

Eisenhardt, K. M. & Bourgeois, L. J. (1988). Politics of strategic decision-making in high-velocity environments: Toward a midrange theory. *Academy of Management Journal*, 31, 737–770.

Ekici, Ş.Ö., Kabak, Ö. & Ülengin, F. (2016). Linking to compete: Logistics and global competitiveness interaction. *Transport Policy*, *48*, 117-128.

Estevão, J., Lopes, J. D., Penela, D., & Soares, J. M. (2020). The Doing Business ranking and the GDP. A qualitative study. *Journal of Business Research*, *115*, 435–442.

Fiss, P.C. (2007). A Set-Theoretic Approach to Organizational Configurations, *Academy of Management Review*, 32(4), 1180–1198.

Fiss, P.C. (2011). Building Better Causal Theories: A Fuzzy Set Approach to Typologies in Organization Research, *Academy of Management Journal*, 54(2): 393–420.

Flaherty, E. (2019). Varieties of Regulation and Financialization: Comparative Pathways to Top Income Inequality in the OECD, 1975–2005. *Journal of Comparative Policy Analysis: Research and Practice*, 21(1), 90–115.

Frieden, T. (2021). Which countries have responded best to Covid-19?, *The Wall Street Journal*, Jan, 1. Available from; https://www.wsj.com/articles/which-countries-have-responded-best-to-covid-19-11609516800. Accessed 11/2/2021

Goldin, I. & Mariathasan, M. (2015). *The Butterfly Defect: How Globalization Creates Systemic Risks, and What to Do about It*, Princeton University Press.

Gopinath, G. (2020). The great lockdown: Worst economic downturn since the great depression, IMF Blog. Available from: https://blogs.imf.org/2020/04/14/the-great-lockdown-worst-economic-downturn-since-the-great-depression/. Accessed 11/2/2021

Gygli, S., Haelg, F., Potrafke, N., & Sturm, J. E. (2019). The KOF Globalisation Index – revisited. *Review of International Organizations*, 14(3), 543–574.

Hale, T., Petherick, A., Phillips, T. & Webster, S. (2020a). Variation in government responses to COVID-19. Blavatnik School of Government Working Paper, 31, available from: https://www.bsg.ox.ac.uk/sites/default/files/2020-09/BSG-WP-2020-032-v7.0.pdf, accessed 02/11/21.

Hale, T., Webster, S., Petherick, A., Phillips, T., & Kira, B. (2020b). Oxford COVID-19 Government Response Tracker. Blavatnik School of Government. Available from: https://www.bsg.ox.ac.uk/research/research-projects/covid-19-government-response-tracker, accessed: 08/25/21.

Hoffman, A. J., & Ocasio, W. (2001). Not all events are attended equally: Toward a middle-range theory of industry attention to external events. *Organization Science*, 12(4), 414-434.

IMF (2021) Policy responses to Covid-19, available from: https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19#top. Accessed 11/2/2021

Jovanović, A., Klimek, P., Renn, O., Schneider, R., Øien, K., Brown, J., DiGennaro, M., Liu, Y., Pfau, V., Jelić, M., Rosen, T., Caillard, B., Chakravarty, S., & Chhantyal, P. (2020). Assessing resilience of healthcare infrastructure exposed to COVID-19: emerging risks, resilience indicators, interdependencies and international standards In *Environment Systems and Decisions*, 40, 252–286

Kurth, M., Kozlowski, W., Ganin, A., Mersky, A., Leung, B., Dykes, J., Kitsak, M., & Linkov, I. (2020). Lack of resilience in transportation networks: Economic implications. *Transportation Research Part D: Transport and Environment, 86*, 102419.

Luthar, SS, Cicchetti, D., & Becker, B. (2000). The Construct of Resilience: A Critical Evaluation and Guidelines for Future Work. *Child Development* 71 (3): 543-562.

Martí, L., Puertas, R., & García, L. (2014). The importance of the Logistics Performance Index in international trade. *Applied economics*, 46(24), 2982-2992.

Mas-Coma, S., Jones, M.K. & Marty, A.M. (2020). COVID-19 and globalization. *One Health*, 9: 100132, doi: 10.1016/j.onehlt.2020.100132

Mayer, J.D. & Lewis, N.D. (2020). An inevitable pandemic: geographic insights into the COVID-19 global health emergency. *Eurasian Geography and Economics*, 61(4-5), 404-422.

Melnyk, S.A., Closs, D.J., Griffis, S.E., Zobel, C.W. & Macdonald, J.R. (2014). Understanding Supply Chain Resilience. *Supply Chain Management Review*, 18 (1): 34-41.

Misangyi, V.F., Greckhamer, T., Furnari, S., Fiss, P.C., Crilly, D., & Aguilera, R. (2016). Embracing Causal Complexity: The Emergence of a Neo-Configurational Perspective. *Journal of Management*, 43(1), 255–282.

MSCI. (2020). The ESG Weekly: Drug shortages and the coronavirus, from whence your drugs came. Retrieved from https://www.msci.com/esg-now-podcast, accessed: 31/5/2021.

New York Times (2020). In Scramble for Coronavirus Supplies, Rich Countries Push Poor Aside. The New York Times, pp. 1–5. Retrieved from https://www.nytimes.com/2020/04/09/world/coronavirus-equipment-rich-poor.html, accessed: 31/5/2021.

Notteboom, T. and Pallis, T., 2020. IAPH-WPSP Port economic impact barometer half year report: A survey-based analysis of the impact of COVID-19 on world ports in the period April to September 2020, available from: https://biblio.ugent.be/publication/8675723/file/8675725, accessed: 08/25/21.

NTI & JHU (2019). *Global Health Security Index: Building Collective Action and Accountability*. Retrieved from https://www.ghsindex.org/wp-content/uploads/2020/04/2019-Global-Health-Security-Index.pdf, accessed: 31/5/2021.

Olya, H. G. T., & Altinay, L. (2016). Asymmetric modeling of intention to purchase tourism weather insurance and loyalty. *Journal of Business Research*, *69*(8), 2791–2800.

Pajunen, K. (2008). Institutions and inflows of foreign direct investment: A fuzzy-set analysis. *Journal of International Business Studies*, 39(4), 652-669.

Pappas, N., 2021. COVID19: Holiday intentions during a pandemic. *Tourism Management*, 84, 104287.

Pappas, N. & Glyptou, K. (2021). Accommodation decision-making during the COVID-19 pandemic: Complexity insights from Greece. *International Journal of Hospitality Management*, 93, 102767.

Park, Y., Fiss, P.C. & El Sawy, O.A. (2020). Theorizing the multiplicity of digital phenomena: the ecology of configurations, causal recipes, and guidelines for applying QCA. *MIS Quarterly*, 44(4), 1493-1520.

Parker, H. & Ameen, K. (2018). The role of resilience capabilities in shaping how firms respond to disruptions. *Journal of Business Research*, *88*, 535-541.

Piñeiro-Chousa, J., Vizcaíno-González, M., & Caby, J. (2019). Financial development and standardized reporting: A comparison among developed, emerging, and frontier markets. *Journal of Business Research*, *101*, 797–802.

Ragin, C.C. (2008). *Redesigning social inquiry: Fuzzy sets and beyond*. Chicago, IL: University of Chicago Press.

Ragin, C.C., & Rubinson, C. (2009). The distinctiveness of comparative research. In *The SAGE handbook of comparative politics*: 13-34. London: SAGE Publications.

Ragin, C.C., & Sonnett, R. (2004). Between complexity and parsimony: Limited diversity, counterfactual cases, and comparative analysis. In S. Kropp & M. Minkenberg (Eds.), *Vergleichen in der Politikwissenschaft*: 180-197. Wiesbaden: VS Verlag fur Sozialwissenschaften.

Reuters (2021) China sees fall in new COVID-19 cases amid strict local lockdowns, Reuters, https://www.reuters.com/article/us-health-coronavirus-china-cases/china-sees-fall-in-new-covid-19-cases-amid-strict-local-lockdowns-idUSKBN29T0AA, accessed 11/2/21.

Rihoux, B., & Ragin, C.C. (2008). *Configurational Comparative Methods: Qualitative Comparative Analysis (QCA) and Related Techniques*, SAGE Publications.

Rose, A., & Liao, S.Y. (2005). Modeling Regional Economic Resilience to Disasters: A Computable General Equilibrium Analysis of Water Service Disruptions. *Journal of Regional Science,* 45 (1): 75-112.

Rose, A. (2007). Economic Resilience to Natural and Man-made Disasters: Multidisciplinary Origins and Contextual Dimensions. *Environmental Hazards* 7 (4), 383-398.

Russo, I., Pellathy, D., & Omar, A. (2021). Managing Outsourced Reverse Supply Chain Operations: Middle- Range Theory Development. *Journal of Supply Chain Management*. In press, 10.1111/jscm.12244

Scheibe, K.P. & Blackhurst, J. (2018). Supply chain disruption propagation: a systemic risk and normal accident theory perspective, *International Journal of Production Research*, 56 (1-2), 43-59.

Schneider, C. Q., & Wagemann, C. (2012). Set-Theoretic Methods for the Social Science. A Guide to Qualitative Comparative Analysis.

Sheffi, Y. (2005). Building a Resilient Supply Chain. *Harvard Business Review* 1 (8), 1–11.

Sheffi Y. & Lynn, B.C. (2014). Systemic Supply Chain Risk, *The Bridge* (Fall), 22.

Shih, W.C., 2020. Global supply chains in a post-pandemic world. *Harvard Business Review*, *98*(5), 82-89.

Soda, G., & Furnari, S. (2012). Exploring the topology of the plausible: Fs/QCA counterfactual analysis and the plausible fit of unobserved organizational configurations. *Strategic Organization*, 10, 285-296.

Soni, U., & Jain, V. (2011). *Minimizing the vulnerabilities of supply chain: A new framework for enhancing the resilience*. IEEE International Conference on Industrial Engineering and Engineering Management, 933–939.

Steven A., & Philip, B. (2020). DHL Global Connectedness Index. Retrieved from https://www.dhl.com/global-en/spotlight/globalization/global-connectedness-index.html, accessed: 31/5/2021.

Tatelbaum, J. (2020). Fears of US Drug Shortages Grow as India Locks down to Curb the Coronavirus," *CNBC*, March 24, 2020, https://www.cnbc.com/2020/03/24/us-drug-shortage-fears-grow-as-india-locks-down-due-to-the-coronavirus.html. Accessed: 5/2/ 21

Tekic, A., & Tekic, Z. (2021). Culture as antecedent of national innovation performance: Evidence from neo-configurational perspective. *Journal of Business Research*, *125*, 385–396.

The Economist (2020). Has COVID-19 Killed Globalisation? *The Economist*, May 14th. Available from: https://www.economist.com/leaders/2020/05/14/has-covid-19-killed-globalisation, accessed: 5/2/2021.

The World Bank (2019). *GNI per capita, Atlas method.* [Data file]. Retrieved from http://data.worldbank.org/indicator/NY.GNP.PCAP.CD

Verbeke, A. & Yuan, W., (2021). A few implications of the covid- 19 pandemic for international business strategy research. *Journal of Management Studies*, 58(2), 597-601.

Verma, S. & Gustafsson, A. (2020). Investigating the emerging COVID-19 research trends in the field of business and management: A bibliometric analysis approach. *Journal of Business Research*, 118, 253-261.

Vogel, G. (2020). Sweden's gamble, *Science*, 370 (6513), 159-163.

Wight, A. (2020). Expert warns cold chain infrastructure overhaul needed for Covid-19 vaccine rollout, Forbes, available from: https://www.forbes.com/sites/andrewwight/2020/11/15/health-expert-from-zimbabwe-warns-of-covid-19-vaccine-cold-chain-challenges /?sh=57061c682055 Accessed 02/05/2021.

Woodside, A.G. (2013). Moving beyond multiple regression analysis to algorithms: Calling for adoption of a paradigm shift from symmetric to asymmetric thinking in data analysis and crafting theory. *Journal of Business Research*, 66(4): 463–472.

Woodside, A. G. (2014). Embrace-perform-model: Complexity theory, contrarian case analysis, and multiple realities. *Journal of Business Research*, 67(12), 2495–2503.

World Economic Forum (2019). Outbreak Readiness and Business Impact Protecting Lives and Livelihoods across the Global Economy. (January), 1–22. https://www.weforum.org/whitepapers/outbreak-readiness-and-business-impact-protecting-lives-and-livelihoods-across-the-global-economy, accessed: 8/25/2021.

WTO (2021). Total Merchandise Imports & Exports (monthly). International Trade Statistics. [Data file]. Available from: https://data.wto.org/, accessed: 5/2/2021.

Xie, W., Rose, A., Li, S., He, J., Li, N. & Ali, T. (2018). Dynamic economic resilience and economic recovery from disasters: A quantitative assessment. *Risk Analysis*, *38*(6), 1306-1318.

Yip, G. (2021). Does COVID-19 Mean the End for Globalization? *Forbes*, January 8th. available from: https://www.forbes.com/sites/imperialinsights/2021/01/08/does-covid-19-mean-the-end-for-globalization/?sh=160ba1a6671e. Accessed 02/05/2021.

Zsidisin, G.A. & Wagner, S.M. (2010). Do perceptions become reality? The moderating role of supply chain resiliency on disruption occurrence. *Journal of Business Logistics*, *31*(2), 1-20.

Table 1 *- Descriptive statistics*

Outcome/Conditions	Original measure	Month	Mean	Std. Dev.	Min.	Max.	N
Trade resilience (**RESI**)	Year-on-year monthly % change in total trade volume	March	-10.21	11.46	-51.14	21.37	74
		April	-29.14	13.81	-62.63	0.19	
		May	-28.48	10.18	-57.9	-2.4	
		June	-10.15	9.33	-34.44	11.43	
		July	-11.39	7.76	-31.57	4.06	
Logistics Performance (**LPI**)	Logistics Performance Index	-	2.88	0.58	1.95	4.2	151
Income Level (**GNI**)	GNI per capita in current USD (Atlas method)	-	15563.66	21129.32	280	117730	161
Government response (**GOV**)	Overall Government Response Index (Uni. Of Oxford)	March	31.74	11.3	3.28	64.24	183
		April	62.07	12.3	14.26	86	
		May	61.99	12.22	14.64	83.04	
		June	57.42	13.16	13.33	81.17	
		July	54.59	13.34	14.55	80.34	
Magnitude of disruption (**DEATHS**)	Number of monthly deaths per 100,000 ppl	March	1.08	6.21	0	76.63	179
		April	3	8.38	0	59.44	
		May	1.47	3.17	0	17.02	
		June	1.26	2.91	0	24.24	
		July	1.76	4.09	0	28.34	
Economic Globalization (**ECOG**)	KOF Economic Globalization Index	-	58.84	16.25	25.64	93.63	170
Social Globalization (**SOCG**)	KOF Social Globalization Index	-	63.96	17.81	26.7	91.5	176
Healthcare preparedness (**GHS**)	Global Health Security Index	-	42.01	14.27	16.6	83.5	170

Table 2 – Pairwise correlations of raw measures in the analysis (70 countries – 5 months)

Measures	1	2	3	4	5	6	7	8
1. RESI	1							
2. LPI	0.184***	1						
3. GNI	0.169***	0.755***	1					
4. GOV	-0.465***	-0.11**	-0.15***	1				
5. DEATHS	-0.197***	0.2***	0.153***	0.241***	1			
6. ECOG	0.172***	0.598***	0.654***	-0.197***	0.084	1		
7. SOCG	0.177***	0.686***	0.813***	-0.185***	0.101*	0.867***	1	
8. GHS	0.152***	0.767***	0.574***	-0.071	0.233***	0.444***	0.572***	1

Notes: *p<0.1, **p<0.05, ***p<0.01

Table 3 *- Calibration details*

Outcome/Conditions	Original measure	Corresponding fuzzy set	Method of calibration	Anchors[1]
RESI	Year-on-year monthly % change in total trade volume (March to July)	*The set of countries that exhibited above-average trade resilience in the first wave of the pandemic*	Direct (based on distributional properties)[2]	e.g. April: Excl. -42.83% Cross. -28.6% Incl. -11.2%
LPI	Logistics Performance Index	*The set of countries with high logistics performance*	Direct (using World Bank set thresholds for level of 'logistics friendliness' – section 3.1)	Excl. 2.38 Cross. 2.88 Incl. 3.41
GNI	GNI per capita	*The set of high-income countries*	Direct (using World Bank set thresholds defining income levels[4])	(in USD) Excl. 1036 Cross. 4045 Incl. 12535
GOV	Overall Government Response Index	*The set of country governments that exhibited an above-average strong response*	Direct (based on distributional properties)[2]	e.g. April: Excl. 47.86 Cross. 62.01 Incl. 75.58
DEATHS	Deaths per 100,000 ppl	*The set of countries that experienced an above-average disruption impact*	Direct (based on distributional properties)[2]	e.g. April: Excl.: 0 Cross. 3 Incl. 6.39

ECOG	KOF Economic Globalization Index	*The set of economically globalized countries*	Direct (following precedence)[3]	Excl. 42.89 Cross. 57.78 Incl. 74.91
SOCG	KOF Social Globalization Index	*The set of socially globalized countries*	Direct (following precedence)[3]	Excl. 45.4 Cross. 66.09 Incl. 82.66
GHS	Global Health Security Index	*The set of well-prepared countries in the event of a world pandemic*	Direct (using ghsindex.org thresholds for level of preparedness – section 3.1)	Excl. 33.5 Cross. 40.2 Incl. 66.5

Notes:

1. Incl. denotes the anchor of 'full membership' in the target set, Cross. the point of 'maximum ambiguity' (i.e., 0.5), and Excl. 'full non-membership'. See Ragin (2008) and Schneider & Wagemann (2012).
2. Thresholds being the mean (cross-over) and 10th and 90th percentiles of the distribution of the measure. Since the measure varies by month, for every month included in the analysis, the measure is re-calibrated based on its distribution in the given month.
3. Following Gygli et al. (2019) who use the quintiles of the distribution to draw comparisons between countries, we use the top and bottom quintile to denote full and no membership, respectively, and the median as the cross-over point.
4. https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

Table 4 *- fsQCA results: Analysis of sufficiency for trade resilience*

Month (2020)	**Intermediate Solution[1,2,3] (consistency, raw/unique coverage)**	**Solution consistency (coverage)[4]**	**Typical Cases[5]**	**Consistency & PRI cut-offs[6] (Cases covered)**
March	1. **~GOV*GHS*** *ECOG* ***SOCG*** *LPI* ***** *GNI* (0.879, 0.356/0.174)	0.855	**MEX SWE THA BGR EST SGP POL CHL**	0.84 & 0.52
	2. **~GOV*~DEATHS*ECOG*SOCG*~LPI*** *GNI* (0.864, 0.168/0.025)	(0.412)	**BLR URU**	(13)
	3. **~GOV*GHS*** *~DEATHS* ***~ECOG*LPI*** *GNI* (0.897, 0.17/0.031)		**BRA IDN ZAF**	
April	1a. **~GOV*GHS*** *LPI* ***GNI** (0.798, 0.492/0.188)	0.8	**CHN IDN TUR CAN DNK EST FIN NOR SWE CHE** BGR GRC ISL +3	0.82 & 0.52
	1b. **~GOV*GHS*** *~DEATHS*ECOG*SOCG** ***GNI** (0.824, 0.327/0.023)	(0.515)	**LVA URU CRI** BGR GRE ISL JAP MEX KOR	(19)
May	1. **~GOV*GHS*~DEATHS*ECOG*** *SOCG* ***GNI** (0.853, 0.391/0.285)	0.836	**CRI ISL LVA URU BGR CZE EST GRC JAP NZL NOR SLO KOR**	0.83 & 0.43
	2. **~GOV*GHS*** *~DEATHS* ***~SOCG*LPI*GNI** (0.837, 0.115/0.009)	(0.4)	**IDN**	(14)
June	1a. *~GOV* ***~DEATHS*ECOG*SOCG*GNI** (0.808, 0.524/0.017)		**MLT** BIH LVA URU AUT AUS HRV DNK EST FIN GRC ISL JAP NZL +8	0.829 & 0.53
	1b. *GHS* ***~DEATHS*ECOG*SOCG*GNI** (0.781, 0.658/0.151)	0.751	**ALB CRI CYP DEU HUN ISR NLD MYS SGP THA** NOR POL KOR +19	(39)
	2. **~GOV*GHS*ECOG*SOCG*LPI*GNI** (0.803, 0.554/0.064)	(0.75)	**ESP SWE MEX ROU BGR** CHE POL NOR KOR SVK LUX SLO NZL +11	
	3. **~GOV*GHS*~DEATHS*~ECOG*~SOCG*** *LPI* ***GNI** (0.89, 0.1/0.011)		**IDN**	
July	1. **~GOV*GHS*ECOG*SOCG*LPI*GNI** (0.835, 0.59/0.047)	0.826	**SWE BGR MEX ROU** NZL NOR POL SVK SLO KOR CHE AUT CZE +9	0.84 & 0.5
	2. **~GOV*GHS*~DEATHS*ECOG*SOCG*GNI** (0.836, 0.553/0.010)	(0.6)	**LVA URU** AUT CZE HRV EST FIN FRA ISL IRL JAP LTU LUX NLD +7	(25)

Key: GOV: Government response; GHS: Healthcare preparedness; DEATHS: Death rate in the month (per 100k); ECOG: Economic globalization; LPI: Logistics performance. GNI: National Income (per capita); SOCG: Social Globalization; '~' suggests the negation of the set (e.g., ~GOV indicates "NOT strong government response")

Notes: **1. Core** conditions in bold, *contributing* conditions italicized, **2**. For each month, the configuration with the highest unique coverage is underlined, **3.** Directional expectations: we expect the absence of DEATHS and GOV, and the presence of all other conditions, to be associated with the outcome. Our results are not sensitive to changes in directional expectations, **4**. Of the intermediate solution, **5**. Cases that belong *uniquely* to the respective configuration are in **bold**. **6.** Specifically, the consistency and PRI of the most inconsistent empirically observed configuration included in the minimization.

***Table 5** - fsQCA results: Analysis of sufficiency for the absence of trade resilience*

Month (2020)	**Intermediate Solution[1,2,3,4] (consistency, unique coverage)**	**Solution consistency (coverage)**	**Typical cases**	**Cases covered**
March	**GOV*~GHS***~*LPI* (0.781, <u>0.053</u>)		UKR MLT	
	GOV*~ECOG*~LPI (0.776, 0.016)	0.793 (0.361)	KAZ RUS	12
	GOV*~SOCG*~LPI (0.814, 0.021)		MAR, PER, SLV	
	~GHS*~*ECOG***~SOCG***~*LPI*~GNI* (0.895, 0.018)		EGY	
April	**GOV*DEATHS** (0.827, <u>0.306</u>)		BEL, AUT, FRA, ITA	
	GOV*ECOG*~LPI (0.868, 0.067)		UKR, MLT, ALB	
	GOV*~GHS*~*SOCG*~LPI* (0.841, 0.011)	0.805 (0.659)	GTM, PRY	30
	GOV*~ECOG*~*SOCG**~**GNI** (0.844, 0.030)		IND, PHL	
	~GHS*~*ECOG*~SOCG**~**LPI*~GNI** (0.898, 0.017)		BOL	
May	*GOV**DEATHS*~LPI** (0.885, 0.011)		RUS, PER	
	GOV*~ECOG*LPI (0.796, <u>0.055</u>)		COL, ARG, BRA	
	GOV*~*SOCG**~**GNI** (0.861, 0.015)	0.782	SLV, EGY, VNM	23
	GOV*SOCG*~LPI (0.797, 0.027)	(0.429)	UKR, ALB, KAZ	
	~*GHS**DEATHS*~LPI** (0.933, 0.019)		BLR, BOL	
June	**GOV*DEATHS***~**ECOG** (0.867, <u>0.103</u>)		ARG, COL, BRA, RUS	12
	GOV*DEATHS*~**SOCG***~LPI (0.893, 0.023)	0.876	PER, SLV	
	~GOV*~GHS*ECOG*~SOCG **~LPI*~GNI** (0.892, 0.036)	(0.364)	TUN	
July	**GOV*DEATHS** (0.836, <u>0.185</u>)		ARG, ZAF, BRA, USA	
	~GHS*~LPI (0.840, 0.051)		TUN, UKR, MLT	
	DEATHS*~LPI (0.868, 0.004)	0.817	BIH	27
	~GOV*~ECOG*~SOCG (0.922, 0.005)	(0.663)	IDN	
	~ECOG*~SOCG*~GNI (0.912, 0.018)		IND, PHL	
	GOV*~*SOCG**~**LPI***~*GNI* (0.901, 0.003)		MAR	

Key: GOV: Government response; GHS: Healthcare preparedness; DEATHS: Death rate in the month (per 100k); ECOG: Economic globalization; LPI: Logistics performance; GNI: National Income (per capita); SOCG: Social Globalization; '~' indicates the negation of the set (e.g., ~GOV indicates "NOT strong government response")

Notes: 1. Core conditions in bold, *contributing* conditions italicized, **2.** Consistency thresholds ranged from 0.81 to 0.86; PRI threshold set to 0.6, **3**. For each month, the configuration with the highest unique coverage is underlined, **4.** Directional expectations: we expect the presence of DEATHS and GOV, and the absence of all other conditions, to be associated with the negation of the outcome. Our results are not sensitive to changes in directional expectations.

Appendix

A. Truth Tables

For transparency purposes, we include herein the Truth Tables of the analysis of sufficiency for the presence of trade resilience, for all months. The column 'OUT' denotes the presence of the outcome (and takes the value of 1 for rows that are above the baseline consistency and PRI thresholds), 'n' is the frequency and 'Incl' is the consistency (or Inclusion) score. It is noteworthy that all truth tables have rows with *both* high and low consistency values, which suggests that the chosen conditions differentiate the cases well with respect to the outcome (Radaelli & Wagemann, 2019). Hence, although we cannot deny that influential variables might have not been considered here, we can be confident that the chosen variables are indeed relevant.

Table A2 - Truth Table for March (R Output)

Conf.	GOV	GHS	DEATHS	ECOG	SOCG	LPI	GNI	OUT	n	Incl	PRI
36	0	1	0	0	0	1	1	1	2	0.898	0.756
46	0	1	0	1	1	0	1	1	1	0.893	0.698
40	0	1	0	0	1	1	1	1	1	0.889	0.691
48	0	1	0	1	1	1	1	1	7	0.888	0.749
64	0	1	1	1	1	1	1	1	1	0.88	0.636
14	0	0	0	1	1	0	1	1	1	0.845	0.52
112	1	1	0	1	1	1	1	0	20	0.758	0.596
104	1	1	0	0	1	1	1	0	1	0.744	0.472
100	1	1	0	0	0	1	1	0	4	0.743	0.534
107	1	1	0	1	0	1	0	0	1	0.727	0.492
110	1	1	0	1	1	0	1	0	4	0.716	0.435
1	0	0	0	0	0	0	0	0	1	0.698	0.245
78	1	0	0	1	1	0	1	0	1	0.688	0.328
66	1	0	0	0	0	0	1	0	2	0.683	0.366
128	1	1	1	1	1	1	1	0	13	0.671	0.452
106	1	1	0	1	0	0	1	0	1	0.64	0.243
102	1	1	0	0	1	0	1	0	2	0.63	0.333
77	1	0	0	1	1	0	0	0	1	0.621	0.29
99	1	1	0	0	0	1	0	0	2	0.597	0.333
73	1	0	0	1	0	0	0	0	1	0.594	0.216
105	1	1	0	1	0	0	0	0	2	0.558	0.206
65	1	0	0	0	0	0	0	0	1	0.55	0.204

Table A3 - Truth Table for April (R Output)

Conf.	GOV	GHS	DEATHS	ECOG	SOCG	LPI	GNI	OUT	n	Incl	PRI
52	0	1	1	0	0	1	1	1	1	0.879	0.52
36	0	1	0	0	0	1	1	1	2	0.864	0.708
46	0	1	0	1	1	0	1	1	3	0.864	0.598
64	0	1	1	1	1	1	1	1	7	0.852	0.598
48	0	1	0	1	1	1	1	1	6	0.822	0.596
14	0	0	0	1	1	0	1	0	1	0.812	0.422
116	1	1	1	0	0	1	1	0	1	0.752	0.332
122	1	1	1	1	0	0	1	0	1	0.747	0.074

112	1	1	0	1	1	1	1	0	13	0.736	0.5
104	1	1	0	0	1	1	1	0	2	0.73	0.45
78	1	0	0	1	1	0	1	0	1	0.712	0.314
1	0	0	0	0	0	0	0	0	1	0.704	0.268
107	1	1	0	1	0	1	0	0	1	0.692	0.438
100	1	1	0	0	0	1	1	0	2	0.684	0.402
102	1	1	0	0	1	0	1	0	2	0.681	0.366
110	1	1	0	1	1	0	1	0	2	0.678	0.223
128	1	1	1	1	1	1	1	0	15	0.613	0.257
77	1	0	0	1	1	0	0	0	1	0.6	0.261
66	1	0	0	0	0	0	1	0	2	0.591	0.267
73	1	0	0	1	0	0	0	0	1	0.572	0.188
99	1	1	0	0	0	1	0	0	2	0.556	0.268
105	1	1	0	1	0	0	0	0	2	0.538	0.148
65	1	0	0	0	0	0	0	0	1	0.491	0.181

Table A4 - Truth Table for May (R Output)

Conf.	GOV	GHS	DEATHS	ECOG	SOCG	LPI	GNI	OUT	n	Incl	PRI
46	0	1	0	1	1	0	1	1	3	0.932	0.702
30	0	0	1	1	1	0	1	0	1	0.857	0.124
48	0	1	0	1	1	1	1	1	10	0.856	0.639
36	0	1	0	0	0	1	1	1	1	0.833	0.43
110	1	1	0	1	1	0	1	0	1	0.81	0.294
78	1	0	0	1	1	0	1	0	1	0.8	0.377
107	1	1	0	1	0	1	0	0	1	0.789	0.393
64	0	1	1	1	1	1	1	0	8	0.781	0.44
112	1	1	0	1	1	1	1	0	11	0.781	0.44
104	1	1	0	0	1	1	1	0	2	0.769	0.381
126	1	1	1	1	1	0	1	0	1	0.754	0.144
102	1	1	0	0	1	0	1	0	1	0.752	0.339
66	1	0	0	0	0	0	1	0	2	0.729	0.419
17	0	0	1	0	0	0	0	0	1	0.717	0.102
77	1	0	0	1	1	0	0	0	1	0.695	0.122
100	1	1	0	0	0	1	1	0	2	0.694	0.337
122	1	1	1	1	0	0	1	0	1	0.691	0.032
73	1	0	0	1	0	0	0	0	1	0.69	0.126
118	1	1	1	0	1	0	1	0	1	0.679	0.228
116	1	1	1	0	0	1	1	0	3	0.671	0.253
105	1	1	0	1	0	0	0	0	2	0.659	0.056
128	1	1	1	1	1	1	1	0	12	0.641	0.304
65	1	0	0	0	0	0	0	0	1	0.596	0.235
99	1	1	0	0	0	1	0	0	2	0.576	0.165

Table A5 - Truth Table for June (R Output)

Conf.	GOV	GHS	DEATHS	ECOG	SOCG	LPI	GNI	OUT	n	Incl	PRI
46	0	1	0	1	1	0	1	1	3	0.892	0.728
36	0	1	0	0	0	1	1	1	1	0.892	0.69

30	0	0	1	1	1	0	1	0	1	0.883	0.445
110	1	1	0	1	1	0	1	1	2	0.841	0.658
48	0	1	0	1	1	1	1	1	19	0.839	0.724
14	0	0	0	1	1	0	1	1	1	0.834	0.548
112	1	1	0	1	1	1	1	1	8	0.831	0.671
64	0	1	1	1	1	1	1	1	5	0.829	0.538
9	0	0	0	1	0	0	0	0	1	0.817	0.393
100	1	1	0	0	0	1	1	0	2	0.805	0.642
66	1	0	0	0	0	0	1	0	1	0.764	0.511
107	1	1	0	1	0	1	0	0	1	0.756	0.526
77	1	0	0	1	1	0	0	0	1	0.752	0.398
102	1	1	0	0	1	0	1	0	1	0.729	0.385
105	1	1	0	1	0	0	0	0	1	0.7	0.37
121	1	1	1	1	0	0	0	0	1	0.676	0.284
99	1	1	0	0	0	1	0	0	2	0.645	0.438
128	1	1	1	1	1	1	1	0	9	0.642	0.341
122	1	1	1	1	0	0	1	0	1	0.635	0.217
120	1	1	1	0	1	1	1	0	2	0.61	0.184
116	1	1	1	0	0	1	1	0	3	0.587	0.179
118	1	1	1	0	1	0	1	0	1	0.549	0.145
82	1	0	1	0	0	0	1	0	1	0.544	0.159
81	1	0	1	0	0	0	0	0	2	0.541	0.238

Table A6 - Truth Table for July (R Output)

Conf.	GOV	GHS	DEATHS	ECOG	SOCG	LPI	GNI	OUT	n	Incl	PRI
30	0	0	1	1	1	0	1	0	1	0.876	0.222
64	0	1	1	1	1	1	1	1	4	0.875	0.503
46	0	1	0	1	1	0	1	1	2	0.87	0.595
62	0	1	1	1	1	0	1	0	1	0.861	0.274
48	0	1	0	1	1	1	1	1	19	0.847	0.728
14	0	0	0	1	1	0	1	0	1	0.835	0.312
9	0	0	0	1	0	0	0	0	1	0.797	0.137
112	1	1	0	1	1	1	1	0	15	0.789	0.557
36	0	1	0	0	0	1	1	0	1	0.787	0.26
13	0	0	0	1	1	0	0	0	1	0.749	0.106
100	1	1	0	0	0	1	1	0	2	0.741	0.481
128	1	1	1	1	1	1	1	0	3	0.731	0.28
66	1	0	0	0	0	0	1	0	1	0.721	0.31
107	1	1	0	1	0	1	0	0	1	0.708	0.396
126	1	1	1	1	1	0	1	0	2	0.684	0.203
121	1	1	1	1	0	0	0	0	1	0.682	0.174
122	1	1	1	1	0	0	1	0	1	0.615	0.129
105	1	1	0	1	0	0	0	0	1	0.591	0.069
82	1	0	1	0	0	0	1	0	1	0.578	0.13
120	1	1	1	0	1	1	1	0	2	0.532	0.032
81	1	0	1	0	0	0	0	0	2	0.53	0.102
99	1	1	0	0	0	1	0	0	2	0.507	0.178
116	1	1	1	0	0	1	1	0	3	0.483	0.031

118	1	1	1	0	1	0	1	0	2	0.463	0.011

B. Robustness tests

B1. Alternative consistency thresholds

To understand whether the results are sensitive to alternative decisions regarding consistency and PRI thresholds, we ran a series of robustness tests for each month. Table B1 includes the results of the most intuitive alternative decision, in the sufficiency analysis for the presence of the outcome. The reader can evaluate these in conjunction with the Truth Tables (see earlier section).

Table B1 - Results from analyses with alternative consistency thresholds

Month	Alternative Decision[1] (cases included)	Result
March	Consistency cut: 0.75 (33)	An additional configuration is included in the minimization with 20 extra cases. Substantively, the results remain unchanged.
April	Consistency cut: 0.80 (20)	A more complex solution, including a configuration signifying a non-globalized country (~FECOG*~FSOCG) but with minimal government intervention and solid infrastructure (~FGOV*FGHS*FLPI).
May	Consistency cut: 0.78; PRI: 0.4 (33)	Solution includes two more variations of the predominant configuration, where ~DEATHS and ~GOV alternate. Substantive results are even stronger.
June	Consistency cut: 0.80; PRI cut: 0.4 (42)	An almost identical solution is derived.
July	Consistency cut: 0.78; PRI cut: 0.5 (40)	An almost identical solution is derived.

Notes: **1.** All robustness tests reported here apply more liberal (but permissible) thresholds. Tests with more conservative thresholds were also run where it made sense; the results do not challenge the main findings of the baseline analysis.

B2. Alternative calibration scheme for the outcome

In the baseline analyses, for the calibration of the outcome (Year-on-Year monthly % change in total trade volume) we used the 90th and 10th percentiles as thresholds to denote full and no set-membership, respectively, in the set of countries that exhibited above average trade resilience, and the mean as the cross-over point. As a robustness test, we re-run the analysis by using the 80th, 20th and 50th (median) percentiles as respective alternative thresholds. Although the choice of the median instead of the mean may not be very consequential (since for all months the distribution of the original measure is almost normal, with the difference between mean and median being about 1 percentage point), the full inclusion and exclusion thresholds differ by an average of 4 percentage points. As such, we consider this robustness test as quite 'severe'.

In all 10 analyses, most configurations in the parsimonious and intermediate solutions remain intact. In some instances, alternative variants of existing configurations appear. The results remain substantively the same. Comparatively speaking, we consider our baseline calibration to be superior not only theoretically, but also empirically (due to higher solution consistency and coverage scores for similar cut-off decisions). The results are not presented herein but are available upon request.

B3. Alternative calibration schemes for the conditions

We are fortunate that there exists external, substantive knowledge that aided the calibration of most conditions: LPI, ECOG, SOCG, GHS and GNI. As such, for these conditions we see no reason to experiment with alternative schemes that lack theoretical backing, with one exception: Originally, to calibrate GNI, we used the 2019 World Bank thresholds that classify countries into low-, lower-middle, upper-middle and high-income[2]. Arguably, and given that our final sample is dominated by high-income countries, these thresholds might be considered too low. We thus re-calibrate this measure after changing the name of the respective set into 'the set of *very* high-income countries' (for terminological consistency), by applying the following thresholds.

- 'Fully in' being the *mean* GNI per capita of the World Bank designated high-income countries ($45,353)
- 'Cross-over' being the World Bank set threshold demarcating the high-income group ($12,535)
- 'Fully out' being the World Bank set threshold demarcating the 'upper-middle' income countries from 'lower-middle' ones ($4,045)

For the two time-variant conditions (GOV and DEATHS) which we originally calibrated using distributional properties, we apply alternative thresholds in the same spirit as in B2 above. Namely, we use the median of the distribution (instead of the mean) as cross-over point, and increase (decrease) the lower (upper) threshold from the 10^{th} (90^{th}) to the 20^{th} (80^{th}) percentile.

To make this robustness test as severe as possible, we run only one set of analyses after substituting all three calibrated measures at the same time. Also, to draw comparisons more easily with the original results, for each month we apply the exact same consistency and PRI thresholds as in the respective baseline analysis (see Tables 4 & 5 of the manuscript)[3]. The results are in general agreement with the original findings, increasing the confidence in our key insights. in Table B3, we provide more nuance with a month-by-month comparison of the intermediate solutions.

Table B3 - Comparison between the baseline and the alternative intermediate solutions

Month	Presence of resilience (RESI)	Absence of resilience (~RESI)
March	A more complex solution emerges, with 3 out of 6 configurations including the absence of very high income (~GNI). This, however, is accompanied by the absence of strong government response (~GOV) and deaths (~DEATHS), or the presence of globalization (ECOG/SOCG), healthcare preparedness (GHS) and logistics infrastructure (LPI).	A more complex solution emerges that resembles very closely the baseline one. One difference is that GHS appears in 2 configurations but accompanied by DEATHS.
April	A more complex solution is generated, which includes variants of the same, baseline, configuration. Substantively speaking, the results are completely consistent with the baseline findings.	A more complex solution emerges, which is consistent with the baseline one. The importance of DEATHS is even more pronounced. But like in March GHS appears in 2 configurations, this time accompanied by ~ECOG/~SOCG or ~LPI.
May	A slightly more complex, but substantively similar, solution is produced. However, one configuration is not in agreement with the main findings since it has GOV, DEATHS and ~GHS as components. Upon scrutiny	Like April, but this time the solution shows that even prepared countries (GHS) can fail to achieve trade resilience if they lack the logistics infrastructure (~LPI) and are

[2] See https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

[3] Only exceptions are: a) the analysis of sufficiency for the presence of resilience in April, where we relaxed the consistency threshold from 0.82 to 0.80 (maintaining the same PRI threshold) because the baseline decision would have allowed only 5 countries to be included in the minimization; b) the analysis of sufficiency for the absence of resilience in June, where we relaxed the consistency threshold from 0.85 to 0.82 (maintaining the same PRI threshold) because the baseline decision would have allowed only 6 countries to be included in the minimization.

	though, this configuration represents only Malta, hence we do not consider this a serious threat to the validity of the baseline results.	constrained by strong government intervention (GOV).
June	A less complex but substantively very similar solution is produced	As above (May).
July	An almost identical solution is produced.	A less complex but substantively very similar solution. Regarding GHS, the same holds as in May and June.

C. Countries included in the analysis

Table C – Country names and respective 3-letter codes

Albania	ALB	**Denmark**	DNK	**Kazakhstan**	KAZ	**Singapore**	SGP
Argentina	ARG	**Ecuador**	ECU	**Latvia**	LVA	**Slovak Republic**	SVK
Australia	AUS	**Egypt**	EGY	**Lithuania**	LTU	**Slovenia**	SVN
Austria	AUT	**El Salvador**	SLV	**Luxembourg**	LUX	**South Africa**	ZAF
Belarus	BLR	**Estonia**	EST	**Malaysia**	MYS	**South Korea**	KOR
Belgium	BEL	**Finland**	FIN	**Malta**	MLT	**Spain**	ESP
Bolivia	BOL	**France**	FRA	**Mexico**	MEX	**Sweden**	SWE
Bosnia and Herzegovina	BIH	**Germany**	DEU	**Morocco**	MAR	**Switzerland**	CHE
Brazil	BRA	**Greece**	GRC	**Netherlands**	NLD	**Thailand**	THA
Bulgaria	BGR	**Guatemala**	GTM	**New Zealand**	NZL	**Tunisia**	TUN
Canada	CAN	**Hungary**	HUN	**Norway**	NOR	**Turkey**	TUR
Chile	CHL	**Iceland**	ISL	**Paraguay**	PRY	**Ukraine**	UKR
China	CHN	**India**	IND	**Peru**	PER	**United Kingdom**	GBR
Colombia	COL	**Indonesia**	IDN	**Philippines**	PHL	**United States**	USA
Costa Rica	CRI	**Ireland**	IRL	**Poland**	POL	**Uruguay**	URY
Croatia	HRV	**Israel**	ISR	**Portugal**	PRT	**Vietnam**	VNM
Cyprus	CYP	**Italy**	ITA	**Romania**	ROU		
Czech Republic	CZE	**Japan**	JPN	**Russia**	RUS		