The role of trade in economic resilience

Building economic resilience requires an understanding of economic challenges and opportunities, as well as the ability to anticipate, evaluate and manage risks. Although trade can spread and magnify shocks, it can help countries prepare for, cope with and recover from shocks. Initial conditions, the nature of the shock and policy choices, including the level of diversification, are important in determining what role trade will play.
1. Introduction

2. Trade can be a spreader of shocks

3. Trade can enable countries to better prepare for, cope with and recover from shocks

4. The role of trade diversification in resilience

5. Conclusion

Some key facts and findings

• Trade and related mobility can increase the impact of shocks by spreading disease, magnifying economic disruptions through value chains, and increasing emissions that contribute to climate change.

• However, trade can also strengthen resilience by boosting productivity and growth and by increasing access to goods and services to prepare for, cope with and recover from the impact of shocks.

• Trade can speed up economic recovery, for example when sustained foreign demand helps to compensate for reduced domestic demand.

• Trade policies are crucial to support the beneficial role of trade, for example by easing trade controls to support the flow of emergency goods, and by limiting the use of export restrictions to promote the availability of essential goods globally.

• A diversified trade and production structure makes it more likely that trade can play a positive role in coping with shocks.
1. Introduction

This chapter explores the relationship between trade and resilience in three different ways.

Section C2 focuses on the role of trade as a potential spreader of shocks, both directly (e.g., in the case of pandemics) and indirectly (e.g., in the case of climate change), as well as the relationship between trade and technological shocks (e.g., cyber-attacks) and socioeconomic shocks (e.g., violent conflict and political instability). The potential for changes in trade costs to be a source of shocks is also considered, as well as how global value chains (GVCs) may spread shocks.

Section C3, conversely, discusses the beneficial role of trade in dealing with shocks. Trade can raise economic growth and productivity, thus helping countries build resilience and facilitate access to essential goods and services. Trade facilitates the resolution of shortages during supply-side disruptions and the channelling of sales abroad during recessions. Trade can also speed up recovery if trade recovery is faster than general economic recovery, as for example with the COVID-19 pandemic. Also, during recovery, reforms can help countries to build a more resilient trading system.

Section C4 shows that both in terms of mitigating shocks, particularly in GVCs, and coping with shocks, trade can play a more beneficial role if trade patterns are more diversified. Diversification reduces the likelihood that price volatility will translate into large fluctuations in export revenues, thus reducing aggregate volatility. Section C4 also considers how trade diversification has changed over time and the policies that could be followed to foster diversification. Section C5 concludes.

2. Trade can be a spreader of shocks

This section analyses the potential role of trade as a spreader of shocks, with reference to the three categories in the taxonomy of shocks in Section B2, i.e., natural shocks, technological and industrial shocks, and socioeconomic shocks.

Section C2(a) considers the direct and indirect links between trade and natural shocks, including the effects of trade on the spread of disease and the indirect effects of trade on climate change. Section C2(b) examines the role of trade in technological shocks (e.g., cyber-attacks). Section C2(c) explores the role of trade in socioeconomic shocks.

Section C1(d) analyses the impact of different types of shocks on trade costs, which potentially make trade itself a spreader of shocks and affect trade resilience. Finally, Section C1(e) discusses the extent to which trade propagates shocks through GVCs, and the factors that determine that propagation.

(a) The role of trade in natural shocks

(i) Trade-related human and animal mobility may affect the spread of epidemics

Trade-related mobility can contribute to the spread of an epidemic; the reasons why humans move are irrelevant to the fact that this movement can spread disease. For instance, international migration (i.e., the movement of people who change residence from their country of origin to a destination country) can contribute to spreading infectious diseases across borders, as shown by Lee et al. (2021) for COVID-19. The same applies to the movement of workers in the logistics sector, such as truckers, as shown by Oster (2012).

There are several examples in human history of trade-related human mobility enabling the spread of communicable diseases. For example, bubonic plague arrived in Europe in October 1347 after 12 commercial ships from the Black Sea docked at the port of Messina, Italy (Antràs, Redding and Rossi-Hansberg, 2020), resulting in the 1347-51 “Black Death” pandemic; the last major outbreak of plague in Europe occurred in 1720, when crew members of a cargo ship from Lebanon carrying textiles spread plague to the city of Marseille in France (Voth, 2020). It is believed that the first human-to-human infections of COVID-19 in Europe may have taken place in January 2020 in Starnberg, Germany, when a local car parts supplier organized a training session with a Chinese colleague from its operation in Wuhan, China (Antràs, Redding and Rossi-Hansberg, 2020). In the COVID-19 pandemic, more internationally connected countries registered their first cases of COVID-19 infections significantly earlier than less connected countries (Keita, 2020).

Nevertheless, the relationship between trade-related human mobility and the spread of communicable diseases is ambiguous. Less exposure to international mobility may be associated with greater harm during pandemics, through various mechanisms (Clemens and Ginn, 2020). First, more isolated countries with less frequent exposure to a variety of pathogens may develop less cross-immunity to reduce the harm from new communicable diseases. Second, a country’s isolation may complicate globally coordinated...
surveillance. Third, exposure to international mobility is likely to allow countries to develop higher incomes, stronger health systems and a greater capacity for innovation (see, for instance, Dollar, 2001; Owen and Wu, 2007). These, in turn, can reduce pandemic-related harm.1

In the aftermath of the COVID-19 pandemic, virtually all countries implemented emergency restrictions on international, as well as internal, mobility.2 While most studies on epidemics of the influenza and Ebola viruses and the human immunodeficiency virus (HIV) conclude that such emergency restrictions have a minimal impact on arrival time of these epidemics, and negligible impact on the overall harm caused by them,3 the currently available evidence relative to the COVID-19 pandemic (Eckardt, Kappner and Wolf, 2020; Linka et al., 2020; Wells et al., 2020) suggests that emergency border measures contributed to limiting the spread of the virus.4 According to Chinazzi et al. (2020), however, travel restrictions alone do not mitigate the effects of the pandemic and are effective only in combination with behind-the-border measures, such as reductions in face-to-face interactions, self-isolation and quarantine requirements.5

Restrictions on international travel implemented in the wake of the outbreak of the COVID-19 pandemic have contributed to disrupting freight transport, business travel and the supply of services that rely on the presence of individuals abroad, such as tourism. Since transport and travel costs account for 15 to 31 per cent of trade costs (depending on the sector), travel restrictions are likely to account for a substantial increase in trade costs (WTO, 2020a). Benz, Gonzales and Mourougane (2020) estimate that closing borders to passengers could increase services trade costs by an average of 12 per cent across sectors and countries in a scenario in which all countries close their borders to passengers but leave freight trade open, while OECD (2021b) estimates that lifting restrictions to international travel unilaterally in G7 countries would increase services trade costs by around 5 per cent, and import levels by around 3 per cent, on average in 2021, and that lifting restrictions to international travel through international coordination would increase the effect by a factor close to two.

The trade-related mobility of live animals is another potential channel of exposure and vulnerability to biosecurity risks, such as the spread of communicable diseases from animals.6 According to FAO data,7 in 2017 nearly 2 billion live pigs, chickens, cattle, sheep and goats were trucked and shipped around the world, compared to 1 billion in 2007. In the early 2000s, global movements of animals for the pet trade were estimated at some 350 million live animals (Karesh et al., 2005).8

Given the risks connected to animal mobility, livestock trade is highly regulated. As further discussed in Section D, WTO members are bound by the WTO Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement), which concerns food safety and animal and plant health regulations. Countries are encouraged to base their sanitary and phytosanitary measures on existing international standards. The international standards relating to animal health and zoonoses are developed by the World Organisation for Animal Health (OIE) and are contained in the Aquatic Animal Health Code and the Terrestrial Animal Health Code,9 which detail the health measures that should be used by veterinary authorities to ensure the sanitary safety of traded animals and their products (Chomel, Belotto and Meslin 2007; Fèvre et al., 2006).

In the presence of a good veterinary infrastructure, it is reasonable to expect that licit (i.e. legal, formal, and therefore regulated) livestock trade should largely not be associated with disease spread.10 Conversely, illicit (i.e. illegal/informal, and therefore unregulated) livestock trade, which normally circumvents screening and quarantine protocols, has been shown to be related to diseases (Fèvre et al., 2006), and to affect humans (Beverelli and Ticku, 2020).11

Much of the discussion about the impact of animal trade on diseases focuses on wildlife trade. Although significantly smaller in size (at least for its recorded part) than livestock trade, cross-border wildlife trade can lead to disease transmission that can not only cause human disease outbreaks, but can also threaten livestock, rural livelihoods, native wildlife populations and ecosystem health (Chomel, Belotto and Meslin 2007). Exotic species, even after being legally imported, can potentially establish themselves in the wild and become pests, including by introducing viruses and bacteria into native populations which are not adequately resistant (Schloenhardt, 2020).12

As with livestock trade, trade in wildlife is highly regulated. As further discussed in Section D, trade in wildlife is regulated by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). At present, CITES bans international trade in approximately 900 species of plants and animals listed in its Appendix I (including tigers, marine turtles, rhinoceroses and pangolins), and controls trade in a further 33,000 species listed in Appendix II (e.g. many parrot and reptile species). Despite the severe resource constraints to which CITES is subject, making trade requirements more...
stringent (via the inclusion of a species in Appendix I of CITES by the exporting country) leads to a decrease in the number of animals traded, as well as a decrease in the risk of a spread of zoonotic disease (Borsky et al., 2020).

Given the difficulty of control and enforcement, even in the absence of trade restrictions or outright bans, a lot of wildlife is smuggled or imported informally (Beltran-Alcrudo et al., 2019) and thus not inspected or tested. This is a lucrative business, due to the value of trafficked wildlife for medicinal use and healthcare, food consumption, collections, clothing and accessories, cosmetics and fragrance, and as exotic pets (Schloenhardt, 2020; Van Uhm, 2016). Illicit trade in wildlife has been shown to be responsible for spreading pathogens such as avian influenza, Newcastle disease and retroviral infections (Gomez and Aguirre, 2008), due to the circumvention of screening and quarantine protocols. Furthermore, there is abundant evidence that the prevalence of zoonotic diseases among emerging infectious diseases is linked to increasing volumes of animal trafficking and smuggling (Aguirre et al., 2020; Fisman and Laupland, 2010).

(ii) Trade may be related to deforestation, urbanization and intensive farming, and to their associated risks

Deforestation – which is largely caused by human activities such as agricultural expansion, cattle breeding, timber extraction, mining, oil extraction, dam construction, and infrastructure development – is responsible for several sources of risks:

- soil erosion, which can lead to clogged waterways and other problems;
- water cycle disruption, which can lead to desertification and habitat loss;
- greenhouse gas emissions and reduced capacity to remove carbon dioxide from the atmosphere, both of which contribute to global climate change;
- biodiversity losses, which can lead to extinctions and loss of natural beauty;
- disease outbreaks and spread.

Diseases are more likely to spill over from animals to humans in “hotspots” such as rainforest edges (Hook, 2020), and deforestation, by changing the length of the edge between forest and non-forest, affects the likelihood of disease emergence (Dobson et al., 2020). For instance, zoonotic Ebola virus disease outbreaks located along the limits of the rainforest in Central and West Africa between 2001 and 2014 have been found to be significantly associated with forest losses which had occurred within the two years preceding the outbreak (Olivero et al., 2017).

Does trade lead to deforestation, and therefore indirectly contribute to the sources of risk listed above, including disease outbreak and spread? From a theoretical perspective, trade-opening can either increase or decrease deforestation. Some recent empirical studies (Abman and Lundberg, 2019; Faria and Almeida, 2016) find that trade-opening is associated with increased deforestation. The empirical association between trade and deforestation, however, is likely to be moderated by a country’s institutional framework (Ferreira, 2004). According to Bellora et al. (2020), trade-opening-induced changes in relative prices can lead to further investment and exports without leading to overexploitation of an open access resource, provided that there exist efficient collective resource management policies, such as land registers in the case of forestry.

Furthermore, restricting trade in the presence of weak institutions can have counterproductive effects, due to the creation of a parallel illegal market. For example, Chimeli and Soares (2017), having studied the effects of trade restrictions on, and eventual prohibition of, mahogany in the Brazilian Amazon, found that such policies created an illegal market, and documented relative increases in violence in areas with natural occurrence of mahogany.

Population density is another potential risk factor for the spread of transmissible diseases. In theory, densely populated areas lead to more face-to-face interaction among residents, which makes them potential hotspots for human-to-human disease transmission (Tarwater and Martin, 2001), as well as increasing the risks of animal-to-human disease transmission. In a study of 6,801 ecological assemblages and 376 host species worldwide, Gibb et al. (2020) find that populations of species known to host diseases transmissible to humans, including 143 mammals such as bats, rodents and various primates, increase in sites under substantial human use (including urban ecosystems) compared with nearby undisturbed habitats.

On the other hand, there can be a higher incidence of implementation of social distancing policies and practices in densely populated areas. It is therefore an empirical question whether higher population density leads to more disease transmission. Some preliminary evidence regarding the spread of COVID-
19 shows that population density has precipitated infections in various countries, including Algeria (Kadi and Khelfaoui, 2020), Bangladesh (Alam, 2021), Brazil (Pequeno et al., 2020), India (Bhadra, Mukherjee and Sarkar, 2020), and the United States (Hamidi, Sabouri and Ewing, 2020; Sy, White and Nichols, 2021). However, population density – at least in the United States – might negatively correlate with COVID-19-related mortality rates due to better health systems (Hamidi; Sabouri and Ewing, 2020).

Urbanization, as discussed in WTO (2013), is one of the most important global demographic trends. According to the United Nations Population Division’s World Urbanization Prospects 2018, the percentage of the world population residing in urban areas increased from 29.6 per cent in 1950 to 55.3 per cent in 2018, and is projected to further increase to 68.4 per cent in 2050. The same data source shows that the percentage of the world’s urban population residing in cities with at least 500,000 inhabitants rose from 33 per cent in 1950 to 51 per cent in 2015, while the percentage of the world’s urban population residing in cities with at least one million inhabitants rose from 24 per cent in 1950 to 43 per cent in 2015.

Urbanization is affected by several economic and non-economic factors, including international trade. A central question is whether trade-opening fosters the concentration or dispersion of economic activity within a country. In theory, the effect is ambiguous, as it depends on the relative importance of agglomeration and dispersion forces. Recent direct empirical evidence points to a positive impact of trade on urbanization (Chhabra, Giri and Kumar, 2021; Nagy, forthcoming; Thia, 2016). In the light of the links between urbanization and disease transmission discussed above, it can be concluded that trade might indirectly affect disease transmission through trade-induced increases in urbanization worldwide.

Intensive farming (i.e., large-scale industrial operations in farming of animals for human consumption) has been associated with the emergence of infectious diseases by various commentators (see for instance Wiebers and Feigin, 2020). Outbreaks of avian influenza viruses, including H5N1, which were almost non-existent 25 years ago, in countries with large-scale industrial poultry operations have been cited as an example of the consequences of intensive farming (Gregor, 2006). The large-scale confinement of animals implied by intensive farming can, in principle, decrease or increase the spread of diseases (Espinosa, Tago and Treich, 2020).

The main reason for the structural change from small-scale to large-scale farming methods is technological economies of scale, both in the industry itself, and in the complementary processing industry (MacDonald and McBride, 2009). Trade-opening, which allows firms to exploit economies of scale (Krugman, 1979), might therefore create incentives to further increase intensive farming in countries that specialize in the production and exports of live animals and animal products.

While trade contributes to increases in the scale of production, and therefore to intensive farming at the expense of small-scale farming, its impact on intensive farming-induced health hazards is likely to depend on where specialization occurs. Intensive farming is capital-intensive. All other things being equal, relatively capital-abundant countries should therefore have a comparative advantage when it comes to intensive farming. At the same time, the costs of intensive farming are likely to depend on the stringency of standards and regulations, such as those concerning the use of subtherapeutic doses of antibiotics. All other things being equal, countries with less stringent standards and regulations should produce farmed animals at lower costs. Borrowing from the theoretical framework in McLaren (2012, Chapter 13), one of the following two opposite outcomes can emerge.

On the one hand, intensive farming may be cheaper in countries with less stringent standards and regulations, even if capital is relatively scarce in such countries. Thus, a reduction in trade costs can lead to expansion of intensive farming in countries with less stringent standards and regulations, and contraction in countries with more stringent standards and regulations, exacerbating the health issues connected to intensive farming.

On the other hand, intensive farming may be cheaper in relatively capital-abundant countries, even if standards and regulations are more stringent in such countries. In this case, a reduction in trade costs can lead to expansion of intensive farming in countries with more stringent standards and regulations, and contraction in countries with less stringent standards and regulations, alleviating the health issues connected to intensive farming.

(iii) Trade can affect the occurrence of natural disasters by affecting climate change

Climate change increases the frequency and intensity of natural shocks such as extreme weather events, floods, storms, rising sea levels and the spread of infectious diseases in the medium to long term (Hoegh-Guldberg et al., 2018). Trade can also affect climate change, and thus a broad range of natural
shocks caused by climate change, by changing the amount of carbon dioxide (CO₂) and of other greenhouse gas (GHG) emissions in the atmosphere.

The expansion of economic activity induced by trade-opening, including the expansion of transportation activities, often results in an increase in GHG emissions. It is estimated that international maritime and international aviation transportation are responsible for 3.5 per cent of total emissions annually (Cristea et al., 2013). However, this does not mean that international trade will necessarily lead to higher GHG emissions. Trade can sometimes reduce emissions if the differences of output emissions between the imported product and the domestic product are large enough to offset transportation emissions. Cristea et al. (2013) estimate that about 34 per cent of international trade measured in value terms results in a net reduction of total emissions. Considering the total amount of trade-related GHG emissions compared with a counterfactual scenario without trade, Shapiro (2016) estimates that international trade increases global emissions by 5 per cent, or 1.7 gigatons of CO₂ annually, and that this effect is almost equally driven by production and transportation.

Trade openness can also alter countries’ production mix, impacting GHG emissions either negatively or positively, depending on whether a country has a comparative advantage in emission-intensive sectors. Overall, research finds that trade benefits the environment in Organisation for Economic Co-operation and Development (OECD) countries, but has detrimental effects on CO₂ emissions in non-OECD countries (Managi, Hibiki and Tsurumi, 2009). In addition, international differences in climate change policies can increase the likelihood of “carbon leakage”, a situation in which the measures taken by some countries to limit their GHG emissions lead to the relocation of carbon-intensive industries to countries with lower carbon emission standards, resulting in an overall increase in global GHG emissions.

On the other hand, trade can enable the incorporation of green technologies into production processes. Research shows that a large part of the cost decline in solar photovoltaic (PV) technologies in the past decade has been attributed to GVCs, which allowed developing countries to acquire solar PV production technology and know-how (Carvalho, Dechezleprêtre and Glachant, 2017). Conversely, restrictions on international trade and foreign direct investment reduce the diffusion of climate-friendly technologies (Dechezleprêtre, Glachant and Ménière, 2019). In addition, trade can promote GHG emission reductions by allocating resources towards more productive, greener firms (Cherniwchan, Copeland and Taylor, 2017; Kreickemeier and Richter, 2014). A diverse array of recent studies shows that large-scale production allows exporting firms to reduce the per unit cost of pollution abatement in both developed and developing countries (Forslid, Okubo and Ulltveit-Moe, 2018; Martin, 2011a).

Considering the different effects, the overall impact of trade on GHG emissions is likely to be minimal, and the key to tackling climate change is to enable trade in environmentally friendly goods and services, while limiting the negative impact of trade and trade barriers. In this regard, Shapiro (2021) shows that in most countries the import tariffs and non-tariff barriers are substantially lower for “dirty” industries that emit larger amounts of CO₂ per output than cleaner industries do. This difference in trade policy creates an implicit subsidy to carbon emissions and contributes to climate change. Governments and international organizations are working to mitigate the carbon emissions in transport to ensure a transition to sustainable mobility. It is estimated that further trade-opening in environmental goods and services would contribute to the reduction of GHG emissions (De Melo and Solleder, 2020; European Commission, 2016).

The mitigation of climate change will require government policies, such as carbon-pricing schemes, to shift the social costs of climate change to the private agents responsible for GHG emissions (High-Level Commission on Carbon Prices, 2017). Carbon-pricing schemes can take different forms, such as cap-and-trade emissions trading systems (ETS), which allow industries to trade their carbon emission allowances, or carbon taxes consisting of a notional tax rate on GHG emissions (World Bank, 2020b). Other complementary policies, such as land and forest management, emission regulations and standards, investment in research and development (R&D) for green technology and financial devices to incentivize the adoption of low-carbon technologies, are needed to help countries mitigate climate change at a more rapid pace (Acemoglu, Aghion, et al., 2012; Cohn et al., 2014; Dechezleprêtre, Martin and Bassi, 2019). Given the global nature of GHG emissions, international cooperation is sorely needed to mitigate climate change in the long term and to create a harmonized global carbon price to avoid carbon leakage (see Section D).

(b) Technological shocks: The role of trade in cyber-attacks

While trade offers access to new and better-quality technologies at more competitive prices, trade can
play a role in spreading technological shocks such as oil spills, transport accidents (e.g., the Suez Canal obstruction of 2021) and cyber-attacks. Among these, cyber-attacks merit special attention, as they have been on the rise both in frequency and in scale, as mentioned in Section B2. Trade in the information and communications technology (ICT) sector, in particular, can expose the economy to cyber risks if, for example, imported telecommunication devices and software contain malicious parts, hidden viruses or spyware.

Cyber-attacks possibly arising from trade and with the objectives of information theft and espionage can weaken a country’s military capability and undermine political and economic stability in a country, thereby harming “national security” (Huang, Madnick and Johnson, 2018; Meltzer, 2020). To anticipate this potential threat, many countries have adopted preventive measures with regard to ICT imports, that, for instance, require that providers request prior approval and undergo thorough inspection, or that debar network providers which could potentially have ties with a foreign government (CCDCOE, 2019). However, some view these precautionary measures as disguised trade-restrictive measures (Huang, Madnick and Johnson, 2018; Moran, 2013).

Trade also plays a role in propagating the adverse effects of cyber-attacks through global supply chains in the same way as other types of shocks, which is discussed further in Section C2(e). For instance, the cyber-attack “NotPetya”, which directly targeted firms in Ukraine in June 2017, also indirectly affected their international trade partners, causing a decrease in profitability, revenue and trade credit for the Ukrainian firms (Crosignani, Macchiavelli and Silva, 2020). Although the cyber-attack only hit firms located in Ukraine, the indirect adverse effect of the shock extended further down along the global supply chain through international trade and spread internationally.

The risk of cyber-attacks induced by trade can, however, be partly mitigated through different policy measures such as intellectual property (IP) protection, instead of focusing solely on fortifying defence mechanisms against perpetrators and increasing cybersecurity. IP protection is relevant because firms in possession of trade secrets are more likely to be targets of cyber-attacks involving a data breach (Ettredge, Guo and Li, 2018). According to Andrijcic and Horowitz (2006), IP thefts that occur during cyber-attacks in the United States indirectly cause significant long-term harm to the economy equivalent to multiples of the direct and short-term damage of the attack itself.

(c) Socioeconomic shocks: The role of trade in conflicts, peace and political instability

Trade can act also as a potential amplifier of socioeconomic shocks. Terms-of-trade variations can have a substantial impact on the business cycle and the variability of output, especially in developing economies, as well as on real exchange rate fluctuations (Mendoza, 1995). Trade can also influence social shocks such as conflicts and political instability by adjusting the opportunity costs of social decisions. In this subsection, special attention will be drawn to the role of trade in conflicts and political instability, as public interest in the subject has risen during the past five years (Google trends, 2021).

While conventional economic theory points to the positive role of trade in promoting international peace, it can also increase the likelihood of conflicts depending on various factors. First, in contrast to bilateral openness to trade which can decrease the probability of conflicts by raising the opportunity cost of engaging in a conflict, multilateral openness, i.e., openness with all trading partners, can lead to an increase in conflicts (Martin, Mayer and Thoenig, 2008b). Moreover, although trade helps to deter domestic conflicts due to the possibility of losing gains from trade, the availability of international trade can offer a promising alternative when domestic production is disrupted by the breakout of a civil war, thus raising the risks of a domestic conflict. Because of these two opposing mechanisms at play, trade openness decreases the likelihood of devastating civil wars, but increases the possibility of smaller-scale conflicts (Martin, Mayer and Thoenig, 2008a).

Trade can also affect political instability. Through the additional wealth it generates, trade can, in the long run, stabilize the political and economic environment of a country. However, unequal redistribution of trade gains may exacerbate social and economic inequality, precipitate unbalanced growth, debilitate governance and institutions, and damage social integrity, all of which increase political instability and thus political risk (Krause and Suzuki, 2005). For instance, the United States has recently witnessed an increase of nationalistic populism and social volatility, which can be partly attributed to economic globalization, including trade and the economic inequality associated with it, among other factors (Rodrik, 2021). Furthermore, more extensive cronyism and the further deterioration of institutions can emerge as an indirect consequence of trade, because trade induces more infrastructure investment and heavy taxation on firms to finance it (Hochman, Tabakis and Zilberman, 2013).
One policy strategy that can contribute to reducing the risk of conflicts and instability is trade diversification, especially with regard to sources of income. Economies whose earnings are dependent on natural resources or on a small number of export commodities can be particularly more susceptible to terms-of-trade shocks and fluctuations (Humphreys, 2005). This susceptibility creates instability and dissatisfaction within the country, potentially leading to political and social unrest, which can eventually further develop into conflict. By diversifying the sources of income and reducing dependency on a single commodity or natural resource, economies can grow to be less susceptible to socioeconomic shocks like conflicts.

(d) Trade costs volatility can impact trade resilience

Changes in the conditions under which goods and services are traded, or trade costs, broadly speaking, can impact trade, as discussed in Section B4, and this, in turn, affects the rest of the economy. Although trade can serve as a shock absorber, as discussed below, it can also, therefore, be a source of shocks, contributing to macroeconomic volatility which can hinder economic resilience (further discussed in Section C3), if trade costs are volatile.

The WTO Trade Cost Index (http://tradecosts.wto.org) tracks the evolution of trade costs decomposed into five main components: transport and travel costs; information and transaction costs; ICT connectedness; trade policy and regulatory differences; and governance quality (WTO, 2021). According to data from 2016, transport and travel costs account for the largest variation in trade costs (about 27 per cent), followed by information costs (17 per cent), trade policy and regulatory differences (12 per cent), governance quality (9 per cent) and ICT connectedness (6 per cent); other factors account for 29 per cent of the trade cost variation, but their share has been decreasing steadily, highlighting the rising importance of the five main components. Between 2000 and 2016, transport and travel costs remained relatively constant, while governance quality and trade policy and regulatory differences have been steadily increasing. Figure C.1 displays trade costs according to the five components and their variation over time.

Based on these five principal components of trade costs, this subsection discusses how different types of shocks can affect the economy through their effect on trade costs. The objective of this discussion is to provide a comprehensive overview of how shocks can affect trade cost volatility and (if applicable) what policies governments could implement to prevent shocks to trade costs, particularly relevant for trade policies.

(i) Shocks to transport and travel costs

Transport costs in trade have been on a steady decline since the mid-1980s due to improvements in transport technology and infrastructure (Combes and Lafourcade, 2005; Glaeser and Kohlhase, 2004;
In March 2020, global air cargo capacity diminished the asymmetric recovery between different regions. to travel restrictions affecting maritime personnel and flights, and maritime transport costs increased due to fewer passenger airplane as a result of fewer passenger costs rose because of the lack of belly capacity in controls and sanitary measures, aviation transport was subject to increased delays due to border the COVID-19 pandemic, international land transport reducing transport efficiency. For instance, during Epidemics affect transport costs by temporarily and Enei, 2014). Europe by 80 per cent in the next 40 years (Doll, Klug weather are forecast to raise rail transport costs in more frequent floods and unpredictable winter transport infrastructure (UNECE, 2020). For example, a heavy downpours, high winds and extreme sea result from climate change, such as heatwaves, disruptions in the road system (Colon, Hallegatte and Rozenberg, 2019). Future extreme weather events resulting from climate change, such as heatwaves, heavy downpours, high winds and extreme sea levels and waves, are likely to increase disruptions to transport infrastructure (UNECE, 2020). For example, more frequent floods and unpredictable winter weather are forecast to raise rail transport costs in Europe by 80 per cent in the next 40 years (Doll, Klug and Enei, 2014).

Economic research has mainly focused on identifying how natural and socioeconomic shocks can impact trade and transport costs, although technological or industrial shocks such as the 2021 Suez Canal obstruction or road accidents can have an effect as well. The growing availability of alternative sources of supply and routes has dampened the impact of external shocks on trade and transport costs (Lundgren, 1996), which is in line with the role of diversification in strengthening resilience (as discussed in Section C3). However, considering that rerouting also comes with additional costs, natural disasters still can increase transport costs despite available alternatives. Moreover, some countries, such as small-island states, are unable to avail of alternative trade routes due to their limited endowment of transport infrastructure and higher dependency on a small number of shipment service providers. These countries tend to be more exposed to higher transport cost volatility, and thus more subject to shocks (Briguglio, 1995; Wilmsmeier and Hoffmann, 2008).

Natural disasters can cause significant destruction or temporary disruptions in transport infrastructure, such as ports, road or railway connections, which can increase transport costs (see Colon, Hallegatte and Rozenberg (2019), Oh (2017), Osberghaus (2019), Rozenberg et al. (2019) and Volpe Martinicus and Blyde (2013) for a discussion of this). For example, a substantial rise in transport costs has been observed in Tanzania due to frequent floods, which generate disruptions in the road system (Colon, Hallegatte and Rozenberg, 2019). Future extreme weather events resulting from climate change, such as heatwaves, heavy downpours, high winds and extreme sea levels and waves, are likely to increase disruptions to transport infrastructure (UNECE, 2020). For example, more frequent floods and unpredictable winter weather are forecast to raise rail transport costs in Europe by 80 per cent in the next 40 years (Doll, Klug and Enei, 2014).

Epidemics affect transport costs by temporarily reducing transport efficiency. For instance, during the COVID-19 pandemic, international land transport was subject to increased delays due to border controls and sanitary measures, aviation transport costs rose because of the lack of belly capacity in passenger airplanes as a result of fewer passenger flights, and maritime transport costs increased due to travel restrictions affecting maritime personnel and the asymmetric recovery between different regions. In March 2020, global air cargo capacity diminished by 24.6 per cent compared to the previous year, and air cargo yields in April 2020 doubled relative to April 2019. According to the FBX Global Container freight index, shipping rates started to surge in May 2020, resulting in a 30 per cent higher shipping rate by July 2020 compared to the previous year (WTO, 2020a).

Violence and conflict can increase transport costs through destruction of infrastructure. For example, transport costs for international trade doubled in Malawi with the redirection of Malawi’s trade to distant ports when nearby ports were disrupted during the 20-year civil war in Mozambique (Milner and Zgovu, 2006). Moreover, the mere expectation of a violent incident can increase transport costs because firms may have to purchase insurance to protect themselves from risks of property loss (Long, 2008).

(ii) Shocks to trade policies

More and more trade restrictions have been imposed in recent years, as shown by the yearly WTO trade monitoring reports. For example, the 2019 trade monitoring report observes that countries imposed 102 new trade-restrictive measures, such as tariff increases, quantitative restrictions, stricter customs procedures, and import taxes and export duties (WTO, 2019e). Uncertainty about trade policy has also increased drastically since 2018, after having remained relatively low and stable during the preceding two decades (see Figure C.2). The spikes in Figure C.2 roughly coincide with the introduction of new protectionist measures during the “trade conflict” between the United States and China. Although the World Trade Uncertainty Index seems to have returned to a lower level since the second quarter of 2020, the potential sudden variability highlights the importance of considering uncertainty in trade policy discussions.

Higher trade policy uncertainty can make entry into export markets more difficult for companies because they must wait to pay the sunk entry costs (i.e. one-time costs to enter a market). For example, one-third of the increase in exports from China to the United States after China’s accession to the WTO is attributed to falling uncertainty on the level of US import tariffs on Chinese goods (Handley and Limao, 2018). A larger difference between bound and applied tariffs, which increases uncertainty over the scope of future tariff increases, depresses trade in a global sample of countries (Osnago et al., 2018). Similarly, larger differences between applied market access and market access commitments in the General Agreement on Trade in Services (GATS) and in free trade agreements (FTAs) reduce services trade, because they increase uncertainty about trade policy (Ciuriak, Dadkhah and Lysenko, 2020).
Trade policy uncertainty also negatively affects investment, as decisions on investing in export-versus import-competing sectors are delayed pending changes in tariffs (Krugman, 2019). For example, trade policy uncertainty has been estimated to reduce investment in the United States by 1 to 2 per cent in 2018 during the US-China “trade conflict” (Caldara et al., 2020).

This analysis underlines the potential for trade policy changes to hamper economic resilience. To prevent trade from becoming a source of shocks as a result of trade policy volatility, it is essential that trade policy is stable and predictable, as will be further discussed in Section D.

An interesting policy question in this respect is whether temporary trade barriers (TTBs) play a stabilizing role or not. On the one hand, the frequent use of TTBs during the global financial crisis of 2008-09 may have prevented the resort to more severe protectionist policies (Bown, 2011). In emerging economies, TTBs were more actively used in response to shocks as the number of imported products subject to WTO agreements limiting the use of import tariffs increased between 1988 and 2010 (Bown and Crowley, 2014). On the other hand, according to Barattieri, Cacciatori and Ghironi (2021) in data from Canada for years 1994 to 2015, an increase in the use of TTBs has a negative macroeconomic impact through a decrease in investment, labour productivity and the number of active employer businesses, in part due to higher trade policy uncertainty. Therefore, it is important to consider that, while TTBs have the potential to raise uncertainty and serve as a source of instability, they also serve as a safety valve for protectionist demands.

### (iii) Shocks to governance quality

Low-quality institutions that do not guarantee efficient transaction and contract enforcement discourage trade (Anderson and Marcouiller, 2002; Beverelli et al., 2018; Yu, 2010). Therefore, shocks that precipitate alterations in governance and institutions, especially socioeconomic shocks, increase the uncertainty associated with contract enforcement, thus increasing volatility in trade costs.

In particular, violence and conflict can destroy social and political institutions, or at least paralyse them temporarily (Blattman and Miguel, 2010; Van Raemdonck and Diehl, 1989), and can alter the societal preferences and norms that constitute the underlying principles of formal institutions (O’Reilly, 2021). Civil wars can also bring about deterioration in the quality of institutions. A significant degradation of institutional quality has been observed in some, but not all, countries that experienced a civil war in an empirical study of a large sample of countries between...
1960 and 2010 (O’Reilly, 2021). In light of these findings, institutional instability caused by violence and conflict, as well as the heterogeneous outcomes of these events, can be expected to increase volatility in trade costs and uncertainty in trade.21

(iv) \textit{Shocks to ICT connectedness}

Trade costs associated with ICT connectedness have been decreasing throughout history. Constant progress in telecommunications technologies has allowed for greater connectivity around the world and lowered communications costs, promoting rapid growth in international trade towards the last few decades of the 20th century (Fink, Mattoo and Neagu, 2005). Nevertheless, such costs are still subject to shocks, and the fluctuation of these costs can increase economic volatility and be an obstacle to trade resilience.

The availability and quality of telecommunications infrastructure are closely linked to information and communications technology (ICT) costs (Abeliansky and Hilbert, 2017; Fernandes et al., 2019; Malgouyres, Mayer and Mazet-Sonilhac, 2021), and natural and socioeconomic shocks can affect physical telecommunications infrastructures, especially ground-based facilities such as transoceanic fibre cables, data centres and cell towers (Chang, 2016). Moreover, the interdependency of critical infrastructure systems can exacerbate the impact of shocks that interrupt ICT infrastructure. Because most telecommunications devices rely heavily on electricity, ICT-related costs are also greatly affected by disturbances in the power network (Chang, 2016; Laugé, Hernantes and Sarriegi, 2013).

In addition to natural and socioeconomic shocks, technological shocks can also trigger changes in ICT costs. As trade rapidly adopts new digital technologies, it is also more exposed to the risk of cyber-attacks (Huang, Madnick and Johnson, 2018). In order to deal with the aftermath of cyber-attacks, damaged hardware and software needs to be repaired and time and personnel are necessary, all of which incur substantial additional costs (Lis and Mendel, 2019). Furthermore, in preparation for the uncertainty that cyber-attacks pose, firms are compelled to invest more resources into fortifying their cybersecurity systems and maintaining them, incurring further ICT costs (Bojanc and Jerman-Blažič, 2008).

(e) \textit{Trade as a shock propagator in value chains}

International production is increasingly organized within GVCs, with the different stages of the production process spread across different countries. This type of production organization often enables greater efficiency in production but may also create vulnerabilities, as relatively small shocks can result in significant supply chain disruptions (Acemoglu and Tahbaz-Salehi, 2020). This subsection will first discuss the role of value chains in propagating shocks and then present factors that determine the propagation of shocks in GVCs.

(i) \textit{The role of value chains in propagating shocks}

International trade can act as a channel through which a shock to one sector or one region can affect the global economy. Trade can thus transmit uncertainties across countries through the cross-border flow of goods and services, along with financial flows (Röhn et al., 2015). For instance, a negative demand shock abroad can reduce demand for a country’s exports, while a negative external supply shock tends to increase import prices.

Multi-stage processing and complementarity between intermediate inputs specific to supply chains can lead to the amplification of shocks, as demonstrated by a well-established literature. Kremer (1993) refers to this phenomenon as the O-ring theory, deriving the name from a 1986 incident in which the Challenger space shuttle was completely destroyed as a result of the failure of a simple gasket, or O-ring, to work properly.22 Just as a chain is only as strong as its weakest link, problems at any point in a production chain can reduce output substantially if inputs enter production in a complementary fashion (Jones, 2011).

Value chain disruptions can exacerbate the direct impacts of a disruption and indirectly impact overall volatility through several channels (OECD, 2020d):

1. an indirect supply impact when production in one location requires inputs from another location that is directly impacted by a shock;
2. an indirect demand impact where GVCs play a role in the transmission of economic shocks through demand channels; and
3. a disruption in international transport networks, where the disaster does not affect the production of inputs but rather the intermediary means of transportation.

Therefore, a shock can not only exert a direct impact on a firm, an industry or a region, but can also indirectly affect the overall economy through input-output linkages to sectors both upstream and downstream from the point of shock. While this propagation effect is present in both domestic and global supply chains, the fragmentation of production process across
countries has led to an international transmission of shocks. Notably, supply-side shocks (e.g., productivity shocks) can propagate downstream more powerfully, and demand shocks (e.g., through imports or government spending) are more likely to propagate upstream (Acemoglu, Akcigit and Kerr, 2016).

Apart from the type of the shock (i.e. supply or demand), the position within value chains also matters. For instance, micro, small and medium-sized enterprises (MSMEs) are less likely to withstand adverse shocks given their position within value chains – as trading MSMEs in developing economies are often suppliers of specialized intermediate inputs – and are thus more likely to contribute to the transmission of shocks. The products supplied by MSMEs can be especially hard to replace in a crisis-induced disruption, creating potential supply chain weaknesses (Baghdadi and Medini, 2021; OECD, 2008; WTO, 2016) (see Box C.1).

The 2011 Tōhoku earthquake is a good example of the impact of exogenous shocks on production through supply chain disruptions. The production losses caused by the supply chain disruptions that resulted from the earthquake are estimated to have amounted to at least 0.35 per cent of Japan’s gross domestic product (GDP) (Tokui, Kawasaki and Miyagawa, 2017). Based on micro firm-level data, the earthquake is estimated to have reduced the growth rate of firms with disaster-hit suppliers by 3.6 percentage points, and the growth rate of firms with disaster-hit customers by 2.9 percentage points (Carvalho et al., 2021). This suggests that the earthquake resulted in both a supply-side disruption affecting downstream firms and a demand effect that impacted upstream firms. Based on a general equilibrium model, Carvalho et al. (2021) also estimate the impact on GDP in the year following the disaster at 0.47 percentage points.

The outbreak of the COVID-19 crisis fuelled the debate on global value chain risks, as empirical studies attributed about one-quarter of the total GDP contraction to the shock transmission through GVCs especially linked to disruptions caused by lockdown measures (Bonadio et al., 2020; Espitia et al., 2021). The lockdown measures in the wake of the COVID-19 pandemic reduced GDP through input-output linkages. Constraints on transportation and labour supply during a two-month lockdown in China, the European Union and the United States could have reduced world GDP by 13 per cent (Guan et al., 2020). A strict lockdown in Tokyo lasting one month could reduce Japan’s total GDP indirectly by propagation through supply chains (based on a simulation framework applied to the supply chains of 1.6 million Japanese firms), leading to a total loss of 27 trillion yen, or 5.2 per cent of GDP (Inoue and Todo, 2019, 2020).

On the other hand, the GVC integration of sectors has also been a factor of resilience to past shocks. For example, after the 2011 earthquake in Japan, affected firms with a more diversified set of suppliers recovered more quickly, so subsequently firms increased off-shoring in manufacturing activities and expanded their network of foreign suppliers (Matous and Todo, 2017; Todo, Nakajima and Matous, 2015; Zhu, Ito and Tomiura, 2016). During the COVID-19-related crisis, after an initial phase of shortages in intermediate inputs in key industries, firms were able to reallocate their sales to other countries and source their inputs from other markets whenever key partners went into lockdowns (Berthou and Stumpner, 2021). Hence, manufacturers integrated into GVCs were able to better insulate themselves from domestic pandemic shocks by sourcing their inputs from foreign markets with less stringent lockdowns, so that trade in these sectors fell by smaller margins than in less integrated sectors (Bellora, Bois and Jean, 2020; Hyun, Kim and Shin, 2020). The extent to which the current COVID-19-related crisis will lead to changes in the organization of manufacturers’ spatial production in the long run is yet to be determined.

**(ii) Determinants of shock propagation through GVCs**

Several factors explain the extent to which trade and supply chains act as a shock propagator.

First, this depends on the degree to which inputs from different sectors are substitutable or complementary. For example, US suppliers affected by a natural disaster impose substantial output losses on their customers, especially when they produce specific inputs, have a high level of R&D, or hold their own patents, which makes their products plausibly more difficult to replace (Barrot and Sauvagnat, 2016).

While it is usually difficult or costly to find alternative suppliers immediately following a disruption, substitution becomes more readily available over time. One unit drop in intermediate inputs imported by US affiliates of Japanese firms in a few months following the 2011 earthquake in Japan resulted in one unit drop in exports (Boehm, Flaen and Pandalai-Nayar, 2019), corresponding to a small elasticity of substitution across material inputs in the short term. Trade elasticities, which measure the amount of trade affected by a change in trade cost, are estimated at about one after one quarter, about five after one year, and about seven after five years following a trade cost shock (Yilmazkuday, 2019). The higher long-run than short-run trade elasticity suggests that firms take time
The COVID-19 pandemic initially hit international trade in goods hard, raising concerns of serious disruption to supply chains. Its consequences have been particularly larger for low- and middle-income countries participating in GVCs, such as Tunisia. Tunisian imports in some sectors declined by between 20 per cent and 60 per cent (see Figure C.3).

In this context, identifying which products are most exposed to external shocks can help when economic resilience strategies are being built. Imported products can be classified into risky (those most exposed to supply chain shocks) and less risky based on how challenging it would be to obtain substitutes in the event of a shock. Different vulnerability criteria can be used to classify the exposure of imported products to supply chain shocks:

1. Market concentration of the importing country’s partners (i.e., how easy would it be for the importing country to find another supplier);
2. Intensity of imports, measured using the revealed comparative advantage for imports (i.e., how easy would it be for the importing country to substitute an imported product with another import); and
3. The feasibility of producing the imported good in the importing country, given the factors of production available in the country (Medini and Baghdadi, 2021).

The analysis for Tunisia reveals that less than 20 per cent of the total number of products imported by Tunisia (among 4,778 Harmonized System six-digit (HS-6) products) can be considered as moderately or highly risky. However, 71 per cent of these risky products are intermediate products (see Figure C.4), which suggests that the large drop in imports could have a significant impact on the country’s production of final products and ultimately exports.

Figure C.3: Most merchandise imports from Tunisia experienced a drastic drop during the first year of the COVID-19 pandemic in 2020

Source: Baghdadi and Medini (2021), based on Tunisian Customs data.
to adjust to changes in trade costs; it generally takes seven to 10 years to converge to the long-run value of trade elasticity (Boehm, Levchenko and Pandalai-Nayar, 2020).

Moreover, there might be greater long-term consequences as firms re-shore or near-shore certain production steps (Altomonte et al., 2013). The expansion of GVCs halted after the 2008-09 global financial crisis, so that supply chains have become more domestic, with fewer production stages located abroad (Miroudot and Nordström, 2019; OECD, 2020d). By contrast, in the aftermath of the 2011 earthquake in Japan, firms increased off-shoring in manufacturing activities, and expanded their network of foreign suppliers (Matous and Todo, 2017; Zhu, Ito and Tomiura, 2016); however, the earthquake did not lead to reshoring, nearshoring or diversification for firms in the automobile and electronic sectors that relied on Japanese imports, likely due to the cost of switching suppliers, especially for relationship-specific intermediate products (Freund et al, 2021).

Second, the structure of a supply network also determines the extent to which an idiosyncratic shock can propagate through input-output linkages, thus leading to aggregate fluctuations. If the economy consists of many non-interacting sectors, microeconomic idiosyncratic shocks average out. But in the presence of input-output linkages, a sectoral shock propagates to the rest of the economy and affects aggregate outcomes (Acemoglu, Carvalho, et al., 2012). And the structure of the production network is key in determining whether and how microeconomic shocks can propagate throughout the economy (Carvalho, 2014). When the linkage structure in the economy is dominated by a small number of hubs supplying inputs to many different firms or sectors, aggregate fluctuations may arise. This is because fluctuations in these hub-like production units can propagate throughout the economy and shorten distances between otherwise disparate parts of the economy. In other words, hub-like production units can function as “choke points” through which a shock occurring to one sector is likely to propagate throughout the economy.

The cross-border transmission of shocks also depends on the granularity of an economy and can thus occur, for instance, through large multinational

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**Box C.1 Impact of COVID-19 on Tunisian imports (continued)**

**Figure C.4: Most intermediate products in Tunisia are potentially exposed to external shocks**

<table>
<thead>
<tr>
<th>Final products</th>
<th>5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermediate products</td>
<td>94%</td>
</tr>
</tbody>
</table>

Tunisia’s share of risky products (%)

Source: Baghdadi and Medini (2021), based on Tunisian Customs data.

Note: The left panel of the figure reports the change in Tunisia’s imports between 2019 and 2020, while the right panel of the figure displays Tunisia’s distribution of risky products by end-use (final goods and intermediate goods).

Risky products imported to Tunisia are mostly related to the extractives sector (representing 51 per cent of the total value of risky products) and the machinery sector (21 per cent). Many COVID-19-related essential products have also been found to be highly exposed to supply chain disruptions in Tunisia.

An econometric analysis further confirms that the decline of Tunisia’s imports between 2019 and 2020 are in part due by changes in Tunisia’s imports of risk products (Baghdadi and Medini, 2021). Identifying and addressing supply chain vulnerabilities are therefore important strategies for building and supporting trade resilience.

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firms. Fluctuations at the firm level can be linked with aggregate economic fluctuations (Gabaix, 2011; Herskovic et al., 2020). Trade linkages at the firm level are significantly associated with increased international business-cycle co-movement between an individual firm and the country with which it trades (Di Giovanni, Levchenko and Méjean, 2018). The downstream indirect linkages, where a firm buys intermediate inputs from firms that import from a particular country, have also been found to matter significantly for firm-level co-movement with foreign markets. As a relatively small number of firms dominate international trade, small differences in firm characteristics can have amplified effects (Bernard et al., 2018). The degree of shock transmission also depends on the type of transaction between firms, i.e. through arm’s length (i.e. trade between independent parties) or intra-group trade (i.e. trade between vertically linked firms). In the trade collapse during the 2008-09 global financial crisis, intra-group trade in intermediates was characterized by a faster drop followed by a faster recovery than arm’s length trade (Altomonte et al., 2013).

Given the importance of value chains in transmitting shocks, it is critical to identify the choke points in global supply chains that may propagate throughout the economy. Figure C.5 provides a network representation of the world input-output linkages, reflecting the amount of value-added trade between economies. At the aggregate level, the global production network appears to be relatively spread out; the United States, China and Germany appear to be larger hubs connecting with other economies. However, Figure C.5 does not capture the degree of interconnectedness for specific sectors.

Finally, the magnitude and nature of a shock can also determine the extent to which trade may impact economic resilience. If a shock is specific to a region or a country (for instance, a natural disaster), openness to international trade can reduce exposure to domestic shocks and allow countries to diversify the sources of demand and supply across countries (Caselli et al., 2020). On the other hand, trade openness can make the economy more susceptible to sector-specific shocks, as trade often leads to increased specialization (Di Giovanni and Levchenko, 2009). If regions specialize in certain industries, import competition affecting local labour markets can lead to significant economic shocks in a region, particularly in the absence of cross-regional labour mobility (Autor, Dorn and Hanson, 2016). As argued in Section C5, a certain degree of diversification may be desirable to cushion the impact of shocks (Hausmann and Rodrik, 2003).

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**Figure C.5: The global production network is characterized by a few larger hubs connecting with other economies**

Source: Authors’ calculations, based on the multiregional input-output table 2018 by the Asian Development Bank.

Note: The figure displays the world input-output linkages between economies in 2018. It reflects the direct value-added and the indirect ripple effect of an economy, captured by the Leontief inverse of the matrix. The Leontief inverse matrix shows the coefficients (economic multipliers) that measure the successive effects on the economy as a result of the initial change of an economic activity. It incorporates both direct and indirect inputs in production. Each node in the network corresponds to an economy. Each line links the origin and final destination of value-added. Bolder lines represent larger amount of trade in value added. The size of circles for each node corresponds to the intensity of connections and trade in value-added. The abbreviation “ROW” refers to “Rest of the world”.
How more resilient supply chains could reshape global trade

In May 2021, a cyberattack shut down the operations of Colonial Pipeline, a major gas pipeline along the East Coast of the United States. Almost two months earlier, a combination of weather and underappreciated fluid dynamic forces had left a giant super cargo ship wedged sideways in the Suez Canal, bottling up a critical global trade route (Greeley, 2021). In February 2021, unusually low temperatures and a power outage in Texas disrupted a number of petrochemical plants, creating shortages of key plastics and resins for a range of industries. And a global shortage of semiconductors in the wake of demand volatility from COVID-19 has caused automotive companies around the world to curtail production.

These incidents are not just a string of bad luck, but rather the latest reminders of the potential fragility of global supply chains, an issue that the COVID-19 pandemic has catapulted to the top of CEO agendas. Industry value chains often span thousands of companies, and their configurations reflect specialization, access to consumer markets around the world, long-standing relationships and economies of scale. But a shock to any node in the network can be amplified in unpredictable ways.

Disruptions to global supply chains, once seen as rare occurrences, now must be considered probable. Research from the McKinsey Global Institute (MGI) (McKinsey Global Institute, 2020) finds that the average manufacturing company can expect to see production disrupted for up to two weeks every two years, and for periods of one to two months every 3.7 years. These disruptions are costly: over the course of a decade, the average company can expect to lose nearly half of one year’s profits from supply chain disruptions.

Companies are actively considering ways to reduce vulnerabilities and enable prompt reactions. While no one can predict the next “black swan” event,24 there are many ways to make value chains more resilient, including by holding more inventory of critical components or adding redundancy among suppliers, simplifying product designs and sharing components across products, digitizing the supply chain to improve transparency regarding potential risks and enabling more nimble responses, and regionalizing production closer to where goods are sold. The pandemic has also prompted policymaker action around the world focused on goods and technologies deemed critical for national economic security.

As a result of both economic calculations of companies and changes in the policy landscape, global trade flows may shift. MGI research estimates that 15 to 25 per cent of global goods trade could shift to different countries over the next five years in a scenario where value chains become more regionally oriented. This scenario does not mean that globalization is dead, or even that global trade flows would diminish. It is possible that a broader set of countries will participate in GVCs in the years ahead. Moreover, more international cooperation will be needed – not less – to monitor and mitigate the shocks that are global in nature, such as pandemics and climate change. The global economy and trading system held up better than many expected in the face of a devastating pandemic. Now we have a chance to build on that system, not abandon it.
3. **Trade can enable countries to better prepare for, cope with and recover from shocks**

This section discusses the role of trade in helping countries to prepare for, cope with and recover from shocks.

(a) **Trade can enable better preparation for disruptions**

As seen in Section B, a broad range of tactics and strategies can be adopted to build and support economic resilience. Rather than waiting for a shock to hit before taking action, advance planning can help in preparing for disruptions.

When a shock hits, the availability of critical goods and services is of the utmost importance, and trade can play a key role in ensuring their timely availability. Services like weather forecasting, insurance, telecommunications, transportation, logistics and health services are fundamental to mitigate the impact of shocks and begin recovery, as is the efficiency of customs clearance and transit procedures and of public procurement processes. Trade can also be useful in preparing for shocks by helping to minimize and manage risk before a shock hits. For example, making risk-informed decisions, i.e. incorporating and valuing risk, requires data and services, which can be traded across borders.

(i) **Trade in services**

Trade in services, including weather forecasting, insurance, telecommunications, transportation, logistics and health services, can play a key role in the preparation of firms, citizens and governments for shocks. Some services might be relevant to managing specific risks (e.g. weather forecast services matter for weather-related disasters), while others are pertinent for a broader spectrum of risks (e.g. telecommunications and logistics).

Actions can be taken in advance to ensure that relevant services are provided for the domestic market, or that a foreign supply can be made readily available if required to meet demand. Although such actions are often taken independently of an economic resilience strategy, they can support resilience. Such actions can include putting in place comprehensive regimes to recognise foreign qualifications (such as medical qualifications), so that if foreign personnel supplying the required services are required, their entry can be facilitated (WTO, 2019a). Opening the services market to foreign services and service suppliers, where the domestic market is not developed enough in these sectors, can have a positive impact on inward investments in these sectors, encouraging the growth of the private sector and, overall, enhancing the domestic capacity to supply services crucial for improving economic resilience capacity and reducing vulnerability to shocks (Thangavelu, Ing and Urata, 2015; WTO, 2019a; 2019b).

**Weather forecast services**

Various studies confirm the critical role that effective weather forecasting services and early warning systems can play in disaster resilience and reduction (Rogers and Tsirkunov, 2013; WTO, 2019c). The provision of early warning services enables communities to prepare for, and minimize the impacts of, tornadoes, storms, hurricanes, heatwaves, wildfires, floods and droughts (WMO, World Bank, GFDRR and USAID, 2015). However, large regional and development-related disparities exist in terms of access to commercial weather forecast services (Georgeson, Maslin and Poessinouw, 2017).

Such services depend on imports of technical equipment and services needed to build and maintain the weather observation infrastructure (WTO, 2019a), in particular in developing countries where the World Bank’s experience suggests a lack of equipment and expertise (Rogers and Tsirkunov, 2013). The World Meteorological Organization (WMO) estimates that national meteorological and hydrological services maintain and operate global hydrological and meteorological infrastructures worth more than US$ 10 billion (WMO, World Bank, GFDRR and USAID, 2015), and the private sector is also now increasingly investing in its own observation networks.

Import policy can play an important role in determining the cost of purchasing such equipment, particularly where the private sector may not enjoy the same exemptions as public sectors from tariff and taxes (e.g. sales tax) or charges.

As many developing countries lack the skills to develop and run models and provide risk information for their citizens, training is critical. Rogers and Tsirkunov (2013) note that a key problem in developing countries is the focus on the infrastructure of the weather stations rather than on training to ensure quality outputs.

**Insurance services**

Insurance services play a key role in mitigating the impact of disruptions, in particular natural disasters,
Multiple economic resilience challenges for Africa in a rapidly digitalizing global economy

For the African Continental Free Trade Agreement (AfCFTA) to fly, the currently missing digital underpinnings need to be in place. Digital infrastructure, both to undergird the financial and logistical trade of analogue goods, and to support tradable digital services, urgently needs to be prioritized.

Yet, there are multiple digital readiness challenges that Africa needs to overcome before it can benefit from digital processes to increase the continent’s visibility on global markets and in global value chains. These are part of the broad objectives of the AfCFTA, and although previously e-commerce and digital services were not specifically part of the agreement, they are now on the agenda for the third round of AfCFTA negotiations. Already the importance of digital trade has been recognised in African policies such as the African Union Digital Transformation Strategy, from which several practical guiding frameworks are being developed, including a data policy framework.

The importance of creating a safe and secure cyber-realm for digital markets and e-trade to flourish is already recognised on the African continent through the African Union Convention (Malabo Convention) on Cyber Security and Personal Data Protection, which was finalized by the African Union in 2014. The problem, however, is that most African countries are not signatories to such enabling agreements, which not only prevents them from capitalizing on a single digital market, but also prevents the trusted cross-border data flows that are required if a single digital market is to be operationalized.

While African countries are understandably sceptical of entering into global free trade agreements while their digital markets remain undeveloped or as long as the data future remains unpredictable, adopting protectionist measures through narrow notions of data sovereignty or localization will not enable them to be competitive, as the digital and data economy is inherently a global economy.

With relatively low levels of internet penetration and limited digital services, even countries with larger populations or economies in Africa do not generate enough data to have an internal data economy. Further, data has little value in of itself and few can benefitize the data that they have to create value on scale.

With data becoming a critical asset underpinning the global economy, ensuring cross-border flows is a prerequisite to the creation of a single African digital market and to enabling that digital market to be globally competitive.

If countries are concerned about the welfare of their citizens’ privacy and the protection of their data, they can control the use of the data at a higher level in the data economy architecture, while enabling the physical flow of data on which the efficiency and effectiveness of the data economy is dependent.

There is a vast amount of data in the global flows of data that is not personal data, has no inherent value and is not sensitive in any way. Any physical interruption at the infrastructural level, as witnessed in its most extreme form through internet shutdowns, not only curtails political freedoms, but instantly stalls trade and therefore economic growth, as well as associated consumer welfare outcomes. Data protection laws in African countries should, and in some cases already do, recognise that there are various kinds of data with different degrees of sensitivity, and allow any data that requires protection to flow among jurisdictions in which the legal protections are equivalent.

Unless African countries harmonize their regulatory frameworks and fully commit to an integrated market, the continent will continue to be marginalized with regard to dynamic global markets and will continue to encounter difficulties in enabling a more even distribution of the benefits within them.
by providing necessary financial support to affected parties. The development of insurance systems can therefore significantly support preparedness (IMF, 2019; WTO, 2019a). However, some shocks may be excluded from private insurance contracts, especially when massive losses are possible, such as in the case of earthquakes. Following the severe acute respiratory syndrome (SARS) outbreak of 2003, many insurers added clauses to exclude damage payment caused by communicable diseases. In practice, business interruption policies pay out only if there is physical damage; thus, business interruption due to the COVID-19 pandemic, for example, may not be covered by insurance (Hay, 2020).

Nevertheless, insurance services can also play a useful role in preventing risk. In November 2019, the International Cooperative and Mutual Insurance Federation (ICMIF) and the United Nations Office for Disaster Risk Reduction (UNDRR) began a multi-year collaboration to help address the urgent challenge of reducing disaster risks by enabling a shift within the insurance industry, from focusing on providing risk transfer products and services as a means to protect the insured from disaster risks, to focusing on prevention through disaster risk reduction incentives, awareness, capacity and financing (ICMIF and UNDRR, 2021). Using analytics to gain a better insight into risk plays an important role in this respect (IDF, 2020).

However, insurance protection gaps, i.e. the difference between insured losses and economic losses, are all too common, especially in developing economies. The natural disaster protection gap, in particular, remains massive, with only about 30 per cent of catastrophe losses insured globally. While some progress in terms of reducing this gap has been made in high-income and upper middle-income countries, there has been hardly any progress in lower middle-income and lower-income countries, with protection gaps persisting in excess of 95 per cent (Schanz, 2018). Estimates of the value of uninsured losses from natural disasters totalled US$ 280 billion for the years 2017 and 2018 (Bevere, 2019). In Nepal, for instance, a limited range of insurance products is offered, and the ratio of total assets/liabilities to GDP is only 7 per cent for insurance companies and 0.3 per cent for re-insurance companies. This means that liabilities end up having the government or family members, through remittances, as the final guarantor (WTO, 2019c). Empirical studies reveal that uninsured disaster-related losses lead to high macroeconomic costs, and that countries whose households and businesses are financially prepared to cope with a disaster recover faster (Von Peter, Von Dahlen and Saxena, 2012).

Another significant insurance gap concerns cyber protection. Attempts to quantify the cyber risk protection gap estimates it at about 90 per cent of damages caused by cyber incidents (Schanz, 2018).

As experience has shown (Swiss Re Group, 2019), preparedness for shocks through insurance could be improved by a variety of measures, ranging from diversification of insurance products (see Section C4) and the introduction of tailored insurance products specifically addressing the risk run by the potential buyers, to proper communication on available insurance products covering specific risks, to the introduction of public incentives to the purchase of risk insurance (such as the tax breaks on premiums approved by the Italian government in the aftermath of the 2010 earthquakes in Central Italy).

For countries with immature financial markets, opening the domestic market to foreign suppliers, in particular suppliers of insurance and reinsurance services on a cross-border basis or through commercial presence, can help to overcome some of the shortcomings of the domestic market, increase the overall supply of insurance services to it, and strengthen disaster preparedness.

Trade-opening can improve the efficiency of financial services, including insurance, with potentially large payoffs for the economy. Eschenbach and Francois (2002) find that financial sector openness leads to greater growth and financial sector competition. Mattoo and Subramanian (2006) estimate that, with full financial services liberalization, developed countries could grow 1.2 per cent faster and developing countries 2.3 per cent faster. Less restrictive economies have also been found to have deeper life and non-life insurance markets, as measured by the size of total gross premiums relative to GDP, indicating that households and firms in these economies are better equipped to deal with common risks and to engage in long-term planning (Kyvik-Nordås and Rouzet, 2016).

**Telecommunications**

Telecommunications play a key role in times of disruptions, and so promoting the development of efficient telecommunications services is an essential element of any preparedness strategy.

Traditional telecommunications services (i.e. mobile telecommunications services, internet telecommunications services and data transmission services), as well as new services technologies (i.e. artificial intelligence (AI), Big Data, cloud capabilities, Internet of Things) could play a critical role in disaster...
management, as they allow communication with disaster-hit areas and collection of information on the actual damages and the needs of the affected population (ITU, 2019). After the floods in Chennai, India, in 2015, for example, several groups used Twitter to share information that helped relief operations to plan assistance, and to provide updates to those living in the area hit by the floods (ITU, 2019).

Some telecommunications services may also support the remote cross-border supply of other services that are equally critical in times of disruptions, such as telemedicine or engineering services.

As in the case of insurance services, trade liberalization in telecommunications can enhance their efficiency and enable the provision of more affordable, higher-quality and more diverse telecommunications services, which can support preparedness. Various studies find that economies with stronger actual and prospective competition in the telecommunications sector tend to have lower prices and better-quality services (Boylaud and Nicoletti, 2000; Eschenbach and Hoekman, 2006; Lestage et al., 2013; Mattoo, Nielsen and Kyvik-Nordás, 2006).

**Transportation and logistics**

Transportation and logistics are essential for business or leisure travel, also enabling other services, as well as goods, to be traded internationally. In 2017 one-third of global trade in transport services, or US$ 529 billion, related directly to the cost of shipping goods across economies, mainly by sea or by air. Supporting transport services, such as cargo handling, storage and warehousing, made up an additional 16 per cent of global trade in transport services (WTO, 2019b).

Deficiencies in transportation and logistics systems can have dire consequences when a shock hits, highlighting the importance of investment in logistics and transport preparedness. In the wake of the 2015 earthquakes in Nepal, shortcomings revealed in trade connectivity, most notably in airport and road capacity, posed serious challenges to the government’s disaster response capabilities. (Logistics Cluster, 2015; WTO, 2019c). Efficient transportation and logistics systems are therefore essential to allow emergency personnel to be brought into a country and goods to be imported and distributed rapidly and smoothly. They can also be instrumental to reduce risk and build resilience. The move to low-carbon and climate-resilient transportation and logistics system is a key part of risk mitigation (Mehndiratta, 2020).

As in other services sectors, there is empirical evidence that trade-opening in the transport sector produces benefits in terms of efficiency and price. According to Fink, Mattoo and Neagu (2002), for example, trade-opening in maritime transport would reduce transport prices by 9 per cent and generate US$ 850 million worth of savings. Given that transport and travel costs make up a large portion of trade costs in goods – 28 per cent on average in 2016 (WTO, 2019b) – and can act as a non-tariff barrier to trade (Nordás and Piermartini, 2004), opening trade in these sectors can boost the efficiency of transport services and help prepare for shocks.

**Health services**

Trade plays a critical role in emergency situations by providing access to medical services and medical assistance to affected populations, including through the entry of foreign medical personnel (WTO, 2019c, 2020d), allowing the shortage of services caused by shocks in one location to be covered by imports from other unaffected places. The conclusion of agreements on the mutual recognition of professional qualifications can be a useful anticipatory measure (WTO, 2019a), as the lack of such recognition can hinder the efficiency of international emergency medical teams (IFRC, 2014; WHO, 2017). For example, the absence of special mutual recognition provisions for doctors or medical professionals wishing to enter Nepal on short notice to provide medical services was highlighted as a key issue of concern following the 2015 earthquakes (WTO, 2019a).

Likewise, mapping and prioritizing the interdependencies between public health and other sectors and developing preventive long-term approaches to health through partnerships can help mitigate risks.

Easing access to e-health and cross-border services can also facilitate the sharing of knowledge and experiences when detecting, monitoring and responding to crises (WTO, 2020d). However, the implementation of e-health requires proper planning and management and good telecommunication services (Li et al., 2012).

**Other services**

Other services sectors can also play an important role in resilience and preparedness to disruptions. For example, expanding renewable sources of electricity generation, such as hydro-electrical and geothermal energy, can lessen dependence on imports of liquid fuels, which can be a major drain on the balance of payments of disaster-prone countries (WTO, 2019c). Likewise, expanding the provision of
the “general services” listed under Annex 2 of the WTO Agreement on Agriculture (i.e. “expenditures (or revenue foregone) in relation to programmes which provide services or benefits to agriculture or the rural community”, which constitute non-trade-distorting “green box” subsidies), such as research, rural infrastructure, pest and disease control, and extension and advisory services for farmers, could contribute to risk prevention and help economic actors to prepare for shocks (including by improving productivity and raising rural incomes).

(ii) Trade facilitation

Trade facilitation measures play a fundamental role in building resilience to shocks. Trade facilitation reforms, including implementation of the WTO Trade Facilitation Agreement (see Section D), can play an important role in ensuring the smooth importation of critical goods such as food, medical supplies and emergency equipment that may be in short supply in countries hit by a shock.

A recent WTO study on countries hit by natural disasters (WTO, 2019c) highlights the critical importance of preparedness and of the anticipatory incorporation of specific measures in customs procedures and processes. A key problem observed in the surveyed countries was that customs would not release goods until payment of customs duties or other fees had been made in full, which resulted in containers piling up at customs when humanitarian relief goods started to arrive. Procedures that would have allowed goods to be released without waiting for duties to be paid would have relieved pressure in the immediate aftermath of the crisis. Another critical issue was the delay in clearing goods that occurred while decisions were taken on what goods should be exempted from customs duties. Such decisions typically only came after a few days. Prior agreement on an approved list of critical goods to be exempted from taxes and duties would have allowed such a situation to be avoided.

A further difficulty was the customs clearance process, in particular the fact that forms had to be filled in by hand. Anticipatory measures to streamline the documentary requirements for imports and establish simplified procedures for customs inspections and for the clearance and release of goods, for example through authorized economic operator and pre-arrival processing tools, digitalization and the establishment of single windows (i.e., a single unified point through which documents can be submitted digitally), could go a long way toward facilitating the importation of critical goods. Another issue that emerged was the accumulation at customs of small parcels, which are frequently the medium through which support is provided, due to the expansion of e-commerce. Such accumulation delayed the timely clearance of relief items and placed additional pressure on the response system. Some stakeholders have noted that the use of de minimis provisions (i.e., a valuation ceiling for goods below which no customs duty or tax is charged and clearance procedures are minimal) combined with the introduction of simplified customs procedures would alleviate administrative burdens at customs and reduce the congestion of customs facilities.

A further critical element in resilience highlighted in these studies is security of transit (WTO, 2019c). The customs laws and procedures of transit countries can reduce the pace and availability of relief assistance for disaster-prone countries, in particular landlocked economies. For example, transit issues disrupted the delivery of essential supplies and delayed recovery in Nepal following the 2015 earthquakes (WTO, 2019a).

Ensuring that critical goods can transit without unnecessary cost and delays is an essential condition in times of a shock. One way to prepare for shocks is to develop stable relationships with neighbouring countries, for instance by signing agreements related to trade and/or transit procedures. Finally, the importance of improved information-sharing and coordination among border agencies has often been stressed. All these issues are best addressed through anticipatory actions to build resilience, including through implementation of the WTO Trade Facilitation Agreement (WTO, 2019a). Studies on the COVID-19 pandemic flag the same issues as being of critical importance to prepare better for possible future pandemics (UNCTAD, 2020c, 2020d).

(iii) Government procurement

Government procurement preparedness is another way to pursue resilience and prepare for future disruptions (IMF, 2019; OECD, 2020c; World Bank, 2015; WTO, 2019c). The effectiveness of the response to emergencies in meeting the immediate needs of the affected populations and embarking on the path to recovery and reconstruction depends directly on the effectiveness of government procurement processes. When a shock hits, governments must urgently purchase critical products and services, including from abroad, meanwhile ensuring the smooth and accountable management of ongoing contracts needed to ensure the delivery of critical public services. The electronic conduct of government procurement can be particularly useful in times of extreme urgency, both by providing transparency in emergencies and thus helping to
prevent corruption, and by allowing governments to accelerate procurement procedures, thereby reducing costs for suppliers.

A recent survey conducted by the Inter-American Network on Government Procurement on the level of preparedness of 18 Latin American governments to manage COVID-19-related procurement (INGP, 2020) highlighted the importance of having strong frameworks in place well before a crisis hits (see also Section C3(b)(iv)). The survey found that countries that had updated their regulatory frameworks and established clear government procurement emergency procedures and long-term agreements were better positioned to deal with urgent supply requests. These countries included Costa Rica, Ecuador, Paraguay, Peru and Uruguay.

(b) Trade can enable countries to cope with shocks more effectively

Section C2 describes the mechanism by which trade can contribute to the spread of shocks. However, trade often plays a more prominent role in helping countries to cope with shocks more effectively by allowing them to import essential goods and services from other regions. Trade can also help firms to cope with shocks by channelling foreign demand and identifying alternative foreign suppliers. To allow trade to play a beneficial role in withstanding shocks, adequate and coordinated policies are of crucial importance. In particular, certain strategies are important to enhance the resilience of supply chains.

(i) The role of trade in addressing supply shortages

Openness to international trade allows countries or regions to confront shortages of goods and services after a shock strikes, enabling them to attenuate the impact of the shock. In this subsection, the role of trade in coping with different types of shocks, including natural disaster shocks and socioeconomic shocks such as regional conflicts, is discussed.

International trade brings goods and services from regions of surplus to regions lacking in those goods and services, thus smoothing the differences between output and consumption. As discussed in Section B, a higher degree of trade openness is often associated with lower economic damages from natural disasters, although other factors such as education, the quality of institutions and financial conditions also matter (Felbermayr and Gröschl, 2014; Noy, 2009; Toya and Skidmore, 2007).

When natural disasters trigger disruptions in domestic production, trade can offer an alternative source of supply through imports and stabilize the market. Following a supply-side disruption, a surge in the price of affected goods is to be expected; however, trade enables the market to meet the excessive demand with imported foreign substitutes and prevents sudden spikes in prices. For example, when Bangladesh was hit by a flood in 1998, massive rice imports from India, which were facilitated by trade-opening prior to the catastrophic event, contributed to stabilizing the market. Rice prices in Bangladesh would otherwise have experienced price increase of up to 19 per cent (Del Ninno, Dorosh and Smith, 2003).

Trade also plays an essential role in adapting to long-term changes in climate patterns. For example, increased variability of regional temperature and precipitation as a result of climate change can reduce agricultural productivity, which can impair food security, especially for populations living in rural areas where agriculture is the predominant form of economic activity (Hertel and Rosch, 2010). It is estimated that northern countries which have traditionally had cold temperatures and short growing seasons may benefit from higher yields in some crops, while tropical countries may see reduced yields because of extreme temperatures. As the impact of climate change and weather variations is heterogeneous across regions, trade can often bridge the difference between supply and demand across regions. For instance, the expansion of railroads across regions in India between 1861 to 1930 is found to have mitigated the effects of agricultural productivity shocks due to rainfall volatilities on famine, as lower trade costs brought about by rail transport allowed surplus regions to sell food to deficit regions (Burgess and Donaldson, 2010).

Adjustments through production and trade patterns can significantly dampen the adverse consequences of climate change. Since climate change has a differential effect on crop yields both within and between countries, some of the negative impacts could be mitigated by changing production patterns (to crops more resistant to warmer temperatures) and allowing international trade (Costinot, Donaldson and Smith, 2016).

While Costinot, Donaldson and Smith (2016) find a relatively small effect of trade in mitigating the negative impact of climate change, Gouel and Laborde (2018) find that international trade plays a major role in alleviating the consequences of climate change by allowing countries that experience a negative impact on food production to import agricultural products; the different results in these two studies can be
explained by the use by Gouel and Laborde (2018) of low elasticity of substitution and opportunity costs of converting land between its various agricultural uses. In a similar vein, rising temperatures are predicted to lower real GDP per capita by 6 per cent and welfare by 15 per cent by the year 2200.

However, reducing trade costs would lead to more geographic concentration in agriculture in northern regions such as Canada, Russia, and Central Asia and less climate-induced migration. Thus, trade can be a powerful mechanism to adapt to rising temperatures (Conte et al., 2020).

In the case of a global shock, essential goods often become scarce, and countries often compete for them, while trade helps to ensure their availability. Essential goods can be defined as goods whose consumption cannot be substituted with other goods and cannot be deferred (Bacchetta et al., 2021; Leibovici and Santacreu, 2020). The COVID-19 pandemic brought considerable attention to trade in medical products, and specifically trade in products for prevention, testing and treatment of the disease. Imports and exports of medical goods were valued at US$ 2,343 billion in 2020, representing a growth of 16 per cent compared to the previous year (WTO, 2020c).

As manufacturers seek to meet the demand for COVID-19 vaccines, shortages have arisen in the wide range of ingredients and goods needed to produce, distribute and administer the vaccines. There are strong international interdependencies in the supply chains of vaccines, and trade plays an essential role in ensuring that vaccines can reach populations (OECD, 2021e). In Box C.2, the role of trade and trade policies in COVID-19 vaccine production is discussed in further detail.

Several governments have called for the domestic production of essential goods to avoid shortages during a global crisis like the COVID-19 pandemic. This, however, would come with three important disadvantages, which would lead to an undesirable outcome.

First, government policies to guarantee domestic production of essential goods would require a mix of subsidies and import protection, which could be costly in terms of government expenditures and higher consumer prices.

Box C.2: The role of trade in vaccine production and distribution

The influenza A (H1N1) and COVID-19 pandemics have highlighted the key role that an open trade regime plays in enabling quick vaccine production and distribution.

Vaccine production relies on complex upstream raw material and component value chains. A typical vaccine manufacturing plant uses about 9,000 different materials sourced from some 300 suppliers across approximately 30 different countries, according to estimates from the International Federation of Pharmaceutical Manufacturers and Associations. Pharmaceutical companies increasingly rely on third parties for the timely supply of goods, such as components of medical equipment (e.g. vials, syringes, stoppers) and raw materials (e.g. active pharmaceutical ingredients), machinery and equipment, formulated drugs, packaging materials, critical product components and services. In view of the complexity of upstream raw material and component value chains, ensuring smooth customs clearance and transit procedures of imported raw materials is critical.

Trade also plays a critical role in the distribution of vaccines (WTO, 2020c). Vaccines are biological products that can be damaged by conditions such as high or freezing temperatures or by excessive light, and are often effective only for a limited time period at room temperature. Thus, inappropriate transportation or improper storage reduces their effectiveness, and functional end-to-end supply chain and logistics systems are essential.

The role of the supply chain is to ensure effective vaccine development, manufacturing, storage, handling and stock management, rigorous temperature control in the supply chain, and the maintenance of adequate logistics management information systems.

As time is of the essence for global vaccine distribution, the speed and reach of air transport is a critical factor in prompt vaccine distribution. Another consideration is transit. Cargo may be transferred between several different flights before it reaches its final destination, and consignments may be subjected to a variety of procedures and documentary requirements.
Second, self-sufficiency and relying on domestic production capacity are not always a guarantee of greater security, as eliminating reliance on foreign production and inputs means increased reliance on domestic production, which is also subject to adverse shocks. In the context of the pandemic, ordering multiple vaccines in advance can be an efficient risk diversification strategy if it is not known which vaccines will prove effective. However, such a policy can only work under open trade policies, so that foreign vaccines can be ordered (Ahuja et al., 2021).

Third, for smaller and low-income countries it is difficult to build up the manufacturing capacity and obtain specialized machinery to build domestic production capacity and seek self-sufficiency. For countries with less advanced production capacity or limited access to intermediate inputs it is difficult to rely solely on domestic production.

Hence, domestic production is not the best decision, from both an efficiency and an equity perspective. Policy cooperation to prevent this suboptimal outcome is discussed in Section D.

Aside from domestic production, there are at least three other policy options governments can consider to guarantee the provision of essential goods during crises (Bacchetta et al., 2021). First, increases in inventory stocks of raw materials, intermediate inputs and finished goods, as well as redundancy in production to be able to quickly ramp up the production of essential goods, can help to address bottlenecks in production. Second, diversification of suppliers at the various steps of production in a value chain can increase robustness and resilience, as a negative shock hitting supplies from one location can be offset by substitute supplies from other locations. Third, innovative solutions can be explored to quickly switch production from non-essential to essential goods when needs arise. Since the outbreak of the COVID-19 pandemic, many companies have repurposed production plants and idle manufacturing capacity to supply personal protection equipment and medical supplies, and have begun to use 3D printing technology to increase manufacturing of face shields and ventilators (Fiorini, Hoekman and Yildirim, 2020; Statt, 2020).

(ii) The role of trade in channelling foreign demand

Trade can also cushion the potentially detrimental effect of socioeconomic shocks, such as violence and conflicts, political shocks and economic crises. Firms that participate in trade have a greater likelihood of surviving through times of economic downturn, especially through exports, although the underlying mechanisms may differ (Amendola et al., 2012; Costa, Pappalardo and Vicarelli, 2014; Eppinger et al., 2018; Görg and Spaliara, 2014; Narjoko and Hill, 2007).

One of the reasons why exporting firms can better withstand macroeconomic shocks is that they tend to demonstrate higher productivity and better resilience to adverse external events, as trade drives out the less productive firms and engenders resource reallocations in favour of the surviving firms (Melitz, 2003). Exporting firms are more efficient than non-exporters and are less likely to fail in the face of shocks, such as foreign exchange rate movements and tariff reductions (Baldwin and Yan, 2011) and the 2008-09 global financial crisis (Amendola et al., 2012). Similarly, internationalized firms seem to have coped with the COVID-19 pandemic better than firms that operate only in the domestic market (Giovannetti et al., 2020).

While the volume of trade in firms already participating in the export market dropped during the 2008-09 global financial crisis, the number of exporting firms did not, as exporting firms tended to survive through the crisis. For example, in the United Kingdom, exporters outperformed non-exporters during the global financial crisis in terms of employment and sales growth, while facing lesser risks of failing (Görg and Spaliara, 2014). In Spain, even though all firms suffered from economic contraction, firms that consistently exported before and during the crisis were more successful in maintaining the number of employees and productivity compared to non-exporters (Eppinger et al., 2018). Another study using a dataset comprising 4,433 enterprises across 133 countries shows that firms engaged in international trade have taken more resilient actions during the COVID-19 crisis than firms that only operate domestically (Borino et al., 2021). These results underscore the importance of global interconnectedness and international trade for promoting resilience to economic shocks.

Trade can also enhance the economy’s capacity to endure disruptions by diversifying supplier and customer networks. As discussed in Section C2, natural disaster shocks can propagate through input-output linkages within an economy (Barrot and Sauvagnat, 2016; Carvalho et al., 2021), but there is little evidence in support of cross-border transmission of natural disaster shocks beyond firms that have direct and tight trade linkages with a disaster-stricken country. For example, Chinese processing manufacturers with tight trade linkages to US suppliers reduced their intermediate imports from the US following the 2005 hurricane season,
Trade also offers the possibility of risk diversification when firms are confronted with economic recessions, as falling domestic sales during an economic downturn can be substituted with foreign sales through trade (Amendola et al., 2012; Costa, Pappalardo and Vicarelli, 2014; Eppinger et al., 2018). For instance, Spanish exporting manufacturing firms compensated for their losses in the domestic market during the 2008–09 global financial crisis by expanding into foreign markets (Eppinger et al., 2018). Exporting allows firms to take advantage of better economic conditions in the foreign market, and a higher degree of diversification in markets and products fosters firm survival (Costa, Pappalardo and Vicarelli, 2014).

In the case of regional shocks, the benefits of exporting to foreign markets can be large, as declining demand in the affected region can be compensated by increasing demand in other regions. During the Asian financial crisis of the late 1990s, the export propensity of Indonesian manufacturing firms was associated with a higher chance of survival because of a boost in relative price competitiveness caused by real exchange rate depreciation in the region (Narjoko and Hill, 2007). On the other hand, if negative economic shocks strike globally or relatively harder in foreign economies, the opposite effect can occur. In Germany during the global financial crisis, exporting firms were relatively more at risk because of a worldwide decrease in demand for exports, while importing firms gained from this and were thus more likely to survive through the crisis (Wagner and Gelübcke, 2014).

(iii) Trade policies in coping with shocks

Supportive policies are often necessary for trade to play a positive role in coping with adverse shocks. In particular, trade facilitation measures can speed up the imports and exports of goods and services and thus bridge the gap between supply and demand in the immediate aftermath of a shock. Some governments also resort to the temporary suspension of customs duties or other taxes to facilitate the imports of goods and to help disaster-stricken regions to withstand the shock. Some governments also impose export restrictions when faced with a shock, although such measures often yield detrimental impacts on other countries. Government procurement is often used to supply essential goods in emergency situations.

Trade facilitation

Trade facilitation measures can significantly enhance efficiency in trade and lower trade costs, thereby boosting trade volume and flows. The beneficial role of trade facilitation is particularly pronounced in coping with shocks. Ensuring that customs and other border clearance procedures operate efficiently and promptly is critical in emergency situations to make goods such as food, medical supplies, and emergency equipment available that may be in short supply in countries hit by a shock.

Since the outbreak of the COVID-19 pandemic, several countries have taken trade facilitation measures with the objective of better coping with the crisis. According to the World Bank (2020), some countries have focused on prioritizing the clearance of critical supplies, to facilitate imports and promote inter-agency cooperation, with a view to smoothing trade procedures for these goods. Canada, for instance, has established a special communication channel between the government and firms to minimize confusion over changed regulations. Furthermore, in an attempt to counterbalance the efficiency loss induced by additional sanitary regulations, such as social distancing of personnel, some countries have expanded their trade infrastructure capacity by temporarily expanding facilities or prolonging their operating hours (Sela, Yang and Zawacki, 2020; Vassilevskaya, 2020).

The digitalization of customs procedures and documentation requirements is also conducive to containing the adverse effect of shocks, as it is known to boost efficiency in trade procedures and subsequently to reduce trade costs (WTO, 2021). On top of this efficiency gain, keeping electronic trade records during the pandemic helped to reduce in-person contact, thereby reducing the risk of disruptions caused by contagion, as well as facilitating business (Vassilevskaya, 2020). Since the COVID-19 outbreak, trade operators have been using interim/alternative solutions relying on digitization. During the lockdowns, flows of original documents were severely disturbed, as they were subject to delays or no transmission at all; however, many national laws still require original documents for verification. Thus, without documents, transactions could not be processed, and deliveries could not be made.
The International Chamber of Commerce (ICC) issued a guidance note in April 2020 allowing for some relaxation of procedural requirements for letters of credit, i.e., a commitment by the importer’s bank to pay the exporter’s bank upon execution of the contract. The guidance note includes recommendations such as a five-day deadline for the presentation of compliant documentation, and a request for governments and central banks to avoid prohibitions on the use of electronic documentation (ICC, 2020). Where it was possible, interim solutions have been found by parties tied to specific transactions, despite the legislation still requiring physical documents and signatures.

**Suspension of custom duties and other taxes**

The temporary suspension of import restrictions, such as custom duties, is usually taken in response to a shock to ensure that essential goods such as food or medical equipment can continue to be imported and supplied. In response to the elevated demand for imported medical supplies occasioned by the COVID-19 pandemic, 106 governments have implemented 240 reforms that eased imports of these goods since the start of the pandemic (Global Trade Alert, 2021). A number of countries also implemented similar measures on food items and exempted imported goods from value-added tax (VAT) or sales taxes as a means to smoothen importation.

The suspension of import tariffs can also be initiated by trading partners to help a disaster-struck country. For example, the European Union’s temporary tariff waiver on goods from Pakistan’s main export industries after the floods in 2010 had a significant, positive effect on Pakistani exports to the European Union, and helped to foster employment in Pakistani industries (Cheong, Won Kwak and Yuan, 2017). Further findings suggest that the measures did not negatively impact the European Union’s trade with competing countries in the industry.

Despite its beneficial role in coping with shocks, a temporary lift of import tariffs can have adverse side effects on other countries in specific situations. For example, analysis by Bouët and Laborde (2012) using a global computable general equilibrium model indicates that, if export restrictions had been implemented by large net food-exporting countries and import tariffs been relaxed by net food-importing countries following the food crisis of 2007-08, this could have driven up world food prices even further, leading to calamitous impacts for small net importers of food.

**Export restrictions**

Export restrictions may be implemented to guarantee sufficient domestic supply of essential goods in times of crises and to alleviate inflationary pressures (Abbott, 2012). This tendency has been especially notable in the agricultural sector. During the food crisis of 2007-08, numerous countries tightened their export restrictions in fear of skyrocketing food prices. This included several major grain and rice exporters, which banned or taxed agricultural exports (Abbott, 2012), hoping to achieve domestic market stabilization through these export restrictions, as well as a potential redistributive welfare effect benefitting the consumers. However, export restrictions can have negative effects on trading partners. By reducing the world supply of a product, export restrictions push up world prices, limiting importers’ ability to access essential goods, in particular poor countries with limited production capacity.

In a global crisis, the negative effects of export restrictions on importing countries are magnified. Since the exporting capacity of some essential medicines and medical equipment is concentrated in a small number of countries, export restrictions by large suppliers effectively denies access to these essential goods to populations in countries that do not produce them (Pierrartini, 2004). The increased use of export restrictions on medical goods during the COVID-19 crisis has exposed the fragility of supply chain production, and has been one of the leading factors inflaming the debate over the need to re-shore production of essential goods. The WTO database tracking COVID-19 measures found 58 active restrictive export measures affecting trade in goods in the second quarter of 2020, although some of these export restrictions have since been lifted (see Figure C.6). Similarly, the adoption of restrictions on food exports was found, on average, to exacerbate the initial impact of the COVID-19 pandemic to a reduction of 40 per cent in food export supply and a consequent rise in world food prices of 18 per cent (Espitia, Rocha and Ruta, 2020).

There are at least three reasons why export restrictions during crises can backfire.

First, the production process of essential goods can be complex, requiring many intermediate inputs that have to be partially imported from abroad. If imposing export restrictions generates tit-for-tat retaliation from trading partners, the value chain production process can be jeopardized, with the country imposing the restriction running the risk of ending up with a smaller supply of the essential goods.

Second, by reducing domestic prices, export restrictions reduce the incentives for domestic firms to increase production and invest in new capacity. Such restrictions can also foster smuggling (Fisman
and Wei, 2004; McDonald, 1985). Similarly, if firms anticipate that they might face export restrictions and thus lower prices during crises (when their goods are in high demand), they will invest less in the production of such goods. Thus, in India, export restrictions in response to the dramatic increase in world grain prices in 2007 and 2008 were followed by a reduction in domestic market efficiency and an increase in domestic price volatility (Baylis, Jolejole-Foreman and Mallory, 2014).

Third, net importers of essential goods will respond to the export restrictions by attempting to build up a domestic production capacity of essential goods in future crises.

Government procurement

As highlighted in Section C3(a), government procurement of goods and services is also important to enable countries to cope with negative shocks. Measures related to government procurement of personal protective equipment (PPE) were introduced during the COVID-19 crisis. Shortly after the outbreak of the COVID-19 crisis in China in January 2020, most of the facemask supplies in China had been ordered by the Chinese government, resulting in a shortage of exports. Exports of facemasks from China resumed in March 2020, and many countries that faced shortages in medical goods engaged in “bidding wars” to divert shipments of PPE to their own country (Hoekman, Fiorini and Yildirim, 2020; OECD, 2020; Ye et al., 2021).

Besides the need to ensure efficient supplies of PPE, access to vaccines to fight COVID-19 is an essential step in the global fight against the virus. The role of government procurement in this regard, from the start of research for the development of a vaccine up to the point of administering the manufactured product to the population, cannot be underestimated. As discussed in Section D, ensuring equitable access to essential goods, including vaccines, is also important, highlighting the important role of international cooperation and coordination of public procurement programmes during global crises.

(iv) Supply chain reorganization to enhance resilience

As described in Section C2, domestic and global value chains can play a role in propagating shocks. Building supply chain resilience can be of crucial importance for many firms. There may also be a role for governments to provide incentives to firms to invest in supply chain reorganization. This subsection discusses firm strategies and government policies to enhance supply chain resilience.
**Firm strategies to enhance resilience**

A firm’s vulnerability can reside in five critical areas: demand planning and inventory management; supplier network structure; transportation and logistics networks; financial fragility; and product portfolio complexity (McKinsey, 2020). The magnitude of losses from supply chain disruptions can be large. A single, prolonged, production-only shock can wipe out between 30 and 50 per cent of a company’s earnings, and an event that also disrupts distribution channels would push the losses much higher for some firms (McKinsey, 2020). Building economic resilience can thus be of critical importance for firms’ survival. A firm’s resilience strategy can include maintaining redundancy (high safety or buffer stocks, additional production capacity) and flexibility (alternative suppliers for sourcing, alternative transportation options), as well as cash flow and balance sheet buffers (Chowdhury and Quaddus, 2017; Dolgui, Ivanov and Sokolov, 2018; Katsaliaki, Galetsi and Kumar, 2021). Easy-to-replace standardized inputs, resilience monitoring (i.e. assessing the time to recover from a shock for each type of supplier) and design of the value chain (i.e. identifying locations and suppliers less subject to risk) can also help when it is necessary to switch production swiftly in response to shocks (Miroudot, 2020). Table C.1 summarizes the various firm strategies to enhance resilience, their advantages and disadvantages.

Diversification in supplier networks is often cited as a critical strategy to help minimize exposure to risk (McKinsey, 2020; Matous and Todo, 2017; Miroudot, 2020; Zavala-Alcívar, Verdecho and Alfaro-Saiz, 2020). As emphasized in Section C4, relying on a single source for critical inputs or suppliers located in the same location can be a source of vulnerability. Having diversified suppliers and a production network spanning various countries enables firms to adjust their production when disruption occurs. For instance, the 2011 Japanese earthquake had a positive effect on firms’ total offshoring in manufacturing activities, possibly because the damaged transport network in the Tōhoku area forced some manufacturing firms to replace domestic contractors with foreign contractors (Zhu, Ito and Tomiura, 2016).

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**Table C.1: Comparison of firm resilience strategy options**

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<tr>
<th>Sourcing option</th>
<th>Pros</th>
<th>Cons</th>
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<tr>
<td>Diversification</td>
<td>• Allows for easier switching between suppliers in response to supply disruptions.</td>
<td>• On average, sourcing from multiple suppliers reduces the size of purchases from each one, weakening buyer leverage.</td>
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<tr>
<td></td>
<td>• Diversification of downstream customers can also reduce firms’ exposure to demand shocks.</td>
<td>• Costlier for buyers to identify counterparties that are better managed, less likely to suffer shocks and able to recover faster from disruption.</td>
</tr>
<tr>
<td></td>
<td>• Trade route diversification minimizes disruption to transportation.</td>
<td>• More time needed to restore full operations after disruption.</td>
</tr>
<tr>
<td></td>
<td>• Competition between suppliers can encourage suppliers to make investments that facilitate recovery.</td>
<td></td>
</tr>
<tr>
<td>Long-term relationships</td>
<td>• Facilitate relationship-specific investments, information-sharing and cooperative behaviour that speeds-up recovery from disruption.</td>
<td>• Can result in complacency and diminished incentives to invest in solutions that could otherwise foster recovery from disruption.</td>
</tr>
<tr>
<td></td>
<td>• Support investments in alternative supplier capacity.</td>
<td></td>
</tr>
<tr>
<td>Increased inventory stocks</td>
<td>• Provides buffer in case of supply shortages.</td>
<td>• Increased cost of inventory maintenance and monitoring.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Not feasible to maintain inventory of perishable goods, such as medicines and food.</td>
</tr>
<tr>
<td>Enhance supply chain transparency</td>
<td>• Allows identification of potential supply chain vulnerabilities.</td>
<td>• Individual firms often do not have information on second- and third-tier suppliers and customers.</td>
</tr>
<tr>
<td></td>
<td>• Allows swift reallocation of resources and inventories in case of disruption.</td>
<td>• Supply chain mapping and real-time monitoring systems require time, resources and planning.</td>
</tr>
<tr>
<td></td>
<td>• Digitalization can facilitate supply chain mapping.</td>
<td></td>
</tr>
<tr>
<td>Flexible production across sites</td>
<td>• Possibility to switch production swiftly in case of supply shortages.</td>
<td>• Requires initial investment in flexible production facilities; production cost likely to be higher per unit of output.</td>
</tr>
<tr>
<td>Sourcing from locations with efficient and low-cost logistics</td>
<td>• High-quality logistics infrastructure and fewer bureaucratic hurdles can facilitate faster recovery after disruption.</td>
<td>• Lean, low-cost logistics tend not to be associated with the redundancy in capacity needed to cope with disruptions (in particular, surges in demand).</td>
</tr>
</tbody>
</table>

Source: Author’s summary partially based on Jain, Girotra and Netessine (2021).
Semiconductors and pandemic resilience

One unsung pandemic-era hero was the mighty semiconductor. Millions of us were lucky to suddenly be able to work, school, or get healthcare from home. All of those new laptops, smartphones, medical devices and data servers needed chips. People could not travel, but open trade meant semiconductors could. As a result, parents continued to work, kids continued to receive education, and many were able to stay safe. Semiconductors helped make many of us more resilient to the crisis.

Things could have gone very differently for the tiny chip. About 10 per cent of all semiconductors are sold to car-makers, with some cars needing upwards of 3,000 different chips. Orders from car companies dried up when commuters disappeared. But for that new stay-at-home generated demand, the semiconductor industry could have suffered the same bankruptcies, layoffs and need for government assistance that impacted so many others.

Semiconductors are made all over the world. Their “inputs”, too, are often from far-flung places – the final chip that emerges is from a highly fragmented and global production process. Some companies just design semiconductors. Others only produce them. Some make the equipment for the manufacturers. Others develop software for the designers. Some firms package them up. But each step is essential. If its supply chain weren’t diversified and resilient, semiconductor flows could easily seize up.

The industry was hardly in peak form heading into the pandemic. Governments had suddenly discovered how to weaponize chips for other uses. Starting in 2019, the sector found itself caught in a row between Japan and the Republic of Korea, hit with United States-China trade war tariffs, and subject to export controls over cyber-security worries for the telecom sector.

Finally – and more than one year into the pandemic – the world ran short of semiconductors. But even that had less to do with a vulnerable supply chain. Demand just grew too big, too fast. The once-departed car companies returned to the chip market with big orders in hand... only to find an industry running at full tilt.

Overcapacity is the opposite of a shortage. It takes time – and tens of billions of dollars of investment – but the semiconductor companies are building new plants, often with generous financial “help” from policymakers (Busvine and Rosemain, 2021). Unfortunately, governments have also been known to show chips too much love.

Historically, the semiconductor industry has known booms, busts, and trade not being open. Chips were a major battleground in the 1980s United States-Japan trade war. Through the early 2000s, governments often imposed trade remedies, segmenting markets. The relative policy calm of the last 15 years may come to be known as the industry’s period of peak resilience.

Today’s semiconductor supply chains also wind through a Who’s Who of trade protagonists. This interdependence may, in fact, have helped keep the peace during a period of escalating geopolitical tensions. But changing supply chain geography to reduce that interdependence could provoke new vulnerabilities. Freak winter storms, droughts, floods and fires happen. Pandemics happen. Don’t forget the pace of technological change. (There are few other industries where a government bet on one firm poses a bigger risk.)

The resilience of the semiconductor industry and supply chain made millions of us better able to manage the crises brought on by COVID-19. Next time might be different.
However, maintaining alternative suppliers imposes additional costs on firms, as they need to invest in multiple suppliers to tailor inputs and to make sure that parts and components from different manufacturers fit together. Certain industries, such as semiconductor manufacturing, are highly concentrated in a few countries and suppliers, because significant upfront investment in production limits the number of suppliers (Leering, Spakman and Konings, 2020). The shortage of semiconductors since the outbreak of the COVID-19 pandemic has caused some downstream industries, such as car and smartphone manufacturers, to halt production (King, Wu and Pogkas, 2021).

In addition to supplier diversification, the diversification of downstream customers can also reduce firms’ exposure to demand shocks (Esposito, 2016). The volatility of firms is directly correlated to the lack of diversification in their portfolio of clients, and such risk contributes to aggregate fluctuations (Kramarz, Martin and Méjean, 2020). Research finds that large firms are less volatile than small firms because they are connected to more customers, which improves diversification. A supplier’s customer network is more diversified if there is less dispersion in the size of its customers, i.e. if the customers have more or less similar sizes, because shocks to the biggest customers would not then exert an outsized influence on the supplier and raise the supplier’s volatility (Herskovic et al., 2020).

Despite the potential benefit of supply chain diversification, most of trade originates or is destined for top trade partners, and thus the level of diversification is still rather low. On average, the top three import suppliers account for 51 per cent of total imports, the top five suppliers for 63 per cent and the top ten suppliers for 79 per cent (see Figure C.7). The level of import diversification differs across countries, with Canada, Mexico and Nepal displaying a higher level of import concentration. Similarly, the top three export destinations on average account for 64 per cent of total exports, the top five suppliers 74 per cent and the top ten suppliers 86 per cent.

As diversification is not always feasible in certain industries, the organization of GVCs relies on long-term relationships between buyers and sellers (Liker and Choi, 2004; Martin, Mègean and Parenti, 2020). Creating relations with suppliers in GVCs entails a fixed cost, especially for specific inputs, and in case of a shock switching suppliers can be costly and inefficient. Supplier diversification is likely associated with slower recovery from disruptions, while the use of long-term relationships is associated with faster recovery (Jain, Girotra and Netessine, 2016).

However, trade policy uncertainty causes a decline in long-term supplier relationships within GVCs even though such relationships increase supply chain resilience (Schott et al., 2017).

Alternatives in transportation and logistics also help to minimize exposure to shocks in trade routes (Katsaliaki, Galetsi and Kumar, 2021; McKinsey, 2020; Rose, 2017). The blockage in the Suez Canal in March 2021, caused by a massive container ship stuck in the waterway, highlights that a lack of diversification in global trade routes can lead to significant supply chain bottlenecks. Some international shipments had to detour around the Cape of Good Hope in South Africa (Veiga, 2021), and an increasing amount of freight was transported between Asia and Europe by rail to avoid shipping delays. Firms with more diversified trade routes are less likely to experience disruptions following a shock (Huang, 2019) and trade often diverts to alternative ports and trade routes after the original trade routes are hit by natural disasters (Friedt, 2021; Hamano and Vermeulen, 2020). Contracting with multiple transport and logistics services and identifying backup providers in advance can help companies reroute critical shipments when a shock hits.

Increased inventory stocks also can help address short-term supply chain disruptions. Inventories enable firms to continue production in the short run, but also to deal with possible changes in prices if a trade partner imposes export restrictions (Glauber et al., 2020). As shocks propagate, the level of inventories kept by each firm also affects partners that belong to the same supply chain, especially in the case of big firms that serve as hubs to spread shocks in the production network. Inventories are a way to smooth the shock for firms that are dealing with delays in supply chains (OECD, 2020d).

Defining the optimal level of inventories at the firm level is a trickier question. Stockpiling of perishable goods such as medicines and foods can results in waste, while limited inventory stocks can make supply chains susceptible to long-lasting shocks. In this regard, economic losses from transport disruptions increase in a non-linear manner with the duration of disruptions, as some firms start to run out of inventory stocks in the face of long disruptions and are forced to delay their deliveries (Colon, Hallegatte and Rozenberg, 2021). In just-in-time supply chains, production is predicated on a downstream demand signal, which is shared between the supplier and the customer in real time (Pisch, 2020). Diligent information-sharing and coordination along the value chain makes managing those additional inventories cheaper and more efficient.
To cope better with shocks, it is important to enhance supply chain transparency. Comprehensively mapping the supply chain allows for the identification of potential vulnerabilities. Unfortunately, the visibility companies have within their supply chain usually extends only to one tier above them and one tier below (McKinsey, 2020; Scheibe and Blackhurst, 2018). Digital technologies can play a crucial role in enhancing supply chain transparency and enabling new capabilities of real-time reconfigurations (Rose, 2017). Technologies like big data analytics and artificial intelligence (AI), the Internet of Things, advanced robotics, distributed ledger technology, and digital platforms enable companies to run scenarios, assess trade-offs, improve transparency and responsiveness, and ensure trade compliance (George, Ramaswamy and Rassey, 2014; Goering, Kelly and Mellors, 2018; Katsaliaki, Galetsi and Kumar, 2021; Viswanadham, 2018).

While most companies are still in the early stages of developing such systems, some large multinationals have developed “control towers” across geographies and products that provide real-time information on production networks, from inventory levels to road delays, to support the efficient management of risks (McKinsey, 2020; Miroudot, 2020). When a problem occurs, the system runs scenarios to identify the optimal solution (Cosgrove, 2019). However, the development of such systems requires time and resources, and therefore planning.

Digitalization also plays an important role in strengthening the resilience of firms to shocks. Evidence shows that companies with online capabilities can better withstand disruptions, for instance through sales via e-commerce (McKinsey, 2019). The surge of the COVID-19 crisis has accelerated the use of AI and other forms of...
This is particularly important for small firms that have limited resources to sustain disruptions. A survey conducted in the early days of the COVID-19 pandemic showed that 20 per cent of small firms risked shutting down permanently within three months (ITC, 2020). However, small firms that had prepared alternative contingency plans and had online capabilities either gained market shares or suffered less by moving to online marketing and sales either through their own or other established platforms, such as Amazon, Alibaba, Shopify and other similar platforms (Etemad, 2020). In the same vein, a survey by the Canadian Federation of Independent Business (CIBC, 2020) found that of the 26 per cent of business owners that do have online operations, 30 per cent have seen an increase in sales and 25 per cent say they have remained the same compared to pre-COVID-19 levels.

**Government policies to enhance resilience**

Market failures can prevent individuals or firms from fully anticipating or internalizing the risks of disruptions in supply chains (Bacchetta, Bekkers, Piermartini, Rubínová, et al., 2021). Thus, governments and policymakers may have a role to play in identifying vulnerabilities to supply chain disruptions.

The COVID-19 pandemic has highlighted several potential market failures related to the organization of value chains. A first potential failure is a biased assessment of risks. As an extreme event like COVID-19 hardly occurs in a generation, individuals and firms tend to underestimate the probability of such an event and thus underinvest in mitigation strategies. The behavioural literature suggests that the perception of risks related to rare but impactful events can be biased. For instance, Hong, Wang and Yang (2020) argue that when such events hit, economic agents “overreact” in updating their beliefs and become pessimistic, overestimating the risk, thus reflecting bounded rationality. However, as time passes without the anticipated event happening, their beliefs become increasingly optimistic and they begin to underestimate the risk.

It would also follow that firms tend to under-invest in mitigation in normal times when they underestimate risks. Investment in mitigation strategies benefits everyone in an economy by curtailing aggregate risk, and it therefore constitutes a public good that would be underprovided by private actors.

According to this view, there is a potential role for governments to stimulate investment in strategies that mitigate risks of value chain interruption (Mehran, Morrison and Shapiro, 2011). In this regard, policy tools to incentivize firms to invest in risk mitigation strategies, such as regulatory requirements or tax credits for minimum stockholding of inventories, may help enhance preparedness for shocks.

A second potential market failure is imperfect information about the value chain. Firms have difficulty understanding the implications of the complexity of their value chains and the costs of shocks to the economy. A prerequisite for an efficient mitigation strategy is acquiring full information about the structure of the value chain. While a company knows its exposure to disaster risks via its first-tier suppliers or customers, it may not be aware that it is indirectly exposed to disaster risk via its second- or third-tier suppliers or customers. Moreover, companies may be able to mitigate disaster impact by switching to alternative suppliers (in the case of non-customized inputs), but for that they need to be aware of their options. As searching for suppliers is costly, few firms will have invested in the full mapping of potential suppliers (Bernard, Moxnes and Saito, 2019).

Market failures associated with information frictions can be addressed by promoting transparency, possibly helping companies with information about the organization of value chains and alternative suppliers. For example, since the outbreak of the COVID-19 crisis, the government of Canada has developed indices to identify which industries in an economy are more vulnerable to supply chain disruptions on both the supply and the demand sides. This vulnerability index includes components such as reliance on direct and indirect intermediate inputs or exports, and geographic concentration of imports and exports (Boileau and Sydor, 2020). The US administration also recommends improving ability to track supply-and-demand disruptions and improving information-sharing between federal agencies and the private sector to identify near-term risks and vulnerabilities more effectively.

Governments can also help to identify components critical for the economy, such as critical minerals and semiconductors, and to recommend policies to enhance resilience in the supply of these components (White House, 2021). In particular, identifying supply-chain bottlenecks is crucial to ensure the provision of essential goods. The Asian Development Bank, for instance, has developed supply chain maps for products essential to tackling the pandemic, and allows investors, governments and healthcare professionals to access this information in order to
reach out to the companies involved in these supply chains of goods.

A third potential market failure in the organization of value chains is the presence of spillovers along the value chain: when deciding on the level of diversification and the inventory holding, firms may not fully take into account the impact of their decisions on upstream and downstream firms. While firms may have an incentive to invest in risk mitigation, private incentives may not fully align with what is socially optimal (Grossman, Helpman and Lhuillier, 2021). In the case of large firms that act as hubs in production networks, idiosyncratic shocks at the firm-level can result in volatility in aggregate economic performance (Gabaix, 2011), thus creating a negative spillover for the entire economy. Although such vulnerabilities apply to any supply chain, irrespective of whether it is international or not, the risk of disruptions does become magnified in sequential supply chains that are spread across production locations.

In light of the potential market failures, many governments have introduced measures to enhance supply chain resilience by encouraging diversification, reshoring or nearshoring. Several studies have estimated the efficiency and risks associated with different policy scenarios of supply chain reorganization. In Bonadio et al. (2020), one-quarter of the fall in real GDP is due to the transmission of the COVID-19-induced labour supply shock through global supply chains. However, the “renationalization” of global supply chains does not in general make countries more resilient to pandemic-induced contractions in labour supply. This is because eliminating reliance on foreign inputs increases reliance on domestic inputs, which can also be disrupted by nationwide lockdowns. Overall, the average GDP drop would have been slightly larger in a world without trade in inputs and final goods.

A localized regime, in which economies are less interconnected via GVCs, has significantly lower levels of economic activity and lower incomes (Arriola et al., 2020; OECD, 2021a). It trades less and has less geographic diversification of production stages in supply chains. As a result, a localized regime is found to be more – not less – volatile to shocks, because while shocks that originate abroad have fewer and narrower trade channels to propagate within the localized regime, that regime also provides fewer opportunities for adjustment to the shocks. This lack of adjustment channels leads to increased instability in trade, incomes, prices, and ultimately household incomes and expenditures. Similar conclusions are drawn in a study by the Bank of England (D’Aguanno et al., 2021) and in research by Eppinger et al. (2021). These results indicate that re-shoring might be counterproductive in terms of reducing aggregate volatility at significant cost of welfare losses, while diversifying can lower volatility by making increased use of inputs from the rest of the world.

The studies do not take into account the long-term dynamic effects of international trade in encouraging innovation and diffusing technology across countries (Buera and Oberfield, 2020; Cai, Li and Santacreu, forthcoming). In particular, GVCs can be a powerful channel of knowledge spillovers by intensifying contacts between lead firms and suppliers and facilitating the transfer of know-how and technology required for an efficient production (Piermartini and Rubínová, 2021). Therefore, policies to renationalize GVCs may significantly undermine the benefits of trade in boosting innovation and diffusing knowledge.

(c) Trade can enable countries to accelerate economic recovery

Trade can accelerate economic recovery after shocks and disruptions. In particular, trade allows for the international diversification of demand and supply in such a way that trade flows can recover at a different speed from domestic flows in the aftermath of downturns. Put differently, fast trade recovery can boost economic recovery. Importantly, economic recovery from shocks can also be used to rebuild the trading system in a more equitable and sustainable way.

Whether trade recovers faster than the domestic part of an economy depends on various factors, including the speed of recovery in important trading partners, the nature of the shock, policy responses, and relational aspects of trade, especially within GVCs. These factors are discussed in this subsection. In addition, this subsection discusses the role of trade for the recovery of disadvantaged groups, and examines how economic recovery can be used to build a more resilient trading system.

In addition to these links between trade and economic recovery, trade can also support economic recovery through its impact on the level and growth of GDP. An increase in trade tends to raise productivity and innovation which benefits economic growth. This effect can be particularly strong in the aftermath of crises, when fewer workers and less capital are bound within low-productivity firms. In addition, trade in services such as insurance, transportation and logistics can determine the speed of recovery of both international trade and domestic trade. For instance, it is likely that the surge in transportation costs following the high demand volatility during the COVID-19 pandemic has
slowed down trade and economic recovery. The trade-growth nexus and trade in services have already been discussed in Section C3.

(i) How trade recovery supports economic recovery

Exports form a part of GDP and, hence, a faster recovery of exports leads automatically to a faster recovery of GDP. In addition, a rebound of imports can provide necessary inputs to the domestic economy while it is still coping with a shock. In a large sample of countries, almost all experienced more rapid trade growth than GDP growth after the trough in the second quarter of 2020, as can be seen in Figure C.8, given that most of the points are below the 45-degree line, with trade growth on the horizontal axis. While this is partially attributable to the sharp drop of trade in the second quarter of 2020, it still indicates that trade has accelerated economic recovery during the COVID-19 pandemic.

It is important to understand the determinants of trade recovery in order to understand how trade can contribute to economic recovery more broadly. There are various reasons why international trade may recover at a different speed from domestic economic activity. Firstly, trade can benefit from beneficial supply or demand conditions abroad. Secondly, shocks can have differential impacts on the traded sectors of an economy vis-à-vis the non-traded sectors, which, in turn, affects the speed of recovery. Thirdly, trade and trade-related policies can lead to differences in the speed of recovery between trade and domestic sales. Finally, the nature of relationships between firms in GVCs can differ from relationships among domestic firms, and can determine how fast trade recovers.

International demand and supply as a driver of trade recovery

The importance of foreign demand-and-supply conditions to trade can lead to a divergence between how fast the traded sector recovers from a disruption compared to the non-traded sector. In the case of a purely domestic shock, or if the crisis persists longer in the domestic market than elsewhere, trade linkages to other countries can be an important source of supply and demand. These linkages can start the recovery process even before the end of the coping period. In contrast, when the shock is less severe domestically than abroad, the traded sector can slow down economic recovery.

In the context of the COVID-19 pandemic, the beneficial impact of foreign demand and supply can be seen from the relatively strong rebound of trade starting in the third quarter of 2020. This rebound was driven in particular by trade with countries in which the virus was more contained at that time (see Section B5) (Ossa and Le Moigne, 2021; WTO, 2021). Ossa

Figure C.8: Economic recovery has been associated with trade recovery during the COVID-19 pandemic (second to fourth quarter of 2020)

Sources: Authors’ calculations, based on World Bank GDP data (https://data.worldbank.org) (quarterly GDP) and WTO trade data (https://data.wto.org).
Note: The GDP growth rate and trade recovery rate are defined as the percentage change from Q2 to Q4 2020. Trade levels were at their lowest point in April/May 2020. The green line represents the 45-degree line.
and Le Moigne (2021) argue, for instance, that the rapid recovery of production by the Chinese economy in the second and third quarter of 2020 stabilized the supply of goods globally. GDP recovered faster in the second half of 2020 in countries with strong pre-existing trade linkages to countries with few COVID-19 cases at that time (see Figure C.9). The list of countries in the note to Figure C.9 highlights that this effect is partially due to the presence of China, as it was by far the biggest trader among the countries with low rates of COVID-19 infections. Using data from January to June 2020, Espitia et al. (2021) show that the sustained imports of inputs from abroad led to a faster recovery of exports in supply-chain-integrated countries compared to countries relying primarily on the domestic supply of inputs.

More generally, in the aftermath of shocks, imports and offshoring tend to increase under certain conditions which can facilitate recovery of domestic production and exports and relieve the pressure on domestic supply chains (Gassebner, Keck and Teh, 2010; Osberghaus, 2019; Zhu, Ito and Tomiura, 2016). Trade recovery might benefit from changes in preferences that shift demand towards exports from the affected country in the form of a solidarity effect: when foreign importing countries are culturally close to a country affected by shocks or host a relevant diaspora, their imports from the affected country increase up to the point that the negative effects of the shock are balanced out (El Hadri, Mirza and Rabaud, 2018).

The positive impact of foreign demand and supply on trade recovery can be shaped by the diversification of the trading network. As noted above, the question of whether foreign demand and supply can accelerate recovery depends on the impact of shocks on the domestic economy relative to foreign economies. A diversified network, both with respect to the number and the spatial distribution of suppliers and customers, reduces dependence on any particular location or firm and thereby increases the likelihood of having access to stable demand and supply from abroad. The fact that diversification through trade can help countries recover from shocks is supported by the literature on trade and volatility, which finds mainly volatility-reducing effects of trade, especially if trade is diversified (see, for example, Burgess and Donaldson, 2012; Caselli et al., 2020; Haddad et al., 2013). The role of diversification for resilience is discussed in more detail in Section C4.

**The nature of the shock and its impact on trade recovery**

Different shocks have different sectoral and geographical implications, and this has consequences for trade recovery. Due to the COVID-19 pandemic, international trade declined sharply in the second quarter of 2020 but recovered quickly over the following months (see Section B5). While services trade remains depressed, trade in goods is almost at pre-crisis levels one year after the pandemic hit...
In contrast, the recovery of trade after the 2008-09 global financial crisis took substantially longer and remained incomplete for a protracted period of time (Ossa and Le Moigne, 2021).

A comparison of the COVID-19 pandemic with the 2008-09 global financial crisis illustrates how the nature of shocks affects the speed of trade recovery. To begin with, demand and supply were affected differently in 2020 compared to 2009. In 2009, the demand for domestic services in part cushioned the sharp fall in demand for manufactured goods, particularly in developed countries. The subprime crisis resulted in financial defaults among many highly indebted private economic agents, leading to a sudden contraction of the consumption of durable goods in developed countries (Eaton et al., 2016). Durable goods, such as cars or machinery, account for a significant share of merchandise trade, but high-value finished goods also drive trade trends for the intermediate parts and components needed to produce them. The 2008-09 global financial crisis also paralysed corporate investment, as the element of aggregate demand had the highest import share (Auboin and Borino, 2017). The collapse in the demand for investment and durable manufactured products was a major driver of the trade collapse (Bussière et al., 2013).

In contrast, the sanitary crisis and related lockdowns of 2020 affected aggregate supply and demand mainly through the services sector. Services output accounts for 80 per cent of GDP in the most advanced countries, and 50 to 60 per cent in developing countries, an even greater share than in 2009 relative to manufacturing, whose share of GDP has continued to erode (WTO, 2019b). The collapse in global economic activity in the second quarter of 2020 was mainly driven by sharp declines in the demand and supply of services, domestically and internationally (World Bank, 2021c). Domestic retail and wholesale trade, tourism and travel, hospitality, entertainment and cultural activities, and, in general, many activities requiring face-to-face interaction have been severely affected by the lockdowns.

The effects of the pandemic on trade in durable goods differed from those of previous recessions (Espitia et al., 2021; Ossa and Le Moigne, 2021), because the increase in remote work, home schooling, and reliance on home entertainment increased demand for electronic devices. The lockdown did not greatly limit purchases of these goods, as customers can observe and compare their characteristics online; the share of e-commerce in global retail trade rose from 14 per cent in 2019 to 17 per cent in 2020 – a trend which is expected to continue throughout the recovery from COVID-19 (UNCTAD, 2021). Additionally, the high demand for medical goods since the outbreak of the pandemic supported trade flows (Ossa and Le Moigne, 2021). All these changes contribute to explaining the fast recovery of goods trade.

The comparison between the 2008-09 global financial crisis and the ongoing COVID-19 pandemic highlights that the sectoral dimension of shocks is central to the question of whether trade recovery slows down or accelerates broader economic recovery. The global financial crisis hit the real estate and financial sectors first; its impact then hit the heavily traded durable and investment goods sectors. In combination with other factors, such as the contraction of trade finance availability, this caused a slow recovery of trade, hampering economic recovery. In contrast, the COVID-19 pandemic limits economic activity most strongly in sectors that are less trade-intensive, with the exception of tourism, while it raises demand for trade-intensive goods. This allows trade to recover faster and to support economic recovery. Interestingly, in the past, trade in services was more resilient to shocks than goods trade, for instance after the global financial crisis (Loungani et al., 2017), perhaps because demand for services tends to be less cyclical and their production is less reliant on external financing (Borchert and Mattoo, 2009). While these considerations remain valid, the limits on face-to-face interaction during the COVID-19 pandemic have affected services trade more than trade in goods.

Local shocks allow trade to recover faster than global shocks. If a shock is limited to a single country, the likelihood that the country’s international trade recovers faster than its domestic trade is high, as demand and supply from abroad remain stable. In contrast, if the domestic economy is less affected by a shock than its trading partners, trade recovery might be slower. However, if foreign demand is sustained by policy measures such as fiscal stimuli, the fact that domestic supply is unaffected by a shock can even lead to an increase in exports and, as a result, to a faster recovery of trade even in such a scenario. This is evidenced by China’s substantial export growth in the second half of 2020.

The nature of the shock also matters. In contrast to health or financial shocks, large natural disasters and conflicts can cause severe damages to seaports or airports, as well as to other transportation infrastructure (see Section B3). This can slow down trade recovery significantly. Thus, the ability to substitute between ports accelerated the recovery of exports from the 2011 earthquake in Japan considerably, especially with respect to perishable goods and goods subject to just-in-time supply chain demand (Hamano and
Vermeulen, 2020). This is consistent with findings that small countries, which tend to have fewer domestic alternatives, tend to be more affected by natural disasters than large countries (European Commission, 2012; Gassebner, Keck and Teh, 2010). Cole et al. (2017) also show that having alternative transportation arrangements increases the speed of recovery, and Hosoya (2016) and Taghizadeh-Hesary et al. (2019) provide further evidence that the quality of infrastructure can substantially accelerate recovery.

Finally, the nature of a shock can induce actions that allow trade to be more resilient and recover faster in future crises. The COVID-19 pandemic has increased the flexibility of firms by boosting both private and public investments in digital infrastructure. The Inter-American Development Bank (2020) reports, for example, that businesses in Latin America and the Caribbean achieved more digital progress over the first months of the COVID-19 crisis than they did in years. These investments were made in conjunction with regulations that made working from home more widespread and efficient. The ensuing increase in firm flexibility has not only increased the coping abilities of economies but has also accelerated recovery, as digital investments lower trade costs, which enables firms to draw more benefit from their participation in international supply chains.

**Policy as a driver of trade recovery**

Fiscal and monetary policies are a major determinant of trade recovery; indeed, they can have a larger impact on trade than trade policy itself (see Section B6(b) on the role of trade policy in trade recovery). Importantly, policy responses to shocks can have significant medium- to long-term impacts on trade recovery beyond their immediate impact, for instance by affecting trade balances and the political economy surrounding them.

The fiscal stimulus enacted in response to the COVID-19 crisis by several countries is considered to be one of the main reasons why trade has been recovering so quickly from its trough (WTO, 2021). Generous fiscal stimuli in advanced countries have eased the contraction of the domestic economy and have also boosted demand in other advanced, emerging and developing markets. UNCTAD (2021c) presents quantitative evidence confirming positive spill-over effects emerging from the 2020 fiscal stimulus package of the United States, in particular to its neighbouring countries through trade linkages. The OECD (2021c) estimates that the large US fiscal package increased GDP in 2020 by 0.5-1 per cent in Canada and Mexico and by 0.25-0.5 per cent in China and the Euro area by accelerating trade recovery in these regions. Chudik, Mohaddes and Raissi (2021) argue that accommodative policies in advanced countries lead to a reduction of volatility in global financial markets and mitigate capital outflow pressures in emerging countries. In line with these estimates, Figure C.10 shows that fiscal stimuli in advanced economies during the COVID-19 pandemic led to sizeable increases in imports, to the benefit of exporting nations.

However, the downside of fiscal stimuli is widening current account deficits, which can have medium- and long-term impacts on trade recovery. The US fiscal stimulus is estimated to have widened the current account deficit by 0.75 per cent of GDP during the first year of the stimulus (OECD, 2021c), and both bilateral and multilateral trade imbalances are robust predictors of future tariff increases from 2009 onward (Delpeuch, Fize and Martin, 2021). As fiscal stance is one driver of such imbalances (IMF, 2020), differences in the fiscal response to COVID-19 between economies could aggravate trade tensions and lead to trade-restrictive measures. Moreover, as argued by Röhn et al. (2015), growing current account deficits in the aftermath of economic crises make countries susceptible to shifts in foreign investor sentiment, leading to a sudden deterioration of a country’s financial situation. This can slow down trade recovery considerably.

Like fiscal stimuli, expansionary monetary policy can accelerate trade recovery by ensuring stable financing conditions and by contributing to currency depreciation, which in turn increases a country’s competitiveness, at least temporarily (Dornbusch, 1979; Inoue and Rossi, 2019). However, currency depreciation can become a zero-sum game when other countries apply similar strategies, thus hindering a global recovery. Interestingly, Beattie (2021) argues that, in the context of the COVID-19 pandemic, the scenario of a weak dollar and a subsequent currency war is rather unlikely. Instead, the extensive US fiscal stimulus package could lead the US Federal Reserve System to tighten monetary policy, which could result in an appreciation of the US dollar. This suggests that an appropriate balance between monetary policy and fiscal stimuli is critical in the aftermath of a crisis to prevent exchange rate distortions. Mishra and Rajan (2016) advocate the international collaboration of countries in the implementation of macroeconomic policies to avoid adverse spill-over effects such as exchange rate distortions.

**The relational nature of GVCs**

Trade within value chains can be more resilient than other aspects of trade due to the relational nature
Recent estimates suggest that more than two-thirds of global trade occurs within value chains (WTO, 2019). Some relationships between firms in GVCs are characterized by long-term, just-in-time practices that require closer links between firms than more shallow one-off transactions. These firms can also trade highly differentiated inputs that lead to significant interdependencies between them. Based on survey evidence from France, a study finds that about 60 percent of French international trade flows depend on firms relying on just-in-time supply chains employing about two thirds of all French manufacturing workers (Pisch, 2020).

The advantage of long-term supply chain relationships for recovery can be manyfold, as they create incentives for cross-firm support in terms of technology or capital both during and outside of crises. Long-term relationships in supply chains can raise profitability by decreasing the need for inventory stock and costly quality inspections, as repeated interactions increase the incentives for suppliers to ensure quality (Schott et al., 2017). Bombardini et al. (2020) find that firms with a higher share of long-term supply chain relationships benefit from size and productivity effects; for example, Cajal-Grossi, Macchiavello et al. (2019) report that international buyers pay larger mark-ups to the suppliers in the Bangladeshi garment sector with whom they have more long-term relationships. Similarly, Minetti, Murro et al. (2019) show that small and medium-sized Italian firms exposed to bank credit rationing and which have weaker relationships with banks benefit from long-term trading relationships with large and international trading partners as an alternative means of addressing liquidity shortages. In addition, Pisch (2020) argues that information flows and transparency are higher within just-in-time supply chains due to the high coordination requirements.

Long-term relationships can increase the likelihood that a firm’s trading links will survive crises, which, in turn, allows for a faster recovery. If long-term supply chain relationships offer an additional margin of adjustment during shocks, they can make firms more resilient and allow them to recover faster. For example, publicly traded US firms recover faster from supply shocks when relying on long-term relationships compared to firms with a more diversified supply network and more ad hoc transactions (Jain, Girotra and Netessine, 2021).
However, long-term relationships in supply chains can also slow down recovery, because they are costly to establish and involve significant sunk costs (Antràs, 2020; Beverelli et al., 2019). This implies that when a disruption severs such a relationship, it can take time to replace it. In a period of heightened uncertainty, such as during or following a shock, fewer new supply chain relationships are formed, and this affects products that more commonly feature long-term relationships (Martin, Méjean and Parenti, 2020). Reliance on long-term relationships also implies that the supplier network is less likely to be diversified, which can lead to bottlenecks when shocks are concentrated. Thus, firms with more diversified supply networks recovered faster from the 2011 Tōhoku earthquake and tsunami (Cole et al., 2017; Todo, Nakajima and Matous, 2015), and Toyota and other automobile manufacturers, one of the earliest adopters of long-term relationships in supply chains, moved to a more diversified supply network in response to the earthquake (Matous and Todo, 2017).

This at first sight contradictory evidence suggests that the questions of whether firm-to-firm relationships survive shocks and whether supply-chain support can mitigate the impact of shocks are central to determining whether the relational nature of supply chains supports or slows down economic recovery. Natural disasters or conflicts are geographically concentrated, and can lead to severe production disruptions even if lead firms can ease the liquidity constraints of suppliers during the shock. In contrast, the impact of macroeconomic and financial shocks or of technological and operational shocks can be significantly mitigated by intra-supply-chain support. This notion is empirically buttressed by evidence from Chile showing that firm-to-firm supply chain links are resilient in small shocks but can be severed by relatively large shocks (Huneeus, 2018).

As a result, the evidence can be interpreted in two ways. First, it can suggest that the relational aspect of GVCs can indeed facilitate trade recovery. However, such a positive link requires the survival of firm-to-firm links even during large shocks. Firms can increase the resilience of supply-chain links by monitoring their suppliers, including suppliers beyond the first tier and other strategies (see Section C4(b) and Mirroudot, 2020), but policies to that effect are necessary too. During the 2008-09 global financial crisis and the COVID-19 pandemic, several countries enacted short-time work schemes that allowed firms to retain workers even during periods of subdued demand or lockdowns (OECD, 2020a), rather than letting them go. This can accelerate recovery by sustaining the accumulated job-specific experience of employees and reducing the need for costly and time-consuming employee searches once demand picks up again or post-lockdown. A similar approach may be needed for firm-to-firm links in supply chains. While many of the existing policies targeted at firm survival contribute to the survival of links, more targeted policies, that take into account key bottlenecks in global supply, might be possible.

Second, the evidence suggests that diversified supply networks might be more conducive to the fast recovery of supply chain trade in more conflict-prone regions, or in regions that are more frequently affected by natural disasters, while long-term relationships are preferable for most other regions. Optimal supply chain organization needs to take into account regional characteristics and risk profiles in order to improve the ability of supply chains to recover from shocks rapidly.

(ii) Trade and the economic recovery of disadvantaged groups

In the discussion on economic resilience and the role of international trade, it is critical to pay attention to the resilience of disadvantaged groups in society. As already noted in Section B, the effects of a crisis on certain demographic groups or types of firms, such as MSMEs, are generally more severe than on other segments of the population, but their recovery is of vital importance for the resilience of the entire society (ITC, 2020). Similarly, least-developed countries (LDCs) have fewer resources to dampen the effects of crises and depend on foreign markets for recovery. Unfortunately, disadvantaged groups are typically less prepared for a crisis event, often due to resource constraints and unequal access to information. This means that the impact of a crisis can be relatively more severe for these groups and they will struggle more to be resilient and will need more time, on average, to return to pre-crisis levels. International trade, which is critical for imported supplies and creating demand for exported goods and services, plays both a direct and indirect role in the recovery of these groups.

Trade disruptions generally have an indirect negative impact on women and MSMEs. Women are often employed in services sectors that engage in low levels of cross-border trade, like education, health and social services, and are disproportionately engaged in informal trade at border crossings in certain developing countries (Bouët, Odjo and Zaki, 2020; WTO, 2018). Similarly, many MSMEs participate relatively less in trade directly, being more reliant on domestic demand (The Economist, 2014; WTO, 2016). As a result, research shows relatively
smaller trade losses attributable to these populations (Hallegatte, 2014; The Economist, 2014; Wheatley, 2021; World Bank, 2021b; WTO, 2016). However, a significant amount of trade in some developing economies occurs at border crossings and is carried out by MSMEs and informal businesses, meaning that border closures can severely disrupt these small-scale traders (UNCTAD, 2021a; World Bank and WTO, 2020a).

Even if they are not direct traders, these groups can still be important links in global supply chains and indirectly dependent on international trade (The Economist, 2020). According to a recent Asia-Pacific Economic Cooperation (APEC) survey, the majority of the MSMEs surveyed were connected to at least one large business (McAuley, 2020), and manufacturing enterprises such as apparel, footwear and electronics, especially in developing economies, which are tightly linked to GVCs, often principally employ women (World Bank and WTO, 2020).

Many of the issues considered elsewhere in this report are particularly important for LDCs. For example, LDCs do not have the resources to sustain a large domestic stimulus policy, and inevitably these economies need to turn abroad to find demand for their products and services and to stimulate economic growth (Razzaque and Ehsan, 2019). In terms of infrastructure, following a disaster, especially a natural event like a storm or hurricane, external assistance – whether in the form of physical aid or emergency workers – must arrive via the same channels as regular trade, and LDCs may find it challenging when a large influx of assistance arrives following a catastrophe unless they already have a strong trading system in place to compensate for the necessity of sharing infrastructure channels (Jackson and Roberts, 2015). In order to support trade by LDCs, it is recommended that institutional capacity development improve trade facilitation (including the digitalization of trade processes), transportation infrastructure and customs changes, so that the cross-border trade of small shipments may be encouraged (UNCTAD, 2021a).

For many vulnerable groups, gaining access to any kind of credit can be a struggle. These groups have fewer resources and more trouble sourcing funding, especially trade finance, either because they lack the required documentation and know-how, or because the amounts they need are too small to interest a commercial lender. This means that these groups are often obliged to rely on internal funds or finance from friends and family, all of which are less reliable than commercial lenders (ADB, 2013; World Bank, 2021b). Those MSMEs that do access financing are highly dependent on bank loans, whereas banks are not dependent on MSMEs for their business revenue, and this creates an unequal power relationship (Gourinchas et al., 2020; The Economist, 2009). Economic crises, such as in 2008-09, when finance became scarce across the board, can create significant problems for businesses without other financing options, as banks turn away from more risky subjects like MSMEs (The Economist, 2009). Although there are significant differences in access to finance by businesses based on macroeconomic levels of development, smaller firms are more constrained across the board (Apedo-Amah et al., 2020). Indeed, Dursun-de Neef and Schandlbauer (2020) found that, while access to finance declined for all firms at the start of the COVID-19 pandemic, the decline in trade credit was larger for smaller firms. The difficulties in guaranteeing trade finance mean that exporting MSMEs have a harder time both coping with and recovering from shocks.

Women in certain economies and demographic groups can also experience significant difficulties in accessing finance, whether because of collateral requirements or gender discriminatory banking requirements, and this can constrain recovery and trade for firms owned by women in such circumstances (UNCTAD, 2021b; World Bank, 2021a).

Trade facilitation policies, especially those that support global supply chains, could be one of the most efficient ways to speed recovery by helping MSMEs to participate as exporters and/or importers and increasing the trade volumes of those that already participate in trade. Measures such as the automation of border processes, the simplification of fees and non-tariff barriers, the streamlining of procedures and the inclusion of MSMEs in regulatory consultations, would be the most efficient ways to help these firms recover from the current shock and become more resilient in the future (OECD, WTO and UNCTAD, 2021). Trade facilitation measures that make full use of digital solutions can also be especially beneficial to small, cross-border traders, many of whom, in certain economies, are women (Sun and Larouche-Maltais, 2020).

Economic recovery as a means to build a more sustainable trading system

This report particularly examines how trade affects economic resilience, and economic recovery can also provide an opportunity to rebuild the trading system in a more sustainable, resilient and equitable way. This subsection looks at how economic resilience,
and in particular, recovery can lead to a better trading system.

Job losses and broken relationships between suppliers and customers caused by crises lead to substantial welfare losses, but they can also lead to the improved reconstruction of supply chains, and of trade more generally. Substantially fewer resources are tied down during crises and, hence, resources can more easily be shifted to sustainable purposes. Crises can also reveal important information about existing problems in the trading system, from bottlenecks in supply chains to distributional inequities, pointing to where improvements are needed. Related to the previous subsection on disadvantaged groups, recent research has highlighted that the gains from trade are not shared equally among workers or regions (WTO, 2017; WTO et al., 2019) and that barriers in the trading system can prevent, for instance, women or MSMEs from fully participating in trade (WTO, 2020; WTO, 2016). In addition, the trading system can do more to address global challenges, from climate change to decent work in supply chains (UN Global Compact, 2018; WTO and UNEP, 2018). Building a more sustainable trading system also can raise productivity, increase transparency, incentivize innovation and unlock demand for sustainable goods.

Policy incentives can make an important contribution when building a more sustainable trading system. In this regard, the substantial fiscal and monetary responses to the COVID-19 pandemic could be important tools to incentivize firms to address societal and environmental concerns. According to a survey conducted by the OECD (2020b), many OECD member countries have either already evaluated the ecological and social impact of implemented rescue measures and packages or are planning on doing so for forthcoming programmes. Similarly, many developing countries are including green production and inclusiveness targets in their fiscal responses to the pandemic.

The European Union’s new trade policy strategy, for instance, is built around a sustainability pillar which includes aspirations to integrate the Paris Agreement on climate change into all future trade agreements, to frequently evaluate the effectiveness of implemented measures, and to use the information gained in future negotiations (European Commission, 2021a). The fiscal stimulus package is intended to help build a greener, more digital and more resilient Europe.

In another example, United States Trade Representative Katherine Tai focused in her first speech in this position, in April 2021, on trade policy as a tool to protect the environment and tackle climate change. She emphasized that trade agreements should include environmental provisions going forward (Office of the United States Trade Representative, 2021).

In another example, the Government of Colombia has organized its recovery package around five pillars, including clean and sustainable growth and support for vulnerable and rural communities (Gobierno de Colombia, 2020).

Finally, the Republic of Korea’s stimulus package aims to transform its economy from a carbon-dependent economy to a green one (IMF, 2021).

Policy can also help firms to establish supply chain links that ensure that trade is environmentally and socially sustainable. The United Kingdom and France have already passed laws requiring firms to conduct due diligence checks on their supply chains, while Germany and the European Union are in the process of passing or formulating laws. An important side benefit of due diligence laws is that they can increase transparency along supply chains and, thereby, increase resilience. This allows firms to also ensure that other policy goals are achieved, such as the better representation of women-led firms in the supply chain, or the reduction of CO2 emissions and the strengthening of labour and ecological standards (Granskog et al., 2020; McKinsey Global Institute, 2020).

Some of these policies are based on the United Nations Guiding Principles on Business and Human Rights, which can serve as a building block for countries working on due diligence laws. When drafting a supply chain due diligence law, authorities must consider potential difficulties that come with it, such as the related increase in transparency requirements, as well as compliance and trade costs for firms. A suitably formulated law, complemented by capacity-building, can guarantee solid export possibilities, in particular for developing countries and their MSMEs. The recovery process after a crisis is likely an optimal point in time for such laws, given that supply chains are naturally restructuring in this period.

Gender inequality has also received increased, albeit more limited, attention, in particular as COVID-19 has led to a widening of already existing gender gaps (see Section B3(c)). After evaluating the impact of its first COVID-19 rescue investment programme on gender equality, Iceland pledged to adjust the subsequent fiscal package in order to give stronger support to women (OECD, 2020b). The Government of Canada has allocated CAD 100 million to its Feminist Response and Recovery Fund (Government of Canada, 2020).
of Canada, 2021). The European Commission has also included gender equality as a consideration in its fiscal stimulus package (European Commission, 2021b). The American Rescue Plan Act of 2021 includes components that help schools and day-care institutions to remain open and financially supports families with children – measures which help women engaged in trade in particular (American Rescue Plan Act of 2021, 2021).

Policies that attempt to capitalize on digitalization can also help to address the trade-gender inequality nexus, as well as the trade-regional inequality nexus. They also help MSMEs to connect to foreign markets by lowering information frictions and market access costs, which tend to be particularly restrictive for smaller firms (WTO, 2016).

The Government of Malaysia has, for example, introduced measures that aim to increase job security in the gig economy (i.e., in which firms tend to hire independent contractors and freelancers rather than full-time employees) and accelerate digital technology transformation and the reskilling and upskilling of Malaysians to serve international clients while working from home (Said, 2020). The Government of Peru has implemented measures to connect more than 3.2 million Peruvians from the country’s rural areas to the internet (Gobierno de Peru, 2021). The European Commission has announced that one-fifth of its fiscal stimulus package will be spent on the digital transformation (European Commission, 2021b). The Government of Ireland plans to address regional inequality by creating a network of 400 remote working hubs and using tax breaks to support employees working from home (Government of Ireland, 2021), as a means to helping workers who are less mobile or more time-constrained due to domestic responsibilities. This is often particularly the case for women, and can lead to inequities in the trading system (Balcer, Javorcik and Ulltveit-Moe, 2018; Orkoh and Stolzenburg, 2020; World Bank and WTO, 2020).

These examples highlight that the aim to build a stronger and fairer trading system influences the fiscal response of a range of countries with the governments of the world’s 50 largest countries having invested US$ 341 billion in green recovery between the onset of the COVID-19 crisis and early 2021. However, while this is a large figure, it accounts for only 18 per cent of what these countries spent in total on long-term recovery from the pandemic up until then (O’Callaghan and Murdock, 2021), and a significant part of COVID-19-related funding has been earmarked for carbon-intensive sectors. Respective measures include airline bailouts and expanding coal mining, as well as investments in oil and gas generation. G20 governments have announced support for fossil fuel industries which considerably exceed the sum budgeted for clean energy (SEI et al., 2020). Moreover, UNCTAD (2020b) states that it is not only environmental aspects which have fallen short in recent stimulus packages, but also issues of gender equality, food security and agriculture, which have been addressed to an insufficient extent given the targets set by the United Nations Sustainable Development Goals (SDGs) and the setback to the SDGs caused by the pandemic. As a result, the fiscal response will likely fall short to address the inequities and vulnerabilities of the trading system.

In addition, elements of fiscal responses that support re-nationalizing supply chains are unlikely to increase resilience and may be justifiable only for very finely specified products. The present report highlights the fact that international trade and cooperation are the most efficient tools to achieve an optimal trade-off between efficiency and resilience. It also highlights the importance of diversification for trade and economic resilience. Policies that support the geographical diversification of suppliers rather than re-shoring therefore appear better adapted to address concerns about bottlenecks in supply chains. Some countries have put in place financial incentives to support supply chain reorganization. Japan has, for example, allocated around US$ 5 billion to enhance domestic manufacturing or diversify supply chains in Asia. However, the majority of the funds have been used so far for domestic re-shoring (Nohara, 2021).

Nevertheless, researchers agree that a more sustainable recovery is still attainable. As argued by O’Callaghan and Murdock (2021), committing to sustainable investments has become easier for governments in 2021 than it was in 2020, when measures were largely focused on taking urgent control of the pandemic. With a widening scope of funding going to long-term recovery policies, governments now have the opportunity to invest more sustainably relative to what has been observed since the outbreak of the health crisis. UNCTAD (2020b) proposes that the SDGs can serve as a blueprint for action in this regard.

Concrete measures that can be taken include promoting green energy and transport, supporting energy efficiency, increasing the transparency of countries’ climate balances, retraining workers, and committing to global cooperation (Geddes et al., 2020; O’Callaghan and Murdock, 2021; OECD, 2021d; SEI, 2020). Researchers emphasize that a commitment to a
4. The role of trade diversification in resilience

One of the most important insights to be gathered from the discussion in previous sections is that diversification of the production and export structure is an important determinant of the ability of countries to prepare for, cope with and recover from shocks. If the production and export structure is concentrated in a few products, price volatility is likely to translate into large fluctuations in export revenues, increasing aggregate (i.e. macroeconomic) volatility. If exporting is concentrated on few export destinations, destination-specific demand shocks will also have a large impact on export revenues and volatility, and the capacity to take advantage of positive spillover effects of foreign import demand during recoveries will be limited. In the absence of geographical import diversification, destination-specific supply shocks are likely to propagate in the economy, again increasing aggregate volatility.

This section digs deeper into the impact of trade diversification on preparing for, coping with, and recovering from shocks. The first part of this section shows evidence that export and import diversification dampen volatility, which is considered an indicator of lack of resilience to shocks, i.e., trade diversification increases resilience to shocks.

At the same time, there is evidence that diversification in the aggregate (at country-level) has increased only modestly in recent decades. This is likely due to two factors. First, micro-level differences in diversification due, for instance, to the entry and exit of firms that may differ in their degree of diversification, may not be captured by aggregate measures. Second, it may be difficult for international firms to highly diversify their import and/or export structure in the presence of the fixed costs of entering foreign markets, or to build a large pool of suppliers of intermediate goods or services in the presence of various transaction costs. This will limit aggregate trade diversification.

In the light of the beneficial impact of export and import diversification in enabling to prepare for, cope with and recover from shocks, the section also discusses which government policies foster diversification of the trade structure of the economy.

At the outset, it is worth emphasizing that several of the aspects of international firms’ diversification that contribute to aggregate trade diversification depend on the organization of supply chains, which is discussed in Section C3. This section complements the discussion in Section C3 by focusing on the channels through which aggregate trade diversification increases the ability of countries to prepare for, cope with and recover from shocks, and by discussing which policies can foster diversification.

(a) Trade diversification reduces volatility, thereby increasing resilience

Aggregate (i.e., country-level) volatility negatively affects economic growth. As reported by WTO (2014), the principal channel through which volatility reduces growth is through its damaging effect on capital accumulation, as it makes the returns on investment in human and physical capital more uncertain. Welfare losses may also arise because of the difficulty in smoothing consumption. Furthermore, volatility tends to worsen income inequality.

Figure C.11 presents descriptive evidence of a negative correlation, at the country level, between macroeconomic volatility – defined as volatility in the cyclical component of GDP, i.e. volatility around the trend growth of GDP – and various measures of export and import diversification that are used throughout this subsection: product export diversification, geographical export diversification, and geographical import diversification.28

The negative empirical correlation between trade diversification and aggregate volatility displayed in Figure C.11 confirms that trade diversification enhances resilience.29 This is likely to occur because of the “diversification through trade” mechanism highlighted by Caselli et al. (2020). Trade allows a country to diversify its sources of demand and supply, thereby reducing the country’s exposure to country-specific demand and supply shocks. For example, when a country has multiple trading partners, a domestic recession or a recession in any one of its trading partners translates into a smaller demand shock for its producers than when trade is more limited (WTO, 2014). Openness reduces volatility through this diversification mechanism as long as it does not expose a country to disproportionately large and volatile trading partners or partners whose shocks are highly correlated with a country’s own.30

Caselli et al. (2020) estimate that for all of the 24 countries in their analysis, except China, macroeconomic volatility would have been larger had trade costs not decreased since the early 1970s.
How has trade diversification evolved over time?

Trade diversification evolves slowly over time, and countries that have reached a certain level of development tend to reconcentrate their production and exports structure (see Cadot, Carrère and Strauss-Kahn, 2011; Imbs and Wacziarg, 2003). However, as shown by Koren and Tenreyro (2007), they tend to do so in intrinsically less volatile sectors, with little impact on macroeconomic volatility (i.e. without becoming less resilient).

With these caveats in mind, this subsection presents descriptive evidence that trade diversification has increased, in the aggregate, in recent years. Figure C.12 displays indexes of product export diversification (left panel) and of geographical export diversification (right panel) in 2003 (horizontal axis) and in 2018 (vertical axis). Most observations lie above the 45-degree line, indicating an increase in export diversification, in particular in terms of geographical scope, between 2003 and 2018.

The aggregate measures of export diversification displayed in Figure C.12 do not necessarily reflect similar trends in the evolution of export diversification at the level of individual firms, which is important because the extent of diversification by individual firms matters for aggregate fluctuations. The sparse
available firm-level evidence on export diversification does not allow analysis over time. However, it suggests that most exporting firms have generally low levels of diversification.

In 2007, large French exporters tended to serve more destinations and more buyers within a destination than small exporters: the 20 per cent of firms that served more than six EU destinations accounted for almost 70 per cent of the value of French exports, and the 12 per cent of exporters with more than ten partners in a destination represented 40 per cent of the aggregate flow (Kramarz, Martin and Méjean, 2020). Even large exporters, however, were poorly diversified: 60 per cent of French exporters had at least 90 per cent of their sales in a single destination country, while 90 per cent of French exporters had at least half of their sales in a single destination country. And among the 12 per cent of exporters that served more than ten buyers, many served tiny importers with a cumulative share of less than 10 per cent of the firm’s exports.

Overall, for the vast majority of French exporters, at least half of export sales were accounted for by a single partner in a single destination (Kramarz, Martin and Méjean, 2020). These exporters were largely exposed to buyer- and match-specific demand shocks, which could, in principle, be diversified along the firm’s portfolio of sales. Since large exporters were also the largest firms in the economy, and in light of the fact that idiosyncratic shocks to large firms contribute to aggregate volatility (Gabaix, 2011), the limited diversification of large exporters exposed the overall economy to more macroeconomic volatility.

Export volatility and export diversification in China were negatively correlated for large exporters over 2000-06, but positively correlated for small exporters (Vannoorenbergh, Wang and Yu, 2016). They explain the latter result by noting that among small exporters, a more diversified pool of destinations makes firms more likely to export occasionally to some markets, thereby raising export volatility. Consistent with Kramarz, Martin and Méjean (2020), export diversification was found to be limited: on average, a Chinese firm exported to seven markets in 2000-06, but 70 per cent of the export value went to the top destination.31

Import diversification has attracted comparatively less attention by policymakers than export diversification (Cadot, Carrère and Strauss-Kahn, 2014). Diversification by source country might impact productive efficiency and welfare in two ways (Jaimovich, 2012). First, products from different countries within the same category may be imperfect substitutes. For both intermediate and final goods, a larger set of import sources will raise welfare because of “love for variety” effects. Second, diversifying the sources of imports reduces exposure to country-specific demand and supply shocks, since importers can mitigate those shocks by shifting part of their spending to suppliers from other countries. Furthermore, in the absence of diversification on the import side, countries are exposed to the risk of policy

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**Figure C.12: Product and geographical export diversification has increased in recent years**

![Graph](http://www.cepii.fr/cepii/en/bdd_modele/bdd_modele.asp)


Note: The figure compares the product and geographical export diversification indexes between 2003 and 2018. See note to Figure C.11 for the definitions of the diversification indexes. The straight line is the 45-degree line. Product export diversification (panel (a)) increased for 136 countries, while it decreased for 85 countries. Geographical export diversification (panel (b)) increased for 174 countries, while it decreased for 47 countries.
changes, such as export restrictions, in exporting countries (Bacchetta et al., 2021).\(^{32}\)

In line with studies such as Parteka and Tamberi (2013), Figure C.13 provides descriptive evidence that import diversification has increased, in the aggregate, in recent years. The figure displays indexes of geographical import diversification in 2003 (horizontal axis) and in 2018 (vertical axis).\(^{33}\) Most observations lie above the 45-degree line, indicating an increase in geographical import diversification between 2003 and 2018.\(^{34}\)

As mentioned in Section C3, the outbreak of the COVID-19 pandemic has revived interest in import diversification to avoid supply bottlenecks, especially in essential goods. The available evidence only concerns levels, rather than changes over time, and does not provide detailed firm-level information. Nonetheless, the extreme concentration of imports in terms of number of suppliers appears to be rare (Guinea and Forsthuber, 2020; Jaravel and Méjean, 2021).\(^{35}\)

(c) **Despite the presence of sector-specific obstacles to diversification, government policy can help**

Many of the costs incurred by international firms in organizing their trade network are fixed, i.e. independent of the amount produced, and sunk, i.e. they can hardly be recouped (Antrás, 2020). Fixed costs constitute a “technological” obstacle to trade diversification that should be taken into account when designing policy to foster diversification (discussed below). The fixed costs of entering foreign markets limit the degree of export diversification by reducing the degree of variation in the extensive margins of trade, i.e. number of products exported or of destinations served (Helpman, Melitz and Rubinstein, 2008).\(^{36}\) Fixed costs also limit the ability of firms to build a pool of suppliers from a large number of countries (Antrás, Fort and Tintelnot, 2017) and, therefore, the extent to which import diversification is possible. As discussed by Bacchetta et al. (2021) in the context of supplier diversification in value chains, fixed costs that limit or prevent such diversification are sector-specific, and hinge on three economic characteristics.

First, some manufacturing sectors are capital-intensive, featuring significant economies of scale (McKinsey Global Institute, 2020), including significant upfront investment in production and cost savings due to large orders, which are logical obstacles to the diversification of suppliers. Descriptive aggregate evidence consistent with the insight that capital intensity can constitute an obstacle to diversification is provided in Figure C.14, which shows a negative correlation between capital intensity and import geographical diversification at the country-level.

![Figure C.13: Geographical import diversification index has increased in recent years](image)

*Source: Authors’ calculations, based on the BACI database (http://www.cepii.fr/cepii/en/bdd_modele/bdd_modele.asp).*

*Note: The figure compares the geographical import diversification index between 2003 and 2018. See note to Figure C.11 for the definition of the diversification index. The straight line is the 45-degree line.*
Second, relationships between buyers and sellers along supply chains are complex and require relationship-specific investments, such as purchasing specialized equipment or customizing products. This means that suppliers and buyers need to develop specific relationships to configure production through repeated interactions, especially in the presence of weak contract enforcement (Antràs, 2020). Identifying new suppliers and managing the production process can be costly and time-consuming, resulting in a certain “stickiness” in supply chain relationships (Huneeus, 2018; Monarch, 2021). Based on the duration of individual buyer-seller relationships in French trade statistics, Martin, Méjean and Parenti (2020) construct a sector-level index of relationship stickiness, showing that it is correlated with measures of relationship-specificity and contract complexity. Descriptive evidence that such relationship stickiness is an obstacle to diversification on the import side is provided in Figure C.15, which shows a negative correlation between the share of imports of relationship-sticky products in total imports and geographical import diversification at the country-level.37

The third sector-specific characteristic affecting the costs of diversification is the intangible component of production. Sectors differ widely in their intellectual property rights (IPR) intensity (EPO and EUIPO, 2019), as well as in the amount of tacit, non-codifiable knowledge in the production process (WTO, 2020b). In IPR-intensive sectors, as well as in sectors where knowledge is largely tacit, the fear of expropriation of intellectual property or imitation may prevent companies with intangible assets from engaging with a wide range of suppliers, and rather opt for vertical integration where the company owns or controls its suppliers (Antrás and Yeaple, 2014; Bolatto et al., 2017). Descriptive evidence in Figure C.16 suggests, however, that countries that import relatively large amounts of patent-intensive and copyright-intensive products tend to do so from a well-diversified set of importers. This positive correlation might be explained by the fact that rich countries, which are more diversified, are also on average the largest importers of sophisticated products, which are more IPR-intensive.38

Against this background of a series of sector-specific obstacles to diversification, governments...
have employed a toolkit of policies to promote trade diversification. Such a toolkit is vast, because there are many factors that affect the incentives of firms to export or import new products, and to export or import existing products to (from) new markets.

Four considerations are worth making at the outset.

First, the type of trade diversification that has mostly been at the forefront of the academic debate and of economic policy is export diversification.\(^{39}\)

Second, since firms’ export and import diversification increases with firms’ productivity, any policy that increases firms’ productivity (including policies to promote innovation, discussed in Section C of WTO, 2020b) is also likely to increase diversification.

Third, government intervention to support trade diversification is justified by various market failures. These include lack of information about the destination countries; positive spillovers on other firms resulting from a firm’s investment in acquiring information on whether a new product can be exported profitably; the threat of entry by imitators, which reduces the number of “discoveries” of export destinations,\(^{40}\) and inter-industry spillovers, whereby export discoveries in one industry lead to discoveries in another industry (Hausmann and Hidalgo, 2011).

Fourth, there is no one-size-fits-all approach when it comes to policies to foster diversification, neither across countries nor within countries. At the initial stages of economic development, industrial policy, such as subsidies, may have limited impacts if institutions are weak and there is limited capacity to implement complex policies (OECD and WTO, 2019).\(^{41}\) Box C.3 discusses the need for diversification in Africa and the role of the African Continental Free Trade Agreement (AfCFTA) in promoting diversification.

Four types of policies tend to foster trade diversification (OECD and WTO, 2019).\(^{42}\) First, an appropriate incentive framework needs to be in place. A clear, transparent and predictable business regulation and investment policy can create incentives for firms to diversify by reducing the costs and risks of investing in new activities. Tax regulation, credit and labour market regulation, entry and exit business regulation, intellectual property rights regulation, and investor protection laws determine the incentives of firms to engage in new activities.

Sources: Authors’ calculations, based on the BACI database (http://www.cepii.fr/cepii/en/bdd_modele/bdd_modele.asp) and Martin, Mejean and Parenti, (2020).

Note: The figure compares relationship stickiness and geographical import diversification in 2018. The diversification index is the same as used in panel (a) of Figure C.11. See note to Figure C.11. for its definition and construction from BACI data. The share of imported relationship-sticky products is computed as the ratio of overall imports by importing country \(j\) in HS6 products \(k\) that are classified as relationship-sticky to overall \(j’\)s imports. Relationship-sticky products are defined as products with relationship stickiness above the median in the classification of Martin, Mejean and Parenti, (2020).
The appropriate design of trade policy, both at home and abroad, can foster diversification. Export diversification and upgrading the value-added content of exports are hindered by import protection at home, which acts like a tax on exports because it raises the relative price of imports relative to exports (Lerner symmetry). Tariff escalation (i.e., a situation in which relatively higher imports duties are applied on processed products compared to those on the corresponding raw products) in destination markets is also likely to hamper export diversification, while there is evidence that some trade preference programmes affording developing countries and LDCs high preferential margins from tariffs and favourable rules of origin, such as the Generalized Scheme of Preferences (GSP), lead to increasing ranges of export products (Persson and Wilhelmsson, 2016).45

Standards and other non-tariff measures in destination markets can increase exports by addressing information asymmetries on product quality and safety (WTO, 2012), but they can also raise fixed market entry costs, limiting export diversification.46 Dennis and Shepherd (2011) find...
Box C.3: The role of regional trade cooperation in coping with and recovering from the COVID-19 pandemic in Africa

The COVID-19 pandemic resulted in a fall in Africa’s GDP growth from 3.3 per cent in 2019 to 2.1 per cent in 2020 (ADB, 2021), as Africa experienced its worst recession in 50 years. In East Africa, for example, sectoral cash flows plummeted, particularly in services requiring face-to-face contact, like tourism and hospitality (see Figure C.17).

These sectors in 2018 contributed 8.5 per cent to Africa’s GDP, 6.7 per cent to employment, and 30 per cent to service exports, a major foreign exchange earner (Jumia, 2019).

Diversification is low in African economies, with most of them producing and exporting only a few agricultural or mineral products, concentrating on the lowest level of the value chains, producing and exporting unprocessed products, and importing and exporting to only a few countries. This increases their vulnerability to external shocks. Moreover, most African economies rely on imports for some of the critical goods that were required during the pandemic. Thus, the closure of borders and disruption of production value chains, in combination with export restrictions in some producing countries, led to shortages of supplies such as disease-testing reagents, masks, ventilators and pharmaceutical drugs, as well as vaccines. Hence, diversification and developing manufacturing are important for Africa to reduce vulnerability to shocks and ensure access to essential goods.

One avenue to increased diversification is to encourage greater trade within the continent. Intra-African trade fell from a high of 20 per cent of total trade in 2015 to 16 per cent in 2019. Data on the share of intra-African trade in 2020 are not yet available. One indicator of the trend is that during the first six months of 2020, Kenya’s trade to other East African Community (EAC) countries appears to have been more resilient than its trade with countries outside the EAC (UNECA, TradeMark East Africa and African Economic Research Consortium, 2021) (see Figure C.18).

Trading under the African Continental Free Trade Area (AfCFTA) started in January 2021 based on the principle that increasing levels of industrial production are necessary for African countries to move up the ladder in GVCs (Attiah, 2019). Through AfCFTA, regional value chains could be created, and integration into GVCs could be fostered. AfCFTA increases the continent’s bargaining power in the global market. Its consolidated market, a combined population of one billion people and a GDP of over US$ 3.4 trillion, provide opportunities for product diversification, industrial growth, home-grown solutions and the development of regional value chains.

Figure C.17: Most sectors in East Africa experienced a significant reduction in cash flow in 2020

![Figure C.17: Most sectors in East Africa experienced a significant reduction in cash flow in 2020](source: East African Business Council (2020).)
Box C.3: The role of regional trade cooperation in coping with and recovering from the COVID-19 pandemic (continued)

Figure C.18: Trade between Kenya and other EAC countries was particularly resilient during the first few months of the COVID-19 pandemic

The response to the shortages due to the COVID-19 pandemic show that there is potential for African industries to respond to local demand. The inadequacy of equipment and other medical supplies led to local innovations to fight the spread of the disease. For example, in Kenya, students from Kenyatta University created ventilators, while researchers from the University of Nairobi designed a local oxygen concentrator. At the same time, textile factories, such as Rivatex in Eldoret and another in Kitui, which had been closed for decades, opened again in order to start manufacturing personal protective equipment (PPEs), including masks, for use in the East African Community. On 18 April 2018, the EAC partner states resolved to develop their own pharmaceutical industry, including vaccine manufacturing, as part of the region’s social, economic and political integration. This would ensure a stable access and supply of vaccines. The AfDB is also supporting development of pharmaceutical products and creation of value chains for the Common Market for East and Southern Africa (COMESA) member states.

Strong regulation is required to ensure that AfCFTA exports meet international required standards. There is a need to strengthen technical regulations, ensure laboratories are accredited, and provide for conformity assessments and metrology.

International cooperation would help African countries reduce their risks and vulnerabilities to economic shocks. Measures could include entering into public-private partnerships in research and development, deepening regional integration in order to pool financial resources to reduce the risk of shortages, and collaborating with international development partners who can provide technical assistance. African countries can also take advantage of the WTO Trade Facilitation Agreement (TFA), the World Bank Trade Facilitation Support Program (WB-TFSP), UNCTAD, and development partners such as AfDB, the European Union and the OECD, among others, to align their trade practices with the TFA, thus supporting diversification, access to technology and resilience.

Prepared by Professor Tabitha Kiriti-Nganga (University of Nairobi and WTO Chair).
that lower market entry costs are associated with greater product export diversification in a sample of 118 developing countries. Services trade policy can also increase diversification, in particular on the export side. Lower services trade restrictiveness in the home market, by increasing the quality and availability of services inputs, can boost exports of service-intensive manufactured goods (see Section C2 in WTO, 2019b).

Policies that foster competition are important in creating an appropriate incentive framework for diversification. In contestable markets, both current market leaders (including a dominant incumbent) and disruptive rivals have an incentive to innovate and capture future sales (Federico, Morton and Shapiro, 2020). Therefore, policies that increase market contestability spur innovation, ultimately leading to more export diversification via increases in firm productivity. Moreover, reforms that boost competition in input markets, including backbone services (transportation, finance, energy and communications), can have positive productivity spillovers on downstream firms, again increasing the prospects for export diversification.

Second, reducing trade costs can improve trade diversification (OECD and WTO, 2019). Both investments in transport-related infrastructure and investments in telecommunication infrastructure are relevant in this regard. Equally important are reforms to improve the quality of transport logistics, because export concentration is often associated with poor logistics. In the above-mentioned study by Dennis and Shepherd (2011), the largest impact on product export diversification is due to improved trade facilitation. Similarly, Shepherd (2010) shows that lower export costs at home have stronger potential for increasing geographical export diversification than do comparable changes in market access abroad or international transport costs. Finally, as argued in Section C4(b), policy measures aimed at reducing reliance on a small number of transport service providers, or at improving trade connectivity, are likely to enable diversification across different trade routes and across different available modes of transportation.

Third, targeting market, policy and institutional failures can support trade diversification (OECD and WTO, 2019). Diversification is likely to be dampened by information failures. For instance, a firm would be able to export to a market because its products would meet the necessary standards, but it does not export because it has inadequate information on the standards in place. Provided that they operate in environments that are not biased against exports, that they function autonomously, and that they are financed through general revenues rather than through taxation of exports, export promotion agencies can help overcome such issues, especially asymmetric information problems associated with exports of heterogeneous goods (Lederman, Olarreaga and Payton, 2010). Similarly, investment promotion agencies can foster economic diversification by attracting foreign direct investment (FDI), in particular efficiency-seeking FDI that is focused on export-oriented production. Finally, special economic zones (SEZs) have also been used to support diversification, but there is scarce empirical evidence of such impact (Aggarwal, Hoppe and Walkenhorst, 2009).

Finally, policies that support adjustment can have a positive impact on trade diversification (OECD and WTO, 2019). For diversification to take place, skills development policies are needed to align with labour market demand. Policies aimed at reducing gender inequality (see also discussion in Section C3(c)) are also likely to increase trade diversification, through two channels (Kazandjian et al., 2016). First, gender gaps in opportunity, such as lower educational enrolment rates for girls than for boys, harm diversification by constraining the potential pool of human capital available in an economy. Second, gender gaps in the labour market impede the development of new ideas by decreasing the efficiency of the labour force. In a sample of (up to) 100 countries at various stages of economic development during the period 1990-2010, Kazandjian et al. (2016) find evidence supportive of both channels in low-income and developing countries, concluding that gender-friendly policies could help these countries diversify their economies.

5. Conclusion

International trade plays an important role in economic resilience to shocks. Although trade can be a spreader and magnifier of shocks, it can also enable countries to better prepare for shocks, better cope with shocks and recover quicker after shocks occur. Diversification of production and trade helps trade to play a beneficial role.

On the one hand trade can be a spreader of shocks if the conditions under which goods and services are traded are subject to shocks. Volatility in transport costs and variability of trade policies can make trade a source of instability. This implies that a multilateral trading system guaranteeing stable trade policies is of paramount importance for trade to be conducive to economic resilience, as will be discussed in
Section D. Trade can also be a spreader of shocks in other situations: for example, pandemics may spread through trade in live animals, and through travel and tourism. However, permanent restrictions are costly and seem to be largely ineffective to reduce the harm of pandemics. Furthermore, trade in livestock regulated by international standards tends to be safe for animals and humans alike, in contrast to illicit trade in livestock and wildlife trafficking. Indirectly, trade has an impact on natural disaster shocks through its role in climate change. Although trade contributes to emissions through increased production and transportation, it also fosters the spread of green technologies. This could be further complemented by domestic climate change policies such as carbon-pricing schemes and incentives for low-carbon technologies and projects.

On the other hand, trade can enable countries to better prepare for, cope with and recover from shocks through various channels.

First, trade can help countries to better prepare for shocks. Services trade can be a source of economic growth and thus increase the available technical, institutional and financial means to prepare for disruptions. Furthermore, services trade plays a vital role in the availability of crucial services during disasters, such as weather forecast services, insurance, telecommunications, logistics and health services. Trade is also important for efficient government procurement during crises. Finally, trade facilitation policies are crucial to ensure smooth imports of essential goods and services during a crisis.

Second, trade enables countries to better cope with the different types of shocks discussed in Section B: natural disaster shocks, technological and operational shocks, and socioeconomic shocks. For example, trade enables countries to better adjust to natural disaster shocks that are the result of climate change. A general principle is that trade makes it easier for countries to adjust to shocks, by being able to switch the sources of supply in case of domestic shortages or the market where goods are sold in case of a fallout in domestic demand. Trade policy measures such as suspension of import-related taxes and government procurement can also facilitate the coping process during shocks.

Furthermore, trade plays a critical role in the provision of essential goods to cope with crises such as the COVID-19 pandemic. Trade promotes specialization and knowledge spillovers, thus fostering technologies needed to confront shocks. Trade also makes it possible to import essential goods quickly in case of local shocks. With global shocks, it is crucial that trade can flow freely, and that essential goods are distributed in a fair way. While countries have an incentive to impose export restrictions and resort to domestic production, in the long run this makes the production process less efficient.

Third, trade can play a beneficial role in speeding up economic recovery, by benefiting from sustained foreign demand on the export side and the availability of intermediate inputs on the import side. Trade seems to have played a beneficial role in hedging countries against the adverse effects of the COVID-19 pandemic. The recovery in trade has been stronger than the recovery in GDP in 2020, and regions with stronger trade links with low-case regions have displayed higher GDP growth. At the same time there is a risk that national fiscal and monetary policies to speed up recovery could aggravate trade imbalances, which could in turn provoke increased demand for protectionist trade policies. Finally, during recovery, countries can implement trade reforms to improve economic outcomes. Various reform policies, such as supply chain due diligence laws, trade facilitation and digitalization, can help countries to build a more resilient trading system as they recover from COVID-19.

Trade diversification makes it more likely that trade will play a beneficial role in promoting economic resilience, as measured by reduced macroeconomic volatility. With a high degree of specialization, trade can magnify the impact of sector-specific shocks, as has been happening in regions dependent on tourism as a result of measures to contain COVID-19. With a diversified economic structure, however, the benefits of trade in coping with shocks will dominate, because trade enables countries to import goods in case of domestic shortages or export goods in case of a fallout in domestic demand. Various policies can be implemented to promote economic diversification, such as an appropriate incentive framework (predictable business regulation, appropriate trade policies, and policies fostering competition); reduction in trade costs; policies targeting market, policy, and institutional failures; and policies supporting adjustment, such as skills-development policies and policies reducing gender inequality.

LDCs do not have the resources to sustain a large domestic stimulus policy, and inevitably these economies will need to turn abroad to find demand for their products and services and to stimulate economic growth. Trade can be a means of diversifying input sources or sales markets, thereby increasing resilience. Having a strong trading system in place before a storm or hurricane is necessary to
absorb external assistance, such as physical aid or emergency workers, that will be sent via the same channels as regular trade. This will be particular challenging for many developing economies. To cope better with shocks, policies to facilitate digital trade and trade in services are particularly important.

Trade through international value chains can both be a shock absorber and a shock propagator, depending critically on the structure of the value chain. Trade can be a shock propagator in complementary GVCs, but can act as a shock absorber with diversified sources of supply. The presence of choke points – sectors crucial for the functioning of value chains – can make production more vulnerable to sudden increases in trade costs. Policies fostering supplier, customer, and trade route diversification can help to make value chains more resilient. Other policies to enhance GVC resilience are diversification of sources of supply, raising inventory stocks, and fostering flexible production across sites.

A lack of diversification and a predictable trade policy can impact more vulnerable groups, particularly women and MSMEs, especially hard. However, the lack of the required detail in trade statistics and substantial levels of informality make these impacts challenging to assess. Nevertheless, these groups may depend heavily on international trade, due to their reliance on large firms for inputs or demand. These groups are also often involved in informal, cross-border trade, so they are particularly affected by the closure of land borders.

Section D discusses how trade policy coordination can limit the potential shock-propagating effects of trade and promote the shock-absorbing role of trade, by helping countries to better prepare for, cope with and recover from shocks.
Endnotes

1 Further theoretical insights are provided by Antràs, Redding and Rossi-Hansberg (2020). In a model where, in order to exchange goods, economic agents travel both within and across borders, they show that international trade or mobility frictions may increase or decrease the likelihood of global pandemics depending on the disease environment prevailing in each country.

2 See Figure 2 in WTO (2020a), based on data from Oxford COVID-19 Government Response Tracker, OxCERT (Hale et al., 2021).

3 See the studies cited in Clemens and Ginn (2020) (page 47). The authors claim that once a pandemic has arrived, acquiring it from an infected traveller is significantly less likely than acquiring it from an infected local.

4 Eckardt, Kappner and Wolf (2020) find that border control had a significant effect in limiting the pandemic in 18 European countries. Linka et al. (2020) show that unconstrained mobility would have significantly accelerated the spread of COVID-19, especially in Central Europe, Spain, and France. Wells et al. (2020) find a significant correlation between the timing of the global exportation of COVID-19 events and airline connectivity with mainland China. They find that travel restrictions decreased the daily rate of exportation by 81.3 per cent on average.

5 Chinazza et al. (2020) show that by the start of the travel ban from Wuhan, China, on 23 January 2020, most Chinese cities had already received many infected travellers. Modelling results suggest that sustained 90 per cent travel restrictions to and from mainland China only modestly affected the trajectory of the epidemic, unless they were combined with a 50 per cent or higher reduction of transmission in the community.

6 Only cross-border trade, as opposed to domestic trade (including trade of live animals in traditional food markets) is considered here. Traditional food markets have received considerable attention as sources of zoonoses and places in which there is an elevated risk of outbreak and/or spread of those zoonoses. On policies that could reduce public health risks associated with the sale of live wild animals in traditional food markets, see WHO, OIE and UNEP (2021). The focus here is on zoonotic diseases, i.e. infectious diseases caused by a pathogen (bacterium, virus, parasite or prion) that has jumped from an animal to a human. In a list of 1,415 pathogens that can affect humans, about 60 per cent are zoonotic (Karesh et al., 2005). The International Livestock Research Institute (ILRI, 2012) estimated that some 56 zoonoses were together responsible for around 2.5 billion cases of human illness and 2.7 million human deaths a year.


8 In the United States only, between 2000 and 2006, approximately 1.5 billion live wild animals (around 120 million per year) were legally imported. Nearly 90 per cent of these were destined for the pet industry (Smith et al., 2012).


10 Empirical evidence of a negative correlation between licit trade and disease spread is provided by Beverelli and Ticku (2020). This is, however, an area where more research is needed.

11 Fèvre et al. (2006) report that in Saudi Arabia, most cases of Brucellosis – a zoonotic disease which infects animals like sheep and cattle – are due to unscreened imports from East Africa. Beverelli and Ticku (2020) provide evidence that illicit trade in livestock (measured through discrepancies in mirror trade statistics that are reported by trading partner countries), in addition to threatening animal health, could pose a risk to human health through the spread of zoonotic diseases.

12 It should be emphasized that a large part of the licit (i.e., regulated) cross-border movement of live wild animals occurs through non-commercial transactions, for instance in the framework of cross-border translocation programmes with the goal of species survival/recovery or restoration. Several examples of adverse side effects of (both domestic and cross-border) relocation of wild animals can be found in Fèvre et al. (2006) and Chomel, Belotto and Meslin (2007).

13 Even in a country with advanced customs administration like the United States, only 25 per cent of wildlife shipments that are declared at the border are inspected (Williams and Grante, 2009).

14 According to Robalino and Herrera (2010), trade-opening can either increase or decrease timber prices or local agricultural prices, thereby increasing or decreasing deforestation. For instance, in countries with a comparative advantage in extensive agriculture, trade liberalization might increase the relative prices of agricultural products produced using extensive agriculture, and, if all other things are equal, this can lead to more deforestation. Moreover, trade-opening can affect the prices of agricultural inputs, such as fertilizers, which can also affect deforestation. Robalino and Herrera (2010) further argue that the location of transport investments, the type of roads, the amount of forest originally present, and the prior development of the area affect the incentives to engage in deforestation in the wake of trade-opening.

15 See footnote 82 in Section C of WTO (2013) for a detailed discussion.

16 As packing plants have become larger in order to exploit scale economies, they have demanded a larger volume from individual producers. This requires either an increase in the size of production or some form of joint marketing (Duffy, 2009).

17 For a discussion of the determinants of comparative advantages in different types of livestock (e.g. poultry and pigs versus ruminants), see Section 2 in Upton and Otte (2004).

18 Using different methodology and definitions, Global Trade Alert (https://www.globaltradealert.org) reports that in the first 10 months of 2020, 2,031 such policy measures were taken by governments. These measures allegedly distorted 13.6 per cent of global goods trade, whereas trade reforms covered 8.2 per cent of global trade (Everett and Fritz, 2020).

19 In cooperation with the International Monetary Fund (IMF), Ahir, Bloom and Furceri (2018) construct a monthly index of uncertainty about trade policy or trade in general, the
so-called World Trade Uncertainty (WTU) Index. The Index is based on counting how often the word «uncertainty» appears together with «trade» (or words related to trade such as «protectionism», «tariff», or «WTO») in reports of the Economist Intelligence Unit.

20 Caldara et al. (2020) measured trade policy uncertainty in three ways using: (i) earnings calls of publicly listed companies mentioning trade policy uncertainty; (ii) newspaper reports about trade policy uncertainty; and (iii) historical volatility in tariffs. They arrive at an estimated reduction of 1 per cent of investment because of trade policy uncertainty based on variation across sectors in the earnings calls of firms and investment.

21 Governance quality is not the only channel through which violence and conflicts affect trade costs. As discussed previously in the subsection on transport costs, violence and conflicts also cause disruptions in the transport network and increase the risk and uncertainty related to shipment and delivery of traded goods. For example, during World War II, trade in the United Kingdom was challenged as trade routes were disrupted by the conflict, although governance and regulations remained relatively stable (Jackson, 2011).

22 Kremer (1993) posits that even the smallest components of a complex production process must perform properly if the end-product is to have any value for users.

23 The Leontief inverse matrix shows the coefficients (economic multipliers) that measure the successive effects on the economy as a result of the initial change of an economic activity. It incorporates both direct and indirect inputs in production.

24 A “black swan” is an extremely unpredictable, rare event, the occurrence of which may, nevertheless, seem obvious in hindsight, and which often triggers severe negative consequences.

25 Several factors explain the insurance protection gap observed in many developing countries. On the demand side, common reasons include potential buyers at low-income levels, expectations of external assistance in case of future disasters (disincentivizing the conclusion of insurance contracts and the payment of the premiums), the limited awareness and understanding on risk exposure by households, businesses and governments, and previous practice attesting delays (Benson and Clay, 2004; Cummings and Mahul, 2009; WTO, 2019a). On the supply side, some weaknesses may be due to unfavourable financial environments at the domestic level and to the lack of insurance products specifically designed to cover losses incurred from shocks, based upon accurate data and tailored risk models and risk profiles (ILO, 2012; Benson and Clay, 2004; Cummings and Mahul, 2009).

26 Costinot, Donaldson and Smith (2016) estimate that the impact of climate change on the agricultural markets would amount to a 0.26 per cent reduction in global GDP when trade and production patterns are allowed to adjust, while the GDP reduction would be 0.78 per cent if production does not adjust.

27 http://www.wcoomd.org/~ media/4B167884A3064E78BCF5D29E229F4E57E.aspx

28 See the note to Figure C.11 for details on the constructions of these three measures of trade diversification.

29 The narrow focus here is on trade diversification and macroeconomic volatility (an inverse proxy of resilience). A relatively large literature has studied the more general relationship between trade openness and volatility. A major contention in this literature is that increased specialization induced by trade mechanically increases volatility (see for instance Di Giovanni and Levchenko, 2009). Caselli et al. (2020) question this view, arguing that trade-induced specialization increases volatility only if specialization occurs in intrinsically volatile sectors, or in sectors that are subject to shocks that correlate with country's aggregate shocks or other sectoral shocks. Consistently, Koren and Tenreyro (2007) find that countries at the initial stage of development (i.e. poor countries) tend to produce in sectors with higher intrinsic volatility, and also tend to experience higher levels of country-specific volatility. As countries develop, they tend to move towards sectors with lower intrinsic volatility. Even if they tend to re-concentrate production, concentration occurs in low-volatility sectors, and is associated with lower macroeconomic volatility.

30 For the diversification-through-trade channel highlighted by Caselli et al. (2020) to be relevant, country-specific shocks must matter. The authors refer to studies showing that country-specific shocks are more important than sector-specific shocks in shaping volatility patterns in a number of industrialized countries, and to Koren and Tenreyro (2007), who show that the relative weight of country-specific shocks is even more relevant in less developed economies.

31 The fact that even large exporting firms are not very diversified points to important costs in building a dense web of relationships with customers.

32 The symmetrical argument is that lack of diversification on the export side exposes countries to the risk of trade restrictions in importing countries (tariffs and non-tariff measures).

33 Only the geographical, and not the product, scope of import diversification is analysed because most countries tend to import most products, with relatively little variation across countries or over time within countries.

34 Geographical import diversification increased for 165 countries, while it decreased for 56 countries.

35 Guinea and Forsthuber (2020) estimate that only 1 per cent of EU imports are imported from a single supplier. Jaravel and Méjean (2021) identify only 644 products, out of a total of 9,334 products imported by France, for which the supply is mainly outside the Union European and is particularly concentrated in a low number of supplying countries. These 644 products account for only 4 per cent of the value of total French imports.

36 Indirect evidence for this can be gathered from several studies – such as Bricongne et al. (2012), Behrens, Corcos and Mion (2013), and other studies cited in footnote 7 of Antrás (2020) – documenting that the bulk of the great trade collapse in the aftermath of the 2008-09 crisis occurred at the intensive margin (value or volume of existing trade flows) rather than at the extensive margin.

37 This result is also consistent with the micro-level evidence in Monarch and Schmidt-Eisenlohr (2020), who document a remarkable degree of persistence in buyer-seller links in US trade, with 80 per cent of US imports occurring in pre-existing firm-to-firm relationships.

38 Qualitatively similar positive correlations are also obtained between IPR-intensity and geographical export diversification. Such diversification may be reduced in IPR-intensive sectors due, for instance, to the fear of
The Role of Trade in Economic Resilience

Economic Resilience and Trade

Export diversification has, in particular, long been advocated in the case of resource-rich countries, not only as a tool to reduce volatility and increase resilience, but also for two other sets of reasons: first, based on the premise that these sectors are characterized by positive spillovers on the rest of the economy, such as learning-by-doing or knowledge spillovers; and second, because of the depletable nature of non-renewable resources, the significant impact of resource extraction on the environment, and the threat that technological shocks could suddenly eliminate or sharply reduce demand by resource-importing countries (WTO, 2014).

This is an application of Hausmann and Rodrik (2003), who consider the problem of a domestic pioneer entrepreneur. See Box C.1 in WTO (2020b).

This is because industrial policies can be undermined by imperfect knowledge of the externalities justifying sector-specific interventions, and by the vulnerability of such interventions to rent-seeking (Lane, 2020).

Only domestic policies are considered here. Policies that are implemented in the framework of international cooperation or trade agreements, such as, respectively, Aid for Trade and the WTO Trade Facilitation Agreement, are discussed in Section D.

NACE stands for “Nomenclature statistique des activités économiques dans la Communauté européenne”, or “statistical classification of economic activities in the European Community”.


Indeed, one of the main objectives of preference schemes is to assist developing countries and LDCs with economic diversification, as can be read in the original EU Generalized Scheme of Preferences (GSP) regulation (Regulation (EU) No 978/2012).

By symmetric reasoning, standards and other non-tariff measures in the home country can both increase or decrease import diversification, depending on their relative impact on information asymmetries and market entry costs.

Product export diversification, geographical export diversification, and geographical import diversification indexes (see note to Figure C.11 for their definitions) positively correlate with the World Bank’s overall Logistics Performance Index (LPI) in a sample of around 160 countries and six years (2007, 2010, 2012, 2014, 2016, and 2018). In particular, both in ordinary least squares (OLS) and in Pseudo-Poisson maximum likelihood (PPML) regressions of each diversification index on the LPI, controlling for country and year fixed effects (N = 912), the coefficients on the geographical export diversification index and on the geographical import diversification index are positive and statistically significant. The coefficient on product export diversification index is also positive, although not statistically significant.

Bauerle Danzman and Gertz (2020) show that investment promotion agencies (IPAs) which are integrated (i.e. with a governance structure integrated into the government bureaucracy) score better than autonomous IPAs (i.e. IPAs with a governance structure autonomous from the rest of the government bureaucracy) in terms of the number of programmes designed to link domestic suppliers to foreign firms.

See WTO (2018b) for a discussion of skills development policies in the digital age.

In particular, Kazandjian et al. (2016) interpret the negative impact on diversification of gender inequalities in opportunities, such as education, as supportive of the first channel (inequality constrains the level of human capital, which limits diversification). They also interpret the negative impact of gender inequalities on diversification in outcomes, such as labour force participation, as supportive of the second channel (inefficient allocation of resources leads to suboptimal creation of ideas).