B Why economic resilience matters

Over the past decades, natural hazard-related and man-made disasters have increased in both frequency and severity. The effects on society and on the economy of these disasters, and the prospect of even greater risks and disasters in the future, linked to the challenges of climate change, have underlined the factors and strategies needed to avoid, mitigate, adapt to and prepare for shocks, as well as to manage risks and vulnerabilities. The term “economic resilience” has become a popular one to describe these broad, diverse strategies.

Contents

Some key facts and findings

- Natural disasters, cyber-attacks and conflicts have become more frequent and more damaging over recent decades.
- Risks are likely to rise in the future due to climate change, the increase in technology's accessibility and usage, increasing inequality and geopolitical tensions.
- The direct impact of a shock on trade depends on the type of shock, initial conditions and policy responses. Some sectors are more vulnerable to different types of shocks. Vulnerable groups, including poor households, are disproportionately affected by shocks.
- Some developing countries are disproportionally vulnerable to natural hazards, and socio-economic crises particularly affect countries with weak institutions and economic fundamentals.
- Governments, firms and households can take effective steps to prevent, prepare for, cope with and recover from the adverse impact of shocks, with a view to building economic resilience.
- Most trade measures in response to the COVID-19 crisis were trade-facilitating, and the rapid trade recovery after the shock underlines how liberalizing trade policies can support resilience.

1. Introduction

Section B looks at why economic resilience matters from a number of different angles. As resilience is often defined in relation to the state of shock, in Section B2 the concept of shock is defined and types of shocks, such as natural disasters, including pandemics and climate change-related shocks, wars, and financial and political crises, are discussed.

In Sections B3 and B4, the impact of these shocks on the economy and on trade, respectively, is discussed, with a special focus on the current COVID-19 crisis compared to the 2008-09 global financial crisis. Economic and trade disruptions are significant, but heterogeneous, highlighting the importance of initial conditions and policy responses.

In Section B5, the different policies adopted in response to shock are discussed. Section B6 concludes by identifying what defines economic resilience and what strategies and actions foster it.

2. Economies are exposed to risks and shocks

Risks and shocks are a recurring phenomenon in economies worldwide. This subsection provides a brief overview of the concepts of risks and shocks by highlighting how multifaceted risks can be, how these risks can materialize into shocks, and how risks and shocks have increased over time but remain unevenly distributed.

(a) Risk originates from a plethora of sources

Conceptually, risk[1] stems from a combination of hazard, exposure and vulnerability (UNDRR, 2019). *Hazard* refers to a potentially destructive natural or man-made phenomenon, substance, human activity or condition. *Exposure* relates to the location, attributes and value of assets (typically individuals, economic activities, infrastructure and the environment) that could be affected by a hazard. Finally, *vulnerability* refers to the likelihood that these assets could be affected, damaged or destroyed if exposed to a hazard. It is for this reason that risk is often simply defined as the probability that a shock occurs.

Risk comes from a multitude of hazard sources. Different efforts have been made to classify the broad spectrum of hazards (UNDRR, 2020). As shown in Table B.1, hazards can be grouped into three broad categories according to their origin, i.e.:

(1) **Natural risks**, which encompass all biological and environmental threats, including geophysical, meteorological, hydrological, climatological, biological and extra-terrestrial threats.

(2) **Technological and operational risks**, i.e. accidents or failures associated with economic activity, technology and infrastructure, which can be further grouped into industrial accidents, transport accidents and cyber-risks. The failure of one element within complex technological, industrial and transport systems can remain localized or can spread throughout the system.

(3) **Socio-economic risks** encompass violence, political risks and financial risks coming from the society and the institutions in which economic agents operate. Political hazards cover a range of governmental actions that increase political uncertainty and instability. Financial and macroeconomic hazards include operational and societal factors that are disruptive to business activity, such as price shocks, trade wars, financial crashes, supplier insolvencies and political barriers to trade (Barry, 2004; Martin, 2012; OECD, 2020e).

(b) Risks can materialize into shocks of varying intensity, frequency, scale and duration

While most of the time risks remain a threat, they sometimes materialize and determine shocks. In many cases, there are multiple causes for why a risk can materialize into a shock, and the complex interplay between risks and shocks can make the origin of a disaster difficult to identify.

Although risks and shocks are often considered individually, they can interact with each other and create cascading risks and shocks (UNDRR, 2020). For example, the 2011 Fukushima nuclear disaster was an industrial accident caused by a tsunami, a hydrological hazard which was in turn caused by a geophysical hazard, namely an earthquake.

Shocks can take many different forms and have complex impacts and consequences. Given their multifaceted dimensions, shocks can be analysed through different lenses, including their intensity, frequency, scale and duration.

Shock intensity refers to the physical, social, environmental or economic impact of a shock, which can be measured in different ways depending on the type of shock and impact being studied (Berz et al.,

Table B.1: Main types of hazards

Hazards		Examples
Natural risks	Geophysical hazard	Earthquakes, dry mass movements, volcanic activity
	Meteorological hazard	Extreme temperatures, storms, fog
	Hydrological hazard	Floods, landslides, wave actions (e.g. tsunamis)
	Climatological hazard	Drought, wildfire, glacial lake outburst
	Biological hazard	Bacterial/viral epidemics/pandemics (e.g. the COVID-19 pandemic), insect infestation, animal diseases
	Extra-terrestrial hazard	Asteroid impact, solar flares
Technological and operational risks	Industrial accident	Chemical or oil spills, building collapse, radiation, explosion, poisoning, fire
	Transport accident	Crashes, sinking
	Cyber disruption	Cyber-attacks, information system failures, data breaches
Socio-economic risks	Violence and conflict	War, terrorism, civil unrest, riots, pirates
	Political hazard	Adverse trade and economic policies, social tensions, institutional instability, rule of law degradation
	Macroeconomic and financial hazard	Commodity price shocks, exchange rate shocks, hyperinflation, market crash, liquidity crises, synchronized insolvencies

Note: This taxonomy is primarily based on the hazard classification of the UN Office for Disaster Risk Reduction (consulted 2020) (https://www.undrr.org) and the Integrated Research on Disaster Risk (consulted 2021) (https://www.irdrinternational.org). The list of socio-economic risks has been expanded to include shocks identified in the economic and business literature.

2001). For example, the intensity of an earthquake can be measured in physical terms (i.e. the energy released or the magnitude of vibrations in a specific location), in terms of the extent of the damage it causes, or in terms of the economic costs resulting from that damage (as discussed later in Section B2). Similarly, the intensity of the socio-economic impacts of an earthquake can be measured in several ways, for example in terms of the number of deaths caused, the number of people left homeless or the resulting loss in gross domestic product (GDP) (Kellenberg and Mobarak, 2011).

Shock frequency refers to how common (or uncommon) a shock is, historically. Frequency is the basis of most forecasts on risk (see Box B.1) and is commonly used in conjunction with intensity metrics. For example, every day there are hundreds of earthquakes, but almost all of them are too small to cause damage. The frequency of high-intensity earthquakes is, however, much lower. On average, every year there are almost 2,000 earthquakes worldwide with a magnitude of 5 (moderate) to 7 (major) on the Richter scale, around 15 of a magnitude of 7 to 8, and no more than one or two of a magnitude greater than 8 (USGS, 2021).

The impact of shocks can also be measured in terms of geographic or economic **scale**. For example, the collapse of a bridge may disrupt traffic and increase transportation costs, but its effects remain mostly localized and impact only a few firms.

However, some accidents can create severe and lasting disruption to an entire region, such as the 2020 Beirut port explosion (Andreoni and Casado, 2021; Oxford Analytica, 2020; Veiga, 2021), while others can propagate, impacting entire economic systems and other countries in unexpected ways. For example, although the collapse of the US firm Lehmann Brothers is often cited as a key point in the 2008-09 global financial crisis, the roots of this shock lay in the sub-prime mortgage crisis following the collapse of the housing bubble in the United States. The effects of this reverberated around much of the world through a series of complex interactions, coupled with second- and third-order effects channelled through financial markets, trade linkages and behavioural changes (Martin, 2011b, 2012).

Finally, shocks are characterized by their **duration**. For example, small-scale industrial accidents, such as fires in industrial plants, mechanical failures, transport accidents and cyber-attacks usually create short-lived disruptions (Ho et al., 2015; Worldand, 2015). Conversely, other types of shocks, such as pandemics, can last longer.

Box B.1: Challenges in predicting shocks

The unpredictability of shocks derives from the intrinsic complexity of reality. Even small events can interact and amplify through complex systems. Hence, even in fully deterministic systems, prediction can be dauntingly complex. This is known as the butterfly effect, whereby any uncertainty in the initial state of a system is amplified through time and linkages. This uncertainty means that, despite technological progress, it is still impossible to predict exactly when a volcano will erupt and disrupt air traffic, when the next pandemic will hit, or when stock markets will tumble and cause cycles of insolvencies. This uncertainty in prediction makes preparedness all the more important for facing shocks when they come (McKinsey Global Institute, 2020).

Notwithstanding the underlying uncertainty on the occurrence and intensity of single events, a few trends can be identified. Trend forecasts are based on stochastic modelling techniques which are developed to study means rather than single events (Bier et al., 1999; Nath, 2009; Tixier et al., 2002).

Typically, these models use past records of shocks to infer trends in risk. Hence, the quality of forecasts depends primarily on the quality of the historical record and on how representative past shocks are of future shocks (Nath, 2009; Nordhaus, 2012, 2014). In some cases, limitations in data availability and quality can lead to erroneous conclusions; for example, the rising frequency in recorded volcanic eruptions and earthquakes is purely a reflection of the improved tracking of active volcanoes and seismic activity (Smithsonian Institution, 2013).

Finally, trends may also vary regionally, and shocks can be of different intensity depending on a country's preparation. Therefore, global trends in shock frequencies can hide strong variations between countries and might not necessarily be representative of the economic impact of shocks.

(c) Shocks are on the rise and are unevenly distributed

Although the spectrums of risk are constantly evolving, the occurrence of some types of shocks has increased over the years and is expected to increase further in the future. In particular, certain types of natural disasters, cyber-attacks and socio-economic shocks are on the rise, and their risks are likely to increase in the future due to climate change, the increase in technology's accessibility and usage, increasing inequality and geopolitical tensions.

Risks remain, however, unevenly distributed across countries, leaving certain developing countries disproportionally vulnerable to natural hazards, while socio-economic crises are particularly hazardous for countries with weak institutions and vulnerable economic fundamentals.

(i) The frequency of many natural disasters is increasing

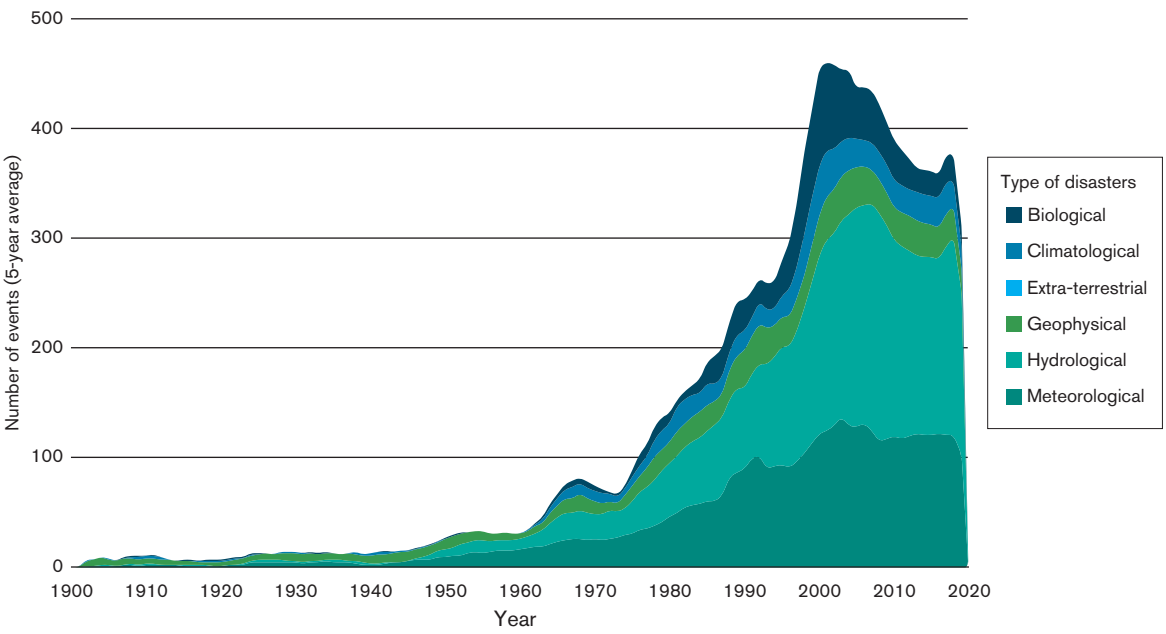
Natural risks are considered one of the most important threats humanity will face in this century. The frequency, strength and economic costs related to natural disasters are all likely to increase significantly in the coming decades, particularly as a result of climate change. Countries will be unevenly impacted by these trends. Coastal nations, island states and countries located near the equator and in arid regions are the most exposed to natural hazards.

Current scientific understanding points toward an increase in the frequency and intensity of extreme weather events due to global warming, such as droughts, cyclones or floods (IPCC, 2014). Despite limitations in data availability, available evidence suggests that there has been a significant increase in hydrological and meteorological types of natural shocks over the last century (see Figure B.1).

Climate change and encroachment upon animal habitats are also expected to increase the risk of future zoonotic diseases in the future (Estrada-Peña et al., 2014; IPCC, 2014). The consequences of climate change will be felt unevenly across the globe, amplifying the existing risks and increasing already existing vulnerabilities such as inundation risks for small-island developing states, increased water stress and food security risks for dry Northern and Eastern African countries (IPCC, 2014) (see Figure B.2).

However, not all natural risks are on the rise; trends for some types of natural shocks, such as volcanic eruptions, meteorite collisions or earthquakes, are expected to remain stable in the next century (NASA, 2021; Smithsonian Institution, 2013; USGS, 2021).

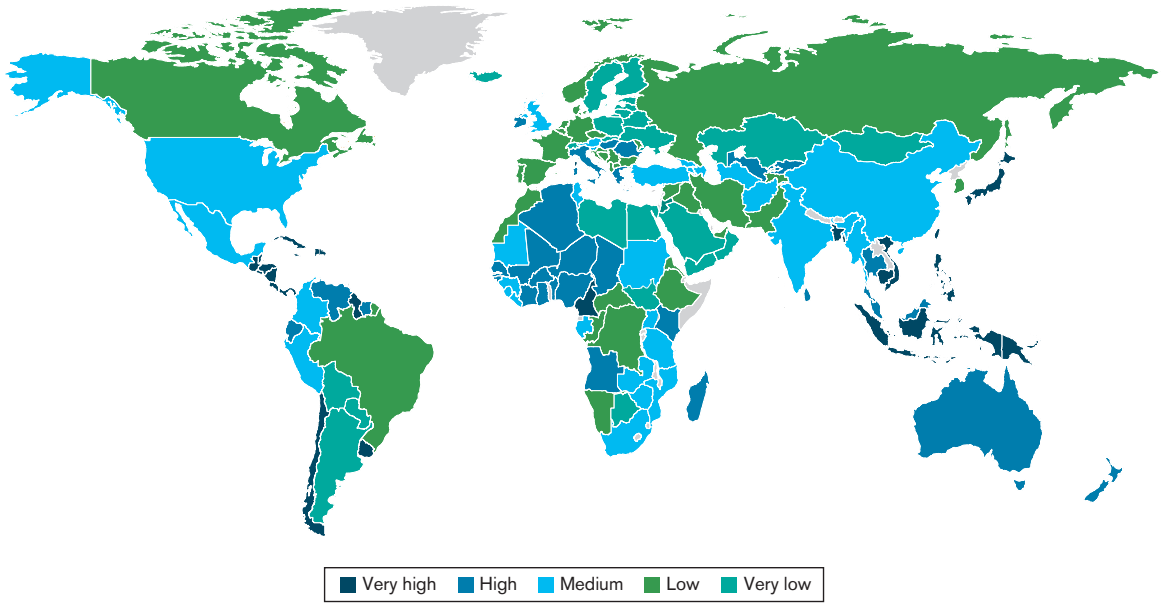
Figure B.1: There has been an increasing trend in the number of natural shocks over the past decades



Source: Authors' calculations, based on Emergency Events Database (EM-DAT) (2020).

Note: The figure displays the five-year moving average of the number of natural events to increase readability. The database includes over 20,000 disasters. However, tracking of events in earlier years of the dataset are less reliable. Events recorded in the database must meet at least one of the following requirements: involve at least 10 deaths, have affected a minimum of 100 people, or have necessitated a declaration of emergency/call for international assistance.

Figure B.2: Exposure to natural hazards differs from one region to another



Source: Authors' calculations, based on the exposition index from the World Risk Report 2020 (Behlert et al., 2020).

Note: Natural hazards taken into account are earthquakes, storms, floods, droughts and sea-level rise. Evaluation of the exposure profile is based on estimates of the population at risk of disaster.

(ii) Most technological and operational risks are decreasing

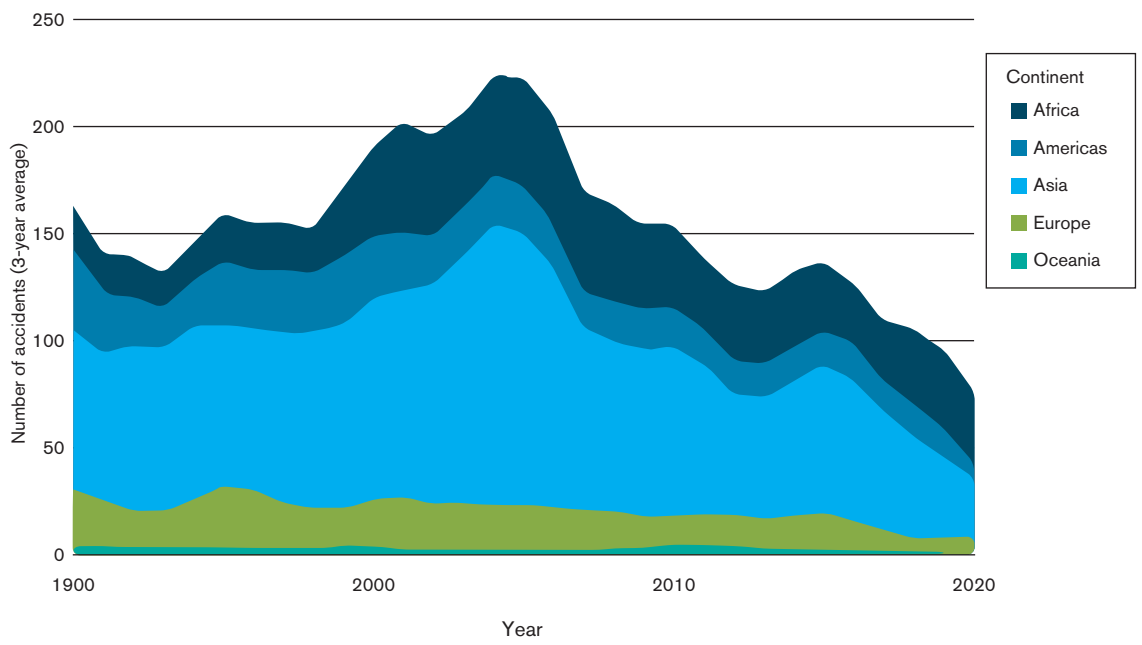
The risk of technological and industrial disasters has globally been decreasing in the past decades thanks to the diffusion of safer technologies and production processes. Nonetheless, some types of technological risks, such as cyber-risks, are expected to increase in the coming years.

Increased safety requirements, economic development and technological progress have translated into lower risks of major industrial and transportation accidents (see Figure B.3).[2] For example, for every 100 million flight departures, the average number of aeroplane accidents involving fatalities in the United States was 64 in the 1980s, 21 in the 2000s and only five between 2010 and 2018 (US Department of Transportation, 2018). Industrial accidents have also decreased. The rate of fatal and non-fatal work-related injuries per employee decreased from 26 per cent in lower middle-income countries to 43 and 53 per cent in high and upper middle-income countries between 2000 and 2015 (UNSTATS, 2021). These trends are expected to continue thanks to technological progress and its adoption and deployment in developing countries.

Although technological risks have been decreasing, the incidence of cyber-risks has intensified in recent years because digital technologies increasingly integrate every aspect of economic activities (Bailey et al., 2014). The 2019 *Global Risk Report* listed cyber-attacks and data fraud as two of the top five risks likely to be faced in the next 10 years. The growing diffusion of artificial intelligence (AI), cloud computing, the Internet of Things (IoT) and 5G is expected to increase systemic risks, including the likelihood, scale and impact of cyber-attacks (WEF, 2019, 2020).

The risk of cyber-attacks is becoming greater, especially in developed economies, which increasingly promote advanced manufacturing (Deloitte and MAPI, 2016). Characterized by the use of innovative digital technology to execute and coordinate production processes, advanced manufacturing is more exposed to the risk of business interruption caused by cyber-attacks than traditional manufacturing, which relied on manual and mechanized production techniques. More generally, advanced manufacturing in developed countries faces a greater risk of business interruption due to infrastructure disruptions such as power outages.

Figure B.3: The number of large industrial and transport accidents is on the decline across all continents



Source: Authors' calculations, based on EM-DAT (2020).

Note: The figure displays the three-year moving average of the number of accidents. The types of accidents considered include air accidents, rail accidents, water accidents, chemical spills, building collapses, explosions, fires, gas leaks, poisoning, radiation leaks, and other technological accidents. Events recorded in the database must meet at least one of the following requirements: involve at least 10 deaths, have affected a minimum of 100 people, or have necessitated a declaration of emergency / call for international assistance.

(iii) Most socio-economic hazards are increasing

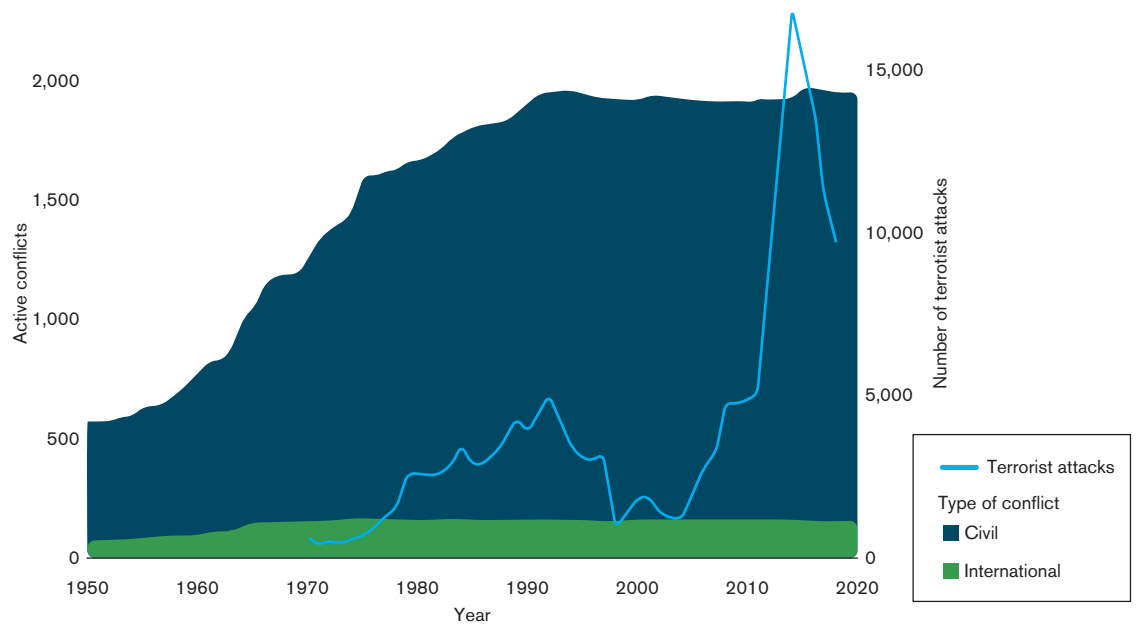
Recent years have witnessed a rise in inequalities, increased fragility of economic growth and growing political uncertainty and geopolitical tensions. These global trends foretell an increase in socio-economic risks. However, as socio-economic risks remain strongly country-specific, there is substantial heterogeneity associated with them.

Although the number of deaths due to war has been declining since the end of the Second World War, other forms of violent shocks have been increasing over time (UN, 2021). Terrorist attacks, for instance, have increased significantly in the last 30 years, rising from 651 attacks in 1970 to a peak of 16,908 attacks in 2014 (see Figure B.4). Conflicts in the last century have primarily stemmed from civil strife rather than international clashes, creating an unprecedented number of refugees and internally displaced persons. Both terrorism and armed conflict show, and are likely to continue to show, strong regional variation, with developing regions disproportionally affected (UN, 2021). Conflict risk is also poised to increase as a reflection of the rising geopolitical tensions. In addition, the use of increasingly sophisticated technologies in warfare, including weapons of mass destruction, have dramatically increased the destructive potential of wars (Knoema, 2019; WEF, 2020).

Political and macroeconomic shocks usually follow a cyclical pattern (see Figure B.5 and Figure B.6). They also tend to be highly correlated across countries due to interconnectedness of economic systems.

A few emerging global trends point towards an increase in political, financial and economic risks for the next years, in particular for countries with weak institutions and vulnerable economic fundamentals (IMF, 2020a). For example, the recovery from the COVID-19 pandemic is likely to be unequal between and within countries (IMF, 2021a), and the uncertain post-pandemic economic outlook is coupled with previous weak past global economic growth, historically low interest rates and historically high government debts (IMF, 2020a). The combination of these factors suggests governments will have limited fiscal and monetary policy space. High levels of private and public debt also raise concerns regarding future solvency (OECD, 2020e). Moreover, growing inequality between and within nations may further spur populism and policy uncertainty (see Figure B.6) (WEF, 2020).

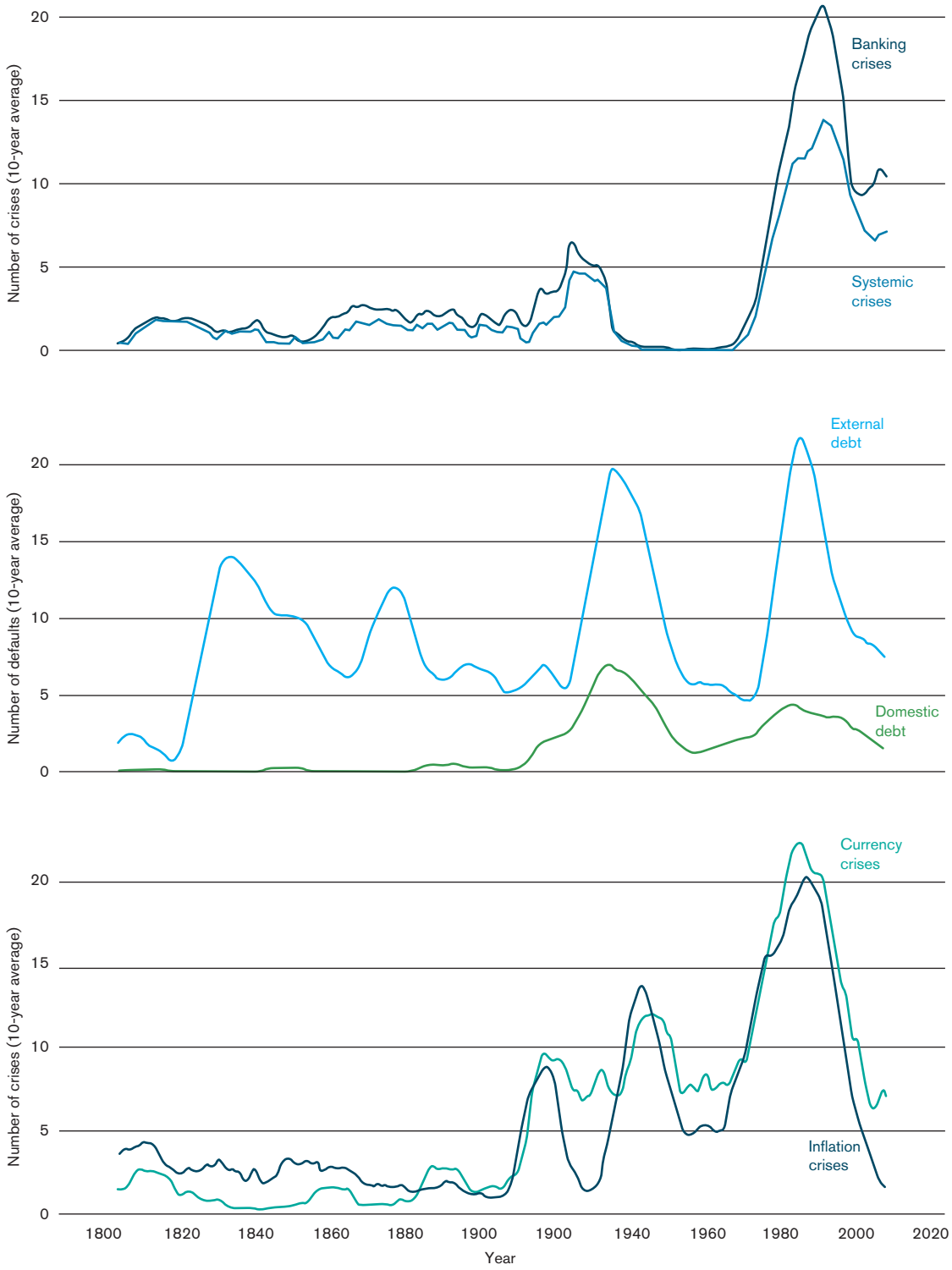
Figure B.4: The number of conflicts and terrorist attacks has increased



Source: Authors' calculations, based on the Uppsala Conflict Data Program/Peace Research Institute Oslo (UCDP/PRIO) armed conflict database (Gleditsch et al., 2002) and Global Terrorism Database (2021).

Note: Active conflicts are ongoing conflicts in a given year where a conflict is defined in the dataset as a "contested incompatibility that concerns government or territory or both where the use of armed force between two parties results in at least 25 battle-related deaths. Of these two parties, at least one is the government of a state" (Gleditsch et al., 2002).

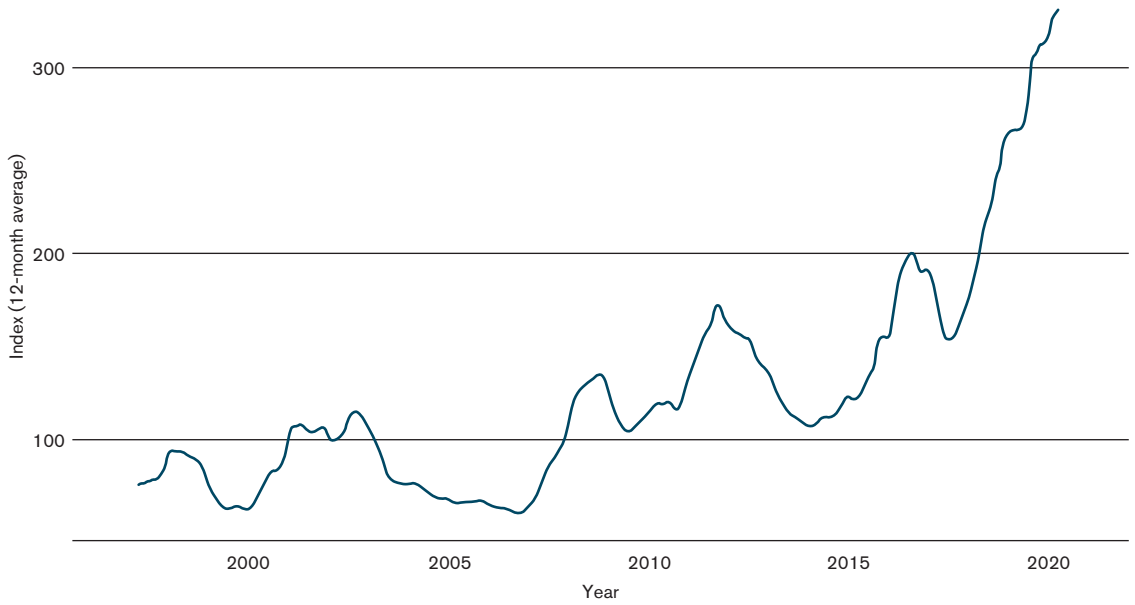
Figure B.5: Macroeconomic and financial crises show an upward trend



Source: Authors' calculations, based data from Reinhart et al. (2021).

Note: The figure displays the 10-year moving average of the number of crises. The dataset covers 70 countries. African, Middle Eastern and Central Asian countries are underrepresented in the sample.

Figure B.6: Global economic policy uncertainty is on the rise



Source: Authors' calculations, based on data from purchasing power parity weighted version of the Global Economic Policy Uncertainty Index (Baker, 2021).

Note: The figure displays the 12-month rolling average index. The index is based on the frequency of press articles discussing economic policy uncertainty in 21 large developed and developing countries.

Developing and least-developed economies are expected to remain disproportionately affected by socio-economic risks. Developing economies have been the greatest victims of violence. Virtually all of the active conflicts in the last 70 years have been located in developing countries (UN, 2021). Since 1970, 95 per cent of all terrorist attacks have taken place in Africa, the Middle East and South Asia, according to the Global Terrorism Database (GTD).[3] Many developing countries continue to face poverty – an important factor of risk. It is forecasted that in 2030, 87 per cent of the people living in extreme poverty will be living in Sub-Saharan Africa (World Bank, 2018).

Compared to advanced economies, developing economies face higher financial and macroeconomic risks and are more vulnerable during downturns because of their lower economic growth, higher average levels of debt, weaker institutions, higher borrowing costs and strong reliance on commodity prices and exchange rates (IMF, 2020a). This exposes developing countries to the risk of hyperinflation crises, exchange rate crises and sovereign debt defaults.

3. Disruptions and shocks can cause significant loss of life and severe economic impact

Shocks can have significant impacts on the individuals, communities and the economies involved. These include, but are not limited to, human casualties, loss of property, including livestock and stocks, relocation or decline of populations, economic recession and stunted economic growth. Although the impacts are unambiguously detrimental, the effects of these shocks differ depending on both the type of event and its channels of transmission. This subsection provides an overview of the impacts in terms of casualties and economic losses triggered by natural, technological and operational, as well as socio-economic, shocks.

(a) Shocks take lives and impact well-being

The destruction brought by shocks – whether natural, technological or socio-economic – can be devastating, including damage to property, ecosystems and lives.

The COVID-19 pandemic, for example, caused almost 4 million deaths between its outbreak and the end of June 2021 (see Figure B.7); compared to fatalities caused by other types of shock or past pandemics, this is an exceptionally high number of fatalities in a relatively short time. In another example, armed conflicts (i.e., socio-economic shocks) appear to have been the deadliest type of shock between 1980 and 2020, including deaths resulting indirectly from conflicts, for example as a result of lack of food, health services and infrastructure.

Wars and conflicts can also cause suffering due to displacement; by the end of 2019, the world had 79.5 million forcibly displaced people, over half having fled to a foreign country (UNHCR, 2020). And while economic shocks do not inflict physical harm on the population affected, the psychological impact can cost lives. Incidences of suicide increased in Europe and American countries following the 2008-09 global financial crisis (Chang et al., 2013).

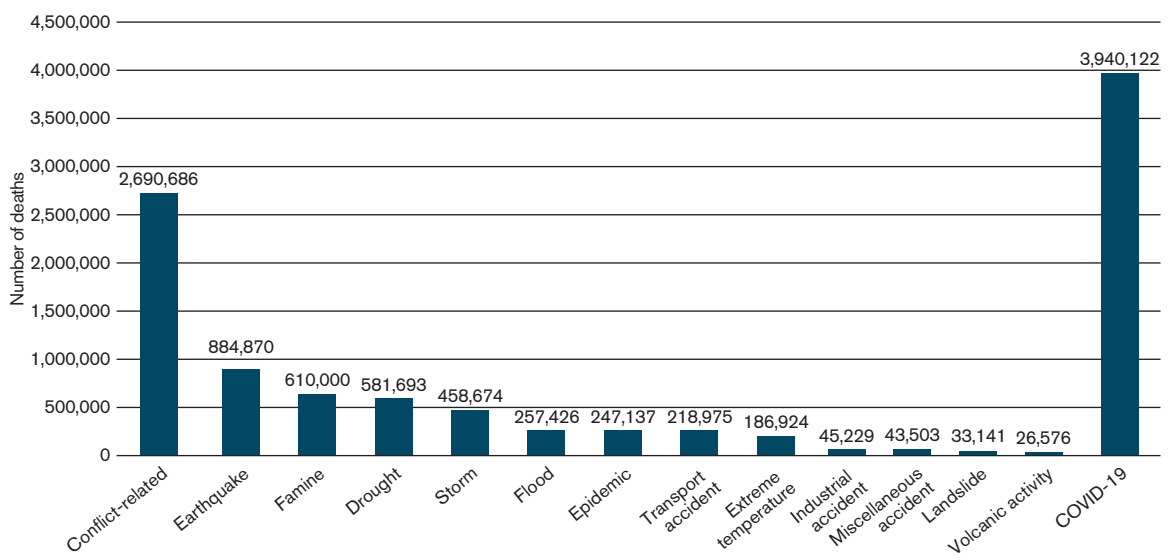
Earthquakes (i.e. a natural disaster) have been the second deadliest type of shock, amounting to over 884,000 deaths between 1980 and 2020 (EM-DAT, 2020). Hydrological events like flooding are the most frequent form of shock and affect the greatest number of people in each event. During the 1980-2020 period, there were over 4,800 floods around the world affecting over 3.5 billion people (EM-DAT, 2020). While not as deadly as earthquakes, these events can still have substantial effects on people's lives by displacing residents of affected regions. Epidemics, and in particular the COVID-19 pandemic, have also resulted in high numbers of deaths and lives affected.

Finally, technological and operation shocks and industrial and transportation accidents have caused a great deal of damage. The Beirut port explosion in August 2020, for example, claimed 178 lives, with a further 6,500 people injured, and 300,000 left homeless (Sivaraman and Varadharajan, 2021). Some of the effects of disasters on lives are immediate, and some develop over time. For example, the Chernobyl Nuclear Power Plant meltdown in Ukraine claimed 50 deaths in 1986, but cancers linked to the nuclear fallout caused a further 4,000 deaths over time. In total, over 135,000 people are estimated to have been directly and indirectly affected (EM-DAT, 2020).

(b) Economic impacts of shocks are significant

All shocks (natural disasters, technological and operational incidents and socio-economic events) cause economic losses, impacting GDP and levels of unemployment and of welfare within a population.

Figure B.7: Fatalities related to COVID-19 surpassed numbers of deaths related to other disasters over the period 1980-2020



Source: Authors' calculations, based on EM-DAT (2020), data on conflict-related deaths from the Uppsala Conflict Data Program/Peace Research Institute Oslo (UCDP/PRIO) armed conflict database, and Johns Hopkins Coronavirus Resource Center (2021).

Note: The figure reports the total number of deaths by disaster type between 1980 and 2020. For data from EM-DAT, only disasters with total deaths above 20,000 between 1980-2020 are considered. Based on the available data, conflict-related death data span 1989 to 2020, while data on casualties triggered by natural disasters and technological/operation accidents span 1980 to 2020. Epidemics between 1980 and 2020 exclude COVID-19 fatalities.

Estimates of damage caused by natural disasters only cover a subset of all natural disasters which have occurred. Yet, the overall economic cost is substantial. Based on the subset of shocks from natural disasters (representing approximately one-third of the shocks reported in the EM-DAT database), the total damage caused by natural disasters between 1980 and 2020 amounts to US$ 3.6 trillion (EM-DAT, 2020).

Natural disasters trigger economic losses not only by destroying physical assets but also by causing bottlenecks in supply chains. For example, in 2011, the Tōhoku earthquake triggered shortages along the global supply chains of multinationals relying on Japanese inputs (Boehm, Flaaen and Pandalai-Nayar, 2019; McKinsey Global Institute, 2020). The COVID-19 pandemic has also shown how epidemics caused by contagious diseases can have significant economic impacts (see Box B.2).

Technological and operational failures and industrial accidents are not only costly to firms which they directly affect, but they can also generate large negative spillover effects.

For example, in 2002, the sinking of the "Prestige" oil tanker off the coast of Galicia in Spain caused massive environmental pollution of the Atlantic Ocean and triggered an increase in expenses from EUR 33.2 to EUR 113.2 million for preventive and palliative measures by the public administration (Surís-Regueiro, Garza-Gil and Varela-Lafuente, 2007). The Chernobyl nuclear meltdown in 1986 cost Ukraine between 5 and 7 per cent of its annual GDP from 1986 until 2015 in clean-up, recovery and compensation (Danzer and Danzer, 2016).

Cyber-attacks also have had important negative impacts, even if the actual economic effects are not always easy to calculate. In 2013, the US retailer "Target" was a victim of a cyber-attack that stole the credit and debit card data of 40 million of its customers (Amir, Levi and Livne, 2018).

Critical infrastructure, such as utilities companies or networks of health services, is increasingly targeted by cyber-attacks. By compromising the systems that are responsible for controlling physical processes, cyber-attacks have the potential to paralyze or block critical infrastructure. For example, the first power outage caused by malicious software occurred in December 2015, when hundreds of thousands of households in Ukraine were left without electricity for six hours due to a cyber-attack against power companies (Allianz SE, 2021). In May 2017, the malware "WannaCry" disabled over 250,000 computers in more than 150 countries and affected the United Kingdom's National Health Service (NHS), resulting in the cancellation of 19,000 patient appointments and critical operations (Lis and Mendel, 2019). Even though the malware was thwarted within 12 hours, it is estimated that the incident resulted in costs of around £ 5.9 million (US$ 7.6 million) due to lost hospital activity (Ghafur et al., 2019).

Box B.2: Economic impacts of the COVID-19 pandemic

The COVID-19 pandemic and ensuing response measures have resulted in significant economic losses. In 2020, global GDP fell by 3.3 per cent, and global per capita GDP by 6.2 per cent, the most severe recession since World War II. In comparison, global GDP fell by about 0.6 per cent in the 2008-09 recession. Global economic growth is projected to recover to 5.3 per cent in 2021 and 4.1 per cent in 2022 – an upward revision of forecasts thanks to the vaccines and additional policy support in a few large economies (IMF, 2021a).

Macroeconomic stimulus, as well as labour market support, have helped to prevent even worse outcomes from the COVID-19 crisis. In 2020 and early 2021, accumulated fiscal and monetary stimulus reached unprecedented levels of more than 15 per cent of global GDP, and governments launched widespread job retention programmes, such as short-term work schemes or wage subsidies, amounting to an average of 1.8 per cent of GDP. Still, such policy support requires sufficient fiscal capacity, fiscal space and labour market programmes. Support varied considerably between advanced and low-income economies, and often did not reach informally employed workers (IMF, 2021a).

As also mentioned in Section A, advanced economies have deployed fiscal and monetary support equivalent to about 25 per cent of their GDP (if liquidity, loans and guarantees are taken into account beyond the 15 per cent represented by fiscal support), according to the IMF. In low-income countries, the equivalent figure is under 3 per cent, of a much lower GDP. Differences among economies with respect to pre-crisis debt levels, labour market structures and speed of access to vaccines may, therefore, lead to uneven recovery dynamics across countries. Projections of future developments are highly uncertain due to the potential for renewed waves and variants of the virus, which will continue to require further policy adjustments.

The economic impact of socio-economic shocks, such as wars, terrorist attacks and economic crises, is also substantial. In a sample of 84 countries over the period 1961-95, a civil war tended to reduce a country's growth by 31 per cent in the long run and by 85 per cent in the short run, and to impose a negative effect in neighbouring countries (Glick and Taylor, 2010; Murdoch and Sandler, 2004). Sub-Saharan countries in conflict between 1989 and 2019 faced lower annual growth averaging 2.5 percentage points, experienced falling tax revenues of around 2 per cent of GDP, and suffered from a persistent decline in the productive capacity with a cumulative impact over time (Fang et al., 2020).

Terrorist attacks also have sizable negative economic effects. Business interruption and behavioural changes of businesses and households due to the 11 September 2001 attack on the World Trade Centre led to a loss of over US$ 100 billion (almost 1 per cent of the GDP of the United States) (Rose et al., 2009). In addition, increased insurance and shipping rates, losses in tourism and travel revenues, the stock market value crash, and increased security and defence spending are estimated to have cost the United States over US$ 500 billion (Looney, 2002).

An important factor affecting the ways in which shocks affect an economy is the channels through which the shocks propagate – that is, whether the shock affects the economy through demand, supply or through its impact on the level of uncertainty within that economy.

The comparison between the 2008-09 global financial crisis and the current COVID-19 crisis offers an interesting example of the differential impact of demand-and-supply shocks (see Box B.3). An overview of the channels through which shocks affect the economy and key facts is provided in Table B.2.

(c) Economic impacts of shocks remain heterogeneous

Although disasters are increasing in frequency and severity, and can have significant economic impact, they affect economic agents heterogeneously depending on the type of hazard and the levels of exposure and vulnerability, as well as the propagation channels in the economy. A broad range of factors, including geography, macroeconomic fundamentals and policy responses, determine the exposure and vulnerability to hazards. In this context, the following subsections highlight heterogeneous effects of shocks provoked by disasters on households, gender groups, industries and regions.

(i) Welfare effects of shocks are stronger on poor households

In addition to monetary losses from shocks, households experience different welfare effects with regard to education, health and consumption, as well as general levels of poverty and inequality. These welfare effects are not only caused by the physical

Box B.3: Demand and supply shocks in the 2008-09 global financial crisis and the COVID-19 crisis

The 2008-09 global financial crisis and the COVID-19-related crisis are characterized by different shocks to supply and demand. The 2008 global financial crisis is largely considered as a negative demand shock caused by a tremendous decline in corporate investments and a significant contraction in the consumption of durable goods by around 30 per cent (Bems, Johnson and Yi, 2013; Bussière et al., 2013). As spending on domestic services largely held up during the global financial crisis, losses to global GDP were limited to 0.6 per cent (Borchert and Mattoo, 2009; IMF, 2010). Although difficulties in obtaining trade finance (Ahn, Amiti and Weinstein, 2011; Chor and Manova, 2012) and increased protectionism (Evenett, 2020) have also been identified as factors in the literature, supply-side factors accounted for much less of the global trade collapse during the 2008 global financial crisis.

In contrast to the 2008 global financial crisis, the global recession caused by the COVID-19 pandemic is described as being both a demand and a supply shock (Brinca, Duarte and Faria-e-Castro; Del Rio-Chanona et al., 2020). On the supply side, governments' responses aiming to contain the spread of the virus, such as strict lockdowns, border closures and social distancing measures, implied skyrocketing trade costs, reduced labour mobility and factory closures or severe declines in production. These, in turn, caused bottlenecks along global value chains, interrupting the domestic and international provisions of both goods and services (Baldwin and Tomiura, 2020; Bekaert, Engstrom and Ermolov, 2020; Berthou and Stumpner, 2021; Ossa and Le Moigne, 2021). On the demand side, income uncertainty, social distancing and unemployment affected aggregate demand and eventually GDP, especially through the services industry. Accounting for between 50 to 80 per cent of GDP in most countries, the collapse of supply and demand for services contributed to a substantial contraction of global GDP in 2020 by around 3.3 per cent (IMF, 2021a; World Bank, 2021d).

Table B.2: Overview of key channels for impact transmission

Category of shock	Key channels for impact transmission	Key facts and examples
Natural hazard-related disasters	Demand shocks refer to quick and unexpected surges or drops in demand. They are quite common following the occurrence of large-scale natural disasters, particularly for medical goods, food and shelter. The physical damages and the disruption of infrastructure can also lead to supply-side impacts through business interruption.	Key facts – Between 1980 and 2020, there have been 21,665 incidents of mass disasters, and natural disasters have the highest count of occurrences among different disaster categories (EM-DAT, 2020). – Natural disasters caused total damage of over US$ 3.6 trillion between 1980 and 2020, with mean yearly damage of over US$ 20,313,000 and median incident damage of US$ 78,200,000 (EM-DAT, 2020). Examples – In 2011, the Tōhoku earthquake in Japan caused supply bottlenecks for multinational firms beyond national borders (Boehm, Flaaen and Pandalai-Nayar, 2019). – The outbreak of the COVID-19 pandemic in 2020 triggered demand surges for medical goods while causing a drop in demand for services (see Box B.2).
Technological and operational shocks	The supply-side effects of technological and operational shocks can affect the production capacity of companies. Business interruption can result in regional shocks having global implications. Certain large-scale shocks in this category can have a significant environmental impact, affecting people's living condition in the region, which can then translate to the demand side, resulting in a general economic decline in the region.	Key facts – Between 1980 and 2020, there have been over 8,200 incidents of technological disasters; key types have included transport, industrial and miscellaneous accidents. – The total amount of damage caused by this category of shocks added up to an annual global average of US$ 91 billion during this period. The median of the damage is US$ 70 million, but the average is over US$ 791.5 million. – While such shocks hit a few agents directly, they can trigger tremendous negative externalities. Examples – The sinking of the "Prestige" oil tanker near Spain in 2002 caused environmental pollution and triggered costs of EUR 113.2 million, including compensations for the fishery industry (Surís-Regueiro, Garza-Gil and Varela-Lafuente, 2007). – The Chernobyl nuclear meltdown in 1986 triggered costs of 5 to 7 per cent of Ukraine's annual GDP for clean-up, recovery, and compensation between 1986 and 2015 (Danzer and Danzer, 2016). The disaster also resulted in the relocation of 335,000 people (Waddington et al., 2017). – Cyber-attacks on firms and critical infrastructure led to a power outage in Ukraine in 2015 and a partial virtual blockade of the National Health Service in the United Kingdom in 2017 (Allianz SE, 2021; Lis and Mendel, 2019).
Socio-economic shocks	Different types of conflicts, crises, and disasters in this category have different, and often complex, origins. Socio-political instability and uncertainty in this context can be a source of perceived risk by economic agents. The economic cost of uncertainty can be significant, and the effects can be persistent.	Key facts – There have been 442 significant political conflicts around the world since 1825.[4] – Between 1970 and 2017, there have been 151 banking crises, 236 currency crises, and 74 sovereign crises (Laeven and Valencia, 2018). – While economic crises generally do not result in casualties, political conflicts often do and can have a detrimental impact on social security and business confidence. Examples – Between 1989 and 2019, sub-Saharan countries in conflict suffered on average lower annual GDP growth of 2.5 percentage points, faced falling tax revenues of around 2 per cent of GDP, and suffered from a negative cumulative impact on GDP per capita which increased over time (Fang et al., 2020). – The 9/11 terrorist attack (i.e., on 11 September 2001 in the United States) triggered damages of US$ 100 billion related to business interruptions and behavioural changes and caused additional indirect costs of US$ 500 billion related to uncertainty (Looney, 2002; Rose et al., 2009).

destruction of assets or personal injuries, but are also linked to income losses of households, which trigger reduced investments, for example in education and health.

With respect to education, disasters can lead to poorer school performance and attendance, as well as to lower numbers of students completing school, particularly among poor households. There is evidence that following a shock, children start or intensify their working time at the cost of school attendance, as a coping strategy for households to mitigate income losses from disasters. For example, the tropical storm "Agatha" in 2010 triggered a 13 per cent cut in education-related expenditures in urban Guatemala (Baez et al., 2016). Similarly, between 2005 and 2009, test scores, as well as schooling, in rural India worsened in the aftermath of rainfall shocks as children shifted from school to work (Shah and Steinberg, 2017).

Disasters can have detrimental effects directly on physical and mental health as well as due to lower investments in public health. For example, after Hurricane Mitch hit Nicaragua in 1998, the probability of malnourishment of children in the affected region increased by 9 per cent, and the likelihood of being able to visit a doctor dropped by 30 per cent (Baez and Santos, 2007). In another example, more than 30 per cent of high school students reported suffering from either partial or full post-traumatic stress disorder (PTSD) after the L'Aquila earthquake in Italy in 2009 (Dell'Osso et al., 2011). Finally, surveys in 2020 have indicated that about 87 per cent of the people discharged from hospital after treatment for COVID-19 infection still had certain symptoms, even up to 60 days later (Carfi et al., 2020).

Income losses from disasters can also reduce the living standards of poor households, due to forced sales of productive assets and less consumption, as well as reduced education- and health-related investments (Hill, Skoufias and Maher, 2019). Around 26 million people fall into poverty every year as a result of natural hazards, mostly in the form of floods and droughts. Poor households are disproportionally affected by consumption losses: while people in the bottom 20 per cent experience only 11 per cent of total asset losses, they suffer from 47 per cent of losses in consumption (Hallegatte et al., 2017).

Importantly, shocks can trigger negative consequences in the long run, especially for poor households. By having a detrimental effect on education, health, savings and investments, shocks can cause persistently lower income growth rates and increased levels of poverty (Hallegatte et al., 2016). Adverse effects can be triggered by the actual occurrence of disasters, but can also arise in the presence of risks, as investments are disincentivized.

(ii) Gender effects of shocks

Disasters trigger heterogeneous effects on men and women, due to the expected roles of men and women in society, along with widespread self-selection into specific occupations on the labour market (Erman et al., 2021). Given their higher representation in risky rescue work and outdoor activities such as forestry and construction, men account for a larger share of casualties from natural hazards, particularly in developed countries (Badoux et al., 2016; Doocy et al., 2013; Erman et al., 2021). Men also tend have higher employment rates than women in sectors that are less robust to typical business cycle shocks, such as construction, natural resources and mining (Wall, 2009).

Accordingly, it is estimated that the COVID-19 pandemic will deepen short-term gender inequalities in terms of employment rates and hours worked (Alon et al., 2021; Bluedorn et al., 2021). As women tend to work in higher numbers than men in face-to-face contact-intensive jobs, for example in the tourism and hospitality sectors, that are less telecommutable than the jobs of their male peers, women are more severely affected by lockdown measures (Alon et al., 2021; WTO, 2020d), although the faster recovery of employment rates of women compared to men in the second half of 2020 likely reflects the reopening of these sectors (Bluedorn et al., 2021).

On the other hand, certain negative effects on women also depend on the fact that when women own businesses, these tend predominantly to be micro, small and medium-sized enterprises (MSMEs), which have suffered from cash flow shortages since the outbreak of the pandemic (IFC, 2014; ILO, 2020). These negative effects are further reinforced in countries where the vast majority of women is employed in the informal sector without access to unemployment benefits (Ghoshal, 2020).

Women were also more affected by the pandemic due to their often greater responsibility for housework, childcare and taking care of sick members of the household. Results from an investigation on the US Current Population Survey, for example, show that mothers with young children reduced their work hours by four to five times more than fathers in order to take on childcare and housework responsibilities, increasing the gender work-hour gap between mothers and fathers by 20–50 per cent between February and April 2020 (Collins et al., 2021).

(iii) Sectoral differences in the effect of shocks

Shocks cascade down to different sectors through various channels. Apart from the material destruction of assets, all types of disasters potentially affect different sectors by shifting demand across and within sectors, as well as by provoking price fluctuations in key inputs such as oil.

Shifts in demand are specific to shocks. For example, in the aftermath of the 2004 Indian Ocean tsunami, reconstruction work in Indonesia led to a significant surge in prices for domestic building materials and wages of construction workers, thus harming domestic industries relying on such inputs (Jayasuriya and McCawley, 2008). Since the outbreak of the COVID-19 pandemic, sectors producing goods and services such as medical equipment, health services, home entertainment and video-conferencing software have experienced a surge in demand, while services such as air travel, restaurants and tourism, have suffered from a drop in demand (see Box B.4 and Box B.5).

Shifts also occur within sectors. Since the outbreak of the COVID-19 pandemic, firms and retailers with distribution channels unaffected by lockdown measures have benefitted from growing demand. For example in Portugal, purchases in the non-specialized retail sector (i.e. shops such as supermarkets and grocery stores), which was unaffected by lockdown measures, experienced a temporary boost, while specialized retailers and services such as vehicle retailers or the travel industry faced the largest decrease (Carvalho, Peralta and dos Santos, 2020). Similarly, online platforms grew like, for example, Amazon, which expanded its net revenue in the fourth quarter of 2020 by 43.6 per cent compared to the previous year.[5]

However, lockdown measures designed to contain COVID-19 adversely impacted MSMEs. This was because MSMEs are disproportionally represented in sectors that have been most affected by the pandemic, such as wholesale and retail trade, air transport, accommodation and food services, real estate, professional services, and other personal services (OECD, 2021h).

Sectors are also affected by price fluctuations of key inputs in the aftermath of shocks. For example, socio-economic shocks in the Middle East boosted oil prices by 25 and 70 per cent in the 1980s and 1990s, respectively (Hamilton, 2009). To date, oil is intensively used in transportation, energy and plastics/chemicals production, so that oil price shocks can depress economic performance indicators such as stock market returns (Sakaki, 2019). Consequently, oil price shocks caused by socio-economic crises such as conflicts can distort the performance of industries based on their respective reliance on oil.

(iv) Regional differences in the effect of shocks

Whether shocks affect different regions around the world, and to what extent, depends on various, partially interconnected, determinants, ranging from geography to macroeconomic fundamentals, to policy responses of governments.

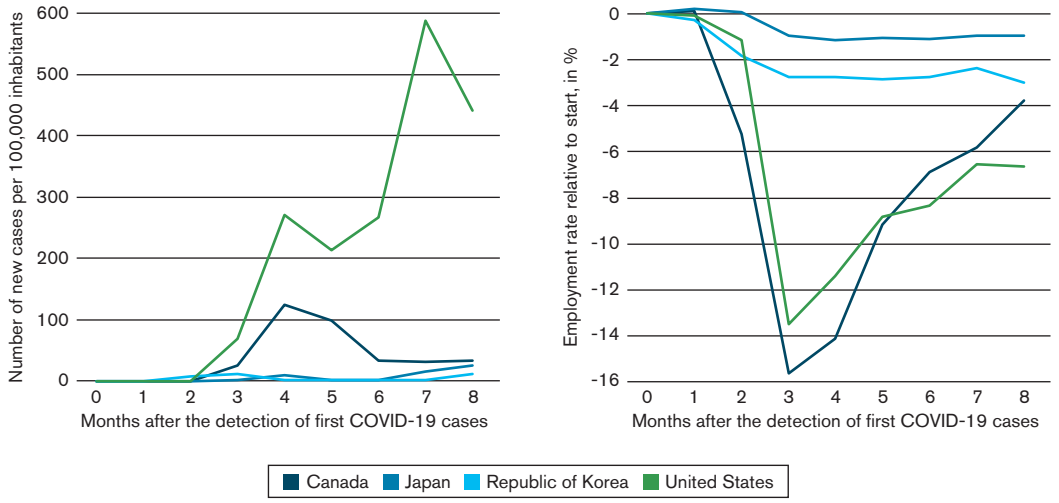
The geographic exposure of regions along coastlines or big rivers makes some areas in the world more prone to be hit by natural disasters such as storms and floods, with significant negative consequences. For example, big tropical storms hitting the Caribbean and the east coast of the United States caused an average US$ 5.9 billion worth of damage per year between 1980 and 2020 (EM-DAT, 2020).

During the 2008 global financial crisis, wealthier emerging economies and poorer high-income countries tended to experience the largest growth collapses (Didier, Hevia and Schmukler, 2012). In this context, current account deficits of economies were identified as one key macroeconomic variable making some economies more vulnerable to financial shocks than others (Lane and Milesi-Ferretti, 2011; Nier and Merrouche, 2010).

Following the outbreak of the COVID-19 pandemic, economies experienced a drop in employment rates of differing magnitudes in the first half of 2020. The United States, for example, experienced a rise in its unemployment rate from 10.3 per cent in March 2020 to 14.7 per cent in April of the same year, the highest monthly increase in unemployment in US history (Shrestha et al., 2020). Figure B.8 depicts employment rates of selected economies during the first wave of COVID-19 in 2020, along with the monthly number of new COVID-19 cases per 100,000 inhabitants.

Various factors may explain these different patterns, including labour market conditions, government support measures targeted to the labour market, and the strictness of lockdown measures adopted to control the pandemic. Figure B.8 shows a potential correlation between the growth rate of the number of confirmed COVID-19 cases and unemployment dynamics. For example, certain economies in Asia like Japan and the Republic of Korea that kept the spread of the pandemic under control during that period also

Figure B.8: Unemployment tends to rise when the COVID-19 health situation deteriorates



Source: Authors' calculations based on 2021 data from the Federal Reserve Bank of St. Louis (FRED) (available at https://fred.stlouisfed.org), World Development Indicators for 2019 populations as well as 2021 data on COVID-19 cases from Johns Hopkins Coronavirus Resource Center.

Note: The figure shows new COVID-19 cases and changes in employment rates in selected countries. Time refers to the months following the detection of the first COVID-19 cases in a given economy in 2020.

appear to have suffered fewer effects on the labour market during the same period.

4. How do shocks impact international trade?

Although it is challenging to generalize the impact of shocks on goods and services trade given the multitude of channels through which disasters can materialize, this subsection highlights how exports and imports can be impacted differently by shocks.

(a) Shocks can affect exports, imports and trade costs differently

Negative shocks triggered by natural disasters, technological and operational incidents or conflicts and violence can impact trade by increasing trade costs and by affecting demand for imports and supply of exports.

All types of disasters have the potential to trigger an increase in trade costs, as shocks can damage physical assets like merchandise goods, infrastructure, or human and physical capital, or may lead to interruptions of transport. The obstruction in March 2021 of the Suez Canal – through which 12 per cent of global trade passes – is estimated to have delayed close to US$ 10 billion in trade every day and to have caused annual trade growth to dampen by 0.2 to 0.4 per cent for each week of closure (Allianz SE, 2021). In 2005, Hurricane Katrina caused short-run disruptions in international trade by damaging and destroying major ports (Friedt, 2021). COVID-19 has had a significant impact on trade costs (see Box B.4). And increases in security measures, such as tougher border controls, following terrorist attacks (a socio-economic shock) also raise the cost of international trade by, for instance, lengthening delivery times (Nitsch and Schumacher, 2004).

Natural disasters can also affect international trade by altering the demand and supply of imports and exports. For instance, while empirical evidence on natural disasters consistently points at a reduction in exports of affected countries, there is ambiguity about the impact on imports (Da Silva and Cernat, 2012; Gassebner, Keck and Teh, 2010; Oh and Reuveny, 2010).

In terms of import demand, increased trade costs and the negative shock to demand caused by unemployment and the destruction of businesses can exert a negative pressure on imports. Conversely, the need to meet domestic demand for essential goods, such as food and medicine, and for materials for reconstruction can lead a country to import more (WTO, 2019b). Consequently, the matter of whether imports decrease or increase depends on a range of factors (see Section B4(b)).

Box B.4: Trade costs in the time of global pandemic

Travel restrictions and border closures, which were an important part of the initial policy response to the pandemic, disrupted freight transport, business travel and the supply of services that rely on the presence of individuals abroad. Depending on the sector in question, transport and travel costs are estimated to account for between 20 and 31 per cent of trade costs (Rubínová and Sebti, 2021). Travel restrictions thus result in a substantial increase in trade costs for as long as they remain in place.

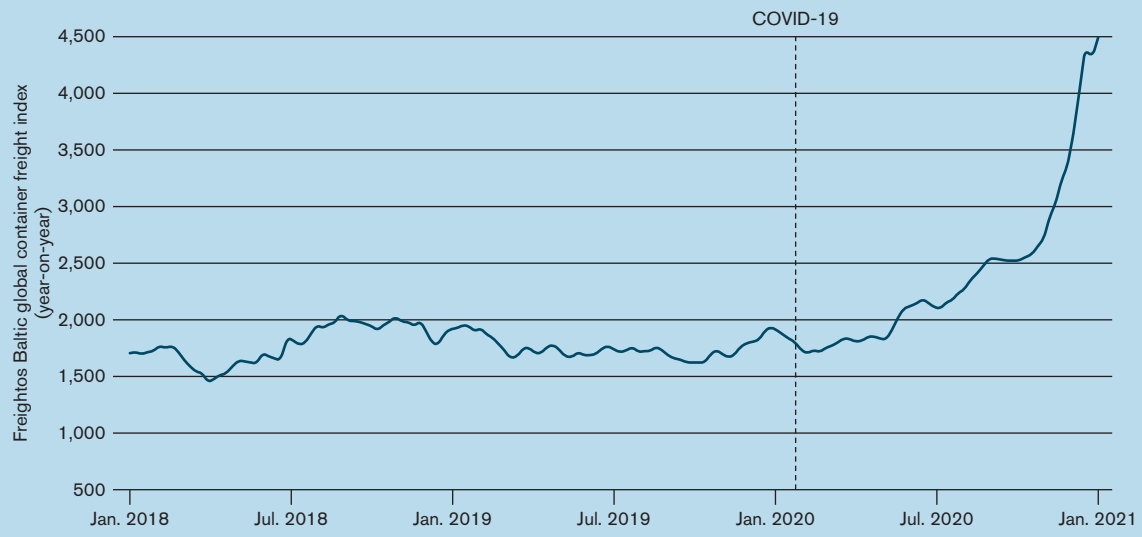
The performance of freight transport services is crucial to trade costs in manufacturing. Since the beginning of the COVID-19 crisis, maritime and land transport have remained largely functional, although they have registered considerable delays at times. Maritime transport issues have mainly related to port logistics, as many economies have changed port protocols, ranging from port closures and crew-change restrictions to additional documentation requirements and physical examinations of vessels and crew members, which disrupt shipping services (Heiland and Ulltveit-Moe, 2020).

Moreover, to prevent lower demand from depressing shipping rates, the maritime freight transport industry has decreased its supply of sailings. As a result, while the cost of container shipping in January and February 2020 was comparable to the same period in the previous year, the rebooting of the Chinese economy started pushing prices up in mid-March 2020, and the rebound of consumer demand in the United States caused a surge in May 2020 (see Figure B.9).

International land transport has been affected by border controls, sanitary measures (such as the measurement of drivers' temperatures) and special arrangements, such as the closure of certain border posts. The risks associated with travel to affected economies may also have resulted in a lack of drivers. These factors have caused delays in road cargo transport (see Figure B.10). To alleviate these issues, some exporters have tried to shift the load from road to rail, as the latter needs much fewer drivers and controls per amount of cargo (see, for instance, Knowler (2020) on the emergence of rail as the most secure option for freight transport in Italy in March 2020).

Travel restrictions have led to a drastic reduction in passenger flights, which account for around half of air cargo volume. Consequently, global air cargo capacity shrank by 24.6 per cent in March 2020, and air cargo yields (i.e. the average fare paid by customer to transport one tonne of freight and mail on one cargo revenue mile, as per www.statista.com) in April 2020 were almost twice as high as in April 2019 (see Figure B.11) (IATA, 2020a). While some airlines started flying passenger aircrafts without passengers just for the purposes of cargo, it was only the historically high prices that induced them to do so, and therefore this costs shock is likely to subside only with a rebound of passenger transport.

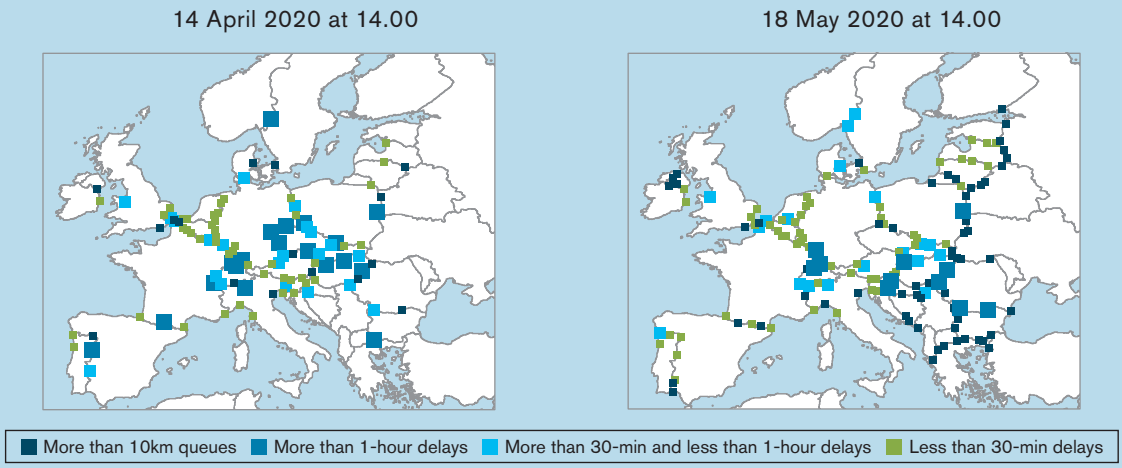
Figure B.9: Shipping rates started rising in March and surged in May 2020



Source: Freightos (2021).

Box B.4: Trade costs in the time of global pandemic *(continued)*

Figure B.10: Waiting times at European border-crossings were particularly high during the first lockdown in 2020

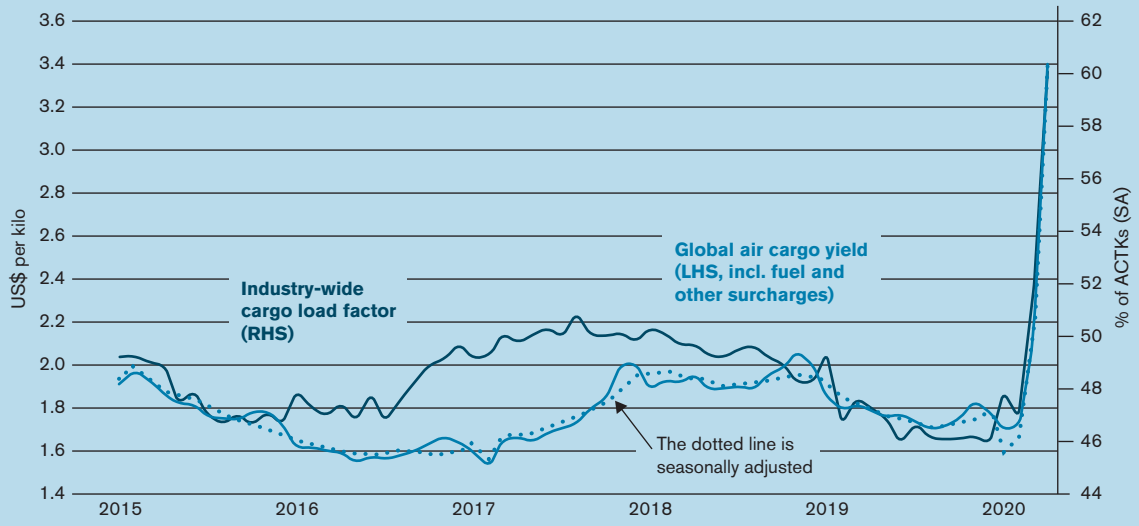


Source: Sixfold (2021) (https://live.sixfold.com).

Tradable services that rely on physical proximity between suppliers and consumers, such as tourism, passenger transport, and maintenance and repair services, have been severely impacted by travel restrictions and social distancing and have seen a prohibitive increase in trade costs. The disruption in business travel has also had an impact on trade in business and professional services, although this has depended on how possible it has been to substitute e-interactions for face-to-face communication in each particular context.

High levels of uncertainty also have increased trade costs. In the first quarter of 2020, the global level of uncertainty was 60 per cent higher than that triggered by the Iraq War and the severe acute respiratory syndrome (SARS) outbreak in 2003 (WTO, 2020e). This may result in a reduction in the supply of trade finance, imposing a particularly heavy toll on emerging and developing economies.

Figure B.11: Global air cargo capacity plummeted, causing a surge in air cargo yields



Source: IATA (2020a).

Note: Global air cargo yield (left) and load factor (right). ACTKs (SA): available cargo tonne-kilometres (seasonally adjusted). RHS: right-hand side. LHS: left-hand side.

Most shocks are local and may have limited effects in other countries. Due to increased global interconnectedness, however, some shocks can have a global scale and cause a severe global economic downturn. Both the global financial crisis of 2008-09 and the COVID-19 pandemic are remarkable examples in this regard. Box B.5 provides a comparison between these two global shocks and briefly discusses determinants of trade collapse and recovery in the wake of these crises.

(b) Shocks tend to have larger negative effects on (small) developing countries

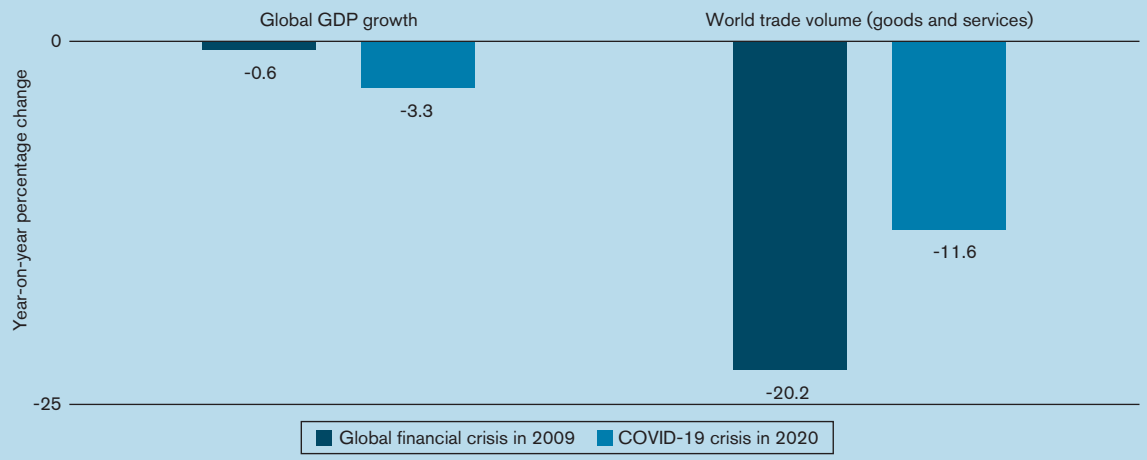
Economic disruptions tend to have a greater impact on developing countries, and in particular on small, poor countries, than on advanced countries. Imports decline by up to 20 per cent in the short run for heavily indebted poor, least-developed countries (LDCs) and landlocked developing countries affected by a natural disaster,[6] as these countries' access to financial markets is limited (Felbermayr, Gröschl and Heid, 2020). In contrast, the estimated average effect of natural disasters on imports across countries at different levels of development is either slightly positive (Felbermayr and Gröschl, 2013), or slightly negative (Gassebner, Keck and Teh, 2010). Similarly, exports from countries affected by a natural disaster are estimated to decline, on average, by merely 0.1 per cent, but exports of developing countries affected by a natural disaster fall by around 9 per cent, and exports of small developing countries drop by about 22 per cent, an effect which can last up to three years (Da Silva and Cernat, 2012; Gassebner, Keck and Teh, 2010; Jones and Olken, 2010).

Terrorist attacks, as well as industrial, transport and miscellaneous accidents, trigger heterogeneous trade effects on countries depending on their level of income. For instance, terrorist attacks have empirically been found to lead to a decline in bilateral trade of between 4 and 5 per cent on average (Blomberg and Hess, 2006; Nitsch and Schumacher, 2004). Bilateral trade between developed economies tends, however, to increase (on average by 5.6 per cent) following terrorist attacks thanks to greater imports from other developed economies and quicker recovery (Oh, 2017). Technological and operational shocks such as industrial, transport and miscellaneous accidents have also been found to increase bilateral

Box B.5: Unlike during the 2008-09 global financial crisis, trade in goods has been helping to sustain global trade during the COVID-19 crisis

A key difference between the global financial crisis and the current COVID-19 crisis has been the extent to which global merchandise trade flows have reacted to the contraction of economic activity. As depicted in Figure B.12, the global financial crisis was characterized by a "great trade collapse", with global trade in goods and services declining by 10.4 per cent in 2009 (12.6 per cent for merchandise alone), whereas global GDP contracted by 0.6 per cent. In 2020, the fall in global trade was also steep in absolute terms (9.6 per cent for trade in goods and services), although less so in terms of GDP, which dropped globally by 3.3 per cent.

Figure B.12: World trade declined less during the COVID-19 crisis in 2020 than during the global financial crisis in 2009



Sources: IMF (2010, 2021a).

Box B.5: Unlike during the 2008-09 global financial crisis, trade in goods has been helping to sustain global trade during the COVID-19 crisis *(continued)*

The reason why the COVID-19 crisis has not been accompanied by a more severe trade collapse, as experiences during the global financial crisis would suggest, is related to different demand-and-supply dynamics during the two crises, as well as a differing impact on tradable and non-tradable goods (see also Box B.3).

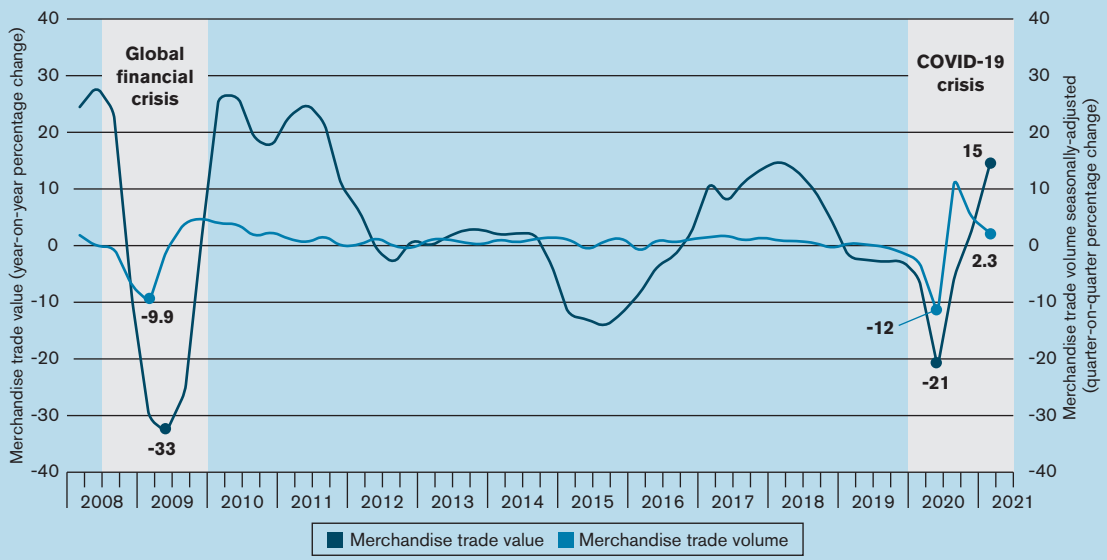
During the global financial crisis, the drop in demand for trade-intensive durable goods, in particular, had a significant impact on international trade and caused a substantial contraction of imports (Bems, Johnson and Yi, 2011; Benguria and Taylor, 2020). Besides accounting for a substantial share of merchandise trade, high-value finished goods also drive trade in intermediates (Eaton et al., 2016).

Consequently, the declining demand for durables translated into an even stronger decrease in trade. Amplified by the existence of highly integrated and synchronized production networks (Yi, 2009), the negative demand shock was propagated via global value chains and triggered a drop in international trade.

In contrast, the demand-and-supply shock caused by the COVID-19 pandemic triggered a substantial contraction in GDP, but a less severe decline in world trade compared to the collapse during the global financial crisis. Rebounding demand for tradable goods along with persistently low demand for less trade-intensive services explains the decoupling of GDP and global trade (Ossa and Le Moigne, 2021). Even though the value of global trade collapsed by 21 per cent during the second quarter of 2020 compared to 2019, it declined to a smaller extent and recovered more rapidly than it did during the global financial crisis (see Figure B.13).

While increased demand for goods related to the pandemic and to "lockdown life" – such as medical goods, masks, home office appliances and consumer electronics – have helped to mitigate the collapse in trade, empirical investigations suggest that the swift trade recovery in 2020 was related to a sharp decline of trade costs due to reduced export restrictions in the second quarter of 2020, a drop in oil prices, China's short-lived recession and firms' adaptation of production processes to the new sanitary regulations (Ossa and Le Moigne, 2021).

Figure B.13: Merchandise trade declined to a smaller extent and recovered more rapidly during the COVID-19 crisis than during the global financial crisis

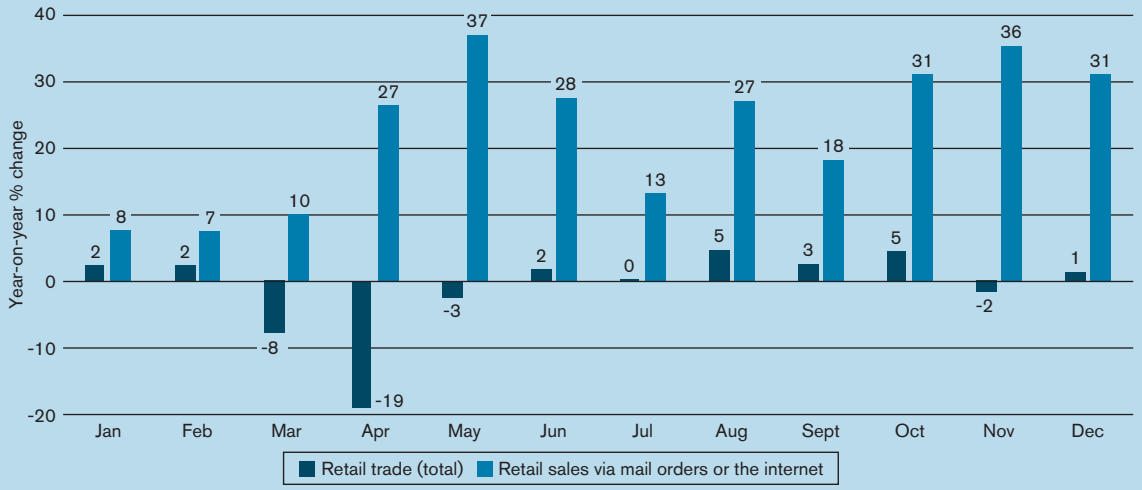


Source: Authors' calculations, based on WTO data (https://data.wto.org).

Note: The left axis shows merchandise trade captured as average of exports and imports, year-on-year.

Box B.5: Unlike during the 2008-09 global financial crisis, trade in goods has been helping to sustain global trade during the COVID-19 crisis *(continued)*

Figure B.14: Euro area retail sales via mail orders and the internet increased during the 2020 lockdowns



Source: Authors' calculations, based on Eurostat (https://ec.europa.eu/eurostat), 2021.

Note: Total retail sales excludes motor vehicles and motorcycles. The Euro area encompasses Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia and Spain.

In this context, the share of intermediate inputs in trade between late 2019 and late 2020 remained stable at around 50 per cent, indicating a limited propagation of COVID-19 related shocks via global value chains at the aggregate level (Berthou and Stumpner, 2021) based on WTO estimates. Moreover, substantial macroeconomic stimulus in 2020 and early 2021 helped trade recovery, as fiscal support to households strongly increased spending, particularly on tradable goods (Chetty et al., 2017; IMF, 2020a; 2021a).

Importantly, during the COVID-19 crisis, digital technologies mitigated the trade shock in terms of both supply and demand by helping firms to maintain activity and accelerating previous trends in consumer online shopping (OECD, 2020c). Although not all online orders involve cross-border trade, the increase in retail trade via mail orders or via the internet led to an exceptional growth in the sector throughout 2020, with companies such as UPS and PayPal reporting substantial growth on cross-border shipment volumes and values, respectively (Fitzpatrick et al., 2020).

Figure B.14 illustrates dynamics of online and total retail trade in the Euro area throughout 2020. While total Euro area retail trade dropped by 19 per cent in April 2020 compared to the previous year, retail sales via mail-order houses and the internet increased in 2020, peaking at year-on-year growth rates of 35 and 36 per cent during the two major phases of the European lockdowns in May and November 2020.

trade between developed economies by around 2.2 per cent. The increase in trade among developed countries is attributed to higher needs for imports to compensate for the loss of domestic production as well as to help with recovery efforts, coupled with little concern over ability to pay (Oh, 2017).

Financial crises also have a stronger impact on developing economies. In the aftermath of financial crises, imports of developing countries are found to decline at almost double the rate of import declines in advanced economies (Benguria and Taylor, 2020). Additionally, advanced economies' imports recover within three years, but the effects on developing economies can last more than five years.

(c) Shocks can have significant sectoral differential effects on trade

International trade in some sectors tends to be more exposed and vulnerable to certain types of shocks. Among those industries, there are the agriculture sector, services and manufacturing global value chains.

(i) Agricultural sectors are particularly vulnerable to natural disaster and technological shocks

Given its high dependence on weather and climate, the agricultural sector tends to be particularly vulnerable to adverse natural phenomena, as well as to technological shocks. For instance, tropical storms disproportionally affect primary agricultural products. Meteorological hazards spreading invasive pests, such as the locust outbreak in East Africa in 2019, can further undermine future exports of agricultural products (Mohan, 2017; WTO, 2019c).

Similarly, the increasing numbers of disease outbreaks of a transboundary nature are undermining food security and safe trade in the livestock sector (FAO, 2018). Moreover, past technological and operational shocks have demonstrated that trade in agriculture-related sectors and the fishery industry suffer when there are environmental incidents. For instance, the Exxon Valdez oil spill in Alaska in 1989 had long-lasting impacts on commercial fisheries production, much of which was destined for exports (Owen et al., 1995). The contamination of food products resulting from the Fukushima nuclear disaster in 2011 and subsequent import restrictions from trade partners reduced exports of Japanese agricultural products, which declined by 11 per cent in the last quarter of 2011. Imports in the same product category increased in the same year to compensate for the loss of local production (Bachev and Ito, 2014).

(ii) Services trade, particularly tourism, can be sharply affected by shocks

The travel and tourism industries are affected by a wide range of shocks. Individual travel decisions are influenced by various exogenous factors such as income, the exchange rate, and political and environmental conditions (Pforr, 2009; Ritchie et al., 2014). All types of disasters can thus trigger a decline in international demand for tourism by destroying relevant assets, reducing incomes, or increasing uncertainty on the political and environmental safety at destinations.

Natural disasters can destroy tourist accommodation and travel-related infrastructure, and can also adversely influence consumer perceptions. For example, tourist visits to the Caribbean fall after hurricanes in the region, due to perceptions by potential tourists that the event has destroyed the entire region (WTTC, 2018).

Industrial accidents, such as the 1989 Exxon Valdez oil spill in Alaska or the 2010 Deepwater Horizon oil spill in the Gulf of Mexico, can interrupt tourism-related business during the clean-up process and disrupt tourists' plans to visit the area (Cirer-Costa, 2015; Ritchie et al., 2014). In Alaska, the oil spill triggered a decline in tourism spending of 35 per cent and caused losses in the tourism industry of around US$ 2.4 billion (Lyon and Weiss, 2010; Robinson, 2020).

Terrorist attacks can reduce demand for tourism due to uncertainty with respect to safety as well as increasing costs linked to heightened security measures. For instance, passenger loads and hotel occupancy rates declined by more than 50 per cent in the United States immediately after the 11 September 2001 terrorist attacks (Goodrich, 2002).

Other socio-economic shocks, such as economic recessions and financial crises, can harm tourism by reducing incomes. In a study of 200 countries (Khalid, Okafor and Shafiullah, 2020), inflation crises, stock market turmoil and banking crises occurring either in the origin or in the destination country were found to reduce tourism, while currency depreciation at the destination, linked to sovereign debt crises, favours services exports and eventually triggers higher international tourist arrivals.

Nevertheless, as shown in Figure B.16 for the period from 1995 to 2020 tourism arrivals were resilient to shocks and recovered quickly from them. For example, no major drop was observed in the aftermath of the 11 September 2001 terrorist attacks, but growth slowed to 1 per cent compared to the average year-on-year growth of 4.3 per cent during the whole period (excluding 2020). During the severe acute respiratory syndrome (SARS) epidemic of 2003, global tourist arrivals fell by 9.3 per cent in Asia and the Pacific area, but this was followed by an increase of around 27.3 per cent in 2004. Similarly, global tourist arrivals declined by 3.75 per cent in 2009 after the 2008 global financial crisis, but then recovered in 2010 and went on to exceed the pre-crisis level by 7.7 per cent.

Having caused international tourist arrivals to drop by 74 per cent in 2020, the outbreak of COVID-19 represents the worst shock to international tourism in recent decades. Widespread travel bans and limited face-to-face interactions to contain the virus have restricted international cross-border movements and trade in tourism-related services (see, for example, Box B.6 on the impact of COVID-19 on the tourism industry in Mauritius).

As Figure B.17 shows, during the second quarter of 2020, trade in services such as transport and spending by international travellers ("travel") plummeted by

Box B.6: The impact of COVID-19 on the tourism sector and economy of Mauritius

The outbreak of COVID-19 has brought a halt to the tourism sector in Mauritius. The island went through a first lockdown from mid-March to mid-June 2020 with the first wave of COVID-19, and again in March 2021 with the second wave. Mauritius closed its borders when the first COVID-19 cases were discovered, and reopened them on 1 October 2020; however, a mandatory quarantine period of two weeks was introduced for all travellers entering Mauritius. This mandatory quarantine period acts as a major constraint to tourist flows in Mauritius, as the average length of a tourist stay is 10 to 12 days.

Mauritius launched a new one-year visa in October 2020, with the possibility of further extensions, to offset the damage caused to the travel and tourism sector by the pandemic. The premium visa targeted tourists, retirees seeking a safe haven from the virus and professionals (i.e. remote workers) who wish to be in Mauritius with their families. These visitors were not allowed to enter the labour market. However, following the emergence of the new strains of COVID-19, Mauritius banned entry for all travellers up to 30 June 2021.

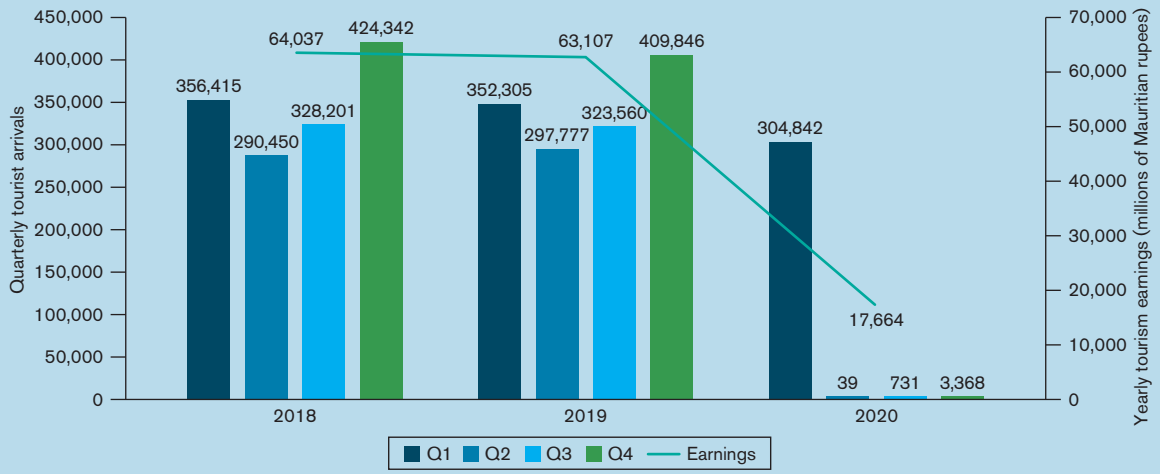
The tourism sector, which accounted for 18.8 per cent of GDP and 19.1 per cent of total employment in 2019, is facing a severe slow-down. In 2020 tourist arrivals fell by 77.7 per cent and tourism earnings by 72 per cent compared to the previous year. The first quarter of 2021 saw a further drastic drop in arrivals by 99.1 per cent relative to the same period in 2020 (Government of Mauritius, 2021) (see Figure B.15).

The authorities in Mauritius adopted the Wage Assistance Scheme (WAS) and the Self-Employment Assistance Scheme (SEAS) to mitigate the socio-economic impacts of COVID-19. The former targets businesses, allowing their employees to draw a monthly basic wage of up to US$ 1,250. The SEAS assists self-employed persons who have suffered a loss in revenue due to the lockdown. Around 24 billion Mauritian rupees were disbursed for these two financial assistance plans during the confinements of 2020 and 2021. Almost 16,700 employers requested the wage assistance schemes, while 258,079 self-employed workers benefitted from the SEAS.

In the tourism industry as of July 2020, an amount of some 2 billion Mauritian rupees had been disbursed to more than 39,000 employees under the WAS, while an estimated 26 million Mauritian rupees had been disbursed to around 1,500 self-employed workers under the SEAS. The authorities have maintained both schemes for workers in the tourism industry for as long as borders are closed. In addition, around 9 billion Mauritian rupees were provided by the National Resilience Fund to support Air Mauritius, the national airline of Mauritius.

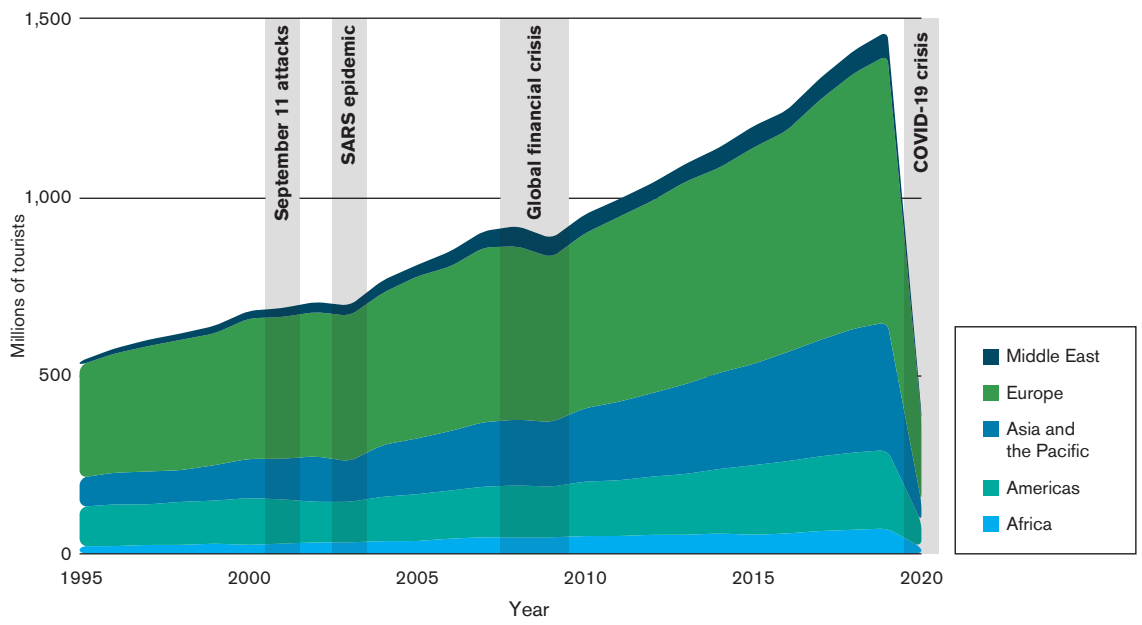
Mauritian authorities have made the vaccination of 60 per cent of the population a precondition for restarting the tourism sector. Priority for vaccination was given to frontline workers, including employees of the tourism industry.

Figure B.15: Tourist arrivals and tourism earnings of Mauritius collapsed during the COVID-19 crisis in 2020



Source: Authors' calculations, based on data from the Government of Mauritius (2021). Box prepared by Professor Boopen Seetanah (University of Mauritius and WTO Chair), Professor Verena Tandrayen-Ragoobur (University of Mauritius) and Professor Jaime De Melo (University of Geneva).

Figure B.16: International tourist arrivals collapsed during the early stages of the COVID-19 pandemic



Source: United Nations World Tourism Organization (UNWTO) World Tourism Barometer (2021).

30 per cent and 81 per cent respectively compared to the previous year, while other services dropped by only 8 per cent. The decrease in transport services trade was driven predominantly by restrictions to passenger travel. LDCs, many of which are particularly dependent on tourism/travel exports, experienced an estimated decline in services exports of 39 per cent in 2020, compared to a decline of 20 per cent for rest of the world.

Tourism showed some signs of recovery in the third quarter of 2020, in line with analyses of the International Air Transport Association (IATA) highlighting signs of substantial pent-up demand in domestic and international air travel for whenever restrictions are eased (IATA, 2020b). Future dynamics in the tourism and travel industry will, crucially, be linked to travel restrictions, the effectiveness of vaccination programmes and the successful coordination of health and safety protocols.

Other commercial services sectors were unevenly affected by the pandemic (see Figure B.18). While services requiring physical proximity, such as construction and artistic and recreational services, faced a tremendous decline in exports, others, such as financial and computer services, experienced only a marginal decline or even expanded due to rising demand – accelerated by the pandemic – for cloud computing and for virtual platforms and workplaces.

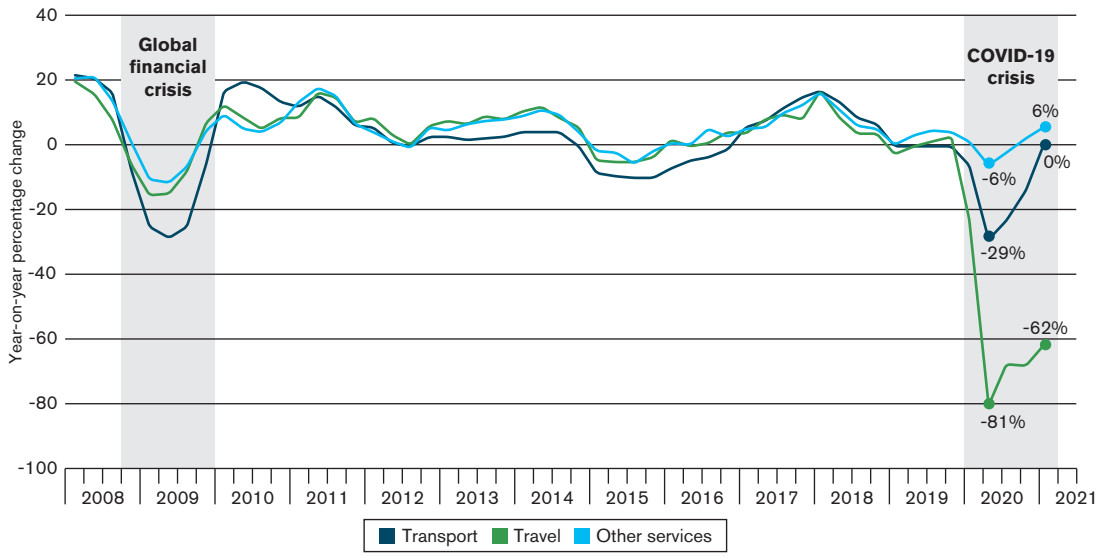
(iii) Manufacturing sectors are affected by supply and demand dynamics along global value chains

Shocks caused by disasters can impact manufacturers via different channels. The outbreak of the COVID-19 pandemic in 2020 triggered different demand-and-supply dynamics for manufacturers. Supply interruptions due to the lockdowns have devastated merchandise trade in certain categories (see Figure B.19). Sectors in exporting countries which have a lower share of occupations that can be done remotely have experienced a more severe drop in trade flows (Espitia et al., 2021). Demand-and-supply interruptions reduced trade in automotive products by 51 per cent in the second quarter of 2020 compared to the previous year (see Figure B.19).

Demand factors also contributed to the fall in trade. Confinement measures of importing countries reduced the demand for consumption goods, such as luxury goods, clothing, leather and footwear, while sectors such as food and agricultural products were relatively resilient (Berthou and Stumpner, 2021).

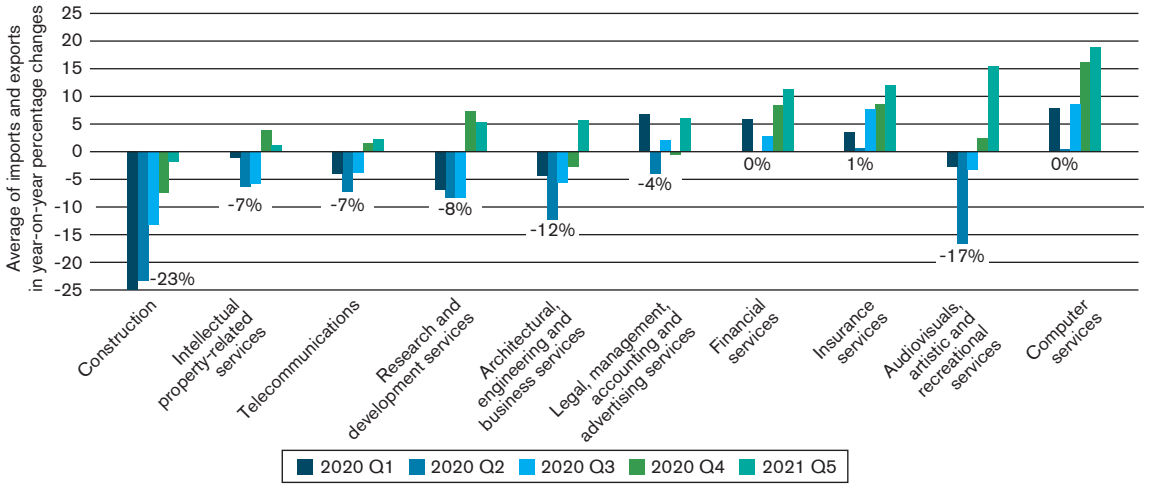
Other sectors have benefited from increased demand. For instance, trade in computers and electronic components – which are complementary with working from home – recorded growth of 4 and 12 per cent in 2020 after the first quarter, as well as growth of

Figure B.17: Trade in commercial services dropped more severely during the COVID-19 crisis than during the global financial crisis



Source: Authors' calculations, based on WTO-United Nations Conference on Trade and Development (UNCTAD)-International Trade Centre (ITC) dataset (https://data.wto.org).

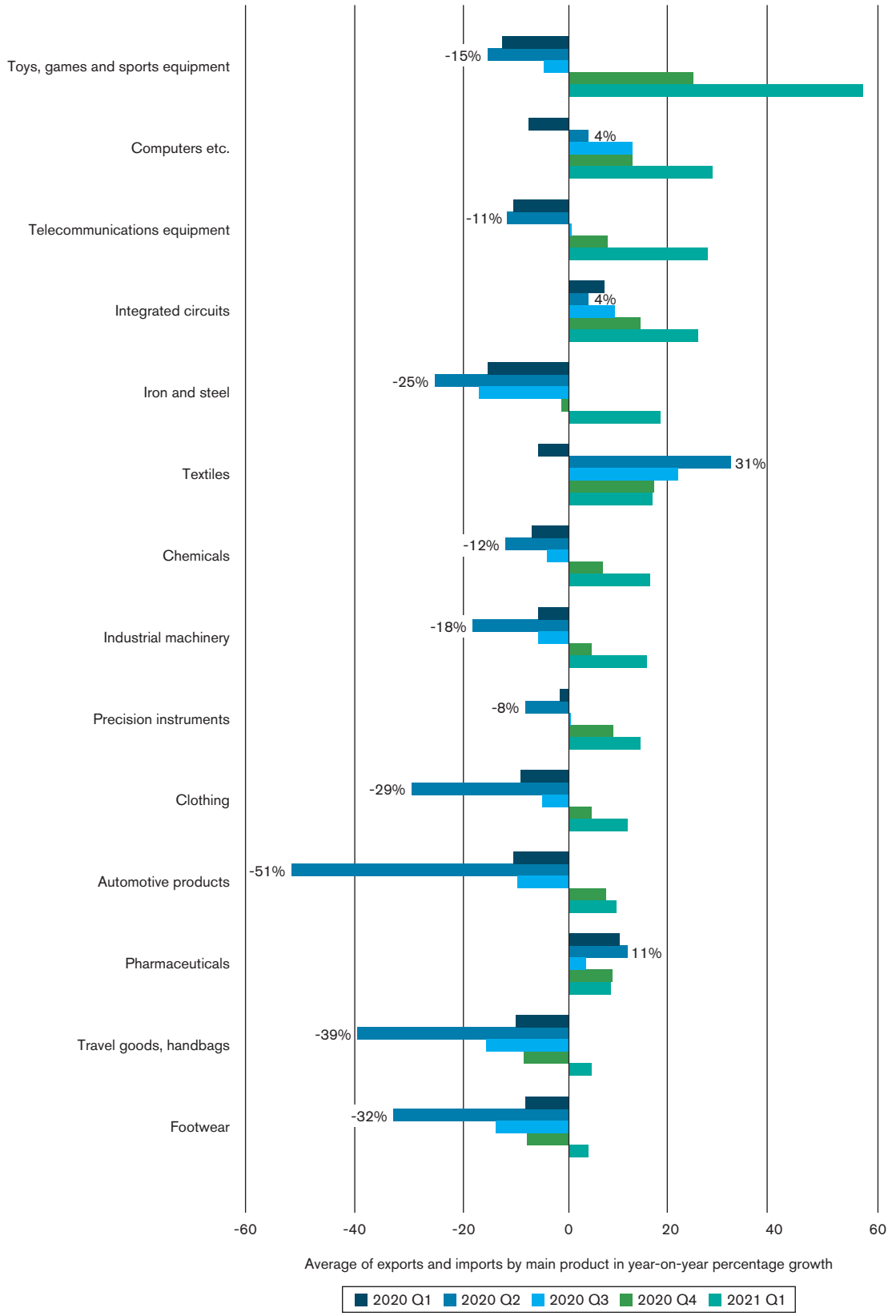
Figure B.18: Commercial services sectors were unevenly affected by the pandemic



Source: Authors' calculations, based on WTO-UNCTAD-ITC dataset (https://data.wto.org).

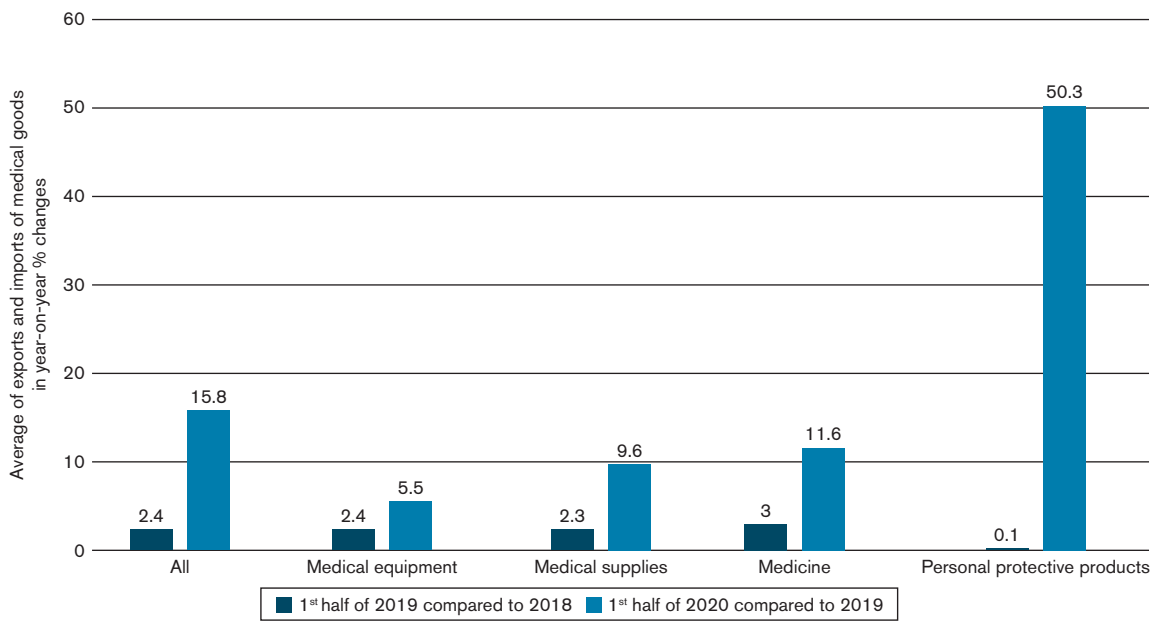
28 per cent in the first quarter of 2021. Pharmaceutical products – necessary to fight the pandemic – recorded the most rapid increase in the second quarter, up 11 per cent, but slowed in the third quarter, suggesting an end to stockpiling. Trade in medical goods necessary to fight the pandemic surged in 2020. The 15.8 per cent year-on-year growth from the first half of the year for medical goods contrasts with their modest growth of 2.4 per cent in 2019 (see Figure B.20). Trade in personal protective equipment (PPE) increased by 50.3 per cent – becoming the second-largest category of medical goods traded in 2020. Trade in medicines, which remain the largest category traded by value, grew by 11.6 per cent, followed by medical supplies (9.6 per cent) and medical equipment (5.5 per cent). Trade in breathing apparatus, such as ventilators and respirators, was up 56 per cent compared with the same period of 2019, while trade in face masks rose by 87 per cent.

Figure B.19: Trade in goods was heterogeneously affected by the COVID-19 crisis in 2020
(Percentage change in US$ values)



Source: Authors' calculations, based on WTO-UNCTAD-ITC dataset (https://data.wto.org).

Figure B.20: Trade in medical goods increased during the first half of 2020



Source: Authors' calculations, based on WTO trade data (https://data.wto.org).

As the World Health Organization (WHO) and national health authorities increasingly recommended the use of face masks in early 2020, the spike in demand for surgical masks and other PPE used by health workers caused a global shortage which could not be covered by one country alone. For example, although China had the capacity to produce about 8 per cent of the daily domestic demand to equip health, manufacturing, and transports workers by January 2020, it still had to import over two billion masks and another 400 million other items of PPE at the beginning of the pandemic, even after ramping up production (Bradsher, 2020; OECD, 2020a).

The impact of shocks on manufacturing sectors' trade dynamics is closely linked to global value chains, which are discussed in Section C.

5. Economic and trade policy response to shocks

When disasters occur, governments around the world react by implementing economic policies aimed at cushioning the economic effects of the shock. These policy responses may take different forms, depending on whether the shock affects the demand or supply. After presenting general economic policies in response to shocks, this subsection highlights how trade-restrictive measures tend to increase after some shocks, although trade-opening measures are also adopted after shocks strike.

(a) Economic policy response

In macroeconomic theory, policy response to shocks is usually defined by the type of impact they have on the economic system. As discussed in Section B3(b), the impact of economic disruptions can be decomposed into: (i) demand shocks, (ii) supply shocks and (iii) increased uncertainty.

(i) Demand shocks

The standard policy response to demand shocks is usually countercyclical. In other words, it aims to mitigate both positive and negative demand shocks in order to stabilize prices and employment levels (Friedman, 1995; Mundell, 1962; Tinbergen, 1952). To this end, a multitude of policy tools is used. Many of these measures take the form of automatic stabilizers (Égert, 2012; ECB, 2010). For example, progressive taxation automatically reduces or increases individuals' taxation depending on changes in income, and payments of unemployment benefits may automatically increase in periods of economic stress and decrease in periods of growth.

In addition, governments usually introduce exceptional measures to face large shocks (Combes, Minea and Sow, 2017; ECB, 2010). For example, in the case of a negative demand shock, expansive fiscal and monetary policies are often favoured, such as increased government spending, reduced interest rates, cuts in

taxes, or the introduction of additional consumption and unemployment subsidies. For example, the most common policy response to the global financial crisis was the adoption of expansive fiscal policies: 65 out of 77 countries examined adopted expansive fiscal policies in the aftermath of the crisis (see Table B.3). On average, countries implemented fiscal stimulus worth about 2 per cent of GDP (WTO, 2014). Other common demand-side responses explicitly targeted employment and included increased hiring in the public sector (47 countries), the reduction of certain employment-related taxes and burdens (52 countries), and actions related to employment conditions (54 countries).

Conversely, when a demand shock is positive, the usual response involves fiscal and monetary contraction to avoid "overheating" of the economic system and a surge in prices (Mundell, 1962). Moreover, trade policy plays an important role in meeting positive demand shocks (see Section B5(b)).

(ii) Supply shocks

Supply effects are common in all types of shocks but play a particularly evident role in natural and technological shocks. An example of a supply shock is the Fukushima accident in 2011, which caused shortages in the supply of over 150 car parts, which left Toyota's North American operations running at 30 per cent of capacity for several weeks (Canis, 2011). Faced with supply shocks, government intervention may be needed to limit potential economic losses. Policy responses to supply shocks take different forms, such as grants and loans, production subsidies, infrastructure investments, deregulation, tax cuts, interest rate cuts or increases in funding for training.

Table B.4 provides an overview of the policy responses adopted in the aftermath of four recent natural disasters: the 2004 Indian Ocean tsunami, the 2010 earthquake in Haiti, the 2011 earthquake and tsunami in Japan and the 2020 Australian bushfires. Many of these policies were supply-side interventions which aimed to restore economic and logistic capabilities. Some examples of adopted supply-side policies are infrastructure reconstruction, emergency grants, concession of loans, support to small businesses and to the industrial sector, subsidies to repurchase machinery and equipment, and the reopening of tourist attractions. Common policy measures following natural disasters include easier access to credit, insurance provision and subsidies to firms and farmers (WTO, 2019b).

(iii) Increased uncertainty

Finally, by increasing uncertainty in the system, shocks may have an economic effect, such as the increased spending for security and defence in the aftermath of the 9/11 terrorist attacks (Baker, Bloom and Davis, 2019; Looney, 2002). Different policy responses are used to reduce uncertainty. For instance, natural or technological shocks might be followed by campaigns to raise awareness, training schemes, mitigation planning, investments in infrastructure and warning systems, surveying and modelling, etc. On the other hand, in socio-economic shocks — such as a hyperinflation crisis or debt default — typical responses to mitigate uncertainty might include regulations to increase monetary and fiscal policy credibility, structural reforms and debt restructuring (Franco, 1990; Mishkin, 2011; Reinhart and Rogoff, 2013).

(b) Trade policy response

In the context of shocks, trade policy takes on a dual connotation. On the one hand, protectionism is seen as a way of prioritizing domestic economic activity while, on the other hand, trade-opening often plays a crucial role in solving sudden demand-supply mismatches and emergency situations. Both aspects are discussed next, including trade policy responses to shocks.

(i) Restrictive measures tend to increase after some shocks

Trade-restrictive measures have often been associated with economic shocks. The average level of trade restrictions tends to rise during economic recessions or business cycles troughs, thereby suggesting a countercyclical relationship between business cycles and trade restrictions (Bagwell and Staiger, 2002; Crowley, 2010). There is an extensive literature providing empirical evidence of this countercyclical relationship, for example Auray, Devereux and Eyquem (2020), Bohara and Kaempfer (1991), Bown and Crowley (2014), Crowley (2011), Grilli (1988), Grundke and Moser (2019), and Knetter and Prusa (2003). Restrictive trade measures typically increase following adverse productivity shocks or economic downturns. Similarly, the intensity of inspections, number of import refusals, and other trade barriers have increased during downturns (Auray, Devereux and Eyquem, 2020; Grundke and Moser, 2019). However, the countercyclical relationship between restrictive trade measures and GDP may have weakened in recent years given the diffused consensus that protectionism has negative economic effects (Rose and Wei, 2013).

Different reasons have been advanced for this countercyclical relationship. For instance, it has been argued that governments face increasing pressure

Table B.3: Policy responses following the 2008-09 global financial crisis

Policy area	Policy measure	Number of countries
Active labour market policy	Training for the employed	45
	Training for the unemployed	49
	Additional recruitment of public employment service and administration	47
	General youth training measures	34
	Measures for unemployed and disadvantaged youth	26
Macro-economic policy	Fiscal policy – expansion	65
	Fiscal policy – contraction	13
Measures to increase labour demand	Credit facilities, access to credit guarantees	49
	Employment retention measures including working time reductions, wage subsidies, incentives such as subsidies to employers to maintain existing jobs	39
	Lowering non-wage labour costs and reduction in taxes	52
	Other special measures for MSMEs and cooperatives	40
	Payment facilities	21
	Public sector job creation, incentives such as subsidies	36
	Wage reductions	5
	Supportive regulatory environment for sustainable enterprises	43
Social dialogue	Actions taken through collective agreements on working time, wages, working conditions, employment protection by social partners	48
	Actions taken by social partners through social pacts on working time, wages, working conditions, employment protection	54
	Measures to reduce gender inequality implemented through social dialogue in the field of employment	24
	Measures to reduce gender inequality implemented through social dialogue in the field of right to work	13
	Measures to reduce gender inequality implemented through social dialogue in the field of social protection	15
	Other measures implemented in the field of social dialogue	20
	Strengthen measures for labour administration and labour inspection	47
Sector-specific policy	Agriculture and fisheries	6
	Real estate	8
	Transport, storage and communication	9
	Construction	16
	Hotels and restaurants	9
	Wholesale and retail, repair of motor vehicles, motorcycles and personal and household goods	5
	Public administration and defence	7
	Various measures	4
	Manufacturing	26
	Not classifiable	18
	Financial intermediation	15
	Mining and quarrying	3
	Education	5
	Electricity, gas and water supply	7
	Health and social network	5
	Exports	38

Source: Authors' calculations, based on data from "The ILO/World Bank Inventory of policy responses to the global financial and economic crisis of 2008".

Note: Policies recorded in the database cover the period ranging from mid-2008 to end-2010 and 77 countries.

Table B.4: Examples of policy measures adopted in response to natural disasters

Objective	Policy measure
Fiscal shock	Request international assistance
	Request participation and support from international actors
	Multilateral lending, grants, concessional loans
	Debt relief
	International assistance, grants, recovery aid
Business recovery and growth	Support for small businesses and primary producers in the form of recovery grants, financial assistance and concessional loans
	Support to manufacturing sector, push for more national technological output
	Industrial support
	International partnerships within technological sectors
	Government subsidies for industries, corporate grants
	Incentives to repurchase machinery and equipment
	Job creation
Human development	Education and training, water and sanitation
	Assistance and psychological support to reduce trauma and distress
	Childcare subsidies
	Budget increase for the health sector
	Infrastructure recovery and reconstruction
	Land-use planning
	Housing reconstruction, changes in housing plans to increase resilience of infrastructures
	Post-disaster recovery of energy infrastructure, including cleaner and renewable sources of energy
Migration and displaced population	Long-term housing for the displaced
	Search and rescue
	Protection and care of separated and unaccompanied children
	Treatment and medical assistance
	Emergency aid/compensation, financial support and cash grants to the displaced population
Post-disaster preparedness lessons	Setting up of evacuation facilities
	Disaster awareness, education and mock drills
	Coastal protection plans, seawalls and breakwaters
	Tsunami warning systems
	Disaster mitigation plans
	Development of robotics to ensure help and assistance for future disasters
	Focus on developing innovative medical and environmental technologies
	Post-disaster impact survey for managing and modelling future catastrophes
Relief and recovery	Evacuation
	Setting up key infrastructure, transportation and logistics operations
	Donation of relief supplies, personnel assistance by neighbouring nations
Wildlife and environmental destruction	Wildlife rescue, care, protection and habitat protection
	Revegetation and reforestation
	Agriculture engineering, employing extensive biological testing data to help assure higher production rates and survivability rates
	Focus on agriculture and rural development

Sources: Authors' elaboration based on Margesson and Taft-Morales (2010); Suppasri et al. (2015); Koshimura and Shuto (2015); Zhang et al. (2019).

Note: Review based on the 2004 Indian Ocean tsunami, the 2010 earthquake in Haiti, the 2011 earthquake and tsunami in Japan, and the 2020 Australian bushfires.

to secure domestic markets for domestic firms, in which case trade policy during recessions depends on the relative political power of import-competing and export industries (Cassing, McKeown and Ochs, 1986). Alternatively, restrictive measures could be viewed as being less costly during a recession, as the losses from restrictive measures, such as increasing import tariffs, are greater in times of economic expansion than contraction (Bagwell and Staiger, 2002). Finally, countries have incentives to employ import restrictions in order to fight off dumping activities motivated by a decrease in demand in a contracting foreign market (Crowley, 2010).

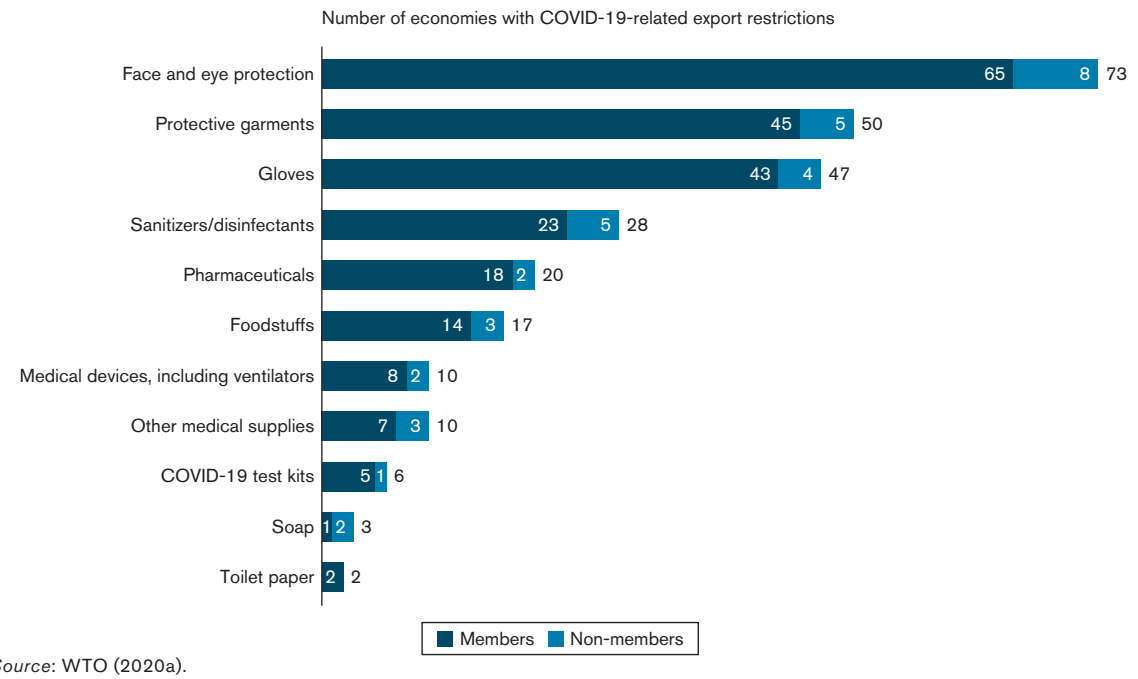
Restrictive trade measures on exports have attracted particular attention during recent crises, including both the global financial crisis and the COVID-19 crisis. In the early phases of the COVID-19 pandemic, temporary export bans on critical goods were used by some countries to address domestic supply shortages of these goods (WTO, 2020f).[7] By the end of April 2020, 80 countries and custom territories had implemented export restrictions (see Figure B.21), and by November 2020 this number had increased to 86 (Bacchetta et al., 2021). These measures primarily targeted medical supplies (e.g. facemasks and shields), pharmaceuticals and medical equipment (e.g. ventilators), but a handful of measures were also imposed on other consumption goods, such as foodstuffs and toilet paper (WTO, 2020f).

Export restrictions were also introduced on vaccines and their inputs. Based on confirmed information, 32 economies restricted exports on at least one input, while 21 economies used export bans and 11 economies used export-licensing schemes. Several measures have been withdrawn, but others still remain in place or have been renewed. A large number of inputs for the production of vaccine could potentially be affected and, since different vaccine manufacturers use different inputs, they are affected differently by the restrictions.

Export-restrictive trade measures have also been implemented in response to other types of shocks. For example, export bans were used in 2006-08 in response to spikes in commodity prices (Evenett and Fritz, 2020). In the case of natural disasters, restrictive measures are also common, and tend to be concentrated primarily in the agricultural sector (Bastos, Straume and Urrego, 2013; Klomp and Hoogezand, 2018). These policies are often unwise. A simulation of shock impacts finds that the implementation of trade-restrictive measures reduces an economy's ability to access critical goods during a shock and increases the efficiency costs associated with recovery (OECD, 2021f).

Finally, restrictive trade policies may also be a direct mitigation strategy for certain shocks (see Box B.7). For example, travel limitations, trade curtailment and

Figure B.21: The number of countries and custom territories introducing export restrictions on certain essential products increased after the outbreak of COVID-19



Source: WTO (2020a).

Box B.7: Trade policy responses to the global financial crisis of 2008-09

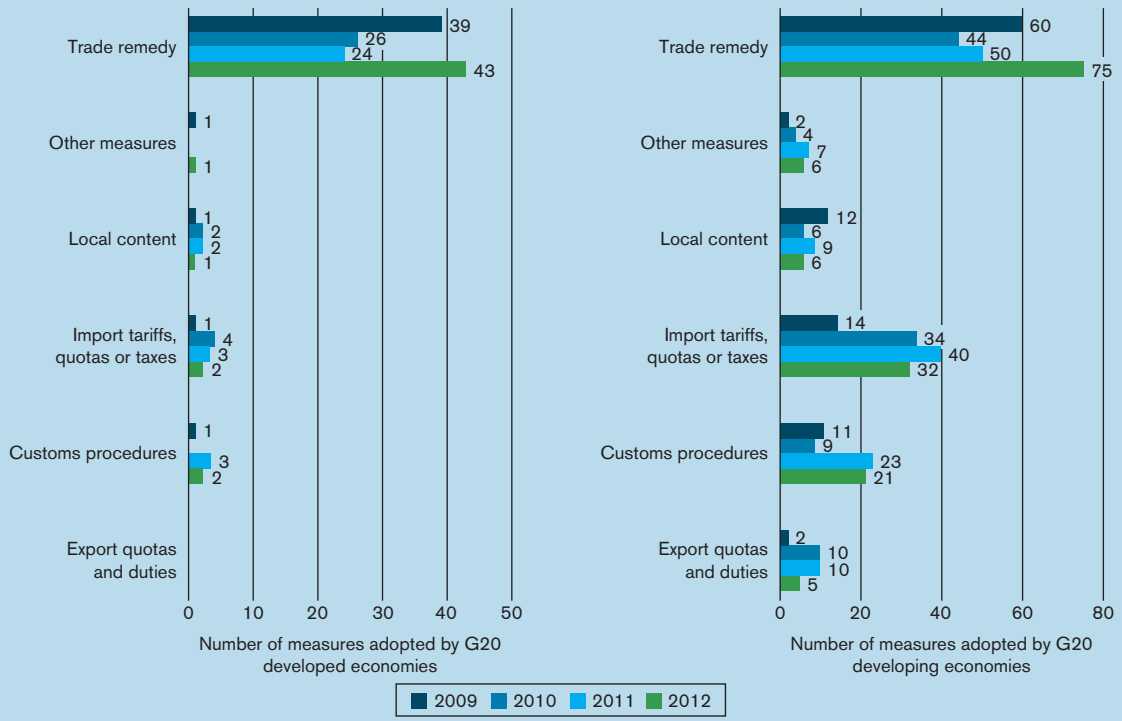
Concerns were raised at the time of the global financial crisis of 2008-09 that restrictive trade policies could return, mirroring policy responses from governments following the Great Depression of the 1930's which triggered a destructive spiral of protectionism (Baldwin and Evenett, 2009b).

Contrary to widespread concerns, many economies exhibited only a moderate use of restrictive trade policies in response to the crisis (Bown and Crowley, 2014; Gawande, Hoekman and Cui, 2015; Kee, Neagu and Nicita, 2013; Ruddy, 2010). While this development can in part be attributed to the WTO and its role as regulatory body, exporters exerted offsetting trade-opening forces against demand for protection in many countries (Gawande, Hoekman and Cui, 2015). More specifically, the economic interests of vertically integrated firms – which have an interest in keeping imported intermediate inputs cheap – helped to limit protectionism during the crisis.

The number of restricting measures on exports and imports increased. As macroeconomic conditions worsened, import restrictions imposed through temporary trade barriers – including measures such as antidumping, safeguards, and countervailing duties – became more prevalent (Bown and Crowley, 2014). Moreover, export-restricting measures, such as export quotas and duties, increased in the aftermath of the crisis (see Figure B.22). Developing economies used these measures more intensively than developed economies and were also the main targets of such restrictions (Bown, 2009; WTO, 2014) (see Figure B.22).

Despite these new measures, total restrictions covered only between 0.2 to 0.8 per cent of the pre-crisis level of imports (see Figure B.23). While trade remedies were the most common trade measure (see Figure B.22), custom procedures, tariffs, quotas and taxes had a significantly larger economic impact in developing countries (see Figure B.23).

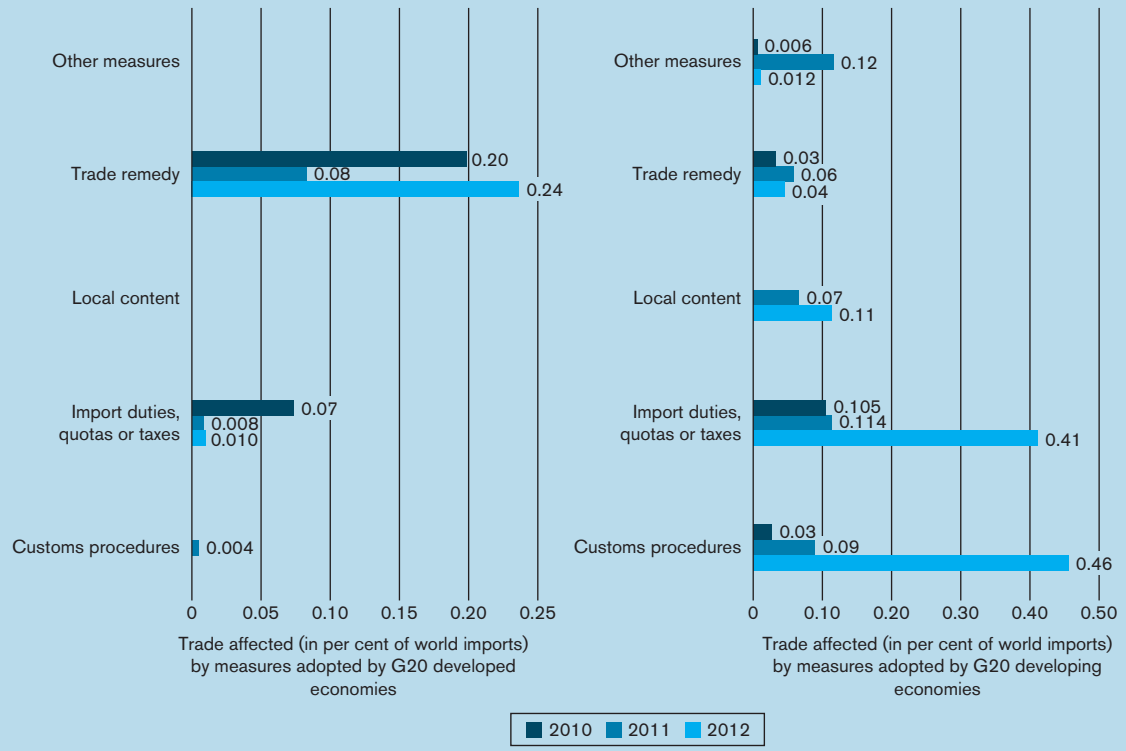
Figure B.22: Trade remedies were the most common trade measure in the aftermath of the global financial crisis



Source: WTO (2014) using data from the Trade Monitoring Database (https://tmdb.wto.org/en). Figures only include confirmed measures that are classified as restrictive. Only measures that are not withdrawn in the same year are included.

Box B.7: Trade policy responses to the global financial crisis of 2008-09 *(continued)*

Figure B.23: Trade-restrictive measures only covered a modest share of world trade between 2010 and 2012



Source: WTO (2014) using data from the Trade Monitoring Database (https://tmdb.wto.org/en) and trade figures from the UN Comtrade Database (https://comtrade.un.org/). Figures only include confirmed measures that are classified as restrictive. Only measures that are not withdrawn in the same year are included.

quarantining of goods and persons were the most effective measures to defeat epidemics before the development of modern medicine (Conti, 2008; Peaks et al., 2017; Tognotti, 2013). The first documented use of quarantine measures dates back to 1348, when the Republic of Venice introduced a 40-day isolation period for incoming ships and travellers to contain the bubonic plague epidemic, which spread through Europe and Asia in the mid-14th century (Gensini, Yacoub and Conti, 2004). Historically, complete city and port closures to foreigners have been another common policy response to contain outbreaks of epidemics; for example, when the bubonic plague reached Russia in 1644, sanitary officials in charge of the quarantining policies banned foreign travellers from entering Moscow (Conti, 2008). Border hygiene checks and licence systems were also introduced. For instance, during the 16th century, bills of health began to be issued to prove that the last port visited by a ship was clear of infection by the bubonic plague (Conti, 2020; Tognotti, 2013). The COVID-19 crisis has shown that these measures are as relevant in containing contagion today as they were in Renaissance Italy (Conti, 2020).

(ii) Shock response also involves trade-opening

Trade-opening measures also can be used in response to shocks to guarantee supplies of critical goods. Of the 335 COVID-19 measures recorded for WTO members and observers between the outbreak of the pandemic and November 2020, 58 per cent were of a trade-facilitating nature and 42 per cent were trade-restrictive (WTO, 2020g). Moreover, while shortages of PPE led to the introduction of

export bans by some PPE-producing nations in the early phases of the pandemic (WTO, 2020a; 2020f), many of these measures were subsequently lifted, and tariffs on critical goods were reduced to fight the pandemic. By the end of July 2020, 40 WTO members had suspended duties, taxes or charges on critical medical goods (WTO, 2020b), and around 39 per cent of COVID-19 restrictive measures on goods had been repealed by mid-October (WTO, 2020g). In most countries, custom procedures and border clearance for medical goods were simplified to speed up imports of critical goods; special channels were set up to simplify imports of medical goods and facilitate the movement of health workers; and exceptional government procurement, as well as intellectual property (IP), measures were put in place to hasten the delivery of medical services, facilitate innovation and ease access to new technologies (WTO, 2020b, 2020c).

As discussed in chapter D, WTO members also engaged in international initiatives to keep markets open for essential goods. For instance, New Zealand and Singapore, subsequently joined by Australia, Brunei Darussalam, Canada, Chile and Myanmar pledged to keep their markets open. Canada also led an initiative (joined by 47 other countries) pledging openness and good practices with respect to world agricultural trade.

COVID-19-related goods such as pharmaceutical products or medical/surgical equipment were the categories of goods subject to the highest number of both liberalizing and restrictive trade interventions in 2020.[8] Despite the attention drawn by trade restrictions during the pandemic, the importance of trade-opening measures has been demonstrated by the fact that, on balance, medical, pharmaceutical and testing equipment were the object of more liberalizing than restrictive trade measures. These measures were fundamental in meeting the sudden surge in demand caused by the pandemic. Rather than increasing domestic production of these goods – which would have been neither cost- nor time-effective – many countries increased imports (OECD, 2021f). International trade in these critical goods increased dramatically during the pandemic; for instance, trade in textile face masks was multiplied by six, trade in face protection products grew by 90 per cent and Chinese exports of medical products tripled (WTO, 2020f). This was essential for low-income countries, which rely entirely on foreign production for COVID-19 related products and to access a broader variety of medical goods options (OECD, 2021f).

Services sectors have been heavily affected by the pandemic, although the extent of the impact varies by sector and mode of supply (WTO, 2020g). Until mid-October 2020, members had adopted 124 measures affecting trade in services in response to the pandemic. Most of these measures appeared to be trade-facilitating, including measures to ease the supply of, and access to, telecommunication services and measures to facilitate the supply of online health services. In a few cases, governments responded by removing existing trade restrictions, such as by relaxing limitations on the supply of Voice over Internet Protocol (VoIP) services (i.e. technology that allows users to make voice calls via the internet rather than via regular phone lines). However, some of the measures adopted also appear to be trade-restrictive, including measures tightening foreign investment regimes.

While trade-restrictive policies have been found to hinder the response to natural disasters (WTO, 2019c), trade policy liberalization is used to cope with and recover from natural disasters. Notable trade-opening and facilitating measures adopted following a natural disaster include the exemption of pre-shipment inspection, the institution of urgent clearance mechanisms for certain goods imported in case of disaster, value-added tax (VAT) exemption, tariff rebates and tariff suspensions on goods deemed to be of public interest in exceptional circumstances (WTO, 2019b). These trade measures focus primarily on facilitating the availability of domestic and foreign relief goods, equipment, services and personnel, as well as on simplifying the import of products used in the reconstruction of physical infrastructures (e.g. building materials), and essential services (e.g. engineering services).

To sum up, trade policy always plays an important role in government response to shocks. Trade policy responses are rarely fully trade-restrictive or trade-opening: a mixed profile is the norm. On the one hand, trade-facilitating and trade-opening policies play a crucial role in harnessing the resilience potential of trade — such as in guaranteeing the supply of critical goods, smoothing emergency operations and easing the recovery phase. On the other hand, trade-restrictive policies may also play an important role in mitigating certain types of shocks (e.g. quarantining of goods and persons during an epidemic) and are sometimes used as a political message to display priority for the domestic situation (e.g. an export ban on medical goods or import tariffs to favour local producers during recessions). The existence of negative spillover effects of trade policy interventions makes the international coordination of trade measures indispensable. Possibilities for effective policy coordination and cooperation will be discussed in Section D.

6. Building and supporting economic resilience has become a key strategy to reduce business interruptions and economic losses caused by shocks

The term "economic resilience" has become a popular one to capture the broad and diverse factors and strategies needed to avoid and mitigate risks, and prepare, manage and recover from shocks. Although the concept of economic resilience has regained significant attention during the COVID-19 pandemic, it sparked particular interest during the global financial crisis of 2008-09 (see Figure B.24).

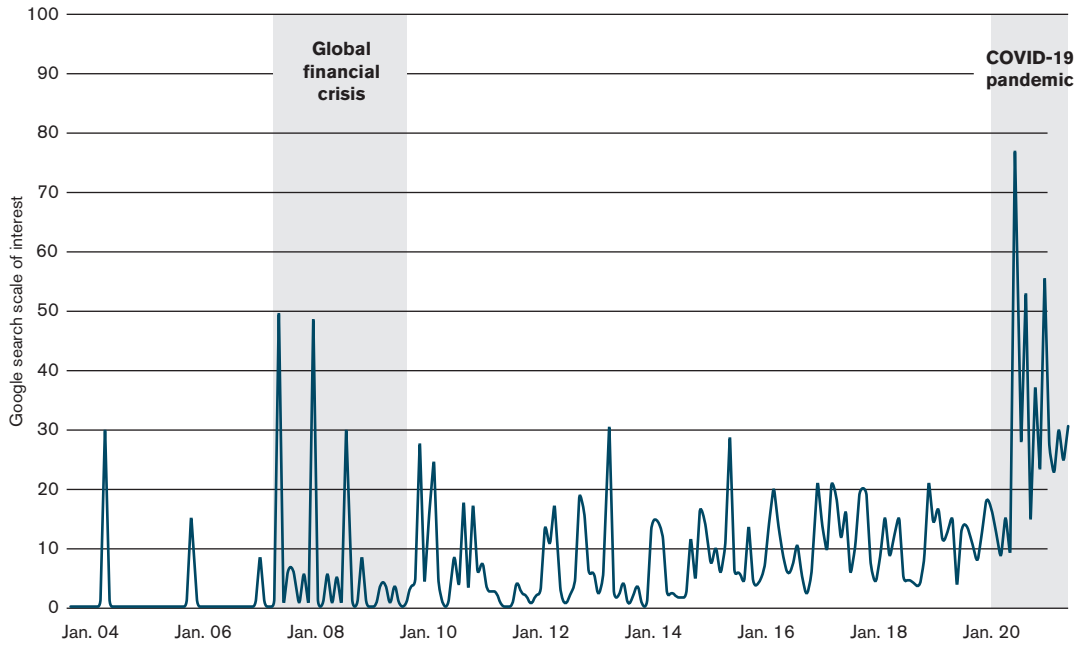
Yet, there is no consensus on the definition and concept of "economic resilience", nor on how to measure it. This is, in part, due to the use of the term in different disciplines, but even in the economics literature, the term "economic resilience" is sometimes undefined, ill-defined or broadly defined. To limit confusion, this subsection provides a definition and conceptual framework of "economic resilience" that will be used throughout the report. It also discusses the broad range of actions and strategies available to build and sustain economic resilience. Building resilience is, however, not costless, and it involves a cost-benefit assessment. Given the complex and multidimensional nature of economic resilience, its measurement remains particularly challenging.

(a) Economic resilience is a complex and multidimensional concept

In this report, "economic resilience" is defined as the ability of a system, including households, firms, and governments, to prevent and prepare for, cope with and recover from shocks.[9] Accordingly, economic resilience can be viewed as a process by which different actions and strategies can be deployed to prevent, reduce and manage as much as possible the risk of shocks, minimize the economic cost of such shocks, and accelerate recovery and adaptation to prevent future risks and shocks. Although economic resilience focuses on the economic cost, sustainable economic resilience cannot be achieved without environmental and social resilience.

Building economic resilience capacity requires an understanding of economic challenges and

Figure B.24: "Economic resilience" has become a popular term in recent times



Source: Authors' calculations, based on Google trends data (search term "economic resilience").

Note: Numbers represent the average relative search interest of "economic resilience" as a search term and topic in Google. A value of 100 is the peak popularity for the term. A value of 50 means that the term is half as popular. A score of 0 means there were not enough data for this term.

opportunities, as well as the ability to anticipate, evaluate and manage risks (Anbumozhi, Kimura and Thangavelu, 2020). While economic resilience is determined by the level of predictive risk reduction and prevention implemented, preparedness for risks that can never be fully eliminated is also critical.

When a shock strikes, economic resilience operates on two interrelated temporal dimensions (Miroudot, 2020; Rose, 2004; 2017). *Static* economic resilience, sometimes called robustness, refers to the ability of the system to use available, possibly scarce, resources to continue functioning when shocked.[10] *Dynamic* economic resilience refers to the ability of the system, once the shock is over or under control, to hasten the speed of recovery by efficiently allocating and using possibly scarce resources to enhance productive capacity and investment for the repair, reconstruction and support of parts of the economy affected by the shock, including by adapting to changes.

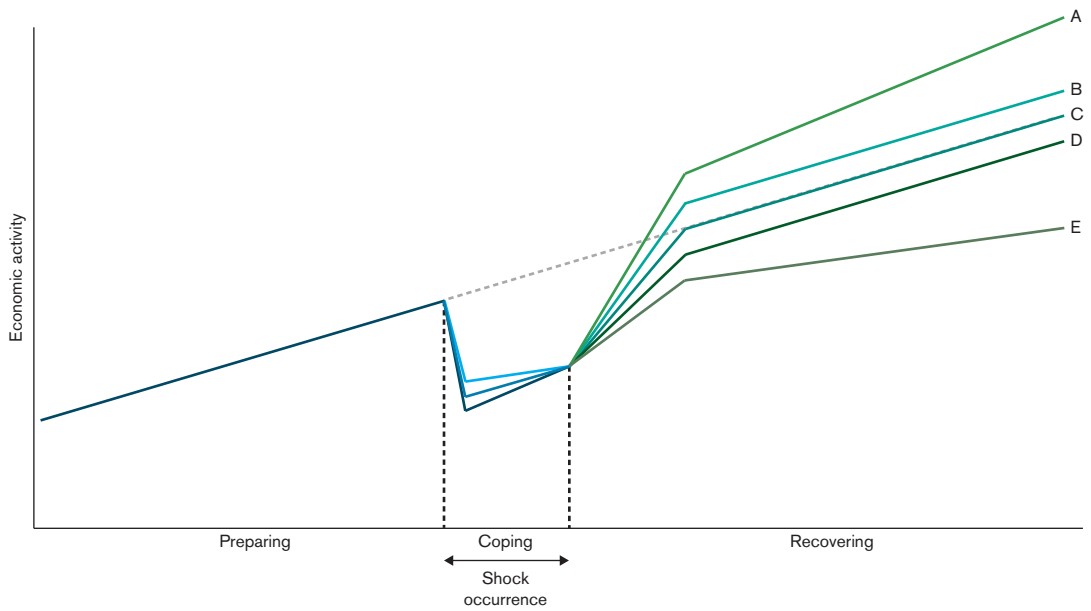
As highlighted in Figure B.25, depending on initial conditions and strategies and actions in place, households, firms and governments, and more generally economies, can experience different coping and recovery trajectories once a shock has hit. Some shocks might cause the trend to deviate in the short term but be absorbed in the long run (line C). Other shocks might permanently shift the economy towards a new lower path (line D or E). Persistence of shock effects, also known as hysteresis or shock memory, can have important and challenging competitiveness, efficiency, and welfare implications. Conversely, economic agents can, thanks to appropriate strategies and actions, withstand shocks and accelerate their recovery, and ultimately deliver a superior performance in the long run (line A or B).

(b) Different strategies can be adopted to build and support economic resilience

Economic resilience is a complex and multidimensional process involving different economic, social and institutional actors and spanning both pre- and post-shock strategies and actions. These strategies and tactics can apply to inputs (including capital, labour, infrastructure services, and materials) and final goods and services.

Given the sharp increase in the frequency of disasters and the economic damage caused by many disasters, risk prevention, reduction and preparedness are increasingly considered as key strategies to reduce response and recovery costs from shocks (UNDRR, 2019). Risk prevention and reduction can be achieved through relevant and well-designed infrastructure, monetary, trade, social, health, energy and environmental policies. The scope of these policies can be broad, depending on the types of hazards, exposure and vulnerability. Explicitly integrating risk management into business decision-making, including

Figure B.25: Economic resilience is a multidimensional process



Source: WTO Secretariat.

the financial appraisal of risks, and enhancing the ability to leverage risk information to adjust business strategy can also contribute to reducing and preventing risks (UNDRR, 2014, 2021a).

Preparedness encompasses strategies and actions designed effectively to anticipate, respond to and enable recovery from the impacts of likely, imminent or current shocks. Business preparedness includes developing disaster responses and contingency planning, identifying priorities, training employees on emergency preparedness, and reviewing insurance coverage.

Business operations can also continue once a shock strikes by using emergency stockpiles of critical inputs, modifying production processes to reduce the use of inputs or to substitute for scarce inputs, replacing damaged equipment, working overtime, or improving the efficiency of business operations (e.g. working from home – see Box B.8).

Some strategies focus on delivery logistics, such as expanding and diversifying wholesale and retail trade networks, negotiating contingency contracts with transport firms, and implementing disaster response planning exercises. As discussed in greater detail in Section C, some actions to build and sustain economic resilience, for example diversification of supply chains, finding new export markets or relocating plants, have a direct international trade dimension. Diversifying supply chains can be achieved by importing needed inputs that are in short supply or are not available from the usual local or regional suppliers. Similarly, economic resilience can be strengthened through export substitution by serving new foreign markets. Relocating some or all economic activities to new or additional locations not affected by or less prone to shocks is another strategy with potential trade implications.

The availability of many of the strategies discussed above to firms can be limited by various barriers, including a lack of access to finance or to

Box B.8: The role of information and communication technologies in economic resilience

The COVID-19 pandemic revealed how a public health crisis can quickly turn into a serious economic crisis, destroying jobs and pushing many firms, in particular MSMEs, out of business (see also Box B.2). Yet, at the same time, the COVID-19-induced economic crisis created opportunities for alternative and innovative solutions based on digital technologies to cope and recover from the pandemic (Aghion, Antonin and Bunel, 2021).

Digital technologies have been instrumental in coping with the pandemic, partly thanks to their flexibility and the reduction in trade costs. Monitoring and tracing the pandemic have been greatly facilitated by digital technologies (Yang et al., 2020). Information and communication technologies (ICT) have also helped to provide COVID-19-related information and financial assistance to marginalized groups and communities in the informal sector, who typically face greater difficulties in accessing public assistance (Nurse and Cabral, 2020).

Lockdown, quarantine and social distancing measures have also led both firms and consumers to start organizing digitally a substantial part of their operations and transactions not requiring physical face-to-face interaction. The increased adoption of teleworking and wider use of e-commerce, including in digital healthcare services, have allowed firms to sustain production and consumption (OECD, 2020d; Strusani and Houngbonon, 2020). As a result, online business-to-consumer and business-to-business activities have been growing, including in low-income countries, since the beginning of the pandemic (Banga and te Velde, 2020; Tuthill, Carzaniga and Roy, 2020). The share of e-commerce activities, for example, rose from 14 per cent to 17 per cent between 2019 and 2020 (UNCTAD, 2021d).

Digital technologies offer a large number of opportunities to recover faster and in a more inclusive way from the pandemic. They can also facilitate risk prevention and preparedness for future shocks. Yet, there remain shortcomings in the current paradigm of digital infrastructures that prevent an inclusive recovery and enhanced preparedness from fully materializing. The digital divide is still significant, with only slightly over 51 per cent of the world population having access to the internet in 2019 (ITU, 2021 statistics).[11] Many MSMEs, particularly those in developing economies, continue to face important obstacles to adopt, access and use ICT tools (Callo-Müller, 2020). Similarly, although women's digital inclusion has increased, it remains limited in many developing economies (WTO and World Bank, 2020). Reducing the digital divide and improving the quality and access of ICT infrastructure, equipment and services are therefore key to building and supporting economic resilience (WTO, 2018).

OPINION PIECE

By Stephane Hallegatte,
Lead Economist, Climate Change Group, the World Bank

Beyond the aggregate: defining and measuring households' resilience

The severity of natural disasters is usually measured based on the "direct damages" they provoke. These "direct damages" include physical damages to assets (e.g. after a hurricane or an earthquake) and losses in agricultural production (particularly in the case of droughts). In most cases, direct damages are estimated as the expenditure needed to repair or replace damaged assets, from repairing roads and roofs to replacing lost appliances and cars. Sometimes the loss due to the interruption in economic activity during the event is also considered.

According to Munich Re, a global provider of reinsurance, primary insurance and insurance-related risk solutions, economic losses due to natural disasters averaged US$ 187 billion per year between 2009 and 2018, a 30 per cent increase over the 30-year average of US$ 41 billion (Munich Re, 2019). However, this increase in direct damages does not fully inform as to the real impact of these disasters. Other dimensions – such as the impact of disasters on health, education or quality of life – are not usually incorporated into disaster loss estimates, even though they are often the main drivers of the full impact of these shocks.

This is not only a measurement issue. One implication of using aggregate economic losses as the unique measure of disaster impacts is that disaster risk management strategies tend to favour the wealthy. Interventions targeting poor people, who have few assets and small incomes to start with, cannot generate large gains in terms of avoided economic losses and are therefore discouraged. Similarly, avoided losses cannot measure the benefit from "soft solutions", such as financial inclusion or social protection, and tend to favour hard solutions such as investments in infrastructure.

This metric is therefore unlikely to prioritize attractive solutions aimed at helping poor people to become more resilient, i.e. better able to cope with and recover from disasters and other shocks (Hallegatte et al., 2017). In addition, risk management does not give sufficient attention to small interventions that could reduce the stunting of children, disease transmission, absenteeism from work and school, lost wages, and other impacts on well-being that reduce resilience.

Interventions that leverage trade to make populations more resilient are also undervalued when benefits are measured solely in terms of avoided asset or economic losses. They do not capture the benefits that accrue from using imports to replace critical goods, such as food or medicine, that cannot be produced domestically. The fact that firms trading with clients and suppliers outside an affected area tend to recover more quickly than firms trading solely within the affected area is often not considered (Todo et al., 2015). The vulnerability that results from being dependent on imports for essential goods and services, and therefore dependent on major ports or airports (Hallegatte et al. 2019), is also not quantified.

A better assessment of risk management solutions would result from metrics which could (1) better capture the impact of disasters on well-being and (2) account for the ability to cope with disaster impacts, including by means of supply chains, trade and financial instruments. The concepts of socioeconomic resilience and well-being losses (i.e., a measure of the impact of disasters that captures the specific vulnerability of poor people) aim to capture these effects. The application of these metrics to the assessment of trade policies would make it possible to balance the benefits that trade brings in terms of resilience against the risks it can also create.

infrastructure, including ICT networks, as well as a lack of information and guidance on risk management. This is particularly challenging for MSMEs that disproportionately face such barriers, while remaining disproportionately vulnerable to risks and shocks (UNDRR, 2021b).

At the industrial level, economic resilience strategies are often designed to pool different resources and develop and implement sharing mechanisms. Pricing and bargaining mechanisms can be used to renegotiate supply contracts. Similarly, short-term agreements can be negotiated between firms to share production and distribution facilities in exchange for the provision of specific inputs or services in the event of a shock. Information- and expertise-sharing between firms can also contribute to economic resilience at the industry level. The industry-level of analysis of economic resilience is sometimes referred to as meso-economic resilience (Rose, 2017).

Although economic resilience is often implicitly focused on firms, many of the same economic resilience strategies can, under some conditions, be adopted by households (indeed, many micro and small enterprises are often family businesses). For instance, households can, in some cases, engage in input conservation activities by changing their consumption habits or adopting new technologies.

The economic resilience strategies available to individual households are determined by their available pre-shock income, as well as their ability to smooth disruptions over time thanks to personal savings, loans, insurance and the social safety net. While, as discussed above, the negative welfare effects of shocks affect poor households more strongly, their strategies to increase resilience are often very costly in relative terms due to their limited resources and alternatives.

At the country level, economic resilience not only depends on the behaviour of individual economic decision-makers, including households, firms, industries and governments, but also on their direct and indirect interactions. The country-level of analysis of economic resilience is sometimes referred to as macro-economic resilience (Rose, 2017). Many of the economic resilience strategies associated with firms, households and industries are also applicable to local and national governments.

As discussed in Section B4, after a shock hits, governments tend to adopt various measures to cushion the initial impact of the shock, and later on to support the recovery. Some of these policies may have conflicting effects on economic resilience. For instance, strict employment protection legislation may reduce the extent to which firms can lay off workers in the short run in response to a negative shock, thereby supporting employment and private consumption. At the same time, such legislation may slow down the wage adjustment process as well as workers' reallocation towards other productive jobs, thereby delaying the labour and output adjustment to new economic conditions (Duval and Vogel, 2008). The relationship between trade policy and resilience is discussed in Section C, while the importance of building public trust in institutions to sustain individual, national and international efforts in economic resilience is discussed in Section D.

(c) Measuring economic resilience can be challenging given its multidimensionality

A cost-benefit assessment of strategies and activities to build resilience can determine how much firms, households, and governments need to invest in developing economic resilience. However, this is a challenging task given the complex and multidimensional aspects of these strategies and activities. Different approaches have been proposed to estimate economic resilience.

The unit of measurement of economic resilience is often expressed in monetary terms,[12] such as GDP, or in (un)employment terms (Martin, 2012). Using an aggregate unit measure, such as GDP, can, however, mask the large heterogeneous impacts of shocks (see the opinion piece by Stephane Hallegatte).

Economic resilience can be measured as the difference between the level of attainment of any economic activity achieved with and without economic resilience actions adopted before and/or aftershocks. This assessment approach is used to estimate the ratio of averted losses as a percentage of the potential losses in computable general equilibrium studies (Rose, 2009; Rose and Liao, 2005). While this approach can be used both before and after the event, it remains complex and data-intensive. An alternative approach to implicitly measure economic resilience is to compare the actual output level impacted by shocks with the counterfactual output level that would have prevailed if the shock had not occurred (see opinion piece by Ralph Ossa).

An alternative approach, adopted in the context of the United Nations Office for Disaster Risk Reduction (UNDRR), is to identify various indicators to measure global trends in the reduction of risk and losses, such as the direct economic loss attributed to disasters

OPINION PIECE

By Ralph Ossa,
Professor of International Trade, University of Zurich and Center for Economic and Policy Research (CEPR)

A simple measure of economic resilience

How should we measure economic resilience? This question is of considerable importance, given that strengthening economic resilience is now a policy priority of many governments. We can only strengthen economic resilience if we understand the determinants of economic resilience; and we can only understand the determinants of economic resilience if we know how to measure it.

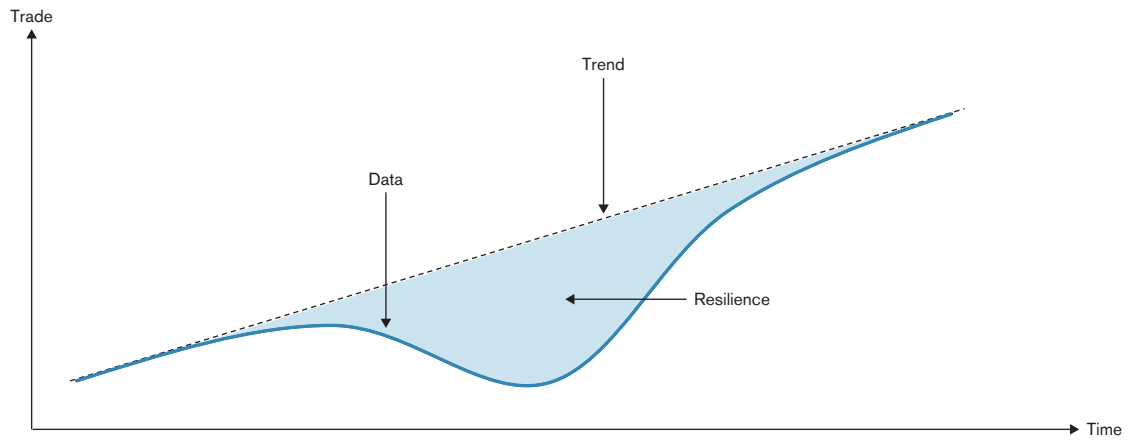
Hereafter I will discuss one simple measure of economic resilience, based on the ongoing research in Le Moigne, Ossa and Ritel (2021). It builds on the idea of capturing resilience as the cumulative deviation from a trend, which is already present in the literature (e.g. Ringwood, Watson and Lewin, 2018). I illustrate this with reference to international trade flows, but it can really be applied to any variable of interest.

Any proper measurement of resilience has to start with a clear definition of resilience, and I will adopt a relatively narrow one: the ability to cope with and recover from shocks (but not the ability to prepare for them).

My starting point is the idea of measuring resilience as the cumulative deviation from a trend, as illustrated by the green area in Figure B.26. The smaller the green area, the higher is the resilience, because it implies a smaller cumulative deviation.
The main advantage of this idea is that it intuitively combines information on the depth and duration of the disruption, essentially trying to calculate the cumulative loss in international trade due to the shock.

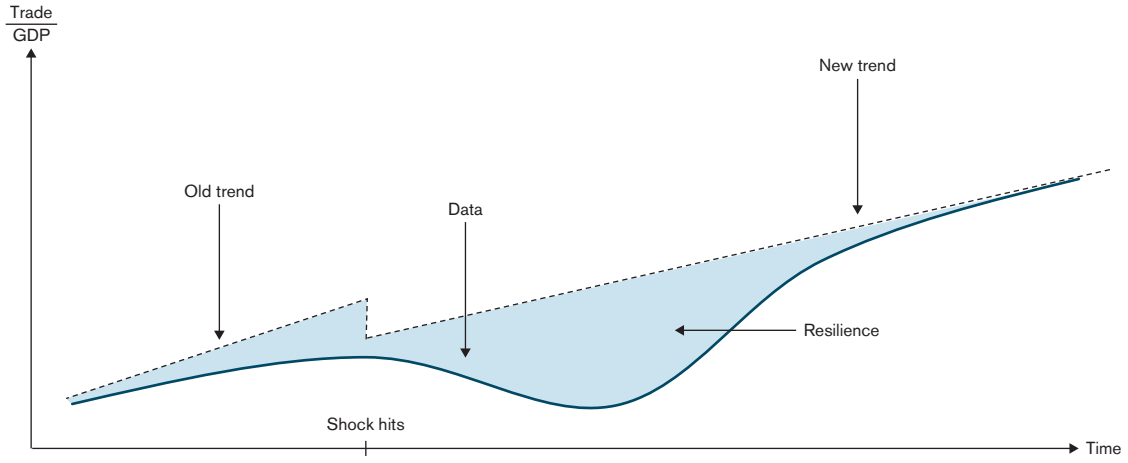
In Le Moigne, Ossa and Ritel (2021), we highlight three problems with this idea. First, it conflates the magnitude of the shock with the resilience to the shock. Second, it does not take into account that shocks often have permanent components; for example, the COVID-19 pandemic is likely to bring about permanent changes in the way we work.

Figure B.26: The original resilience measure only considers the pre-shock trend



Source: Le Moigne, Ossa and Ritel (2021).

Figure B.27: The resilience measure can be adjusted to account for the post-shock trend



Source: Le Moigne, Ossa and Ritel (2021).

And third, it relies on strong assumptions that trade would have behaved as predicted by the trend had it not been for the shock, and that the deviation from the trend is solely due to the shock.

The first two problems can be addressed straightforwardly, as illustrated in Figure B.27. To isolate resilience, one simple option is to express the series relative to the shock. For example, when investigating the resilience of international trade to a major recession, it would make sense to look at the trade-to-GDP ratio instead of just at trade. To accommodate persistence, one simple option is to allow for the convergence to a new trend.

The third problem, however, cannot be addressed without a model, which allows us to estimate the shocks driving the disruption and simulate more reliable versions of the "trend" and "data" lines in Figure B.27. In Le Moigne, Ossa and Ritel (2021), we therefore use a fully specified dynamic general equilibrium model, which allows us to link the behaviour of international trade to a number of underlying shocks, including shocks to the supply of traded goods, the demand for traded goods, and trade costs. The natural alternative is to apply a reduced form statistical model from the toolbox of time-series econometrics.

in relation to global gross domestic product, and the damage to critical infrastructure attributed to disasters.

Another approach involves identifying and monitoring the factors that have been found or expected to contribute to or hinder economic resilience (Briguglio et al., 2009; Cutter et al., 2008). These factors cover a broad spectrum of issues, from socio-economic and financial determinants to infrastructure and institutional capacity, many of which determine the initial conditions before the shock occurs.

Some of the socio-economic and financial factors include high economic diversification, income per capita, labour force size and insurance coverage, and low poverty rates, fiscal deficits, inflation, external debt, and export and import concentration. High quality infrastructures, such as transportation network, broadband services and housing, are associated with higher economic resilience.

Efficient institutional capacity can also play a key role in economic resilience through good governance, including impartial and independent courts. As discussed in Section C, trade policy plays an important role in the resilience of transport and logistics services and of digitally-enabling and digitally enabled services (WTO, 2020a). A high level of social capital and strong community capacity, including a high quality of life and low share of vulnerable people, can strengthen the economic resilience of households. Similarly, natural resources

endowment, including the environment, can be an important determinant of economic resilience.

Given the high number of variables needed to capture the different dimensions of economic resilience, composite indexes are sometimes used to facilitate the analysis, such as the Swiss Re Institute Macroeconomic Resilience Index, Prasad and Foda's Tracking Indexes for the Global Economic Recovery, and Briguglio et al.'s *Economic Resilience Index*.[13]

7. Conclusion

This section has highlighted how past shocks, such as natural disasters, pandemics, industrial accidents, financial crises, cyber- and terrorist attacks, as well as increasing risks of future disruptions, have led firms and policymakers to consider economic resilience as a strategy to reduce business interruption and economic loss. The review of the large disruptions produced by shocks underlines the need for effective strategies to prepare for, cope with and recover from disasters.

There are four key takeaways from this section. First, the analysis of the frequency of shocks and the magnitude of their damages shows that shocks have not only become more frequent over past decades, but also more substantial with respect to economic implications, including international trade disruptions. This increasingly justifies a focus on economic resilience.

Second, the heterogeneous effects of shocks across countries, regions, industries, households and gender groups shows the relevance of prevailing initial conditions and the channel through which a shock affects the economy (demand, supply or increased uncertainty and trade costs) as factors affecting resilience.

Third, economic responses to shocks have a lot to do with resilience. For instance, countercyclical fiscal and monetary policies, payments of unemployment benefits and subsidies to firms and farmers in response to demand-and-supply shocks, and the implementation of warning systems and regulations to mitigate uncertainty can be effective tools to enhance economic resilience and to stabilise an economy in the aftermath of shocks. Economic resilience strategies to prevent and mitigate adverse effects of shocks can be adopted by individual economic agents, for example by households through savings as a means to smooth income fluctuations, by firms through the enhancement of digitalization and diversification, or by governments through well-designed infrastructure, fiscal, monetary, social and trade policies.

Finally, trade policy also matters. Trade policy responses to disasters are neither fully trade-restrictive nor fully liberalizing, and mixed policy stances are the norm. Although restrictive measures gained more attention during the onset of the COVID-19 crisis, most of the related measures were trade-facilitating – in contrast to the 2008 global financial crisis, when trade restrictions became more prevalent. The fact that trade recovered swiftly after an initial drop during the first half of 2020 stresses the potential of liberalizing trade policies to harness the resilience potential of trade.

While this section has focused on whether economies and trade have been resilient to shocks or have been seriously disrupted, and on the policies that can make an economy or trade more resilient, Section C will discuss the role of trade in economic resilience.

Endnotes

1 The origin of the word "risk" has been traced to the classical Greek nautical term rhizikon, rhiza — referring to the difficulty to avoid sea rock (Abdel-Basset et al., 2019). In its current meaning, the word risk has lost its nautical application, but it has conserved all the original connotation of danger present in its etymology.

2 The global number of road accidents is recorded to be increasing, but in relative terms (i.e. relative to the population), transportation has become safer and mortality rates from road accidents have been falling.

3 The Global Terrorism Database, an open-source database, is managed by the National Consortium for the Study of Terrorism and Responses to Terrorism (START) and includes information on more than 200,000 terrorist attacks dating back to 1970. Available at https://www.start.umd.edu/gtd.

4 According to 2021 data from the Heidelberg Institute for International Conflict Research (https://hiik.de/hiik/organization/?lang=en).

5 Figures from Statista (https://www.statista.com).

6 This study covers natural disasters such as earthquakes, volcanic eruptions, storms, droughts, excessive precipitation and temperature anomalies (Felbermayr, Gröschl and Heid, 2020).

7 Although a government may introduce export restrictions with the intention of avoiding critical shortages of essential goods and keeping domestic prices low, export restrictions can backfire rather than help in situations of shortage. Export restrictions can lower domestic production of essential goods and lead to retaliation. Lack of predictability in the administration of export restrictions makes it difficult for firms to plan the sourcing of critical inputs and to execute those plans, resulting in suboptimal supply chain decisions. From a political perspective, there is also the risk that, in the aftermath of the pandemic, economies may move away from open and transparent trade policies toward policies driven by strategic political considerations. This would further increase operation costs for supply chains, thus making production sub-optimal.

8 WTO estimates based on the Global Trade Alert Database (https://www.globaltradealert.org).

9 This broad definition is in line with current national and international policymaker discussions. However, it departs from the other major approach to economic resilience found in the economics literature, which focuses only on the post-shock dynamics, in particular the ability to cope with and recover from shocks (Hallegatte et al., 2017; Rose, 2017).

10 The literature on social-ecological resilience defines robustness as the probability that a system maintains its identity and does not cross an undesirable (possibly irreversible) threshold following one or more adverse events (Brand and Jax, 2007).

11 https://www.itu.int/itu-d/sites/statistics.

12 Property damage is an imperfect unit of measure because the capital stock does not contribute directly to economic well-being. It is the flows of goods and services stemming from capital stock that make actual contributions to economic well-being.

13 Other resilience indexes have been developed, including the Pandemic Resilience Index, FM Global Resilience Index, and the Global Labour Resilience Index.