FOSTERING ECONOMIC RESILIENCE IN A WORLD OF OPEN AND INTEGRATED MARKETS

RISKS, VULNERABILITIES AND AREAS FOR POLICY ACTION

REPORT PREPARED FOR THE 2021 UK PRESIDENCY OF THE G7

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BETTER POLICIES FOR BETTER LIVES

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PREFACE

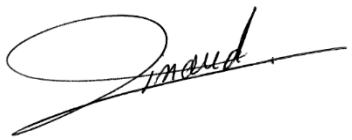
Crises such as the Global Financial Crisis (GFC) in 2007-09 and the COVID-19 pandemic in 2020 demonstrate what can happen when risks become reality and resilience is put to the test in our globalised economies and societies. Global openness and integration have brought important benefits to raise productivity gains, facilitate technology diffusion and lift hundred millions of people out of poverty. However, within such globally integrated economies, shocks, whether endogenous, such as the GFC, or exogenous, such as the pandemic, can rapidly turn into severe global economic downturns, as impacts cascade through interconnected systems and sectors.

Our economies and societies face a multifarious array of risks. Some acute shocks may be challenging to predict, while others may be the result of the chronic build-up of vulnerabilities, such as the impacts of climate change or imbalances and distortions in markets, both of which are shaped by policy and regulatory choices. Building resilience across our economies as a whole calls for a systemic policy approach to prevent the build-up of vulnerabilities and reduce exposure to shocks; to absorb shocks when they do occur; and, to recover rapidly and sustainably from these shocks through adaptation and transformation ("bouncing forward").

This report, prepared by the OECD for the UK Presidency of the G7 to inform the debates of the G7 Panel on Economic Resilience, provides a conceptual framework for understanding challenges to economic resilience articulated around endogenous and exogenous risks, as well as acute shocks and chronic vulnerabilities. The report focuses on three policy areas where international co-operation is critical and where coordination through the G7 and other global fora would bring substantial benefits for all countries. These include strengthening the resilience of global supply chains, particularly for essential goods; improving the international rulebook to make global markets more predictable and reliable (such as for critical minerals), notably by addressing distortions and imbalances which are sources of vulnerability, and by levelling the global economic playing field; and, addressing the challenges stemming from the digital transformation of our economies and from emerging technologies. The latter can be both sources of vulnerability and a bulwark for future resilience through improved innovation policies, financing models and regulatory approaches.

Addressing these challenges, alongside heightened ambitious efforts to tackle climate change and social inequalities, is essential to improve economic resilience but also to rebuild trust in governance structures, institutions and evidence itself. This is because effective crisis responses and recoveries depend on public acceptance and adherence to necessary measures and policies

This report, which includes analysis and key recommendations, provides policymakers and stakeholders in the G7 and beyond a framework to understand the main sources of risks and vulnerabilities and a set of policy options to strengthen economic resilience as they set in place the foundations for a robust and sustainable recovery.



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INTRODUCTION

1. Economic resilience has emerged as a priority in response to the devastating impacts of recent system-wide crises, in particular the Global Financial Crisis (GFC) of 2007-2009 and the 2020 COVID-19 crisis, both of which will continue to leave lasting scars on our economies and societies. The fallout from the GFC hit the poorest hardest, contributing to an extensive erosion of public trust in global economic governance. The COVID-19 crisis has brought unprecedented impacts in peacetime, with many countries putting entire sectors of their economy "on hold" to contain the spread of the virus, necessitating in turn a more prominent role for the state. Tests to economic resilience have come -- and will continue to come -- in many forms. Some may be challenging to predict; others, such as the impacts of climate change, are well- documented and already bringing severe impacts. The lessons from COVID-19 and other crises show that we need to have resilient economies and societies as a whole, not just resilient financial sectors.

2. As countries overcome this crisis through a combination of vaccine rollouts, ongoing containment and fiscal support measures, policymakers are increasingly looking to strengthen resilience to future crises as an integral part of "building back better" after the pandemic. No two crises will ever look the same, but it is critical to learn the lessons of this one and those that preceded to guide the policy actions needed to strengthen economic resilience understood as the following policy "tryptic":

- preventing the build-up of potential vulnerabilities;
- preparing to absorb shocks when they occur; and
- the ability to engineer a swift rebound from those shocks.

3. These include increasing ambitions to tackle existing and emerging vulnerabilities, notably, in supply chains; climate change, including the catastrophic potential of tipping points;[1] and a range of security threats, including those arising from the digital transformation, which is both an emerging source of risk while also offering new solutions to increase adaptability and innovation for resilience. It is also noteworthy that countries are increasingly using economic levers for national security purposes. As countries work to address these challenges, trust in governance structures, institutions and evidence itself is critical to ensuring public acceptance and adherence to necessary measures, and yet trust has been one of the casualties of recent crises. It is important therefore to address not only exogenous risks and acute shocks to the system, but also risks emerging from within the economy itself, often from the build-up of gradual distortions or imbalances, which can be addressed through sound regulatory frameworks and principles for open and transparent markets.

4. Interconnectivity and global openness remain two of the structuring and determining features of the modern world, which have brought considerable benefits to much of the global population. Growing global economic integration has facilitated productivity gains and their diffusion, global economic growth,

[1] "Tipping-points" are thresholds that if exceeded could lead to abrupt and irreversible changes in the climate system that could have catastrophic and cascading outcomes for natural systems and society. Recent IPCC research suggests a risk of triggering some tipping points even with warming of less than 2 °C, such as the melting of the West Antarctic Ice Sheet (WAIS) and the Greenland Ice Sheet (GIS). Other examples of potential non-linear irreversible changes include the potential decrease of Atlantic overturning circulation; increases in ocean acidity and accelerated methane emissions from permafrost melting

the integration of emerging economies in global markets and the lifting out of poverty of hundreds of millions of people, while also disseminating technological advances and spurring transformative innovation, not least in the field of digitalisation. However, for all its benefits, global integration has also left many people behind and has created systemic weaknesses, particularly as the nested systems and complex imbrications of globalised economies (across areas as diverse as digital, communication, transport, production, finance and eco-systems) increase the risk of failures cascading from one system to another, as seen during the GFC and the COVID-19 crisis. The concentration of industrial capacities and economic activity into smaller though more efficient sectors, up to the international level, has produced profitable and efficient yet potentially fragile supply chains, and economic exchanges whose disruptions can bring unintended consequences. When these concern essential or critical goods, there is a need to be particularly cautious to ensure global supply, even in the event of shocks. Developing resilience through international co-operation and within an open international economic system is vital to build systems that are designed to facilitate recovery and adaptation in the aftermath of disruption – while keeping markets open and upholding the benefits from an open, interconnected global economy.

5. The G7 has the potential to play an important role in helping to develop a common understanding of how global interconnectedness and openness have both contributed to and challenged economic resilience; in providing a forum to discuss collective risks and in fostering international co-operation on economic resilience. In this respect, particularly in the context of COVID-19, the decision by the 2021 UK Presidency of the G7 to convene a Panel on Economic Resilience is timely and necessary. This report, prepared by the Organisation for Economic Co-operation and Development (OECD), aims to support and frame the discussions of the Panel to develop a shared understanding of the collective, systemic challenges to our economic resilience. The analysis is intended to inform the Panel's discussions on systems-based approaches to strengthening the resilience of open global markets and supply chains, and to help build consensus around safeguarding the delivery of global public goods and shaping incentives for long-term resilient, inclusive and sustainable economic growth.

6. The OECD has more than a decade of experience in developing a systems-based approach to resilience, covering prevention and absorption, but also recovery and adaptation in the aftermath of disruption. Risk management of a system driven by resilience as a central goal should actively identify those uncertainties and risks likely to have an effect on resilience and seek to prevent and mitigate their acute manifestations and effects, while also acknowledging that the infinite variety of future threats cannot be adequately predicted and measured, nor can their effects be fully understood *ex ante*. Equally, governments can and should learn the lessons of past crises, such as the GFC as well as the ongoing COVID-19 crisis, to ensure our international economic systems can withstand a broad range of shocks and facilitate recovery, drawing on the strengths of interconnected, open and transparent global market economies.

7. This report addresses key areas to support international co-operation on resilience through the G7 and beyond.

- **Chapter One** makes the empirical case for considering the strengthening of resilience as a primary objective of public policy, as well as proposing a conceptual framework for a systemic understanding of economic resilience.
- **Chapter Two** sets out how global, diversified, open markets depend upon well-functioning global supply chains, which can nevertheless face challenges from a global demand and supply crisis such as COVID-19. The analysis demonstrates that international co-operation has a key role to play in ensuring resilient global supply chains, notably through increasing transparency on essential goods, enhancing international regulatory co-operation, disciplining export restrictions and collaborating on global standards, including on Responsible Business Conduct (RBC). However, for global markets and global supply chains to serve as a source of resilience, governments, as well as the public, need to have confidence that global markets are open and fair.

- **Chapter Three** discusses how to promote a level playing field for competition, trade and investment, including addressing concerns about government support, as well as ensuring global markets are reliable and predictable. This includes through access to critical raw materials, disciplining export restrictions and avoiding harmful practices that undermine trust, such as foreign bribery. International co-operation on standards and regulation are essential to ensure that all can benefit from global openness, to prevent market fragmentation and to align global flows of trade and investment with international commitments such as the 2030 Agenda for Sustainable Development and the Paris Agreement.
- **Chapter Four** explores the role of emerging technology as both a source of potential shocks and a tool for adaptation and recovery, as seen during the COVID-19 crisis. It provides an overview of the key technologies that are expected to emerge in the next 5-10 years, as well as the opportunities and challenges they may raise, including the need for more forward-facing and agile regulatory approaches.

Key Findings and Policy Recommendations

8. In our globally interconnected economies, shocks within a part of the economic system -- or originating from outside -- can turn into severe global economic downturns through cascading failures across the whole system, contributing to growing inequalities, polarisation of society as well as trust erosion and the spreading of disinformation. Building resilient economies and societies requires a systemic approach to a diverse range of known and unknown risks, from pandemics and climate change to developments in globalisation and emerging technologies. Building protective social capital and trust may help to reduce the cost of future crises, such as pandemics and other crises, for which social behaviour and trust in institutions and science matter. This calls for reinforcing the capacity of the economic system to withstand or absorb a variety of shocks and to adapt or transform itself to bounce forward during the recovery. It also implies a need to mitigate risks, through efforts to detect and address distortions and externalities at their source, so that the chronic build-up of vulnerabilities and tensions within the system turn into acute events.

Strengthening resilience to shocks, risks and vulnerabilities in an interconnected world

- **Governments could revise their risk management policies and frameworks** to ensure a systemic and comprehensive all-hazards-and-threats approach to resilience with international co-operation and tools playing a central role, consistent with the *OECD Recommendation on the Governance of Critical Risks*. This should be supported by a comprehensive evaluation of lessons learned from the COVID-19 crisis, including through benchmarking of preparedness and responses. For example, comparing national health emergency response plans.
- **Governments, starting with the G7, could work on identifying and agreeing on a diverse set of vulnerability indicators covering a range of threats.** This would allow for the monitoring of domestic threats, as well as potential interlinkages to mitigate against cross-border negative spillover effects. For example, in the economic and financial areas, such variables could include measures of access to and use of private credit, market concentration in various sectors, market fragmentation, competitive market practices, ease of doing business, costs of living, house price pressures, external account imbalances, as well as various forms of inequality, exclusion and social stress.
- **Governments would benefit from paying particular attention to the impact of reduced satisfaction and trust in democratic governments and in the resilience of their economies.** Key areas of focus could include how governments communicate with the public in an age of widespread disinformation and misinformation; how to ensure more representative and inclusive policy-making; bolstering government capacity to deal with challenging global trends such as digitalisation and climate change; and proactive measures to bring citizens back to participative democracy.
- **Governments could act to improve resilience to climate change through agreeing to adopt ambitious climate change policies for both mitigation and adaptation.** Mitigation policies should be embedded in a long-term commitment towards net-zero emissions and can include a renewed impetus to phasing-out fossil-fuel subsidies, effective and predictable carbon pricing, as well as other measures such as stress-testing of the financial system to minimise spillovers of a rapid transition to a net-zero economy. Adaptation includes factoring heightened climate risks into

all new and existing infrastructure, to improve resilience to more frequent and severe climate-related shock events, and to slow onset changes.

Building resilient global supply chains

9. In the face of global shocks, ensuring the resilience of global supply chains has become a key concern for policymakers and citizens alike, both to ensure the supply of essential goods and to underpin a strong and resilient global economy more broadly. G7 countries have a leadership role to play in strengthening co-operation with the private sector, improving national and international planning strategies, enhancing critical infrastructure resilience and increasing international co-operation to achieve a stable, predictable, rules-based international trading system. All are critical to ensuring economies can prevent, withstand, absorb and recover from a wide range of crises.

- **Governments could work proactively, including with the private sector, to promote the resilience of global supply chains** and ensure the supply of essential goods, guided by the *OECD toolkit of policy options* set out in Chapter 2. These options include action at the national level (such as reforms and investments in trade facilitation and promoting digital trade); more specific measures for essential goods, including in co-operation with the private sector (such as stress tests for supply chains; horizon scanning and scenario planning; stockpiling; upstream agreements with firms to increase supply); and working with other countries to boost transparency, discipline export restrictions and improve international regulatory co-operation.
- **Governments stand to benefit from implementing policies to strengthen the resilience of their global value chains by developing and sharing national guidelines for crisis planning**, which can be adapted to the specific needs of crises. These flexible guidelines pre-establish relations, expectations and emergency operating procedures and enable rapid centralised purchasing and price tracking, supply mapping and diversification strategies.
- **G7 governments could create a *G7+ Rapid Response Forum for Essential Goods in Crises*** to facilitate early, political-level co-ordination; in particular, dialogue and transparency on supplies, surge needs and production capacities, as well as on planned policy measures (including commitment to consultation before imposing any trade measures, notably export restrictions). The initiative could also prepare timely co-operative actions in areas such as logistics, transportation, procurement, planning and communication (including to combat disinformation and to promote responsible business conduct). The initiative could be a crisis-specific emergency forum under the rotating presidency of the G7, with the participation of the G7+ and the possibility of involving other countries as needed, depending on the nature of the crisis.
- **Governments could enhance the resilience of global value chains by reinforcing predictable, rules-based trade and avoiding unilateral or retaliatory trade measures**. In particular, countries should work to strengthen WTO disciplines on export restrictions. Concrete benefits for traders could also be achieved by efforts to increase the digitalisation of trade processes.
- **To strengthen the resilience of global supply chains, countries can also strengthen the governance of critical infrastructure**, which underpins the functioning of global markets and supply chains, by establishing trust, ensuring secure information sharing, developing cost-sharing mechanisms and strengthening international co-operation, drawing on the *OECD Policy Toolkit in the Governance of Critical Infrastructure Resilience*.
- **In parallel, governments could strengthen international regulatory co-operation**, such as agreements on simplified procedures and adoption of international standards to facilitate the flow of essential goods, in line with the *OECD Best Practice Principles on International Regulatory Co-operation*.

International rulemaking for resilient, open and innovative global markets

10. A resilient global economy needs strong institutions, rules and norms to ensure open, fair and innovative markets operating on a global level playing field. Adherence to common "rules of the road" ensures inclusive and sustainable growth and underpins trust in government and in the multilateral system more broadly. A global level playing field requires policy actions to: address government support that distorts competition and leads to excess capacity; facilitate the supply of critical minerals; prevent corruption such as foreign bribery and illicit trade; and make investment, particularly FDI, a driver of progress towards international development and climate goals.

- **Governments could stress the importance of international rules and standards** in the health of the global economy and commit to work with international organisations to further improve their quality and effectiveness, ability to flexibly respond to short-term challenges and ensure more co-ordinated approaches to shared long-term policy priorities, including by supporting the OECD *Best Practice Principles on International Regulatory Co-operation*.
- **Governments could agree to work collectively to strengthen resilience by further levelling the global playing field,** by:
  - actively supporting reform of the rules-based multilateral trading system embodied in the WTO, including strengthening WTO disciplines on government support and state ownership in industrial sectors, starting with enhanced disciplines on transparency.
  - ensuring that screening of investment in sensitive sectors, while necessary and legitimate, remains closely tailored to risk and that policies conform to the *OECD Guidelines for Recipient Country Investment Policies relating to National Security*.
  - ensuring that even in times of crisis, governments maintain competitive neutrality, whereby state intervention in the form of emergency support to otherwise viable firms is transparent, time-limited, non-discriminatory and consistent with longer-term objectives. Where the state becomes an owner, it should act in line with internationally agreed best practices such as the *OECD Guidelines on Corporate Governance of State-Owned Enterprises*.
- **Governments could work together to ensure reliable and predictable global markets, including to secure the supply of strategic raw materials such as critical minerals**. In particular, countries could enhance co-operation to develop international agreements towards stronger monitoring, notification and disciplines on export restrictions on critical raw materials, and increase circularity by enabling technological advances in material recuperation and recycling as well as reducing barriers to trade in end-of-life goods. Countries can also draw on instruments to strengthen governance in extractive sectors, such as the *OECD Due Diligence Guidance for Supply Chains of Minerals from Conflict-Affected and High-Risk Areas*, as well as ensuring responsible sourcing, which is increasingly a determinant of strategic security of supply.
- **To ensure market-based global openness is a driver of international development, governments should promote and uphold open, non-distortionary, predictable and transparent trade and investment policies**. They should support progress in WTO negotiations on Investment Facilitation for Development. Countries could also promote and use the OECD Policy Framework for Investment (PFI), which can help countries, particularly developing countries, reduce costs, risk and uncertainty for investors.
- **Governments could foster resilience and sustainability, and contribute to the achievement of development and climate goals**, by including SDG and Paris Agreement conditionality in their recovery and stimulus packages, with particular attention to infrastructure and embedding responsible business conduct (RBC) principles and standards into investment practices. In this regard, countries could implement and promote relevant tools such as the *OECD Guidelines for Multinational Enterprises* and due diligence guidance, while working to enhance the qualities of FDI, drawing on instruments like the *OECD FDI Qualities Indicators*.

Harnessing emerging technologies for resilient and dynamic economies

11. Emerging technologies, including digital technologies, provide solutions for resilience in terms of prevention, absorption and recovery capabilities. However, these can also pose threats to human-centred values, as well as cyber threats, data privacy challenges and inequalities of access, diffusion and skills. To address these challenges and foster innovation for resilience, governments need to strengthen their science, technology and innovation (STI) capacities through well-balanced STI investments; improve incentive structures and address silos within the STI system; link support for innovation more closely to broader public policy missions; and, crucially, improve international collaboration on technology governance and develop more innovation-friendly and future-focused regulation.

- **Governments could work to strengthen their national policies for digital transformation and improve the international policy frameworks supporting the digital economy, by:**
  - Adopting whole-of-government digital strategies, including actions to address digital divides, strengthen digital security, and develop national data strategies to improve data governance and the interoperability of data protection regimes.
  - Making digital security a strategic priority while strengthening international co-operation to enhance their collective resilience to increasing cyber-threats -- through information exchange, capacity building and the development of digital security standards in partnership with the private sector.
  - Boosting their ability to become digitally and globally competent, capable of shaping the digital world and addressing challenges beyond their boundaries, through fostering public-sector innovation, advanced digital government strategies, drawing on the *OECD Digital Government Policy Framework* to embed data practices at the heart of policy, and enhancing international co-operation.
- **Governments could work to strengthen the capabilities of science, technology and innovation systems in support of economic resilience**, by:
  - Improving the funding and governance of science and innovation to influence the direction of innovation towards public policy goals and ensure support to longer-term, high-risk research and innovation with high potential for knowledge spillovers. This includes linking their support for innovation more closely to broader public policy missions, for example in the context of mission-oriented innovation policies (MOIPs).
  - Strengthening international science and technology co-operation aimed at addressing global challenges, for example by developing and scaling up agile technology platforms.
  - Fostering innovation within the STI system itself, for example by promoting transdisciplinary research, enhancing mobility between academia, public and private sectors, and strengthening innovation within government, to enhance its ability to respond to shocks.
- **Governments could commit to working together to improve technology governance at the national and international level, by:**
  - Strengthening international co-operation on norms, technical standards and regulations through multilateral dialogue, building on examples such as the *OECD Artificial Intelligence (AI) Principles*. G7 countries and interested countries could consider launching through the G7 a multi-stakeholder Future Tech Forum.
  - Proactively reforming regulatory policy to achieve agile and future-focused approaches to regulation; developing a whole-of-government approach to regulatory management tools; stepping up international regulatory co-operation, reflecting the transboundary nature of emerging technologies; and adapting enforcement methods and practices through more outcomes-oriented and risk-proportional approaches. Those efforts could draw on the *OECD*

Principles for agile regulatory governance to harness technological innovation, which countries could endorse.

Chapter 1. STRENGTHENING RESILIENCE TO SHOCKS, RISKS AND VULNERABILITIES IN AN INTERCONNECTED WORLD

12. This Chapter reviews sources of risks and points of vulnerability that may be conducive to severe crises through cascading failures across the economic system. It does so by focusing on risks associated with pandemics and climate change, as well as developments in globalisation and emerging technologies. The chapter proposes a conceptual framework for how policymakers should approach economic resilience in the face of different kinds of economic shocks and vulnerabilities, which can ultimately severely affect public trust in open markets and democratic institutions. In this framework, economic resilience comprises approaches to

- reducing the risks of large shocks;
- quickly and smoothly absorbing those that occur;
- adapting to recover from them through well-governed economic markets as well as efficient reforms of structural policy settings and institutional frameworks.

13. Shocks and vulnerabilities include those that are external to the economic system and thus largely exogenous, as well as those that are building up within the system as a result of policy shortcomings and other human interventions. The strengthening of resilience is considered as a primary objective of public policy, alongside the pursuit of income growth, social inclusion and environmental sustainability in the quest for maximum social well-being. Because so many of the relevant shocks and vulnerabilities are global in nature, this will need to be done in ways that involve international co-operation in setting and playing by common rules.

1.1. Introduction and scene setting

1.1.1. Learning the lessons of the most recent large shocks

14. A common pattern has emerged in recent decades, whereby poor policy and short-term institutional-design decisions lead to the chronic build-up of stresses and strains in the global economy, society and the environment. Such build-up ultimately manifests itself in the form of severe economic recessions that follow acute shocks or triggers, with major consequences for public trust in government (Box 1.1). The origin of such events may in some cases be initially unclear and their timing uncertain, but their severity can arguably be traced back to those earlier policy decisions. Both the COVID-19 crisis and the Global Financial Crisis (GFC) fall into that pattern, albeit with an important difference regarding the nature of the shock triggering the crisis. These are just two illustrative examples from the recent past, yielding lessons that policymakers can draw from to make sure that economies are as resilient as possible to future shocks whose nature, magnitude and complexity cannot be known in advance. The combination of global interdependencies and local vulnerabilities in particular create the conditions for shock events to cascade across borders and sectors of the global economy (OECD, 2011). Hence, there is a need to understand those sources of vulnerability, invest in risk management and strengthen international co-

operation to build economic resilience against those severe global disruptions, as put forward by the *Recommendation of the OECD Council on the Governance of Critical Risks* adopted on 6 May 2014.

15. The COVID-19 crisis has hit the world economy at a time when multiple sources of macroeconomic stress and vulnerability were prevalent, despite progress made by governments to address a number of the factors that had contributed to the widespread and severe nature of the earlier GFC. In particular, the latter had underscored important risk exposures in both public and private finances, which had their roots in policy distortions as well as institutional and regulatory failures, and which were amplified by several features of housing markets. Many of these are still to be fully addressed, notably the bias in many tax systems in favour of corporate debt and household mortgages, as well as constraints on housing supply related to rental market and land-use regulations (Cournède, Sakha and Ziemann, 2019). More recently, the COVID-19 crisis has laid bare weaknesses in public health and gross social inequities and revealed stress points in our global production and distribution systems. The crisis has highlighted the importance of adaptable social and economic infrastructure for resilient societies (OECD, 2020r). The crisis has also highlighted concurrent risks related to climate change and environmental sustainability as potential sources of adverse shocks, (such as raw-material supply-chain vulnerability) as well as factors that aggravate the effect of events such as pandemics. Indeed, before the outbreak of COVID-19, climate change had been the number one perceived global risk according to two major surveys (Box 1.2).

Box 1.1. Reduced citizen trust in public institutions as a major risk for economic resilience

The COVID-19 health and economic crisis is challenging the relationship between citizens and their governments in unprecedented ways, coming after the GFC had already dented confidence in public-sector institutions for a decade, on average, in OECD countries (OECD, 2019g). There is a risk that such confidence, could be further downgraded, by rising inequalities caused by the COVID-19 crisis and a perceived lack of responsiveness, effectiveness and transparency in its handling. Longer-term trends around the use of evidence in policy-making, the complexity of the (social) media landscape and the rise of populist movements compound this risk, accelerating political apathy and exclusion (Ananyev and Guriev, 2019).

Since 2017 the OECD has developed a unique framework to measure citizen trust in government and its main drivers (reliability, responsiveness, integrity, openness and fairness) in order to identify concrete levers that public institutions can use to foster trust (OECD, 2017b). Defined as a "person's belief or expectation that institutions will act in favour of one's well-being," trust is a precondition for keeping societies cohesive, successfully implementing public policies, reducing costs of collective action and facilitating compliance with government regulatory measures and taxes, which are all key to economic resilience. Preliminary results of the OECD Trust Survey in eight OECD countries (OECD, 2017c) show that the percentage of the population that considers its national government as responsive, reliable, acting with integrity, open or fair varies greatly among countries -- from more than half in Germany and Finland to less than a quarter in Italy and Korea.

Additional insights into what shapes trust during crises can help governments build robust evidence for the COVID-19 recovery, as well as to better prepare for future crises. Three emerging factors will require specific attention -- in addition to better measurement (OECD, 2020p). First, the success of countries' recovery plans will depend on the trust people have in governments' capacity to deliver and to safeguard long-term interests, as well to design policies that are fair, trustworthy, and open to public scrutiny. Second, the COVID-19 crisis has unveiled a growing distrust[2] towards public institutions that threatens the legitimacy of governments to respond to the crisis, changes the quality of democratic representation and fuels mis-information. Evidence from the United States and United Kingdom shows that distrust is associated with substantially lower levels of behaviour change and compliance with government measures during the pandemic (Devine et al., 2020). Measuring distrust will be key to gauging the extent of disengagement among populations and to better understand the links with misinformation. Finally, ensuring open and equal access to policy-making processes is at the core of democratic public life and effective policies. How the public is involved, whether governments are listening to people's concerns and, equally, considering their interests will determine the quality of the economic recovery and reduce future risks.

[2] Mistrust, or political scepticism, plays an important role in representative democracy, as critical citizens are more likely to engage in political activities and to keep office-holders accountable. When mistrust turns into distrust and cynicism, then the quality of democratic representation itself may change (Zmeli and Van Der Meer, 2017a).

Box 1.2. The recent evolution of perceived risks and government preparedness for them

Each year the insurer AXA issues a Future Risks Report. The 2020 edition, published in October, reports on the results of early-summer surveys of over 2600 experts in 54 countries and 1000 members of the general public in 15 of these countries. Expert respondents were asked to rank the 25 pre-selected risks by their probability of realisation over the next five to ten years and the general public to assess their vulnerability to each. Unsurprisingly, pandemics and infectious diseases jumped from 8th to the top position (Table 1). Technological risks other than cybersecurity (such as from Artificial Intelligence and Big Data) dropped from 6th to 12thposition. Environmental risks were also seen as somewhat less of a priority, although climate change remains high on the list.

Table. Top ten risks in 2020

Nature of risk	Rank change since 2019	Per cent citing among top 5	Per cent Citing
1. Pandemics and infectious diseases	+7	56	+33
2. Climate change	-1	54	-13
3. Cybersecurity	-1	51	-5
4. Geopolitical instability	-1	38	-4
5. Social discontent and local conflicts	-1	33	+5
6. New threats to security[1]	+3	30	+13
7. Macroeconomic outcomes	+3	24	+8
8. Natural resources and biodiversity	-2	22	-5
9. Financial	+2	21	+6
10. Pollution	-3	20	-3

Note: These include such risks as cyber warfare, new forms of terrorism, malicious use of new technologies and fake news.
Source: AXA Future Risks Report 2020.

When asked about overall vulnerability compared to five years ago, 73% of the general public and 83% of the selected group of experts believed it to have increased. This varied from 75% in the United States down to 25% in China. Finally, there were disparate changes in the confidence placed by the general public in the authorities' preparedness for pandemics and infectious diseases: in the Asia-Pacific region, that share rose from 16% to 45% and in Europe from 27% to 34%, while it fell in the Americas from 31% to 16%.

These results can be compared with those presented in a similar annual exercise by the World Economic Forum (2020), which was undertaken prior to the outbreak of the COVID-19 pandemic (in autumn 2019). In it, 1 047 "global shapers" attributed a risk of infectious diseases barely among the top ten among 40 selected risks in terms of impact, and only 28th as to likelihood. Rather – for the first time since its inception in 2007 – all of the top five positions for likelihood were environmental, as were three of the top five for impact, whereas there had been none in either dimension until 2011. Economic risks were deemed to have diminished radically: occupying three and four of the top five ranks for likelihood and impact in 2010, they had disappeared entirely from among the leaders by 2015 and 2016, respectively. Risks were seen to be rising across the 40 listed by 23 to 78% of respondents, depending on the risk. Five of the 15 risks receiving the highest support were environmental, led by extreme heat waves (3rd, cited by 77%) and destruction of natural ecosystems (4th, cited by76%). Interestingly, two kinds of cyber-attacks placed 5th and 8th, with 76% and 75% support, respectively. By the time of the subsequent, just released edition (World Economic Forum, 2021), infectious diseases had, not surprisingly, moved up to the top spot in terms of impact and fourth position in terms of likelihood, ahead of biodiversity loss and human-made environmental disasters. There were also notable gains for digital power concentration and digital inequality in the likelihood dimension to 6th and 7th position, respectively.

16. The fallout from the need to socially distance in 2020 on the economies of the developed world and elsewhere was -- and continues to be -- buffered by the widespread availability of digital technologies. They enabled efficient remote working (and possible productivity gains) for many workers and also, boosted e-health, e-commerce, e-learning and e-payments, as well as innovative business models. However, the potential for remote working and thus for reducing the costs of pandemic-related lockdowns differs sharply, above all according to occupations and skill levels, with low-paid sectors like hospitality generally less able to shift to such ways of working. There have been considerable differences between and within countries, with urban areas having a pronounced advantage, owing to generally superior broadband connections as well as a higher concentration of jobs more easily amenable to remote working (OECD, 2020g). This advantage for larger and more densely populated cities has at least partly compensated for the faster spreading of the virus and the greater specialisation in sectors (hospitality, entertainment, personal services) that have been hardest hit by strict lockdowns. As sustained remote working expands, there is scope for policy to encourage the necessary investment to spread the benefits of agglomeration economies to other places, such as mid-sized urban areas.

The main risks as they are perceived today

17. According to the United Nations Office for Disaster Risk Reduction (2020), over the last 20 years 7 348 natural and manmade disasters have cost 1.23 million lives, affected over 4 billion people and incurred almost USD 3 trillion in economic losses. This is a significant increase from the 4 212 events recorded during the previous 20 years, which affected 3.25 billion people, resulting in 1.19 million deaths and USD 1.6 trillion in losses. The UN singled out climate-related disasters as having been the biggest contributors to the increase in deaths and losses. The *Sendai Framework for Disaster Risk Reduction 2015-2030* seeks to prevent new and reduce existing disaster risks, notably by strengthening disaster-risk governance, investing in disruption reduction in critical infrastructure and essential services (OECD, 2019c), and enhancing disaster preparedness so as to respond better in recovery, rehabilitation and reconstruction.

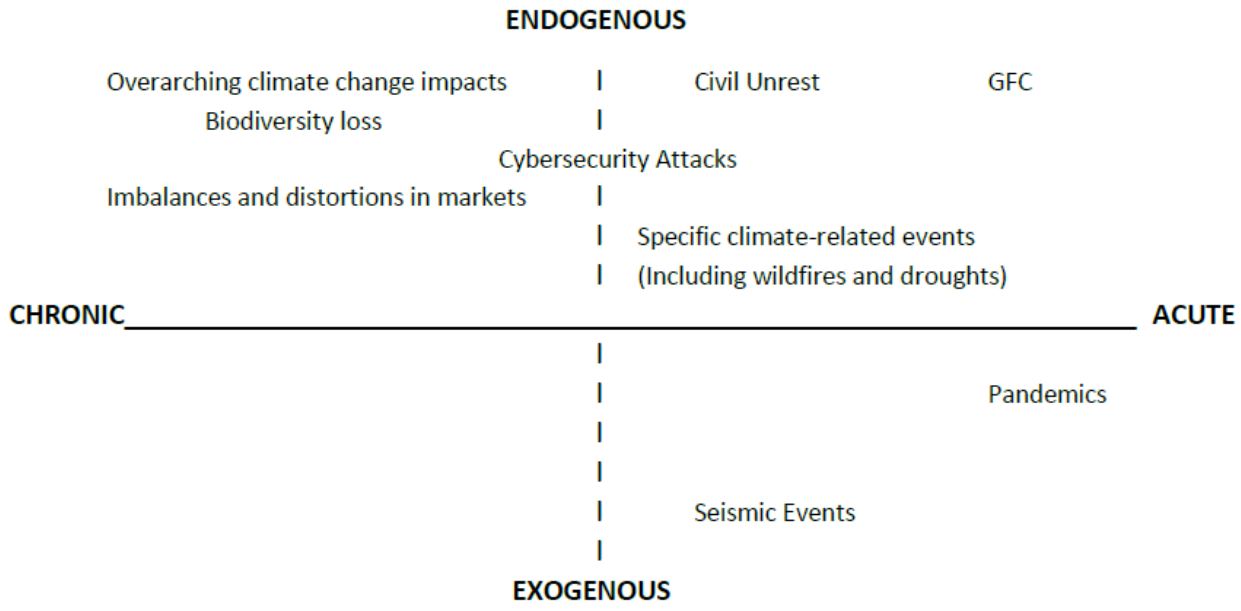
18. While natural-disaster risks have worsened, one other type -- terrorism risk -- has receded in recent years, according to the Institute for Economics and Peace (2020). In 2019, the number of fatalities resulting from terrorism worldwide fell for the fifth consecutive year to 13 826, and the number of incidents and injuries, as well as property damage, also declined. Its estimate of the global economic impact of such incidents fell 77% to USD 26.4 billion since the 2014 peak. Such infringements to economic and societal security have both direct and indirect effects on public behaviour, especially on travel, tourism and hospitality services and call for international co-operation by law-enforcement agencies and diplomatic channels. However, the report noted a worrying trend: an increase in far-right political terrorism, e.g. the Christchurch mosque attack. It warned of signs that political violence is becoming more publicly acceptable, pointing to nearly 70 violent demonstrations in Western countries in 2019, up from only 19 in 2011. Its analysis points to high levels of group grievance and weak rule of law as fundamental causes, with important roles in developed countries for social disenfranchisement and exclusion as well.

1.2. **A conceptual framework for economic resilience**

19. The concept of economic resilience is complex, and definitions vary among those trying to gain insights into its drivers and impacts. The starting point for any consideration of economic resilience is answering the question of resilience to what. This report takes this to be resilience to bad events of all kinds, which can be distinguished along two dimensions: i) endogeneity (as opposed to exogeneity, or in other words the extent to which the event is anthropogenic); and ii) acuteness (as opposed to being chronic). Figure 1.1 below is a simple rendition of this idea with a suggested classification of some of the

main risks reported in Box 1.2 along these two dimensions. Most shocks would appear to be at least partly endogenous in the sense of resulting from human activity or intervention of some sort; only seismic events (including volcanic activity) would qualify as purely exogenous in this respect, though some (e.g. weather events and pandemics) are external to the economic system and can thus be seen also as exogenous.[3] Similarly, most are acute by nature, but environmental shocks seem to be more chronic, even if some -- notably individual wildfires and storms -- have acute local impacts. However, some acute events can result from the chronic build-up of sources of tensions and vulnerabilities in the economic system as the example of the GFC illustrates and which contrasts with the pandemic.

Figure 1.1. The nature of shocks



20. In the span of barely a decade, the world economy has been buffeted by two severe crises of very different natures. The GFC originated largely from human activity, and from factors within our economic system and governance mechanisms. In that sense, it can be characterised as endogenous, mainly resulting in this case from tax and regulatory distortions such as those mentioned above, along with insufficient prudential buffers and inadequate supervision of the financial sector. These policy shortcomings contributed to an excessive build-up in private-sector debt and a proliferation of poorly assessed, low-quality assets, whose value plunged when their inherent worth was revealed as housing prices dropped, leading to enormous losses. The severity of the crisis was amplified by the extent and complexity of interconnections in the global financial system. These resulted from a combination of globalisation and financial deregulation (e.g. rapid development of securitisation and shadow banking), whose consequences in terms of global financial system vulnerability to a localised shock had also been

[3] The notion that “shocks” can be endogenous may come across as a contradiction given that the economic literature typically considers shocks as exogenous by definition. However, endogenous shocks are referred to here as a situation where conditions are created for a given event to trigger a severe economic downturn or crisis. The (exogenous) triggering event is less important than the (endogenous) conditions that make the event snowball into a severe downturn or crisis.

largely overlooked by national financial supervisors.[4] It then spilled over to the real economy as the labour market weakened considerably.

21. By contrast, COVID-19 is a shock originating largely outside the control of human activity and economic systems. Its massive economic impact to date has come primarily from the health crisis and the containment measures that were needed to control the pandemic, lest health systems collapse and a much larger human tragedy ensue. Hence, the spreading of the virus via human contact was the main channel through which the economic impact of the shock propagated across the world. Compared to the GFC, transmission of the COVID-19 shock through financial linkages has played less of a role in the spreading of the crisis around the world. In that sense, COVID-19 is a good example of an acute shock with potentially long-lasting effects that is exogenous to the economic system, even though the arrival of some sort of microbial pandemic was predictable in light of earlier warnings and episodes.[5]

22. The severity of the pandemic was also magnified by the extent of co-morbidities present for so many members of the public, including from the prevalence of high levels of air pollution in some hard-hit regions, such as northern Italy (Conticini et al., 2020), and notably of varying amounts of airborne fine particulates in the United States (Wu et al., 2020). Furthermore, in all G7 countries the strength of the socio-economic determinants of health as well as the differential ability to reduce individual risk by teleworking across the occupational job structure have together led, not surprisingly, to highly heterogeneous economic and mental-health outcomes from the pandemic across different ethnic and income categories.

1.2.1. How policies can lower the risk of shocks, prepare for them and speed recovery

23. The two events underscore the important role of policies in addressing systemic threats, both before they occur and once they have materialised. Before shock events occur, actions can be taken to mitigate risks and short-term consequences, at least in the cases of shocks that are largely endogenous to the economic system (Figure 1.2). Mitigating risks entails the development of adequate tools to detect the types of endogenous vulnerabilities that create the conditions for shock events to turn into severe crises, while taking timely actions to stem the build-up of such vulnerabilities before it is too late.

24. In turn, this underscores the importance of being able to monitor home-grown tensions and imbalances, but also the nature and extent of local connections to foreign vulnerabilities. In many areas, this monitoring is possible through detection of any potentially worrisome trends in a number of observable variables, such as, access to and use of private credit, market concentration in various sectors (not least digital-intensive sectors, see Box 1.3 below), market fragmentation (as measured by indicators of regulatory barriers to market access), competitive market practices, ease of doing business, costs of living, house price pressures, external account imbalances, as well as various forms of inequality, exclusion and social stress (notably across regions, income groups and generations).

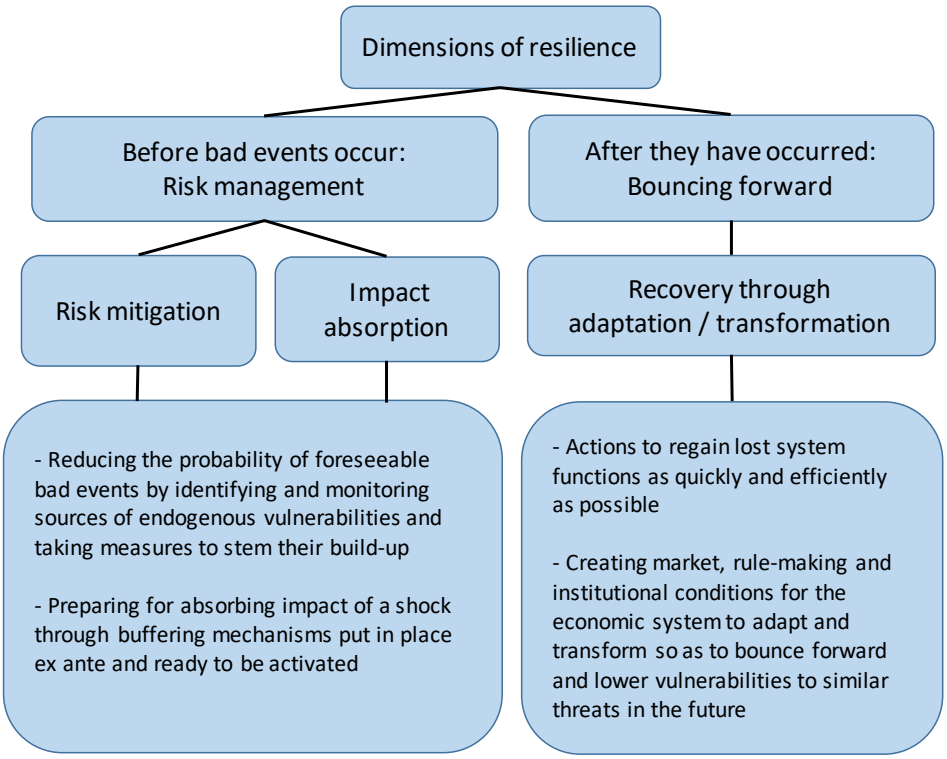
25. Mitigating risk also involves identifying policy settings and mechanisms that can be put in place *ex ante* to enhance preparedness and help with the absorption of the impact of acute shocks. Automatic

[4] As an illustration, the GFC started in the subprime sector of the US mortgage market. In testimony to the Senate Banking Committee of US Congress in July 2007, the Governor of the Federal Reserve at the time (Ben Bernanke) reported that the financial losses could reach between 50 and 100 billion dollars, and that they would likely remain confined to the sub-prime market. This was seen as a significant cost, but still, only a tiny fraction of the overall losses eventually recorded in the global financial system, which amounted to trillions of dollars (https://www.reuters.com/article/businesspro-usa-fed-bernanke-dc-idUSN1933365020070719).

[5] The strong risk of a pandemic had in fact been previously highlighted, notably by Bill Gates in his sobering yet prescient TED Talk in 2015 (Gates, 2015). Some studies have argued that the damage our way of life has been inflicting on the biosphere is contributing to a higher risk of pandemics (WWF, 2020; OECD, 2020o).

budgetary stabilisers through the system of public taxes and transfers are one common example of the type of buffering mechanisms that help with the absorption of negative economic shocks. This requires conducting budgetary policy in a sufficiently prudent manner in normal times to allow for such stabilisers to fully operate in times of crisis to avoid creating a vulnerability. Encouraging redundancy or spare capacity in production in areas of critical importance for the absorption of shocks is another example, though more under the control of private-sector decisions, thus requiring activation through market governance and incentives.

Figure 1.2. The conceptual framework of economic resilience



26. Mitigating risks and short-term consequences through stronger absorption capacity can both be seen as being part of risk-management strategies. However, considering the inherently uncertain, unpredictable and inevitable nature of systemic threats, resilience goes beyond risk management and concerns the performance of the economic system once a threat has materialised (Hynes et al., 2020). This is characterised by the speed and strength of recovery, in particular through adaptation and transformation. The latter reflects our capacity to learn from previous crises and to adapt so as to better deal with future threats of a similar nature -- considering that the economic system is neither closed nor stable but a constantly evolving nexus among all economic agents and their interactions. This implies not only the need to avoid responding to shocks through policy actions that could sow the seeds of future crises[6] but also to allow for taking advantage of new opportunities revealed by the crisis to improve

[6] The persistent implementation of ultra-loose monetary policy in the face of economic downturns is one example of a response that is needed in the short term, but which in absence of other actions to promote economic restructuring carries a strong risk of leading to asset bubbles, further fuelling income and wealth inequality, thereby creating conditions for a future severe downturn (White, 2012). For instance, without adequate measures to properly handle non-performing loans, persistently loose monetary policy keeps alive not only illiquid but also insolvent businesses,

resilience to a still broader range of threats moving forward. In this respect, the recovery is as much about bouncing forward as bouncing back.[7]

27. Viable policy strategies need to take into account all dimensions of resilience, and in particular, the fact that impact absorption on the one hand, and recovery through adaptation and transformation on the other, are different aspects that may require complementary policy settings. For example, learning lessons from the GFC, governments in advanced economies were better prepared to absorb the employment and well-being impacts of the COVID-19 shock by activating various kinds of job-retention schemes. These have helped to preserve the value of employer-employee matches during lockdowns, while offering income protection to workers in the acute phase of the crisis. This has been critical in reducing the immediate transaction costs associated with frictional unemployment. However, if left in place too long, such job-retention schemes run the risk of delaying or slowing the rebound thereafter by stultifying the economy's industrial and corporate structure. Bouncing forward requires that policies also facilitate the necessary reallocation of labour and capital across sectors and firms, in recognition that some economic sectors may be permanently smaller or require significant reorganisation. Similarly, equity provided on an emergency basis to distressed domestic enterprises may end up inadvertently creating mini-state-owned enterprises (SOEs), with possibly an even worse balance of costs and benefits than those deliberately created as SOEs, should public equity support be maintained long beyond the crisis.

28. In the multilateral context, considering each dimension of resilience (risk mitigation, absorption and recovery through adaptation and transformation) is also essential to ensuring the stability of the globally agreed rules-based system and its capacity to deliver sufficiently robust governance to underpin economic openness and provide the predictable economic environment needed for sustained growth. These dimensions also stress the importance of the flexibility of the global market architecture to safeguard against external shocks and risks, as well as its ability to shape and incentivise markets to channel emerging challenges into opportunities. Decades of steady increases in global interconnectedness through globalisation and digitalisation have led to the emergence of risks of a more varied and systemic nature. These demand a stronger and more coordinated response at the multilateral level to avoid the risk of market fragmentation and the unravelling of many of the benefits from globalisation. Disparate national approaches — let alone retreats from international market openness -- could not only fail to realise available synergies but could also lead to outright losses relative to the non-response scenario.

1.2.2. A broad range of vulnerabilities and shocks can be analysed through the framework

29. The rest of this chapter documents a number of shocks and vulnerabilities, both of an exogenous or endogenous nature, in order to make the empirical case for considering the strengthening of resilience as a primary objective of public policy, alongside the pursuit of income growth, social inclusion and environmental sustainability in the quest for maximum social well-being. By virtue of their unpredictable nature, exogenous events call for more attention to be devoted to reinforcing the system's capacity to withstand or absorb external shocks and adapting or transforming itself to bounce forward. In contrast, endogenous vulnerabilities and tensions growing within the system leave more scope for the risks they create to be mitigated by detecting and addressing the distortions and externalities at their origin.

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creating a wave of "zombie firms", undermining business dynamism, sound investment and the scope for a strong recovery.

[7] For a more detailed exposition of the proposed framework for resilience, and more specifically the recovery dimension, see the contributions from the OECD New Approach to Economic Challenges unit on a *Systemic Resilience Approach to Dealing with COVID-19 and Future Shocks*, and in particular *Resilience Strategies and Policies to Contain Systemic Threats*.

30. While the classification of events into exogenous/endogenous categories provides a useful framework to analyse their potential consequences and the nature of policy responses, it should be borne in mind that the two are often intertwined and even causally linked. Longstanding distortionary trends within the system can make us more vulnerable to external shocks, and these in turn can trigger further distortion or downturn. For example, the growing impacts of climate change, including extreme weather events, are exogenous insofar as they originate from outside the economic system. However, there is compelling scientific evidence linking the frequency and intensity of such events to, amongst other things, a failure to address a longstanding negative externality: the failure to adequately price greenhouse gas emissions. In this way, the risk stems from within the economic system, thereby presenting a strong case for cost-effective risk mitigation by investing in a rapid transition toward net-zero emissions. The same could be said about a higher risk of new pandemics due to environmental pressures, including deforestation and species extinctions (Tollefson, 2020), as well as through shifts in habitats that bring wildlife, livestock and humans into closer contact with viruses to which they are less than fully immune. Furthermore, the extent of the damage in terms of both physical and human costs inflicted by exogenous shocks such as natural hazards depends heavily on local social and economic conditions, which are endogenous.[8]

1.3. Major sources of risks, potential implications and areas of policy response

1.3.1. Weaknesses revealed by COVID-19

31. The massive impact of COVID-19 is a vivid illustration of how failing adequate government preparedness, vulnerabilities and lack of anticipation originating in one part of the economic system -- the health sector -- can lead to colossal economic losses, along with heavy human and social costs. The relative success of some countries in controlling its propagation while avoiding stringent containment measures shows how much of a difference better preparation and learning from past crises can make. In particular, the experience has highlighted the importance of having the capacity to act responsively to absorb shocks, implement effective strategies (in this case testing, tracing and isolating, and obtaining adequate personal protective equipment), and thereby gaining public trust and confidence in the rules being implemented. This has not been the case in many countries, where much higher rates of infection have also resulted from a strong resistance in some quarters to any infringement to personal liberties, which has led to a refusal to accept restrictions on mobility, wear masks and maintain social distance.

32. The pandemic has also underscored the importance for economic resilience of ensuring appropriate surge capacity for the provision of public goods — in this case health services, strengthening primary health care, mental health services, tele-health and preventive measures (Colombo, 2020; OECD/European Union, 2020, Chapter 1). This involves improving healthcare infrastructure, investing more in health workforces to avoid structural shortages and creating diverse supply networks for, and higher stocks of, protective equipment. Countries that had a pandemic-response strategy or plan in place were in better shape to cope with the impact of the epidemic on the health-care system following the initial breakout (e.g. Germany). However, a separate and crucial channel has been the reinforcement of public-health measures to improve public understanding of healthy living, thereby reducing the vulnerability of populations to developing severe cases when confronted by viruses and other microbes (such as by discouraging self-damaging behaviours that result in chronic conditions, such as obesity, that raise mortality).

33. A parallel concern in the space of public goods and service provision is the steady increase in antimicrobial resistance. This has resulted from the combination of overuse and misuse of antibiotics in

[8] Taking an extreme example, the Haitian earthquake of 2010 resulted in far greater human casualties and devastations than the Chilean one the same year, even if the latter hit populated areas (including Santiago) with the same or even much greater strength in some parts.

human medical contexts and in animal husbandry, especially in the milieu of factory farming, as well as a lack of new drug development due to reduced economic incentives and challenging regulatory requirements. Antibiotic resistance leads to longer hospital stays, higher medical costs and increased mortality: in 2019 the US Centers for Disease Control and Prevention estimated that 35 000 people die each year in the United States because of antibiotic-resistant infections, compared to 23 000 cited in its previous report in 2013 (Centers for Disease Control and Prevention, 2019). While equally reliable corresponding data do not exist at the global level, the worldwide total death toll due to antibiotic resistance may be around 700 000 (Ginsburg and Klugman, 2020), but that figure could rise steeply in the coming decades.[9]

1.3.2. Policy options to manage health-related risks

34. The relatively high degree of robustness and flexibility shown by global supply chains in the face of tremendous pressures argues for measures primarily aimed at boosting their resilience, rather than attempting to reconfigure or partially dismantle them through some combination of subsidies, tariff barriers and local-content requirements. To better prepare against future emergencies that require urgent expansion of public goods/services provision, governments can first and foremost better marshal available intelligence through horizon scanning, risk anticipation and scenario planning to identify and mitigate potential weaknesses in global supply chains. This can be facilitated through improved data analytics to track demand, availability and stock of certain essential goods and inputs. These early actions can be further strengthened through information sharing between regulatory, public procurement and trade authorities, and the private sector, to detect weak signals and to determine the best course of action once a shock hits.

35. The assessment of the potential impact of single and compound shocks on demand for and availability of essential goods in turn can inform policy options for their provision. From the perspective of government authorities, such policies can range from (i) strengthening supply chain resilience; or (ii) improving cross-border co-operation, e.g. agreements to share essential goods, to conduct joint procurements at a bilateral or regional level or to avoid export restrictions; to (iii) improving the domestic interface with global supply chains so that public purchasing bodies can further mitigate risk, e.g. by diversifying suppliers, developing template agreements, working with the private sector to identify possible bottlenecks in supply chains and encouraging a certain margin of spare productive or supply capacity (redundancy). In doing so, however, governments should resist the temptation to go too far and react with disproportionate measures when seeking to enhance resilience (e.g. excessively promoting “just in case” strategies in supply chains even where “just in time” remains more appropriate). Maintaining widespread government-supported standby capacity may lead to an attraction to use it, even if the resulting low prices are less than full costs, leading to price wars, unfair competition in global markets and trade disputes.

36. Some buffering strategies such as stockpiling should be considered for essential medical items for which existing supply chains were unsurprisingly overwhelmed by soaring pandemic-related demand. Stockpiling is an important resilience strategy, but it entails careful handling of a number of issues, including related to the management of stocks, the scope of products appropriate for stockpiling and the need for international co-operation in the management of stocks. It should be kept in mind that short of significant increases in health budgets (which might indeed be called for), trade-offs arise in building reserves, including in the non-trivial choice of which products to stockpile in order to mitigate future risks. The last shock is not necessarily the best guide in this regard. Some of these issues could be partly alleviated

[9] In 2019, the UN Interagency Coordination Group on Antimicrobial Resistance warned that by 2050 antibiotic-resistant diseases could cause 10 million deaths each year and cause damage to the economy so catastrophic that, by 2030, antimicrobial resistance could force up to 24 million people into extreme poverty.

through international co-operation, for instance promoting regional stockpiling, which could facilitate diversification and risk sharing.

37. The temporary shortages of essential equipment have revived debates about the goal of self-sufficiency in a number of sectors and the re-shoring of production of vital goods and services, especially where public- and private-sector assessments of optimal risk management differ. However, such strategies would likely be counter-productive, as they would distract from effective risk-management approaches based on ensuring some spare capacity in supply chains, supported by selective stockpiling, while going against the benefits from diversification of sourcing. Indeed, there is a risk that localisation would leave domestic economies even less stable in the face of unforeseen shocks (Arriola et al., 2020; D'Aguanno et al., 2021). Binding commitments by governments to refrain from imposing export restrictions would reduce supply risks and regulatory uncertainty and also weaken the case for promoting domestic production capacity through distortionary measures. As an alternative to outright reshoring, one strategy worth exploring for selected essential goods would be for the state to commit to regular purchases of a minimum quantity from a locally-established supplier at a set price in exchange for a commitment by the latter to stand ready to temporarily scaling-up production in the case of an emergency surge in demand.[10]

38. In the longer run, the ongoing crisis also suggests that beyond raising reserve healthcare capacity, building protective social capital and trust may help to reduce the cost of confronting future pandemics or other crises for which social behaviour matters. This impact arises as expert advice from public officials might be accepted in good faith more universally. It would also mitigate the risks of social discontent, exclusion and local conflicts, as identified in the AXA Report's list of the most severe risks in 2020 described in Box 1.2 above. The extent of regional disparities in income and other quality-of-life indicators within OECD countries varies widely and seems to have shrunk somewhat in most over the past decade (OECD, 2020f, Figures 2.8 and 2.9), but the gap between metropolitan regions (and those nearby) and more remote localities has widened (op. cit., Figure 2.10), leading to concerns over social exclusion. OECD data can greatly aid analysis needed to develop the place-based policies that are crucial in light of growing public discontent with the economic, social and political status quo (OECD, 2019d). These notably matter when it comes to regional well-being (*www.oecdregionalwellbeing.org*) and sustainable development (*https://www.oecd-local-sdgs.org/*).

1.3.3. Spill-overs from COVID-19 to other risks

39. The urgent and massive attention of policymakers needed to respond to COVID-19 has by no means diminished other important sources of risks. If anything, the pandemic may further increase vulnerabilities to other shocks, for example by:

- exacerbating inequalities along age, gender, racial, socio-economic and regional lines, as well as between richer and poorer nations;
- raising public-debt levels -- not only for the duration of the business–cycle downturn but potentially long beyond this, especially in the absence of effective and credible medium-term budget policy frameworks. This is relevant even if there may be no immediate additional cost in the form of debt servicing, thanks to aggressive monetary easing by central banks and a strengthened desire by investors for high-quality securities;
- raising corporate leverage (higher debt and lower profits in many countries, which create more fragile credit conditions that could complicate the exit from monetary and fiscal stimulus);

[10] As an example, approaches along those lines have been implemented in electricity production, in the form of a "capacity market", which is a mechanism for governments to ensure that electricity supply continues to meet demand as more volatile and unpredictable renewable generation plants come on stream (see https://www.engie.co.uk/wp-content/uploads/2016/07/capacitymarketguide.pdf).

- potentially increasing market concentration and distortions to competition in many sectors, as many smaller firms are forced to close once public support is withdrawn, and as other potential challengers to dominant incumbents face illiquid markets for risk capital, particularly early-stage equity, despite robust public policy responses (OECD, 2020c, especially Chapter 3).

40. The range of developments or trends that create important challenges to economic resilience and will be discussed in greater depth below and in the following chapters include: the evolving nature of globalisation, including the issues it raises in terms of the international rule book and governance; rapid technological advances; and environmental degradation, notably in the form of climate change and the needed transition to a low-carbon global economy.

1.4. The evolving nature of globalisation and the need for updating the international rulebook

1.4.1. The economic benefits proffered by globalisation

41. Globalisation has brought enormous benefits around the world in terms of higher productivity and living standards through several channels. These include: lower prices resulting from stronger competition in domestic markets; greater scope for cost reduction from exploiting gains from specialisation and scale economies; faster diffusion of technology through trade in goods, movement of people and participation in global supply chains; and quicker diffusion of managerial best practices and know-how through foreign direct investments by multinational enterprises. For instance, the massive reductions in transport and communication costs brought about by containerisation and the ICT revolution were key factors behind the development of global supply chains. These technological advances gave firms the possibility to offshore increasingly sophisticated parts of their production processes to lower-wage countries and yet still be able to handle the coordination function and manage the whole chain as if it were in the same location (Baldwin, 2016; OECD, 2013). In turn, this has allowed for an expansion of the production of manufactured goods at lower costs, benefiting consumers around the world and providing new opportunities for jobs and growth in developing countries. Many of these advances have been underpinned by internationally agreed rules and standards, typically in the context of regional or multilateral bodies such as ASEAN, the IMF, the OECD, the UN and the WTO, which have developed the policies necessary to achieve global gains and tackle global problems.

42. These successes of globalisation are in no small way attributable to an agreed set of rules by which international commerce is organised and regulated. But these rules need to be kept up to date and fit for purpose as the nature of commerce evolves (see Chapter 3). That observation applies to the World Trade Organization (WTO), which is charged with negotiating the trade rulebook -- on issues such as subsidies, rules of origin, trade facilitation, technical barriers, sanitary and phytosanitary measures -- and adjudicating individual disputes. However, it also concerns equally other formal international institutions whose activities grease the wheels of international economic relations and the rules and agreements for which they are responsible (such as the OECD and its key Codes and Conventions) and the principles and values that have fostered their existence and development, notably democracy and the value of free and open markets.

43. A good example of such rule-making is the setting of standards, which are technical specifications that play a central role in trade worldwide. The International Standards Organisation (ISO) is a useful forum for negotiating standards of global relevance which underpin global trade and trade rules. Such negotiations provide a means for aligning national-level regulations internationally. This sought-after convergence promotes trade facilitation, market access and circularity (i.e. recycling). Progress can also be made by international regulatory co-operation to reduce unnecessary trade costs (Chapter 3). One

sector where achieving greater standardisation and co-operation is likely to prove beneficial is in critical materials, including rare earths, discussed in detail in Box 1.3 below and in Chapter 3.

1.4.2. The vulnerabilities: concentration, trade and investment restrictions, trade credit

44. The rapid pace of product and financial market integration at the global level, as well as the relentless pursuit of efficiency gains through global supply chains has also led to a number of vulnerabilities, some of which have been exposed in recent years. The trend towards increasingly complex supply chains has reinforced both logistical and policy risks, as host countries may be tempted to use threats of intervention and barriers to exact gains from partner countries elsewhere in the chain.[11] For example, the specialisation of production, which in some areas was magnified by the development of global supply chains, has led to a high level of concentration of production of critical components of many goods in a small number of countries, such as some forms of ICT equipment (OECD, 2020e), semiconductors, and rare earths and other critical minerals (Box 1.3). This reduces the scope for shock absorption by suppliers, and raises volatility (D'Aguanno et al., 2021), although in principle it could just as well be a manifestation of comparative advantage and specialisation in the context of economies of scale that would be costly to resist (op. cit.). The concentration of production in geographical areas and/or the lack of diversification of suppliers of components also increases the potential cost linked to natural and manmade disasters. For example, the Fukushima tsunami was followed shortly by extensive flooding in Thailand, just as Japanese motor vehicle production located near the Fukushima incident had been moved to Thailand. The critical minerals sectors also seem to be especially susceptible to export restrictions, whose effect is to boost uncertainty and reduce security for all, calling for stronger attempts to convince producing countries to forswear recourse to such policies.

45. It is crucial for businesses to have the confidence necessary to move forward with investment plans in the rebound from the ongoing crisis to have stable, transparent and predictable trade and investment policy regimes. To that end, as argued in Chapter 2, co-operative efforts are called for to avoid export restrictions and other trade barriers, strengthen resilience of and boost confidence in global markets as reliable sources for key products like medical supplies and food (OECD, 2020d and 2020q). Such co-operative efforts can take place directly among governments, typically through the development of international standards within an international organisation, and then be relayed at the domestic level by each respective government, through domestic rulemaking (see Chapter 3). This ensures coherence across countries, reduces unnecessary regulatory divergences and facilitates market access. Thus far, such efforts have been fairly successful on net, as new trade facilitating measures have outnumbered new cost-increasing border protocols in 2020 (OECD, 2020m), and world trade in medical supplies jumped by nearly 40% in the first half of 2020. The *OECD Policy Framework for Investment* is designed to increase investment flows and ensure foreign direct investment plays an appropriate role in ensuring systemic resilience. Governments can also collaborate with their large MNEs to ensure that crucial supply chains are stress-tested and co-operation can bring public procurement processes up to best practice.

46. Another source of vulnerabilities relates to the financial side of global supply chains: running in parallel to the flow of goods and services along supply chains is a flow of payables and receivables as downstream firms borrow from their suppliers (and lend to their clients) in the form of trade credit. Trade credit has always been an important source of funding for non-financial corporations purchasing inputs from other businesses, but has remained relatively stable as a share of GDP over the past few decades (Boissay, Patel and Shin, 2020). The steady increase in cross-border payables and receivables between firms associated with the rapid expansion of global supply chains since the early 1990s has led to the development of various forms of trade finance whereby non-financial corporations turn to financial

[11] However, traditional arms-length trade has long been exposed to such risks as well.

intermediaries to lower their exposure to collection difficulties and payment defaults (factoring). The latest data show they do so with a much greater share of their foreign receivables (around 80%) than domestic (about 15%) (op. cit.).

47. In turn, financial intermediaries (banks and insurers) can shift the risk off their books by packaging the receivables into asset-backed securities (ABS), which are sold to outside investors, the ultimate bearers of the exposure. So far, the latter still represent a tiny fraction of total cross-border receivables, but trade ABS have grown rapidly in recent years, representing a potential source of additional vulnerabilities associated with global supply chains. Trade-related ABS further diversifies risk, which is good in normal times, but could further propagate stress during shocks such as COVID-19.

Box 1.3. The risks of concentrated production of key digital components and other critical raw materials: the cases of semiconductors and rare earths and other strategic metallic minerals

A. Semiconductors:

The USD 500 billion semiconductor industry is a technology enabler, notably for the electronics sector. It comprises a number of different sub-sectors with quite different geographic distributions (McKinsey, 2020b, Exhibit 2). Those involving manufacturing, assembly and testing are highly concentrated, mainly because of the enormous upfront investment costs in building state-of-the-art production facilities. However, smaller firms are able to specialise upstream in computer-assisted design (OECD, 2019a) and rely on arms-length deals for manufacturing while retaining the valuable intellectual property for themselves. The top 20 vendor firms accounted for 81% of the global market in 2018 and the top five about 50%, led by Samsung (17%) and Intel (15%) (op. cit., Table 1.1, p. 20). Annual sales by contract or pure-play foundries, almost all of which are in East Asia and mostly in Chinese Taipei, were worth USD 63 billion in 2018, with Taiwan Semiconductor Manufacturing Company (TSMC, a pioneer in the contract manufacturing market) responsible for 54% alone and the top 10 for 87% (op. cit., Table 1.2, p. 21). There are also outsourced assembly and testing firms (OSATs), again almost all of which are in East Asia (predominantly Chinese Taipei), with USD 30 billion in 2018 sales. The top 10 had 91% of the market, led by Advanced Semiconductor Engineering (ASE) with 40% (Table 1.3, p. 22). Overall, 80% of semiconductor foundries and assembly/test operations are located in Asia. Only five firms worldwide are currently manufacturing leading-edge chips; all are from Chinese Taipei, Korea and the United States (SIA, 2020). The top 15 300mm wafer capacity leaders hold 80% of the world's 300mm manufacturing capacity, essentially comprising the entire future total available market for leading-edge Integrated Circuit fabrication equipment and materials (source: IC Insights).

Even though there are no doubt important advantages to regional concentration and clustering, having so much of the sector in the hands of so few players, most of whom are in East Asia, means that supply bottlenecks could ensue for a number of reasons ranging from natural disasters to politically motivated restrictions. Which sectors would be the losers from a supply interruption? The largest uses of semiconductors are in telecoms, computers and other consumer electronics, as well as motor vehicles and medical devices. Specifically, in 2017 mobile phones embodied USD 90 billion worth of chips, personal computers USD 69 billion, motor vehicles USD 28 billion and the “Internet of things” USD 21 billion (OECD, 2019a, Table 1.4, p. 25). The advisability is clear for firms located downstream in the supply chain to pay close attention to its robustness, while identifying weak spots and building a strategy to address them, such as upskilling local vendors as backup supply sources.

There are obvious national and economic-security implications from this corporate and geographic concentration, and from the widespread use of below-market financing (OECD, 2019a) and, by the United States, of export controls (beginning in 2019) (Brown, 2020).

B. Rare earths and other strategic minerals:

An example of concentrated production of critical raw materials is rare earth elements, which comprise 17 chemical elements in the periodic table (scandium, yttrium and 15 lanthanoids) that are valued for their unique chemical, magnetic and fluorescent properties. They are regularly rated among the most critical in national and regional criticality assessments worldwide (D. Schrijvers et al., 2020). Their key uses are in trace amounts for electronics, green technologies essential to energy transition goals (renewable energy generation and storage; energy efficient lights; electric cars; auto catalysts), and military and aerospace applications. In most cases, there are few known substitutes, boosting producing-country leverage over global markets. Nevertheless, there are often multiple geophysical

sources: many rare earths are not that rare, even if profitable concentrations are more so, and economic exploitation often entails significant environmental costs.

According to the US Geological Survey, in 2019 China accounted for 63% of the production of rare earths concentrates, followed by the United States with 11% and Myanmar and Australia, each with 10%. The United States had dominated the market in the 1960s and 1970s, but when China entered in the 1980s it quickly gained a dominant position. This was made possible not only by its large share of reserves but also by its lower costs, in part attributable to its large informal market (thought to be about half of total production in recent years) that does not internalise the considerable environmental damage caused by its mining and processing. This lowers their costs and allows them to depress prices to the point that other Chinese and foreign producers could not maintain profit margins (Packey and Kingsnorth, 2016).

Two market features are worthy of note. First, there are significant entry barriers, including high capital costs, a very long investment horizon and customer-specific marketing, given the absence of any exchanges. Second, Chinese production is subject to non-automatic export licensing requirements, making supply quite uncertain. This provides a further barrier for potential non-Chinese entrants: restrictions could be lifted at any point, resulting in much lower global prices.

Looking forward, demand growth is thought likely to outstrip supply increases in the next 30 years, unless future technological change allows for greater substitution or more recycling of materials (which currently amounts to only 3-8%, according to the European Commission [2020, Figure 12]). That would entail high upfront investment costs and require overcoming substantial technical R&D challenges. Yet, it could possibly be encouraged by innovative circular-economy financial initiatives, such as the European Investment Bank's 2019 EUR 10 billion Joint Initiative on Circular Economy. Stockpiling may be another option (Schmid, 2019). Further ways forward are discussed in Chapter 3.

A number of other critical minerals – for example, lithium, chromium, chromite, cobalt, manganese, graphite – share many of these features, most notably:

- use in key downstream sectors necessary for digital transformations and transition to lower carbon economies (lithium and cobalt are variously used in phones, wind turbines and electric vehicles and their batteries; some others, when combined with steel, produce alloys that withstand friction or heat and are used in motor vehicles and aerospace);
- an abundance of export restrictions; and
- high geographic concentration of reserves and production: in many cases the majority of production comes from three countries or fewer, giving them a quasi-monopoly on supply, including countries categorised as politically unstable or extremely unstable (World Mining Data 2020), such as the Democratic Republic of the Congo and other countries in the Great Lakes region of Africa. Only a few OECD countries had any of the top three market positions in the 21 minerals considered by Korinek and Kim (2010).

Global standards for a range of critical minerals, including rare earths, are at varied stages of development. For some, these developments started in 2016, while work on lithium is now getting underway. Greater standardisation across entire critical-mineral value chains, from mining through processing and refining to product end-of-life reuse and recycling, could help to build the circular economy and foster market transparency and faster development and resilience in this significant area of global trade.

48. The integration into the world's trading system of countries where production in many sectors is dominated by State-Owned Enterprises (SOEs) or those that may be covertly controlled or at least heavily assisted by governments or their sovereign wealth funds or state-influenced financial institutions is also adding to systemic vulnerability and creating distortions to the international level-playing field.[12] This has occurred, through explicit budgetary support (mainly for R&D activities and tax incentives for investment) and below-market supply of equity and debt capital, in numerous cases leading to excess capacity, global market distortions and trade conflicts that have spilled over into broader disputes and political tensions. The case of the Semiconductor Manufacturing International Corporation (SMIC) is illustrative. There are challenges in disciplining such support via agreed subsidy rules. These are discussed in greater detail in Chapter 3.

49. The expansion of global trade and investment has greatly benefited consumers the world over, while allowing a number of emerging-market economies (EMEs) to close their productivity and income gaps, resulting in significant reductions in poverty and increases in well-being across many countries. However, along with technological change, it has also contributed to growing socio-economic and territorial inequalities in many advanced economies -- and a corresponding increase in the demand for trade protection (Di Tella and Rodrik, 2020) -- through the disappearance of middle-skilled jobs in manufacturing and sharply rising anti-globalisation sentiment as well as political support for populist parties and their policies across the G7 and beyond (see, for example, Rodrik, 2020).

50. Trade is not the root of all these problems, nor can it solve them on its own (OECD, 2017a). While some governments have implemented trade adjustment assistance programmes, they were generally too slow and almost always too limited to provide adequate support and preparation for alternative employment. In any event, given the role of other factors such as technological change in job losses -- and perhaps even more so than trade developments --the rationale for targeting support programmes to trade-related job losses specifically was always questionable. A better way to handle the losses experienced by some groups and regions is by investing in worker skills and digital and physical infrastructure and strengthening effective, broad-based social protection, along with making the international trading system work better (OECD, 2017a).

51. Nevertheless, this process of gradual deindustrialisation in many advanced economies, to the extent that it is accompanied by a shift towards high-skilled services in the same communities (a goal that is often not achieved), should shift the burden of cyclical fluctuations in demand that is endemic to goods production away from them. Hence, a good level of general skills among the working-age population and an efficient and widely available system of training and retraining are crucially important in ensuring that the benefits from trade can be more broadly shared. Implementing the principles and standards of *Responsible Business Conduct* can also promote economic and social justice and therefore boost popular support for globalisation.

[12] See OECD, 2019a and 2019f for evidence on the presence of non-market forces in the semiconductor and aluminium industries, respectively.

1.5. The benefits and risks arising from technological advances

1.5.1. The economic benefits from technological advances, in particular digitalisation

52. Rapid advances in technology and scientific knowledge are among the key drivers of productivity and progress in living standards. These advances are driven by, often publicly funded, scientific progress and by market pressures, pushing firms to innovate as a means to escape competition based on price alone, as well as by the prospect of huge financial rewards for entrepreneurs able to capitalise on some transformational innovations made possible by both public and private R&D. Some innovations are embodied in capital goods, while others result in completely new products and services.

53. The deployment of digital technologies such as high-speed broadband have greatly contributed to economic resilience during the pandemic through extensive use of tele-working (OECD, 2020a) and by allowing flexible transport and logistics to handle the extra demands from e-commerce, in particular by platforms in keeping business-to-business and business-to-consumer commercial transactions running smoothly (OECD, 2020i; Pisu, Costa and Hwang, 2020). OECD (2020b) outlines how policymakers can ensure that the increased demands on the network can be handled in times of emergency, taking lessons from the pandemic. In addition, thanks to enormous progress in biotechnology, it has been possible to develop and roll out an array of vaccines against COVID-19 in record time. Looking ahead, technological advances will continue to play a critical role in developing cost-effective solutions to reduce greenhouse-gas emissions – including in so-called "hard to abate" sectors such as heavy industry and aviation – and thus contribute to reduced risks from climate-related shocks.

1.5.2. There are also related risks

54. At the same time rapid advances in emerging technologies raise a number of challenges for economic resilience. The brisk pace of digital transformation has exposed the vulnerability of firms, households, governments and key networks (notably the power supply) to attacks on digital security and critical infrastructure (Box 1.4). And such risks have increased of late, as firms have increased their digital activities, and more people work from home, shop from home and interact with colleagues through video-conferencing software. There is evidence that some kinds of attacks, notably phishing emails, increased massively at the outset of the pandemic in March 2020, not least targeting hospital and medical research centres (OECD, 2020k). Although these are generally not events of a systemic nature, the economic cost of more sophisticated attacks targeting the functioning of critical activities and infrastructure in the areas of defence, health, energy, banking, communications or transport could be very substantial. The OECD has developed a *Recommendation on Digital Security of Critical Activities* (OECD, 2019e) and a *Policy Toolkit for Governance of Critical Infrastructure Resilience*, for which indicators are available for a majority of its Member countries (OECD, 2019c).

55. Shock events may push market actors, including financial institutions, to adopt more digital tools and techniques, bringing a number of benefits to economies in terms of greater ability to track, store and share information, and to engage in commerce and finance through less costly and faster means. On the one hand, this may also allow smaller firms to access important forms of finance and various forms of e-commerce more easily, while digitalisation also carries risks related to data protection and privacy, and consumer protection. On the other hand, in financial markets it could also contribute to market and credit risks, and could disrupt cross-border flows. It also raises the risk of higher market concentration through "winner-take-most" dynamics, as well as concentration of data in certain firms, sectors and countries. Maintaining competitive market conditions in the era of digitalisation may call for specific action, particularly in light of recent disappointing trends in business dynamism (Box 1.5).

56. Greater international co-operation is needed to boost data access and sharing, including across borders, while addressing challenges associated with the protection of privacy, intellectual property rights and data governance and stewardship. The same is true for the setting of international technology and regulatory norms, regulations and standards, the development and update of which is crucial to lowering the risks of market fragmentation in the global digital economy. Keeping up with innovation can be challenging in this regard, and may require new and more agile approaches to technology governance, regulation and international regulatory co-operation. In particular, international regulatory co-operation is key to addressing the transboundary nature of emerging technologies notably by preventing regulatory arbitrage and forum shopping while safeguarding sovereignty, as envisaged in the *Agile Nations Charter* and the *OECD Principles for agile regulatory governance to harness technological innovation* (Chapter 4).

Box 1.4. Digital security risks

Digital security risk increases with digital transformation. The very functioning of our economy and society relies increasingly upon critical infrastructure and products embodying software, which inevitably contains vulnerabilities: on average, for example, 40 new vulnerabilities are discovered daily in Android, Windows or iOS software (OECD, 2021), which can be exploited by malicious actors, such as cyber criminals seeking financial gain, ideologically motivated "hacktivists" or more sophisticated State-sponsored organisations.

The COVID-19 crisis has highlighted both our increasing reliance on these "smart" products (e.g. video-conferencing tools) and the ability of malicious actors to take advantage of crises (OECD, 2020j). In many countries, there was a surge in phishing emails using COVID-19 content as bait, while Distributed-Denial-of-Service and ransomware attacks have hit especially critical organisations, such as hospitals (OECD, 2020k).

It is difficult to measure the global cost of digital security incidents. Many remain undetected, and too often organisations choose not to disclose that their assets have been compromised. In addition, digital security incidents often have impacts on non-financial assets, which makes their cost difficult to quantify (e.g. personal data breaches, intellectual property theft, reputation). However, partial estimates tend to value the global cost of these attacks as ranging between USD 100 and 6 000 billion annually (World Economic Forum, 2020) (see Box 1.2 above).

Beyond their technical impact on the availability, integrity and confidentiality of data and information systems, digital security incidents have significant economic and social consequences (OECD, 2015). Over the past decades these consequences have evolved from annoyance to severe disruptions and economic losses. For example, while the "ILOVEYOU" computer virus from the 2000s mostly resulted in spamming, the 2017 WannaCry and NotPetya attacks paralysed thousands of small and medium-sized enterprises across the world, many global firms such as A.P. Moller-Maersk (shipping), Saint Gobain (construction materials) and Merck (pharmaceuticals), and government agencies such as the UK National Health Service. The estimated total damages amounted to billions of dollars. Most recently, the software company SolarWinds' Orion software package, used by 18 000 clients worldwide, was found to contain malware that was in updates as far back as October 2019. Users included various US government agencies and large US and other firms. The security breach allowed hackers to access a variety of internal documents and data.

Security incidents can also have physical and safety consequences, leading to serious injuries or death in some extreme cases. In 2015-2016, two attacks targeting the Ukraine power grid created blackouts in large parts of Kiev (Cybersecurity Intelligence, 2019), and at least one patient died due to the indirect effect of a ransomware that affected a German hospital during the COVID-19 crisis. Such physical consequences of attacks are likely to multiply with the rise of the Internet of Things.

In response to these challenges, governments are adopting digital security strategies and policies to strengthen the digital security of critical activities in areas such as finance (McKinsey, 2020a), energy (Bailey, Maruyama and Wallace, 2020), transport, health care and digital government, as outlined in recent OECD Recommendations (OECD, 2015; OECD, 2019e). These strategies and policies usually include a wide range of measures, for example, to raise awareness, foster the adoption of digital security risk management by organisations, enhance the digital security of products, develop digital security skills and increase international co-operation in the field (OECD, 2020i), extending even to the UN Security Council, which held a meeting devoted to advancing cyber stability on 22 May 2020.

Box 1.5. How business dynamism contributes to a speedy and sustained recovery

The entry of new businesses, reallocation of resources across firms and efficient exit mechanisms are key to dynamic and resilient economies and to boosting aggregate productivity growth and avoiding stagnating living standards. New and young firms are engines of job creation and are crucial for the introduction of novel business models, methods of management and radical innovations. Those in need of support without being overburdened with debt are increasingly being supported by structural measures to strengthen their resilience and competitiveness, including assistance in greening their business, accelerating their adoption of digital tools and technologies and identifying new markets. Yet, there is a growing concern that a secular decline in business dynamism – the process of firm entry, growth and exit, and the simultaneous creation and destruction of jobs – is harming most advanced economies, notably by slowing potential output growth (OECD, 2020h). Moreover, industry concentration has been growing (Bajgar et al., 2019), as have price mark-ups (Calligaris et al., 2018).

Several structural factors are contributing to these trends (OECD, 2020h). Countries and sectors with higher levels of digital intensity have experienced a faster decline in business dynamism, associated with their growing maturity. So have those with higher productivity dispersion between leaders and laggards and higher levels of industry concentration, whereas more mature industries have experienced milder declines. This suggests that "winner-takes-most" dynamics and barriers to technology diffusion, reinforced by the transition to a digital economy, may be important drivers of the slowdown in business dynamism.

While policy cannot easily address these underlying factors, policy reforms can mitigate these trends and strengthen business dynamism. In particular, governments can remove unnecessary regulatory barriers to competition, reduce entry barriers in key sectors, improve judicial efficiency and bankruptcy regulations, and ensure the vigorous enforcement of competition laws. The latter may need to be reviewed in light of digitalisation with a view to adapting antitrust tools to the rapid development of multi-sided markets, to enhance the protection and promotion of innovation in merger controls and to improve the capacity of competition authorities to address emerging digital-related issues. Also, facilitating access to business finance, supporting innovation and strengthening human capital can also positively affect business dynamism and bring double dividends for other economic outcomes that support resilience, notably productivity growth.

57. In the area of finance, digitalisation brings the prospect of transformational technologies such as blockchain and fintech, which can drive efficiencies in payments and credit and market intermediation, and could advance financial inclusion where traditional banking has under-served certain populations. However, digitalisation of finance can give rise to a host of potential risks:

- Tokenisation of assets could bring near-term liquidity and allow more efficient access to capital markets, yet could eventually disrupt the market-making model, which could in turn affect the resilience of liquidity provision during periods of stress (OECD, 2020l).[13]

[13] Tokenisation is a highly-secure method of protecting payment credentials. In the payments world, it involves replacing sensitive data – credit card/account numbers – with a one-time number known as a token that has no value or connection to a person or their account and therefore has no value if breached.

- The growing use of so-called global stablecoins (fiat-backed crypto-assets) raises concerns over product complexity, cross-border regulatory arbitrage and rapid growth in use that might allow them to become systemically important.

58. The growth of decentralised finance in less regulated markets allows for high leverage against volatile crypto-assets, which might help to boost risks that spill over from virtual to real currencies.

59. In light of these developments, authorities in a number of OECD Member countries are either tailoring their existing regulatory frameworks or developing new regulations that address at least some of these identified risks. Emerging practices vary widely, in part due to regulatory precedent and the alignment of tools with levels of identified risks. Even so, achieving global convergence of principles and regulations will be important to ensure that the benefits from these technologies can be reaped and widely enjoyed. They take the form of greater cost efficiencies for businesses and households, and higher median real incomes. At the same time the risks to competition, stability and investor protection should be properly addressed at the multilateral level by means of greater regulatory co-operation and collaboration.

1.5.3. Other aspects of science, technology and innovation that contribute to resilience

60. While digital technologies stand out during the current crisis, broader capabilities for science, technology and innovation (STI) -- including adequate skill levels among the workforce to handle cutting-edge production and design systems -- are also fundamental for resilience. However, the crisis has highlighted some of the challenges STI systems are facing today. For example, changes in the overall funding mix for R&D over the past two decades -- including stagnating government budgets and a shift to R&D tax incentives -- have limited governments' ability to influence the direction of innovation towards addressing public policy goals (see Chapter 4).

61. The deployment of the "Internet of things" (IoT) along with the use of AI technologies and Big Data also raise concerns about privacy protection and risks to human values, for instance those of entrenched biases and discrimination linked to the use of algorithms (see Chapter 4). For example, the growing use of AI in finance can bring benefits, such as more accurate credit scoring of individuals, which may improve financial inclusion and economic growth. The concerns over the tractability and robustness of AI models call for additional scrutiny from regulators and may merit further attention to setting supervisory expectations about the reliance of AI models in firms or activities that are considered systemically important.

1.6. The crucial role of environmental risks, especially climate change

62. Among vulnerabilities that arise from the failure to address negative externalities, climate change deserves particular consideration: it has been termed "the biggest market failure the world has seen" (Stern, 2008), which studies show may cut global GDP by 20% by the end of the century (Auffhammer, 2018). Climate change, along with interrelated global environmental challenges such as biodiversity loss, pose multiple threats to economies and societies. Impacts range from a set of recurrent, apparently exogenous events (e.g. extreme weather events, like floods and storms) to medium-term outcomes (e.g. droughts and degraded ecosystems and species extinctions) to longer-term tipping points, non-linearities and irreversibilities in the earth's ecosystem (e.g. sea level rise, ocean acidification, the shutdown of the Thermohaline Circulation and the melting of the West Antarctic ice sheet). A coincidence of tipping points and systemic risks from the biophysical climate dimension and from the economic and finance sectors could lead to cascading systems failures much more severe than those that have been evident in the COVID-19 crisis (OECD, 2019b). Chronic effects leading to less habitable regions and shifting agricultural

patterns are also likely to increase migration pressures, potentially exacerbating social and political tensions.

63. Such climate-related events in the past 20 years alone have already led to estimated costs of the order of as much as USD 125 billion (Hurricane Harvey in 2017) and 55 000 excess deaths (Russian heat wave in 2010), with climate change to date exacerbating the hazard rate by as much as three times (Woetzel et al., 2020, Exhibit E5). Should emissions continue to rise, future potential impacts by 2050 could range from (op. cit., p. ix):

- sharp rises in the probability of lethal heat waves for huge numbers of people (in India, for example);
- a surging share of annual harvests hit by recurrent droughts sufficient to cut yields by at least 15% (from 10% to 35%);
- a quadrupling of the amount of capital stock exposed to damage from riverine flooding, as well as up to USD 75 billion in residential real estate damages from storm surge in Florida alone; to
- a loss of water for drinking and irrigation from glacial ice melt for around one in six of the world's population.

64. Limiting the risks of climate change requires both reducing greenhouse gas emissions to mitigate impacts and building longer-term resilience by adapting to those impacts that will occur. Rapidly reducing greenhouse gas emissions will require ambitious climate policies including a prompt phasing-out of fossil-fuel subsidies and effective and predictable carbon pricing. These, among other measures, will help to ultimately diminish the risks of severe climate impacts, including weather-related disaster events and forest fires, and boost climate resilience down the road. Such policies should be backed up by binding long-term strategies that lay out a clear roadmap towards net-zero emissions, in order to both provide clear long-term investment signals and to ensure that all government policies are increasingly aligned with the needed transformation.

65. Although essential for reducing future risks, ambitious climate policies can create short-term risks that need to be managed. They need to be designed to avoid exacerbating inequalities and increasing the cost of living. In an interconnected world, they also require co-operation at the multilateral level. Otherwise, divergence in climate policy stringency might lead to trade-related issues such as carbon leakage, and some countries might be tempted to use technically complex and controversial instruments such as border carbon adjustments, as proposed by, for example, the European Commission as part of its Green Deal. Such instruments require very careful design and implementation, lest they risk exacerbating trade and geopolitical tensions (see Prag, 2020; OECD, 2020n).

66. Even with effective emissions reduction trajectories in the coming decades, adapting to the inevitable impacts of climate change will be important to improving overall resilience. It is important to ensure that infrastructure investments are resilient to climate risks, as networks will face increasing pressures from the impacts of climate change but also play an important role in building society's resilience to those impacts. Climate and other important risks (notably digital security and terrorism), must be addressed in all infrastructure projects across their full lifetimes to minimise exposure and vulnerability. This will reduce direct economic damages from climate-related disasters and minimise the indirect costs created by the cascading impacts caused by the disruption of both critical services and economic activities. Retrofitting existing infrastructure is also important but is more costly, both organisationally and in terms of physical investment. Assessing the carbon and environmental impact of proposed infrastructure investment over its life cycle helps to minimise the environmental impact of investment decisions made as part of today's recovery packages, as well as to set the path for a green recovery.

67. In the short to medium-term, climate-related risks can also spill over to the financial sector through a number of channels. One spillover risk is financial turbulence caused by abrupt repricing of a large range of assets, often referred to as "transition risk". For example, central-bank stress testing of climate risks

suggests that disorderly climate transitions in financial markets from an abrupt recognition of the extent of "stranded" fossil-fuel assets could contribute to contagion, defaults and market losses across sectors (BIS, 2020; Bank of England, 2019). Another key spillover of climate risk is through physical risk -- i.e. damage caused by climate-related events, and includes fast-rising costs to insurers and reinsurers (or even the disappearance of coverage) in the face of financial losses to households and corporations (NGFS, 2020). Such losses can arise from disruptions and physical damage caused by extreme weather events and stresses in both chronic and acute manifestations as well as sea-level rise and flooding (Woetzel et al., 2020). Moving towards fuller and mandatory disclosure by firms of their exposure to both physical and transition risks is underway in several markets and can help to better price in the risks facing climate laggards and leaders. The UK, for example, has announced mandatory disclosure for most firms by 2025 (HM Treasury, 2020)

1.7. Summing up

68. This Chapter has identified sources of risks and points of vulnerability that may be conducive to severe crises through cascading failures across the economic system. It has done so by focusing on risks associated with pandemics and climate change, as well as developments in globalisation and emerging technologies. The latter two topics are examined in more detail in the rest of the Report, which lays out policy avenues for a more resilient global production and trade system (Chapters 2 and 3) and for harnessing emerging technologies to underpin economic resilience (Chapter 4).

69. While these topics are addressed sequentially in this Chapter and the remainder of this Report, the discussion has already provided some indications of their interconnections and ramifications. Climate change, for example, poses a significant underlying threat to economic stability, and it could have a multiplier effect on other social and economic risks. Interconnected risks are due to both spillovers from risks and vulnerabilities in one part of the economic system to another, as well as of the policy response to one crisis sowing the seeds for the next one. For example, following the GFC, governments felt compelled to deal with the legacy of higher public debt through widespread budget austerity measures, resulting notably in unwise severe cuts in public investment, including investment in health-system infrastructure and preventive public-health spending.[14] In turn, in various EU countries at least, these budget pressures, together with unclear responsibility for ensuring the adequacy of basic protective supplies (WHO Regional Office for Europe et al., 2020) undermined the capacity of health systems, both to limit the spreading of the virus once it arrived on the scene due to shortages of such items and to cope with the huge influx of patients developing severe forms of the disease. The ensuing widespread economic lockdowns and (necessary) massive public financial support have resulted in much higher public deficit and debt levels than in the wake of the GFC.

70. In parallel, the unprecedented surge in worldwide demand for health-related equipment (masks, tests, ventilators, etc.) has placed strains on global production and distribution systems. These have added to a list of chronic developments that have led to a proliferation of protectionist measures, and more

[14] Breunig and Busemayer (2012) showed that fiscal austerity generally led to cutbacks in discretionary public investment spending at the expense of entitlement spending across 21 OECD countries from 1979 to 2003. Similarly, Streeck and Mertens (2011) showed that in Germany, Sweden and the United States in the years 1981-2007 the greater the pressure for fiscal consolidation the less was spent on "soft" public investment (education, R&D, family support and active labour market policy). One specific example occurred in 2018 when the United States closed a directorate of the President's National Security Council that had been set up in the wake of the Ebola outbreak to deal with preparedness for global pandemics. Nonetheless, in 2019 the federal Department of Health and Human Services went ahead with a simulation exercise called Crimson Contagion, which involved 110 million cases of influenza and 586 000 deaths and demonstrated severe problems of underfunding, as well as lack of preparedness and coordination across the various responsible agencies and levels of government.

fundamentally, a deeper re-assessment of the benefits from globalisation and a risk of retreat. Such developments include the political backlash arising from the growing socio-economic and regional inequalities within advanced economies, as well as the distortions to the international level playing field brought about by the integration into the world's trading system of countries with widespread state-ownership and influence in production systems operating under a different set of rules. In the absence of an appropriate and co-ordinated policy response to these developments, there is a risk that the legitimate business case for greater diversification in global supply chains -- highlighted by the pandemic and earlier natural disasters -- will result in a far more significant global supply chain reconfiguration than desirable from a strict resilience perspective, induced by distortionary measures tilted towards domestic production.

71. Rapid advances in digital technologies have allowed for, and continue to underpin, the development of complex supply chains but are also adding an additional layer of vulnerability to other sources of disruptions through cyber-attacks. The latter can result in operational, financial and reputational damage that may prove hard to repair, while attacks across multiple jurisdictions limit the efficacy of any one of them to engage in legal action against cyber criminals. The flow of potentially sensitive information transiting through global electronic networks that is needed to make supply chains work smoothly makes multinational enterprises particularly prone to such digital risks.

72. Conversely, the development of the Internet of Things will result in more components and parts of manufactured goods (smart objects) incorporating in their design various sensors or chips to collect and transfer all sorts of information feeding into big-data analysis. These innovations can contribute to economic resilience through the more decentralised system they can facilitate or the redundancies they bring. However, the sourcing of such components via supply chains, along with specifications adopted, will play an important role in protecting the integrity and safety of the final goods by consumers or businesses against digital threats as well as in ensuring the privacy of the information collected. In most jurisdictions, digital security risks are still not fully integrated in existing product safety legislation. Considering the speed of technological advances, doing so may call for new approaches to regulatory policy that allow for more timely updates of regulatory requirements (Chapter 4; Brass and Sowell, 2020).

73. The main sources of risks and vulnerabilities highlighted in this Report are summarised in Table 1.2. While not intending to be exhaustive, the topics covered have been chosen with a view to policy areas that have some cross-border spillovers. Table 1.2 indicates areas for policy actions that would either mitigate those risks, enhance countries' capacity to absorb the fallout from their realisation or create the conditions for a recovery through adaptation and transformation. These distinctions are made for illustrative purposes but are by no means always clear-cut. Policy settings that help to mitigate the risks of bad outcomes may also facilitate the transformation needed for a strong recovery. For instance, developing digital security skills and encouraging innovation through public support in this area can help both with mitigating the risks of damaging cyber-attacks, thereby safeguarding the productivity and well-being gains from the recent jump in tele-working, and facilitating the recovery through easier adaptation. Also, promoting strong market competition, combined with rules to ensure a level playing field, can help to address distortions that can lead to the build-up of vulnerabilities to economic shocks, while at the same time encouraging business transformation through innovation and new firm entry.

74. There are also potential trade-offs. For instance, in the area of emerging technologies measures to mitigate risks must avoid going as far as to stifle innovation altogether. Such measures necessarily involve a certain degree of experimentation that is not without some risks. This is why anticipating and identifying vulnerabilities and actions that would reduce systemic risks and strengthen the absorption capacity of the economy and society can raise the level of tolerance to entrepreneurial risk-taking and uncertainty. As discussed in the rest of the Report, given the complexity of our economic systems, vulnerabilities are not always easy to identify *ex ante*, but are often associated with excessive concentration (in markets, data control and storage, for example) and systemic network connections. As mentioned above, the monitoring of observable variables providing early warnings of tensions and imbalances in the economic system is one tool to detect growing risks. Where feasible, the stress testing of production or

distribution networks and information sharing, as well as horizon scanning and scenario analysis can also be useful tools to increase preparedness for future major shocks.

75. Overall, it is best to consider risks and the associated shocks as some combination of chronic and acute, since those that seem chronic, if not decisively dealt with at the source, will most probably eventually manifest themselves acutely. The GFC is a prime example. Also in reacting to the realisation of any individual risk, decision makers should give sufficient thought to the complete, system-wide effects of their proposals so as to avoid adding to other existing chronic tensions and vulnerabilities, which would help to bring forward other shocks.

Table 1.1. Overview of sources of risks and areas for policy actions

Points of vulnerability and shocks	Risk mitigation and impact absorption	Recovery through adaptation and transformation
Pandemics and natural disasters		
1. Pandemics	- Global health surveillance, virus detection and early warning - Preparation and benchmarking of national pandemic response plans - Private and public healthcare capacity - Stockpiles of medical goods and equipment, preferably internationally coordinated	- Vaccine research and developments - Public antimicrobial drug research - Human, animal and environmental health nexus (ONE health concept) - Pro-active public health actions to reduce co-morbidities - Resilience of health infrastructure - Broadening of access to high-speed internet connections
2. Climate-related shocks (e.g. storms, floods, droughts, wildfires) and other natural disasters (e.g. earthquakes, tsunamis)	*Reducing climate risks through a clear plan towards net-zero emissions, including*: - More resolute and comprehensive carbon pricing - Removal of fossil-fuel subsidies - Investment in new technologies like carbon removal and storage, clean energy and transport technologies, building efficiency, battery storage (also key to transformation) - Stress-testing of the financial system to a disorderly climate transition *Improving impact absorption, including*: - Early warning systems and earth observation - Support for emergency services - Business continuity planning and stress-testing - Strengthening disaster-risk governance, enhancing disaster preparedness so as to respond better in recovery, rehabilitation and reconstruction. - Investment in disruption reduction in critical infrastructure and essential services	- Creation of conditions for climate risks to be adequately factored into all financial, investment and consumption decisions - Factoring of climate resilience into all critical and new infrastructures (energy, telecoms, transport) and water management - Reforestation and soil retention to reduce impact of natural disasters - Investment in coastal infrastructure to confront rising sea levels - Cost/benefit assessment of promoting changes in dietary habits
Digitalisation		
1. Threats to digital security	- Sharing of strategic intelligence on global threats and actors - Stronger international policy and regulatory frameworks related to digital security	- Development of a culture of security across key sectors, SMEs and the public sector - Development of digital security skills - Innovation in digital security
2. Societal and ethical risks (e.g. data privacy and discrimination)	- International regulatory co-operation in emerging technologies	- New approaches to technology governance to anticipate societal concerns - Good practices for implementation of principles for trustworthy emerging technologies - Societal resilience to dis-information

3. Financial risks (e.g. fintech and blockchain)	- Achieving global convergence of principles and regulation - Promoting experimentation with the use of regulatory sandboxes	-
Globalisation		
1. Global supply chain vulnerabilities	- Toolbox of approaches to promote resilience, including: - "no regrets" policies (investments in trade facilitation, digital) - Transparency on essential goods - Stockpiling of essential products based on cost/benefit analysis - Possible upstream agreements on supply (including cross-border) - Commitments to refrain from export restrictions	- More systemic approach to the resilience of critical infrastructures underpinning trade - Implementation of responsible business conduct (RBC) principles and standards - Reinforce international regulatory co-operation to standardise approaches to, and support the sharing and flow of, essential goods
2. Concentrated production of critical components	- Trade facilitation measures - Good governance and supply chain due diligence - International disciplines to reduce the regulatory uncertainty caused by export restrictions	Diversification of production of critical components without distortionary measures (where feasible) - Investment in circular economy technologies and supportive regulatory frameworks for recycling of critical raw materials
3. Global market distortions and fragmentation	- Ensuring that governance of SOEs is compatible with competitive neutrality - Reducing trade costs related to border controls, technical standards and protocols - Tackling government support in the global economy through reform to WTO rules.	
4. Economic concentration (market, data, etc.)	- Antitrust action, especially on M&A - SOEs' role and competitive neutrality	- International co-operation for greater data access, mobility and sharing within and across borders - Ease of entry of new businesses and exit of non-viable ones - Reallocation of capital and labour resources across firms and sectors

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Chapter 2. BUILDING RESILIENT GLOBAL SUPPLY CHAINS

76. Arguably more than the global financial crisis of 2008-9, the COVID-19 crisis has underscored the inter-connectedness of the global economy, and in particular the role of global supply chains.[15] Global supply chains have been important in expanding the participation of a wide range of countries, and firms of all sizes, in the opportunities from integration with the global economy. Global supply chains have also played a pivotal role in reducing poverty and offering an opportunity for developing countries to grow and catch up with richer countries (World Bank, 2019). Yet COVID-19 has exposed some of their vulnerabilities, and the risks for the economy and society at large when supply chains are disrupted. In the face of the shocks from COVID-19, ensuring the resilience of global supply chains has become a key concern for policymakers, both to ensure the supply of essential goods and to underpin a strong and resilient global economy more broadly.

77. Indeed, beyond COVID-19, recent shocks to supply chains have been caused by natural hazards, industrial accidents, cyber-threats, or other security or geopolitical risks. These illustrate how disruptions to key global supply chains, infrastructure systems and essential services, such as health, water, energy, transport or information and telecommunication systems can result in substantial economic damage, and disrupt flows of goods, people, data or services. As there is no way to avoid all risk, the challenge is to understand, plan for, mitigate and be able to recover and emerge stronger from disruptions and disasters; that is, to build resilience in supply chains.

78. Resilient global supply chains underpin a resilient global economy that is able to ensure the supply of goods and services to people around the world, including those that are essential during a crisis. While building resilience is critical in increasing confidence in the global economy, increased confidence is also itself essential for a sound and prosperous global economy in creating the conditions for businesses to invest and create jobs and for governments to plan and invest for the longer term. Building confidence and trust in the global economy requires action and new forms of co-operation -- across the public and private sectors, across countries, and with consumers and citizens. While there are actions and investments that governments can take alone, co-operation with the private sector will be essential. Moreover, in a global economy, benefits are greater -- or sometimes can only be realised -- when countries work together.

79. This chapter provides insights on tools and approaches that governments can use to promote resilience of international supply chains acting alone, in co-operation with the private sector, or acting

[15] Global supply chains are used in this chapter to refer to the provision of final or intermediate goods and services across borders. This covers the global fragmentation of production, with goods and services produced across a range of countries and exported to another country where they are used as inputs for that country's exports or as inputs into production for domestic consumption, or consumed as final demand. This term thus encompasses the concept of global value chains (GVCs), which looks at the value added contributed along different parts of global supply chains as goods and services produced across a range of countries and exported to another country are used as inputs for that country's exports. Trade flows seen through the lens of trade in value added are captured in the OECD's Trade in Value-Added (TiVA) database (see below). GVCs are characterised by the deepening and expansion of global specialisation. Most international trade and investment takes place within GVCs. 70% of international trade consists of exchanges of raw materials, parts and components, services for businesses and capital goods that are used by firms to produce and serve their customers (See OECD (2020a) and (2013)).

together. It draws on the OECD's trade analysis tools (TiVA,[16] METRO[17]) and trade data, as well as sector-specific analysis, and consultations with business federations and individual firms. While drawing on the recent experience of the COVID-19 crisis, notably in relation to the discussion of essential goods, the issues and approaches outlined are applicable to a range of shocks and crises.

2.1. Acute shocks can place huge strains on global supply chains…

80. The COVID-19 pandemic and related containment measures have highlighted the scale of impacts that an acute global shock can have in a globally interconnected economy and the range of stresses, both domestic and global, to which global supply chains can be subject. This has given rise to a debate about the risk and rewards of global supply chains and highlighted the importance of strengthening their resilience -- be they for global sourcing of intermediates or traditional trade in final products. Understanding the nature of these stresses, and accurate diagnosis of the problems, such as those that arose due to COVID-19, is key to identifying the most appropriate policy responses not simply in the present context, but also to provide important insights for the handling of future shocks. Indeed, acute shocks to global supply chains can relate to a number of factors, often in combination.

81. In the context of the COVID-19 crisis, global supply chains have been affected by shocks relating to:

- **Demand**: Some goods, notably medical goods but also ICT goods and services, were the subject of huge surges in demand. Others saw a shift in demand, as in the case from food consumed away from home to food consumed at home, which led to changes in product choice (e.g., away from high value fresh seafood and specialty foods and towards more frozen and processed foods) and packaging requirements, so suppliers could not always readily adjust. Other goods and notably, services, saw declines in demand due to confinement measures, or falling incomes (as for travel or in-person services or purchases of durable goods).
- **Transport and logistics**: In some cases, goods were available but could not get to where they were needed; for example, due to labour shortages (such as at ports, due to illness or new social distancing requirements); new transport regulations (such as those limiting the number of drivers in trucks); new border procedures; or transport disruptions (such as those affecting air cargo with the collapse of passenger travel, or the closure of ports). These disruptions were both global and domestic ("last mile"). Such factors may be exacerbated in the case of essential goods with specific transport and storage needs (e.g., products requiring cold chains, such as vaccines).

[16] The (TiVA) database considers the value added by each country in the production of goods and services that are consumed worldwide. TiVA indicators have shown the important role of imports of intermediate goods and services in export performance and the fact that imports often embody a country's own (returned) domestic value added. The TiVA database shows that on average, across sectors and countries, foreign value-added content of gross exports is close to 30%, with the share even higher in some manufacturing sectors which tend to be more integrated into gobal supply chains. TiVA data has underscored that in a world of global supply chains, tariffs, non-tariff barriers and other restrictive measures are amplified and affect not only foreign suppliers, but also the competitiveness of domestic producers. TiVA data has also highlighted the growing "servicification" of economic activities: the value created by services as intermediate inputs represents over a third of the total value-added in manufacturing exports. See OECD (2020a). Further information on TiVA is available at http://www.oecd.org/industry/ind/measuring-trade-in-value-added.htm

[17] METRO is the OECD's multi-country, multi-sector, computable general equilibrium trade model that traces international interdependencies in a theoretically and empirically consistent framework, focusing on several key features of trade integration such as trade of intermediate and final products and trade in value added (TiVA) in global value chains. More information can be found at: https://www.oecd.org/trade/topics/metro-trade-model/

- ***Supply*** - some goods were undersupplied in the global market, such as some unprofitable off-patent medications; others experienced disruption of supply due to COVID-19, exacerbated, in some cases, by highly concentrated supply.

82. Stresses on supply chains were also "artificially" created as a result of actions or policy failures, which have also been seen in past shocks and are likely to remain a feature of shocks in the future unless addressed:

- ***Regulatory failures*** – supply of some goods/services was additionally constrained by regulatory procedures and requirements that were not always sufficiently risk-proportionate, agile or coherent across countries – leading to significant delays or supply reductions, for example for testing equipment, even when global supply chains were not (or no longer) overloaded. Regulatory barriers also delayed mobilization of local resources and productive capacity.
- ***Dis-information and profiteering*** – unfounded rumours, exacerbated by social media, led to runs and panic buying of certain goods, such as hydroalcoholic gels, creating temporary shortages. Lack of clear information in some cases led to hoarding, bulk purchases for resale, and price gouging, as well as an uptick in the production of counterfeit goods, and the smuggling of illicit goods. (See Chapter 1 and Chapter 3).
- ***Export restrictions*** – in some cases, notably in the early stages of the pandemic, supply shortages were exacerbated by export restrictions put in place by key suppliers, which reduced supply available for other countries on global markets. Fear of such restrictions can also contribute to hoarding and panic buying.

2.2. Yet, overall, supply chains have held up reasonably well

83. Notwithstanding these stresses, overall, supply chains have held up reasonably well to date in the context of the COVID-19 crisis.[18] While there have been shortages of medical equipment, notably masks and PPE in the early days of the pandemic, bottlenecks and immediate shortages of certain products were not caused by the collapse of supply chains, but rather by the unprecedented surge in the scale of demand -- a surge which domestic production would face similar difficulties in addressing. Indeed, global supply chains have been part of the solution to global shortages: global production and trade of face masks both increased tenfold to meet demand (OECD, 2020b). Similarly, global supply played an important role in the availability of COVID-19 test kits: in less than three months and leveraging its global supply chain experience, Korea became one of the main exporters of in-vitro diagnostic tests, serving more than 100 countries. Rather than trying to create domestic production capacity, especially in the face of confinement strategies, many countries turned to global markets to address shortages and increase supply. The resilience offered by global markets was helped by the fact that COVID-19 affected countries at different times and to different degrees (Korean was less affected by the pandemic in the first wave due to its greater domestic preparedness) (OECD, 2020c).

84. Food and agriculture supply chains have been affected by disruption to transport and logistics (notably air cargo for higher value perishable goods and rising shipping costs); labour shortages on farms, processing facilities and inspection services; and new biosecurity arrangements – disruptions that were both domestic and international. Many of the most serious bottlenecks have been observed in domestic

[18] An example is the IT and electronics supply chain, with the production of smartphones. Apple launched a new model during the crisis, sold mostly on-line. While the smartphones were manufactured before the crisis, Apple will also launch four new iPhone models next fall, with production delayed by only one month (The Wall Street Journal, "Apple Delays Mass Production of 2020 Flagship iPhones", 27 April 2020). Its main competitor, Samsung, reported not having any meaningful production disruptions (Financial Times, "Inside Samsung's Fight to Keep its Global Supply Chain Running", 12 May 2020).

processing and retail distribution (i.e. the domestic part of value chains) (OECD (2020d)). Whereas prices of staple crops were relatively low during the first wave of COVID-19 because of favourable production prospects and ample stocks, prices have started to rise in recent months fuelled by strong demand, concerns about supplies and cuts in stocks. While supplies have held up well, the economic downturn threatens access to food for the poor and vulnerable.

85. While global supply chains have proved reasonably resilient, in the face of some temporary shortages, the COVID-19 crisis has raised questions about the policy tools governments can use to ensure the timely provision of some essential goods in case of shocks. COVID-19 is leading to a reassessment of the likelihood and severity of different risks, and of the necessary risk management strategies to ensure supplies of essential goods (for example, some governments reported having reduced their stockpiles of certain essential goods prior to the pandemic, in view of both budget constraints and a reliance on global supply chains to supply as needed). Not all public purchasing bodies have accompanied greater reliance on global supply chains with the necessary steps to build resilience, such as supply network mapping or developing skills to deal with foreign suppliers.

86. For some governments, exposure to global supply chains has also led to debates about the role of re-shoring of production, particularly in large markets or where public-sector and private-sector assessment of optimal risk management differ. As discussed below, there is a continuum of policy options to complement global supply chains, including reinforced bilateral and regional co-operation to share, jointly procure, and/or stockpile essential goods, or, for some governments, even reconsidering global supply chains themselves. It has led to useful discussions about the extent of concentration of supply in some final or intermediate goods and the need for diversification of sourcing. Overall, the COVID-19 crisis revealed a disconnect between the growing cross-border nature of policy challenges and the traditional national anchor of many laws and regulations, and the pressing need for international regulatory co-operation to develop effective policy action in today's interconnected world and avoid regulatory divergences that can be costly for businesses and citizens.

2.3. Diversified and open markets are needed to ensure supply, in particular for essential goods

87. Empirical analysis of various recent country experiences suggests that strategies based around a reliance on domestic production are unlikely to ensure supply of essential goods. Indeed, such strategies can remove important risk management strategies and adjustment channels, such as the diversification of supply offered by the global economy. Rather than posing a trade-off between efficiency and security of supply, global sourcing can help to ensure both.

88. In the context of the current pandemic, analysis of COVID-19 related *medical products* demonstrates that that no country or region can meet its own needs alone.[19] Countries are exporters of one set of goods, but importers of others: countries in Southeast Asia are important global suppliers of surgical gloves and disposable masks and sheets, while major developed countries specialise in the export of medical equipment.[20] OECD countries tend to be both importers and exporters of medical products used to fight COVID-19, while, many developing countries depend on OECD countries for access to these, highlighting a high degree of interdependence in trade in essential items (OECD, 2020). Indeed, as noted

[19] While this analysis was based on goods relevant for COVID-19, many would be relevant to a range of pandemics or medical care needs following natural disasters. See: OECD (2020e).

[20] This strong interdependence in trade in COVID-19 goods means, for instance, for every euro of German exports of COVID-19 goods Germany imports 0.7 EUR; for the United States, for every dollar of imports, it exports USD 0.75 (OECD, 2020e).

above, trade played an important role in ensuring supply of medical goods in the context of COVID-19, with trade in medical supplies increasing by just under 40% in the first half of 2020 (WTO, 2020a).

89. Reliance on domestic production is neither feasible, nor cost effective for strained health budgets, especially for lower income countries which are almost entirely dependent on global markets to source medical products related to COVID-19. Global supply can allow products to be sourced from the most efficient and cost-effective supplier and enable access to more and different varieties of medical products; for countries participating in global supply chains, including developing countries, they offer important sources of jobs and growth. The nature of the next crisis may be quite different. Global supply will be required to meet future demand surges, and diverse production networks boost resilience.

90. Likewise, resilient global supply chains have been critical in ensuring food security, and climate change and other environmental stresses will further increase the importance of international trade to enable food to move from where it can best be produced to where demand is growing fastest.[21] An open, predictable and transparent international trade system is essential to pool risks, including from increasingly severe shocks from weather, pests, and climate change. Global markets are an essential part of helping food systems confront the triple challenge of ensuring adequate access to safe, affordable and nutritious food for a growing world population; providing livelihoods for actors along the food chain and ensuring the environmental sustainability of the sector while contributing to lower GHG emissions and adapting to climate change. Moreover, the long experience with risk and resilience strategies in agriculture can provide insights for trade in other products.

91. *Scenario analysis using the OECD METRO model* shows that generalised localisation and re-shoring -- through tariffs and production subsidies -- would not only come with high efficiency costs, but is also unlikely to increase certainty or stability of supply (Box 2.1).

[21] The overwhelming majority of GHG emissions related to food occur through agricultural production and land-use change; all other stages of the food chain (including inputs, energy, processing, transport, etc.) account for only one-fourth of the total (see IPCC (2019). While transportation of food itself can generate emissions, the environmental sustainability of food production differs strongly by region and by food product; depending on circumstances, locally-produced food may be more or less sustainable than imported alternatives, even after taking into account transport. See OECD (2021 forthcoming).

Box 2.1. Interconnected versus localised economies: insights from the METRO model

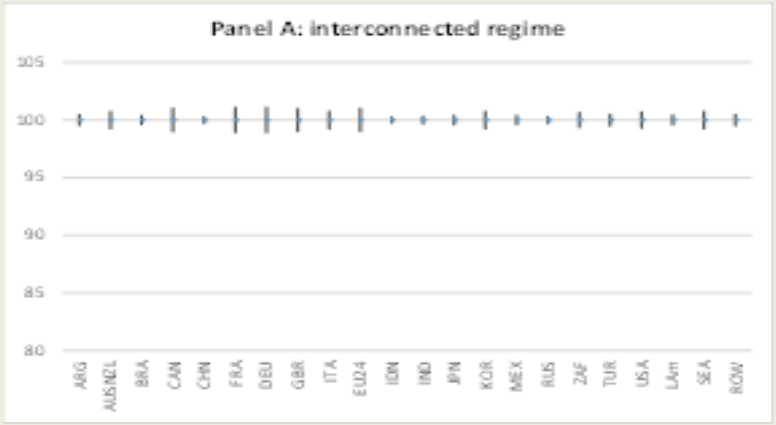
Scenario analysis using the OECD METRO model shows that generalised localisation and re-shoring – through tariffs and production subsidies – is unlikely to result in increased certainty or stability of supply.

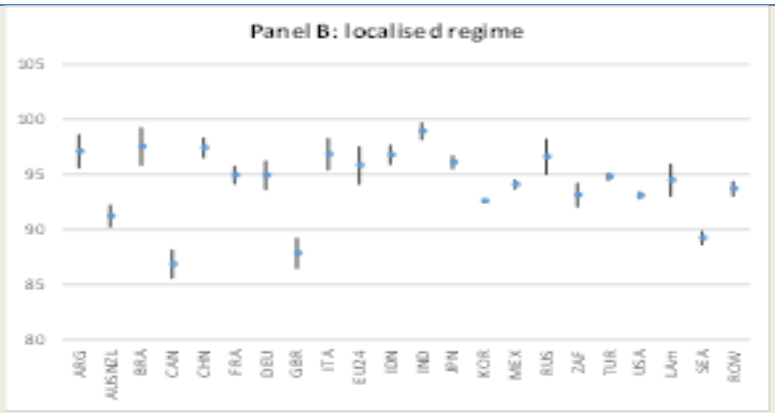
Even with the support and protection offered to domestic producers under a hypothetical "localised" regime, not all stages of production can be undertaken in the home country. Trade in intermediate inputs and raw materials continues to play an important role in domestic production. While re-shored production may have fewer transmission channels for global shocks, when a shock occurs, firms in the domestic economy also do not have the same capacity to manage the impacts of those shocks via global markets. Localised supply chains are thus vulnerable to shocks due to lack of adjustment channels, which can lead to increased instability and negatively affect trade, prices and ultimately household incomes. Additionally, domestic shocks are generally found to have bigger effects on the home economy than external shocks.

Furthermore, the measures available to governments to promote re-shoring include subsidies, tariff barriers and local content requirements – all measures that distort markets and are likely to introduce inefficiencies into their economies. A localised regime would thus have significantly lower levels of economic activity and therefore lower incomes. In the context of COVID-19 such policies can be particularly damaging: far from contributing to a robust, sustainable and inclusive recovery, increased localisation would add further GDP losses to the economic slowdown caused by the pandemic.

In the localised regime, countries have lower incomes and shocks result in lower stability of incomes for most countries

Levels and deviations of real GDP in the interconnected and localised regimes





Note: All changes in real GDP are relative to the level of the interconnected regime base scenario, which is set to equal 100. Blue dots show the base in the given regime relative to the interconnected base, and whiskers show average deviations of real GDP for negative and positive trade cost shocks.

Methodology

To shed empirical light on efficiency and stability gains (or losses) from re-localisation, two stylised versions of the global economy were explored along two dimensions: efficiency (mean levels of economic activity) and relative stability (deviations in levels of economic activity from the mean in response to shocks). The interconnected regime represented production fragmentation in global supply chains, much as it is seen today, accounting also for the identified effects of the demand and supply changes to date in the COVID-19 crisis. The localised regime reflected a situation where, on top of the effects of the COVID-19 crisis, incentives to source inputs from abroad were reduced through (i) a global rise in import tariffs to 25% in all regions imposed on all traded products; and (ii) national value-added subsidies equivalent to 1% of GDP directed to labour and capital in domestic non-services sectors in each country (in order to mimic rescue subsidies that favour local production). In addition, it was assumed in the localised regime that firms are more constrained in switching between different sources of inputs, making international supply chains more 'rigid'.

The analysis explored the effects of shifting to the localised regime on key economic variables such as trade, production and real GDP, i.e. the overall cost of making the supply chains more 'local', or the 'efficiency' side of the purported efficiency/stability trade-off. To explore how the interconnected and the localised regimes compare in terms of propagation of, or insulation from, shocks (the stability dimension), a stylised set of supply chain shocks was explored, based on a 10% increase in costs of bilateral exports and imports between a given region and all other countries. While stylised, the chosen shock reflects the main characteristics of supply chain disruptions experienced during the COVID-19 crisis and allows broad comparisons across different countries, sectors and value chains. The shocks are country-specific, as was the case with COVID-19, where supplies across many industries were initially disrupted in China and subsequently in other countries.

The shocks are sector generic -- that is, they are applied equally across all sectors to capture the fact that sectors source from a range of different industries (e.g. car producers do not just source from other firms in the car industry, but also from other sectors). The stability of an economic variable, such as real GDP, is calculated for each country as the absolute value of an average percentage deviation from the initial base level of this variable (i.e. from the base level in either the interconnected, or the localised, regime) across all country-specific shocks, including the one originating in the domestic economy.

Source : Arriola, Guillox-Nefussi, Koh, Rusticelli and Van Tongeren (2020).

2.4. How governments can work with the private sector to foster resilient supply chains

92. Yet if governments are to resist calls for much greater reliance on domestic production, they need to be confident that global supply chains will be able to provide needed goods and services at the right time and in the right quantities. More can be done to increase the resilience of global supply chains. While much of this is the business of the private sector, governments, through the implementation of demand-driven strategies, can play an important role, notably for essential goods.

2.4.1. The private sector has a critical role in managing supply chain risks

93. While COVID-19 has presented particular challenges, the private sector has experience in managing a wide range of risks and shocks along the supply chain, including related to natural hazards (Box 2.2). From the private sector perspective, resilience can be enhanced through strengthened firm risk management and due diligence strategies that emphasize awareness, transparency, accountability and agility. Sourcing strategies may differ depending on the level of acceptable risk. Supplier diversification and 'just in case' processes (such as supplier redundancy or shorter supply chains where delivery speed is critical) are important for essential activities which cannot afford any break in supply, notwithstanding their additional costs and loss of scale economies. Other activities may rely on the ability of existing networks of suppliers to recover faster from shocks ("just in time" strategies, with an emphasis on bouncing back faster). Instead of switching to other suppliers and incurring sunk costs, the trusted relationship with the same supplier can lead to higher investment by that supplier in avoiding disruptions and ensuring rapid recovery. Supplier relationships are a key aspect of risk management strategies in supply chains, but vary considerably across sectors and firms.

94. Private-sector risk management strategies can include a range of approaches: avoidance (of unacceptable risks); postponement (producing or shipping goods once customer orders are received); selective risk taking (producing or shipping goods based on anticipated customer demand); hedging (diversifying suppliers and locations of production); control (through vertical integration of main suppliers); transferring/sharing risk (via outsourcing and offshoring); and security (identification of shipments at risk, facilitated by the use of information technology).

Box 2.2. Global supply chain resilience to natural hazards

In 2011, two major natural disasters occurred in Japan and Thailand with deep economic implications for firms operating in global supply chains. These two events drew attention to the need for resilience in supply chains.

The impact of the Tōhoku earthquake and tsunami on Japanese firms

The Great East Japan earthquake, the fourth largest earthquake in the world since 1900, profoundly impacted the Japanese economy in 2011. Several studies have analysed the propagation of the economic shock through supply chains. In particular, the propagation was stronger in supply chains where inputs were specific and difficult to substitute. But studies at the firm level also found that Japanese companies were relatively resilient. According to Inoue and Todo (2017), most plants that were directly hit by the earthquake restarted their activity within three months. Todo et al. (2015) find that firms with extensive networks of suppliers made a faster recovery. Because of their complex supply networks, these firms were initially more affected, but these networks became their advantage in the recovery phase. Todo et al. (2015) conclude that the positive effects of supply chains typically exceed the negative effects.

Other studies shed light on how firms have changed their sourcing strategies after the earthquake. Zhu et al. (2017) show that firms in the area affected by the earthquake reacted by offshoring more, which can point to some supplier diversification. In the motor vehicle industry, Matous and Todo (2017) find that, in the wake of the disaster, manufacturers diversified their suppliers and moved away from the "keiretsu" model of long-term relationships with first-tier suppliers.

The impact of the Chao Phraya floods on the hard disk drive industry

In Thailand, severe flooding occurred during the monsoon season in 2011, with serious implications for the hard disk drive (HDD) industry. 43% of world HDD production was concentrated in the Chao Phraya river basin affected by this natural disaster. But the outcome was different among the main producers (Haraguchi and Lall, 2015). The leading firm in the industry, Western Digital (United States), saw its factories inundated, while its main competitor, Seagate (United States) had factories in the same place, but on higher ground. Toshiba (Japan) also saw its factories inundated, but was able to divert production to the Philippines. Seagate became the main producer of HDD in 2011. But it took only six months for Western Digital to retake the market lead. With the help of Thai navy divers, Western Digital managed to salvage most of the manufacturing tools and restarted production 46 days after the flooding. It was a costly process, but high sales in 2012 compensated for the loss.

While greater diversity in the location of production was expected after the 2011 experience, Western Digital not only continued to produce next to the Chao Phraya river, but even decided to close a factory in Malaysia in 2017 to further concentrate its production in Thailand.[1] This underscores that some offshore locations provide significant advantages for manufacturing firms and that such considerations are important for firms in managing risks in supply chains.

Source: OECD (2020c).

[1] The Register, "Wester Digital Formats Hard Disk Drive Factory as Demands Spins down", 17 July 2018.

2.4.2. Promoting resilience through responsible business conduct will also be key

95. The way businesses anticipate, prevent, prepare and respond to shocks can play a role in minimising or amplifying these disruptions and the impact they may have not only on businesses themselves, but also on people and societies. These impacts play an important role in shaping public perceptions of, and trust in, the global economy as being not only strong and resilient, but also fair.

96. Throughout the COVID-19 crisis, many companies have been looking to collaborate towards solutions to the challenges brought about by the pandemic, including to ensure access to essential goods, and enhance supply chain resilience. In the United Kingdom, as part of a government plan to boost testing for COVID-19, AstraZeneca, GSK and the University of Cambridge collaborated to establish a testing laboratory to help overcome supply shortages and expand national testing system capacity (AstraZeneca, 2020). Some companies have made efforts to support their suppliers and business partners, for example by accelerating payments to solve immediate cash-flow issues, or helping suppliers to reconfigure factory floorplans and implement flexible working hours to maximise interpersonal space.[22]

97. Conversely, the COVID-19 crisis has shown that some business responses could exacerbate supply chain vulnerabilities and lead to serious harm to people and societies. For example, abrupt cancellations of orders or contractual non-performance by importing companies, which have been widespread during the COVID-19 crisis, have caused obstruction of scheduled wages, and shut down factories, leading to shortages in raw or intermediary inputs (Lovell, 2020). In the garment sector, retroactive order cancellations led to suppliers dramatically reducing or suspending operations, resulting in a sharp drop in both import volume and prices in key importing markets (CGWR, 2020). When supply chain disruptions are compounded with pre-existing environmental and social vulnerabilities, the impact of disruptions is likely to be more severe. A rise in unemployment may hit hardest those workers who are not covered by regular (e.g. sick or unemployment paid leave) or exceptional COVID-19 specific safety nets, such as independent workers, zero hour contract workers, or informal workers, among whom are many migrant workers and women (OECD, 2020f).

98. These examples underscore the importance and opportunity for policy makers to collaborate with the private sector to promote standards of conduct that both reduce the risks of supply chain disruptions, and minimise the negative social and environmental impacts of such disruptions when they do occur. Responsible Business Conduct (RBC) principles and standards can provide a common framework to support such public-private collaboration and ensure that the private sector meets broader government expectations in this regard. These standards, in particular the wide-ranging OECD *Guidelines for Multinational Enterprises* (the *Guidelines*) and related OECD due diligence guidance, lay out the expectation that businesses contribute to sustainable development, while avoiding and addressing adverse impacts of their activities, including throughout their supply chains. The *Guidelines* cover business responsibility in a wide range of areas, including disclosure, human rights, workers' rights and industrial relations, environment, bribery, consumer interests, science and technology, competition, and taxation. They provide recommendations to companies in all these areas, and include an expectation that companies conduct due diligence in respect to risks associated with their operations, including their supply chains and other business relations (Box 2.3).

99. At the firm level, RBC due diligence can improve businesses' knowledge of their supply chains and build the capacity of businesses to anticipate and respond to future shocks. Through risk-based due diligence processes, businesses map their supply chain and gain a better knowledge of the risks that they might entail. Information from supply chain due diligence, for example on origin of raw materials, and other traceability data, can be used to understand short-term and medium-term vulnerabilities in the supply

[22] See for example the cases of Boeing and Apple https://www.wsj.com/articles/boeing-offers-more-support-for-max-suppliers-11582465420; https://www.bloombergquint.com/business/apple-helps-suppliers-reconfigure-factories-to-limit-COVID-19

chain, and support continuity planning to manage disruptions (OECD, 2020f). The comprehensive approach to risk management inherent to RBC due diligence makes it particularly well suited to help businesses understand and navigate a broad range of sustainability issues that may exist in the supply chain. In a context where risks related to climate change and other sustainability threats are becoming more pressing, adopting this comprehensive approach to risk management is becoming a necessity for the viability of firms and global supply chains.

100. The relevance of responsible business practices to strengthen firm resilience has been verified empirically through the COVID-19 crisis. Multiple studies have found that firms with high Environmental, Social and Governance (ESG) ratings saw their share prices climb higher relative to their competitors during the crisis (Amundi, 2020). Recently, a study conducted between January and June 2020 using a sample of 1 597 listed firms in China concluded that companies with higher corporate social responsibility (CSR) performance before the shock experienced fewer losses and took a shorter time to recover (Huang et al, 2020).

101. By adopting a holistic approach to risk, establishing common standards of conduct and promoting industry and multi-stakeholder collaboration, RBC standards and tools contribute to building the resilience not only of firms, but entire systems. They play an important role in underpinning public trust in a free, fair and open global economy. Policymakers should actively seek to promote RBC principles and standards, including the *Guidelines* and associated due diligence guidance, and facilitate their implementation through multi-stakeholder dialogue and public-private co-operation.

Box 2.3. OECD due diligence guidance for responsible business conduct

Due diligence is the process enterprises should carry out to identify, prevent, mitigate and account for how they address adverse risks and impacts in their own operations, their supply chain and other business relationships, as recommended in the OECD Guidelines. Effective due diligence should be supported by efforts to embed RBC into policies and management systems, and aims to enable enterprises to remediate adverse impacts that they cause or to which they contribute.

Due diligence addresses, actual adverse impacts or potential adverse impacts (risks) related to the following topics covered in the OECD Guidelines: human rights, including workers and industrial relations; environment (including biodiversity issues); bribery and corruption; disclosure; and consumer interests (RBC issues).

For many enterprises, the term “risk” means primarily risks to the enterprise -- financial risk, market risk, operational risk, reputational risk, etc. Enterprises are concerned with their position in the market *vis-à-vis* their competitors, their image and long-term existence, so when they look at risks, it is typically risks to themselves. The Guidelines and due diligence process, however, are concerned with impacts on people, the environment and society that enterprises cause, contribute to, or to which they are directly linked. In other words, it is an outward-facing approach to risk.

2.4.3. Consultation, co-operation and coordination between the private and public sectors is needed

102. Greater understanding of the risk management and resilience strategies already in place in companies, how they performed during the COVID-19 crisis, and the challenges they faced is important not just for the private sector, but also for governments seeking to ensure the supply of essential goods. Boosting the resilience of global supply chains will require greater coordination, consultation and co-operation among government and the private sector. Indeed, the effectiveness of government

measures to enhance the resilience of global supply chains will hinge, to a large extent, on their ability to generate the expected response at firm level, where resilience is primarily built. Collaboration with the private sector is of particular importance to design measures grounded in a practical understanding of firms' challenges and decision-making processes, to facilitate their implementation, and to involve businesses more broadly in collective efforts to build resilient and sustainable economies.

103. Improved strategic governance of essential goods, including through public-private co-operation should be based on coherent and evidence-based policy tools covering the whole cycle from production, trade, storage, transport and distribution globally, regionally and at the national level up to the end user. Governments can support new forms of engaging with the market and suppliers, including partnerships with the private sector for agreed action plans in times of crisis. Such policies should include relations with SMEs who tend to be closer to local needs, can respond more quickly with the proper support, and can innovate in domestic production, such as. repurposing local manufacture and repair in cases of surge in demand, e.g. production of hydro-alcoholic gels by local distilleries, enabled by administrative simplification and temporary suspension of regulations unrelated to health and safety. It is of particular importance proactively to put measures in place before crises hit in order to pre-establish relations, expectations and emergency operating procedures to enable swift action and to ensure clarity of role of different actors. Once a crisis has begun, governments can adapt guidelines to the specific needs of the crisis; centralise purchasing in order to conduct emergency procurements, conduct central price tracking and quality verification; and monitor and report in order to reassess and adjust policies in light of changing needs. Governments can further facilitate transactions with template agreements; develop data-driven approaches to better monitor needs, supply and risks; support contracting authorities with a better understanding of global supply chains, of contractual relationships, and of dealing with foreign suppliers; and map their supply network and diversify suppliers.

104. Indeed, there is a toolkit of approaches that governments can take, ranging from "no regrets" policies and investments, many of which they can implement alone, through to more specific measures to promote the resilience of global supply chains, notably for some essential goods. Many of these measures require co-operation with the private sector, or indeed with other governments. Other options involve reconsideration of global supply chains themselves. Options here range along a continuum, from efforts to diversify supply of key goods or services, in particular where supply is viewed as being too concentrated and thus a source of risk, to efforts to re-shore production of some essential goods, using incentives (such as government support).

2.5. Governments have a toolkit of policy options to promote resilience of global supply chains

2.5.1. At the national level, there are a range of "no regrets" policies governments can implement to underpin the resilience of global supply chains

105. Some of the actions that governments can take concern the basic enabling conditions for international trade, and represent sound long-term investments, with payoffs outside of crises. These include:

- ***Efforts to lower the costs and increase access to digital trade*** are key for resilience, enabling firms and individuals to stay connected to markets, jobs and each other. Access to the products that underpin digital infrastructure are increasingly critical for all economic activity and for international trade. This centrality has become more apparent in the context of COVID-19, where digital enablers such as computers, smartphones, network equipment and telecommunications services are playing a key role in alleviating the social and economic consequences of confinement and social distancing measures. They allow people to shop online, cushioning some of the

economic impacts of health-related restrictions and enable remote working and teleconferencing, while digital services are facilitating business transactions and physical distancing. With the shift towards a digital economy accelerating, governments will need to continue to enable digital trade as a means to increase resilience of supply chains, mitigate the economic slowdown and speed up recovery. This includes easing restrictions on goods and services that underpin access to digital networks, reducing barriers to digitally enabled services and promoting policies that tackle digital divides.

- ***Trade facilitation*** underpins global supply chains, reducing the time and cost of moving goods around the world and promoting more inclusive trade (reducing trade costs is particularly important for micro, small and medium-sized enterprises (MSMEs).[23] Trade facilitation measures taken at the border have made it possible for supply chains to continue delivering and have been critical during the COVID-19 crisis -- by early May 2020, the number of COVID-19-related trade-facilitating measures outweighed the new, potentially cost-increasing, protocols.[24] As part of their response to the challenges arising from COVID-19, many economies have been making increased use of digital tools to implement measures aimed at streamlining processes and documentary requirements at the border. Examples include establishing specific COVID-19 online information portals -- typically for easy access to all relevant measures for traders across the world --, acceptance of digital trade-related documents in place of physical copies (including sanitary and phytosanitary certificates), or increases in the number of procedures benefitting from electronic pre-arrival processing. Many of these reforms are win-win reforms that could outlast the pandemic, and lessons about what worked can support additional reforms both to the benefit of the economy in normal times and in promoting the resilience of trade to a range of future shocks. The OECD *Trade Facilitation Indicators* (TFIs, covering over 160 countries) highlight the areas where countries can do more, including transparency and predictability, streamlining and automating border processes, and co-operation among border agencies to manage new protocols. These will be particularly important in planning for the distribution of vaccine(s) and related inputs. In addition, the growing number and diversity of digitally ordered parcels crossing borders means that border agencies need to manage risks over a more numerous set of consignments while aiming to facilitate trade of all safety- and quality-approved products.
- ***Stable, transparent and predictable trade and investment policy regimes*** reduce information and uncertainty costs for business. More open-policies facilitate supply chain diversification choices by business. Efforts to facilitate investment should be intensified, including by providing clear, transparent and stable regulatory conditions (including predictable and risk-proportionate interpretation and enforcement of rules in line with the *OECD Regulatory Enforcement and Inspections Toolkit*). Strong investment climates in line with the *OECD Policy Framework for Investment* will help increase investment flows and ensure FDI plays a role in a resilient global economy.
- ***Ensuring the resilience of critical infrastructure underpins the flow of goods, services and people.*** There is a need to shift from asset protection to system resilience to account for the

[23] Trade facilitation reforms reduce fixed and variable trade costs, helping MSMEs not only to become importers and exporters, but also helping those MSMEs that already export and import to increase their volumes. Measures such as streamlining of procedures, automation of the border process, simplification of fees, or inclusion of smaller firms in consultation processes have the largest differentiated impacts on MSMEs relative to larger firms. See López González and Sorescu (2019).

[24] Examples of new protocols at borders during the first COVID-19 wave included: introduction of additional controls and inspections; requirements for traders and shippers to present extra information and documentation to border agencies, including related to at-the-border health checks; adjustments to release and clearance of goods procedures in response to temporary staffing disruptions due to confinement and physical distancing measures; and adjustments to port call processes.

increased interconnectedness and interdependencies between infrastructure assets and sectors. Most OECD governments developed dedicated critical infrastructure policies in the 2000s, with a security lens following 9/11, and regulators have had policies and tools in place to ensure service quality and risk management in the critical sectors for years. However, shock events in recent years -- such as the Great East Japan Earthquake, Hurricane Harvey in the United States, the cyber-attacks on the Ukrainian electricity grid or the Genoa bridge collapse in Italy -- have demonstrated the diversity of disruptions affecting critical infrastructure and the cascading failures they can create. This underscores the need for sectoral and single-hazard policies to be complemented by more holistic systems approaches, such as that recommended in the OECD *Policy Toolkit in the Governance of Critical Infrastructure Resilience* (Box 2.4).

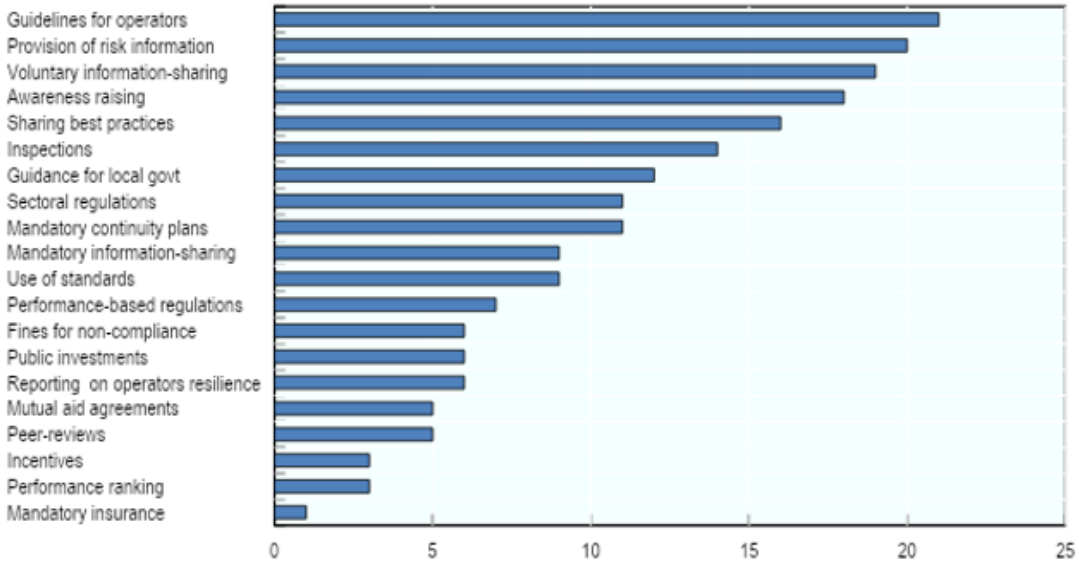
Box 2.4. Ensuring the resilience of critical infrastructure

The OECD Policy Toolkit in the Governance of Critical Infrastructure Resilience calls for a focus on the continuity of the most critical functions and services against multiple hazards and threats, and for built-in resilience measures across the infrastructure life cycle -- from design and planning to operations and retrofitting. This requires robust governance models to enable infrastructure operators to understand their exposures and vulnerabilities to disruptions, including those caused by third parties, as well as to define collectively what resilience levels should be and how to pay for upfront investments needed to ensure a system's robustness.

While operators and governments agree on the need to protect critical assets and maintain service, their views may differ on the level of resilience required, the means to achieve it, and the regulatory requirements that should apply. Resilience leads to greater reliability of essential services, but it comes at a cost. A key question is how business models can integrate those costs up-front, while limiting repercussions on costs to customers on the back-end. Public-private co-operation between governments and operators to encourage dialogue on these issues is useful for jointly setting and implementing critical infrastructure resilience and security policies. Establishing trust, ensuring secure information sharing, developing cost-sharing mechanisms and strengthening international co-operation are among the key challenges to be addressed in creating such partnerships, and require appropriate governance mechanisms.

Governments can choose from a variety of policy tools for strengthening critical infrastructure resilience. In a recent survey (OECD, 2019), the OECD identified twenty-two such tools ranging from prescriptive regulatory tools and compensation mechanisms to voluntary frameworks based on partnerships (seeFigure 2.1). It is important for governments to find the right balance between mandatory and voluntary frameworks to enhance stakeholder engagement in the process and ensure that investments in resilience are effectively made.

Figure 2.1.Use of policy tools for critical infrastructure resilience across



Note: Twenty-two OECD countries responded to this survey in 2018.
Source: OECD (2019).

2.5.2. Governments may also consider specific measures to ensure supply of essential goods

106. Beyond reforms and investments to create the conditions for resilient global supply chains more broadly, governments may want to consider specific measures to address the issue of ensuring the supply of specific essential goods. In the wake of the COVID-19 crisis, as countries (and companies) re-assess risks and the costs-benefit ratio of risk management strategies, there are a range of options for action which can serve to promote the resilience of supply of a range of essential goods (which can vary over time and depending on the nature of the shock) in the context of a range of future shocks:

Reviewing and improving regulatory systems to make them more risk-proportionate, agile, and flexible when coping with crises situations, is essential to ensure that countries are able to mobilise all available and potential supply sources without undue delays or constraints. Regulatory reforms include simplified, risk-based procedures for market approval (recognition of equivalence of foreign standards/approval methods, reduction in procedural steps), as well as facilitation of market entry for domestic operators seeking to change or scale-up activities to meet market gaps. In the transport sector, for instance, in the context of COVID-19, rail regulators prioritised the operations of essential supply chains; the *Autorité de Régulations des Transports* (ART) in France, for example, gave priority to freight trains to support supply chains of critical sectors (such as agriculture and health). In Greece, the rail regulatory authority proposed an extension of certificates and licenses, to enable freight trains to continue operations.

- ***Working with the private sector on risk assessment and stress tests for supply chains***. Resilience is built at the firm level, but governments can mitigate supply chain risk by facilitating the development of stress tests to assess vulnerabilities in specific supply chains. Stress tests could anticipate surges in demand, identify potential supply chain bottlenecks, collect and disseminate information on the concentration of production, and the possibilities for diversifying sources of supply as part of risk management and resilience strategies, clarify the scope of essential products (from inputs to final outputs) and identify paths to increased production. Based on such stress tests and risk assessments, countries can also require suppliers of essential goods to implement contingency plans to avoid or mitigate supply disruption. Such an exercise would be an important precursor to effective approaches to stockpiling.
- ***Upstream agreements with firms to reconfigure supply chains*** to produce essential goods. In the context of COVID-19, initial shortages of masks saw extensive efforts to reconfigure supply chains. In China, the ten-fold increase in production of masks was enabled by participation by companies across a range of sectors from cars to baby goods.[25] Such reconfiguring is not always feasible: some goods or parts of goods can be rapidly reproduced; others require a higher degree of specialisation or capital investment and cannot be rapidly reconfigured. Agreements can be developed with companies in the domestic market that can potentially convert their production lines. These companies need to be prepared with the relevant capital investments and access to inputs (some of which may need to be imported). Governments can coordinate such efforts and provide subsidies or financial incentives for firms to participate in a contingency programme (OECD, 2020b). Consideration could also be given to paying for additional redundancy capacity in efficient producers located outside the home country, as a cost-effective alternative, with appropriate safeguards against export restrictions.

[25] The carmaker BYD, a joint venture between SAIC and General Motors, DaddyBaby (a manufacturer of baby goods), Foxconn (the company manufacturing iPhones for Apple), and China Petroleum and Chemical are all examples of companies that started to produce face masks at a large scale (i.e. more than 1million per day). “China pushes all-out production of face masks in virus fight”, *Nikkei Asian Review*, 19 February 2020, cited in OECD (2020b).

  - One strategy that a number of governments are considering, and which may be worth further exploring for selected essential goods, would be for the State to commit to regular purchases of a minimum quantity from a locally-established supplier at a set price in exchange for a commitment by the latter to stand ready to temporarily scale up production in the case of an emergency surge in demand.[26]

- ***Stockpiling for essential goods***. As governments re-assess risk, they are also considering whether, or the extent to which, they need to stockpile essential goods. Stockpiles can be part of an effective risk-management strategy and are used by both firms and governments. Key issues for consideration include:
  - *The choice of essential goods for stockpiling*: while some products (such as masks) can be easily stored, not all products can readily be stockpiled and there is a risk of "generals fighting the last war" (stockpiling masks based on the current experience when the next crisis might call for syringes). For some goods, a choice may need to be made between stockpiling a final good versus critical inputs.
  - *The optimal risk-management strategy:* there are opportunity costs in investing in stocks of goods as a risk management strategy (this is likely to be the case, for example, for already strained health budgets). Assessments of the probability and impact of shocks and risks is a key consideration in the cost/benefits of investing in stockpiles. A further consideration is the most cost-effective way of building stocks. Global sourcing may reduce the costs of building stockpiles.
  - The *respective roles of the public and private sector* and how stocks should be best managed;

- As experience with food has shown [Deuss (2015); OECD (2018)], *management of stockpiles* is not straightforward; even beyond issues of perishability, are decisions about access and release. Here new data-driven innovations have the potential to facilitate dynamic and cost-effective management of stockpiles of essential goods. Anticipatory and scenario-planning approaches can also help governments better plan for the type and amount of essential goods that may be required, and therefore the level (and placement) of stockpiles to buffer surges in demand.
- Lastly, *stockpiling can also benefit from international co-operation*. First, because if countries simultaneously build stockpiles they can compound problems by causing price surges and shortages, while simultaneous release can cause prices to collapse and producers to exit the market, undermining future supply. Second, and more positively, regional stockpiles of some essential goods may be a cost-effective solution, notably for poorer countries.

2.5.3. International co-operation is also essential for resilient global supply chains

107. While governments can take a number of actions at the national level, ensuring resilient global supply chains can require collective efforts at the international level. This can involve the full range of international economic co-operation tools, from multilateral, plurilateral and bilateral agreements, to softer forms of policy coordination and peer review (such as in the G20), and OECD guidelines on RBC, international regulatory co-operation and policy transparency initiatives. Transparency is critical in helping governments manage fast-evolving crises, including by learning from each other, building confidence in supply and trust in global markets, and helping avoid harmful policy choices such as panic buying or hoarding. Some of the key actions include:

[26] As an example, approaches along those lines have been implemented in electricity production, in the form of a "capacity market", which is a mechanism for governments to ensure that electricity supply continues to meet demand as more volatile and unpredictable renewable generation plants come on stream (see https://www.engie.co.uk/wp-content/uploads/2016/07/capacitymarketguide.pdf).

- ***Boosting transparency on essential goods*.** Transparency is an essential underpinning of well-functioning global markets able to provide a resilient supply of essential goods. However, transparency is not automatic. Governments are not monolithic entities, but rather hold information in silos and at different levels of government. In order to build a coherent picture of needs and availability, governments must first invest in standardising and gathering comparable information at both the national and international level, monitoring market and policy developments, and communicating clearly about the findings. During extreme situations such as the COVID-19 outbreak, market conditions change quickly, and increasing the frequency of monitoring and reporting is necessary to support informed decision-making. This is more easily achieved where there is an existing infrastructure to build on or scale up (such as for data reporting), underscoring the importance of investing upfront in the necessary mechanisms and institutions, including for data governance. Timely information to underpin decision-making in times of crisis depends on the investments made in calmer times. Communications of information on essential goods, in particular by centres of government, can help reduce confusion and minimise hoarding and/or other behaviour that aggravates real or perceived shortages.
    - For agrifood, the AMIS (Agricultural Market Information System), created in the wake of the food price crisis of 2007-8 for governments to share information on markets, policies and stocks for key commodities, has underscored the value of timely information and transparency in preventing crises induced by panic buying, hoarding or export restrictions. AMIS rests on co-operation among major importing and exporting countries, with a commitment to providing timely information. There are a number of useful lessons from the food price crisis for international co-operation on essential goods (see Box 2.5).
    - Transparency on trade-related measures helps maintain confidence in global supply. Notifications to the WTO of trade measures taken in the pandemic has both provided needed information and facilitated peer pressure. According to the WTO (2020b), 41 new COVID trade measures were recorded for G20 economies between May and October 2020, of which just over half (56%) were trade restrictive (largely export bans). By mid-October 2020, just under one third (27%) of restrictive measures had been repealed, and almost two thirds (63%) of the remaining measures were trade facilitating. Transparency provided through international organisations can also play an important role where domestic regimes do not facilitate policy transparency at the national level.
    - Transparency also serves to build citizen trust in government's management of a crisis. Even when the government does not have all the answers, regular updates and honest responses can strengthen compliance with executive action such as confinement or evacuation orders, fight disinformation, and reinforce preventative measures.
- ***Collaborative approaches to strengthen public procurement processes*** -- including at the international level -- and to understand their impact on global supply chains. Cross-border sharing of information on risk-management intelligence, availability of essential goods, prices, market research and contacts and brokers, serves to inform procurement strategies and to smooth over global supply chain disruptions. Furthermore, regional or bilateral standardisation of procurement procedures, joint procurement agreements and lending agreements can help smooth over temporary disruptions in the flow of goods by simplifying cross-border transactions, facilitating the sharing of goods and inputs, and improving buying power -- especially of small states.

Box 2.5. International co-operation and essential goods - lessons from the food price crisis

The period 2006-8 saw huge increases (in some cases, of the order of several hundred percent) in prices as well as price volatility for staple food crops, leading to global concerns over food security and, in some countries, food riots. High prices and price volatility for some crops (such as wheat) were caused by a "perfect storm" of underlying factors (drought in key producing countries, low stocks, increased used of feedstock for biofuels and higher oil prices). These problems were exacerbated by policy measures by governments, notably hoarding, biofuel policies and export restrictions. Moreover, other crops (such as rice) that did not suffer from the same underlying factors also experienced significant price increases and volatility but essentially caused by panic buying, hoarding and export restrictions. In early 2011, the FAO's food price index was again at the level reached in the peak of the crisis in 2008 and fears emerged that a repeat was underway (FAO, IFAD, IMF, OECD, UNCTAD, WFP, World Bank, WTO et al. (2011)).

In response, the 2011 French G20 Presidency sought agreement amongst Agricultural Ministers from G20 countries on a range of measures to avoid a recurrence of these issues. A key issue to be addressed was the lack of a shared information base on the level of food stocks, or production outlooks, and of a common understanding of the forces and factors that had caused the earlier food price crisis. To address this, the AMIS (the Agricultural Market Information System) Initiative was established, which brings together market analysts, government experts from the major agricultural producers and traders (including those outside the G20) and international organisations and under which participating countries committed to provide timely, transparent information and analysis on markets, policies and stocks of the main staple food crops (maize, rice, wheat and soybeans).

But, beyond a shared technical understanding, it was also essential to build a network of policymakers to establish the relationships to enable them to work together to address emerging challenges. AMIS thus also includes a Rapid Response Forum, which brings together senior government officials from the 28 AMIS members. The Forum meets annually to build understanding, drawing on the shared information base that AMIS provides, but also meets on an as-needed urgent basis to exchange information and coordinate policy responses in the event of severe food price volatility.

AMIS has subsequently played an important role in avoiding a repeat of earlier crises, building confidence and trust across countries and calming markets with timely and transparent information. Important elements for success have been: (i) the recognition of common interests in stable and open global markets by both importers and exporters; (ii) the development of better information and a shared, objective evidence base, with experts from the private sector, governments and international organisations talking together; (iii) embedding these new mechanisms within existing structures, from the G20 as the basis for negotiation, through to drawing on IOs such as the FAO and OECD to ensure implementation; (iv) the commitment of participants to providing transparent and timely information on stocks, market developments and policy intentions; and (v) the creation of an architecture to create the habits of dialogue and trust, and the expectation that in future such global challenges would be dealt with collectively.

- ***International regulatory co-operation*** to address heterogeneous health and other measures that add to uncertainty and compound supply chain challenges. In addition to communication and information-sharing to assist sectors in adjusting to changing requirements, international co-operation can focus on:
  - Collective action among governments, firms and international organisations to promote consistency in the application of measures. In particular, the development of common approaches, such as agreements on simplified procedures and adoption of international standards to facilitate the flow of essential goods, can benefit from co-ordinated efforts among all these actors. International organisations have the institutional setting and technical expertise to promote a common understanding of the specific products that are relevant to fight crises such as COVID-19 and thus can help focus regulatory co-operation across countries and in time facilitate the availability of essential goods. Similarly, recognising conformity assessment procedures – such as testing conducted by partner economies -- can facilitate regulatory delivery by expediting administrative procedures.
  - Systematic use of international regulatory co-operation is essential when developing emergency measures to increase predictability and fostering consistency of policy approaches and mitigate unnecessary impacts on trade, as indicated in the draft OECD Best Practice Principles on International Regulatory Co-operation. Typically, regulatory impact assessments offer a privileged opportunity to assess trade impacts and impacts on foreign jurisdictions. Conversely, the notification of draft emergency regulations with a significant impact on trade to international organisations provides an important means by which to alert and draw inputs from foreign stakeholders. Finally, using international standards as a basis for domestic measures may prove particularly useful to ensure they are coherent with those chosen by other countries.

- ***Harmonizing approaches to avoid unnecessary frictions and negative transboundary effects***. Policies in one country can have transboundary effects on one or more countries, particularly in today's interconnected global economy. Some essential principles, such as those embodied in the *OECD Recommendation on Policy Coherence for Sustainable Development*, can help countries equip policymakers with the necessary institutional mechanisms and policy tools to avoid frictions and anticipate and address negative transboundary effects of policies.
- ***Disciplining export restrictions***. Export bans hurt the poorest countries (which generally lack production capacity), while causing increases in world prices and domestic production costs. Export restrictions can also backfire on the country imposing them when those countries, in turn, need to import intermediate inputs to sustain domestic production. Export restrictions create uncertainty that affects firms' investment strategies and reduces confidence in international sources of supply (and demand) -- hurting everyone in the medium term by undermining incentives for production. The lesson of the food price crisis of 2007-08 is that export restrictions undermine food security for everyone.
  - An important step in the COVID-19 crisis was agreement by G20 Trade Ministers on 30 March 2020 that any emergency trade measures designed to tackle COVID-19, if deemed necessary, must be targeted, proportionate, transparent and temporary, and do not create unnecessary barriers to trade or disruptions to global supply chains and be consistent with WTO rules.
  - There is scope to build on this and to strengthen WTO rules on export restrictions. This could be important not only for essential medical goods, but also for critical raw materials (see Chapter 3).

- ***Reinforcing predictable, rules-based trade.*** A range of initiatives are under discussion among groups of WTO Members to reinforce open and predictable trade in medical goods.[27] More broadly, trade and investment policy can contribute to resilience in global supply chains and ensure that open trade and investment drive recovery, but can also risk compounding policy uncertainty, contributing to higher trade costs, lower productivity, and slower income and job growth. A stable, predictable rules-based international trading system will be important in underpinning a strong, sustainable recovery from which all countries can benefit.
  - Reinforcing confidence in and commitment to the rules-based trading system will require efforts to address gaps in the rules that have given rise to growing trade tensions, such as those relating to government support (see Chapter 3).
  - Unilateral actions or retaliatory trade wars that threaten the access of countries to inputs and markets in global supply chains undermine confidence in those supply chains and in global supply more generally. This creates a vicious circle where one departure from rules-based trade, in the form of new and unpredictable trade barriers, leads to another in the form of increased government support and trade protection, leaving everyone worse off.

2.6. Some governments are reconsidering the role of global supply

108. Some governments have suggested that, in order to avoid temporary shortages, including during crises, in addition to stockpiling and upstream agreements with firms to boost supply in case of emergencies, ***investing in domestic production capacity*** is necessary to ensure the supply of some essential goods. Such capacity could be developed with the aid of incentives (such as tax breaks, subsidies or other forms of government support), and may require trade protection (such as tariffs or local content requirements).

109. When addressing the issue of domestic supply, it is important to not just focus on domestic production capacity, but also to address issues of market barriers, pricing, distribution and market information. Domestic production is not a silver bullet, and is itself tightly integrated with global supply. Moreover, experience from the COVID-19 response shows that supply-side shocks also appear to have occurred in sectors with national production capacity, where there was little vertical integration and thus high dependency on imported inputs for production of many final goods.

110. Other debates have focused on whether the supply of certain essential commodities is overly concentrated and the extent to which this represents a source of risk. Indeed, this has been suggested as an important focus for supply chain stress-testing. In some cases, concerns over concentration of supply are based on specific risks seen as being associated with the supplying country or region (such as political instability, geopolitical tensions or exposure to natural hazards). Concentration can reflect specialisation (including in capital-intensive sectors requiring long-term investments) or comparative advantage (or indeed, the presence of scarce raw materials). Depending on the reason, the costs versus the benefits, or even the feasibility (including in terms of the time-frames and scale of investments required), of addressing this may differ. Options include efforts to diversify sources of supply, including through cooperative agreements with other countries (see Chapter 3), through to active strategies of supporting the development of domestic producers.

[27] At its Ministerial meeting on 23 November 2020, the Ottawa Group (a group of 13 like-minded WTO Members) agreed on an initiative calling on WTO Members to work toward enhanced global rules to facilitate trade in essential medical goods. The Ottawa Group includes Australia, Brazil, Canada, Chile, the EU, Japan, Kenya, Korea, Mexico, New Zealand, Norway, Singapore and Switzerland. See https://trade.ec.europa.eu/doclib/press/index.cfm?id=2215e.

111. Where efforts are focused on supporting development of domestic production capacity, there are a range of issues to consider, requiring complicated assessments and political economy trade-offs. These include:

- ***Choice of products/sector***: there can be a range of views about which goods and services can be considered essential, and there are risks that policy debates become captured by other domestic sectors seeking to benefit from government support or trade protection. What is considered essential may also vary with the nature of the crisis. This can pose particular challenges when newly essential products (e.g., hand sanitiser) may have previously made different cost-benefit choices in their risk-management strategies than other, more transitionally essential sectors (such as food).
- ***Feasibility of re-shoring (including in terms of supply of necessary inputs) or of developing domestic production capacity:*** not all sectors can be re-shored, or the expected gains in terms of certainty of supply may not be achieved where key inputs, including raw materials, are available only from certain locations, and thus must still be imported. In some cases, significant investment or expertise (including tacit knowledge that is hard to acquire quickly) may be required for production capacity. For many countries, notably developing countries, re-shoring may not be an option – notably for higher-technology medical or other goods and services. For some essential goods, the issue is not so much one of production capacity, but rather ensuring regular demand in non-crisis times as part of the production business model.
- ***Opportunity costs of public funds:*** where re-shoring requires government support (in the form of foregone revenues resulting from tax breaks or direct budgetary transfers), there are debates over whether public funds are best spent to promote specific activities or to fund more general investments in public goods and services (such as digital infrastructure or education). For example, in Australia, protection for the automotive sector supported around 40 000 jobs, but at a cost of around AUD 30 billion over 1997-2012 (AUD 2 billion per year). This support was found to have forestalled, but not prevented, the significant structural adjustment facing the industry (Australian Government Productivity Commission (2014)); there were also environmental spillovers as the high costs of new cars kept ageing cars on the road. (See also Chapter 3).
- ***Possible costs of introducing other distortions into markets via trade protection and support for certain goods and sectors, and related spillovers:*** while supported sectors may benefit, downstream users and consumers can face higher costs. Activities supported solely by protection are unlikely to be sustainable, with costs often increasing over time. They are unlikely to be sufficiently competitive to be able to generate other jobs; indeed, they may cost jobs in other sectors by raising input costs. For example, additional US tariffs on Chinese tyres in 2009 are estimated to have cost at least USD 900 000 a year for each job saved and were associated with three times as many job losses in other sectors (Hufbauer and Lowry, 2012).
- ***Impact on other countries, including their incentives to adopt similar policies, or on global supply for the poorest countries:*** whether out of retaliation for loss of market access or loss of confidence in global markets as important players re-shore certain activities, re-shoring by one country can have cascading effects on others. With fewer players in global markets, supply for those countries dependent on global markets can become compromised. Given the connectedness of the global economy, there can be multiple effects including on firms' risk management strategies for other countries.
- ***Extent to which this strategy mitigates risks and promotes resilience of supply, including cost/benefit analysis with alternative policies in the toolkit.*** There are no risk-free locations or activities: the issue is how those risks are managed and supply best assured. Given the above, governments need to make a careful assessment of whether the goal of ensuring supply of essential goods is being effectively met by re-shoring production, including whether risks and the means to manage them are actually increased or reduced. Governments also need to consider

cost-effectiveness, including in light of whether the other options in the toolkit outlined above can more efficiently also ensure the stated policy objective of ensuring supply of essential goods. Transparency over measures and support provided is critical to allow for informed public assessment and debate on trade-offs.

2.7. Conclusion

112. In an interconnected global economy, shocks in one part of the system can reverberate around the world. COVID-19 is but the latest example, and is giving rise to debates about how to ensure the resilience of the global economy, and in particular of the global supply chains that underpin the provision of many essential goods. It has also led to questioning of global supply itself, as a source of additional risk. Global supply can indeed be a source of shocks, but it is also the means of managing shocks that occur domestically. There is no risk-free environment; the challenge is to build resilience to risk and shocks, notably in supply chains for essential goods.

113. While the private sector plays a key role in managing risks in global supply chains, governments also play an important role and have a range of tools at their disposal to promote resilience. Some of these involve working with the private sector, such as to promote transparent and beneficial supply chains through RBC. Others are “no regrets” investments and reforms that can be undertaken domestically, such as investments in critical infrastructure, digital infrastructure or trade facilitation. Even here, however, benefits can be greater when other countries act as well. Some actions require co-operative efforts across countries, such as international regulatory co-operation on standards or efforts to boost policy transparency or disciplines harmful policies such as export restrictions.

114. A number of measures are targeted specifically at ensuring the provision of essential goods, notably in times of crisis. Other measures in the toolkit for essential goods can range from stress tests and addressing concentration and bottlenecks in supply chains, to stockpiling, or advance agreements with firms to adapt production lines to increase supply. Some governments are looking to build domestic production capacity for certain goods, using subsidies, incentives and possibly trade protection.

115. All the approaches in the toolkit come with costs and benefits. This chapter aims to clarify some of the issues and trade-offs involved in difficult choices. Some concerns -- notably those related to national security -- are not specifically addressed, as countries are best placed to assess their security concerns; this report aims to shed light on the economic issues to be taken into account as governments weigh actions and approaches.

116. While governments have a range of options and the context and trade-offs will vary, one consistent message is that resilient global supply chains require co-operation – public and private sector, government and citizens, across countries. Co-operation both builds and requires trust, and transparency is a critical first step for building both co-operation and trust.

117. The role of international co-operation in building a trusted, fair and resilient global economy is the focus of the next chapter.

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Chapter 3. INTERNATIONAL RULE-MAKING FOR RESILIENT, OPEN AND INNOVATIVE GLOBAL MARKETS

3.1. A resilient global economy needs strong institutions, rules and norms to ensure open, fair and innovative markets

118. For integrated global markets to serve as a source of resilience, including in the face of shocks such as COVID-19, governments need to have confidence in them; equally, improving the resilience of the global economy requires action to ensure that global markets are indeed open and fair. Building a resilient global economy and fair and open global markets is the work of international economic co-operation. This co-operation draws on the full range of instruments, institutions and mechanisms to develop the rules, norms and standards that underpin the global rules-based system.

119. However, while the global rules-based system provides the predictability and stability that is essential in underpinning global economic prosperity and resilience to future shocks, trust in that system has been eroded. There is an urgent need to rebuild that trust.

3.2. Rebuilding trust in the global rules-based system

120. One contributing factor to the loss of trust in the global rules-based system is the growing concern, notably since the Global Financial Crisis, that the global economy is not fair. This concern is related to the belief of many citizens that the benefits of the global economy are not widely shared, that competition in the global economy is unfair and that everyone is not playing by the same rules (OECD, 2017a).[28] There are particular challenges in this respect from the rise of economic powers with very different economic systems.

121. These two concerns are inter-linked: the latter contributes to the former, both in terms of contributing to mistrust and, more concretely, because unfair practices in the global economy undermine shared benefits. Coupled with less redistributive domestic policies, and technological change, this is contributing to growing economic inequality, and "left behind" communities. In turn, this feeds public mistrust of the global economy and helps give rise to populist and nationalist movements that limit the political space for international co-operation.

122. A further layer of mistrust comes from the growth of disinformation, and the echo chamber effect of social media, where people are exposed only to views that reinforce their own. The erosion of a shared

[28] An international survey pre-dating COVID-19 found public views towards globalization and international trade have become more negative, with less than half 54% agreeing that globalization increases social inequalities and less than half (45%) agreeing it contributes to increased wages. See Attitudes on globalization on the eve of the corona crisis: 2020 GED Globalization Survey", Bertelsmann Stiftung, available at: https://www.bertelsmann-stiftung.de/en/publications/publication/did/attitudes-on-globalization-on-the-eve-of-the-corona-crisis-all

fact base and lack of trust in evidence, combined with economic inequality that limits shared experiences, are leading to further polarisation and fragmentation domestically and internationally.

123. Rebuilding trust in the global economy thus requires tackling both public mistrust and re-booting the engines of international economic co-operation, creating a virtuous circle. The aim of international economic co-operation is fundamentally local: to improve the lives of citizens. Restoring faith in the international rulebook is about demonstrating the benefits for people in their everyday lives -- from international regulatory co-operation in the supermarket, to global co-operation to ensure the supply of critical minerals for everyday technology, to international norms on investment that help deliver better jobs and decent work.

124. Indeed, international efforts to build resilient, open and fair global markets also need to be accompanied by parallel efforts at the national level, with domestic policies that promote innovation and good practices in regulation, open and competitive markets and business dynamism. Domestic policies and global rules of the road together shape a resilient, open and fair global economy.

3.2.1. Rebuilding trust in the international rulebook will require action across the whole system

125. G7 countries have long experience of the iterative process of building effective international co-operation, and of creating the habits of dialogue and trust. From formal gatherings such as the G7 and the G20, to a range of broader international partnerships and informal dialogues, co-operation builds understanding and trust, which enables further co-operation to underpin both national security and economic prosperity.[29]

126. International organisations play a key role, underpinning this process with evidence and analysis; serving as the convening forums to bring countries together; working with countries to create the rules, norms and standards that form the “rules of the road” for the global economy; and providing the architecture for ongoing international co-operation. International organisations need to ensure that their processes for developing rules and standards are transparent and inclusive. The governance and rulemaking procedures of the institutions developing international economic rules need to follow the most ambitious criteria to ensure the transparency, inclusiveness and relevance of their rules worldwide. International organisations also need to ensure that standards are implemented, monitored and evaluated -- by governments or international organisation secretariats -- to ensure their continued relevance and effectiveness.

127. International organisations are increasingly working together, combining their expertise to help address global challenges. One such example is the OECD-hosted *Partnership for Effective International Rulemaking*, which brings together more than 50 international actors developing international rules and standards (Box 3.1). The Partnership has shed light on the specific challenges that international organisations face in ensuring the effectiveness of their international normative action; taken stock of the efforts of individual international organisations to deliver better on their mandate; and provided impetus for international organisations to undertake collective efforts to strive for quality and relevance in an increasingly diverse and rapidly evolving global governance landscape. “The Compendium of International Organisations’ Practices” under development by the Partnership, as well as various targeted studies of international organisations’ governance and rulemaking practices (including ISO/OECD (2016) and OECD/WTO (2019)), can help inform and support countries as they rethink and reform multilateralism and thus reinforce confidence in it.

[29] While not the focus of this chapter, national security of course underpins economic prosperity, and economic prosperity contributes to stability and national security.

Box 3.1. OECD Survey on rulemaking by international organisations

A 2016 survey of 50 international organisations (IOs) led by OECD helped identify priority actions to strengthen the impacts and outcomes of international rules and standards developed.

By comparing the rulemaking processes of the 50 responding IOs, the survey pointed to:

- a common need for greater inclusiveness, transparency and relevance in an ever changing world;
- the difficulties of monitoring implementation and evaluating the impacts of international standards and legal instruments; and,
- broadly speaking, an institutionally-crowded international scene, in which relevance, flexibility, focus and efficiency are a concern for all international bodies.

Drawing on these common priority areas, the Partnership for Effective International Rulemaking brings together 50 IOs continuously working together to improve their rule-making processes by being more transparent and inclusive; ensuring more systematic implementation of their rules; measuring the actual impact of their rules; and avoiding duplication.

Source: OECD (2016a).

3.2.2. Using the full range of tools for international economic co-operation

128. Building a resilient global economy and fair and open global markets requires investments across the full range of tools for international economic co-operation -- ranging from binding rules (as negotiated, for example, in the WTO or in the context of preferential trade agreements), to soft law principles, recommendations and guidelines (such as those agreed at the OECD), and more informal norms and values as expressed in, and underpinned by, forums such as the G7 and G20.

129. A sustainable and resilient global economy requires investments in the building blocks of open, integrated and fair global markets. International economic co-operation in this sphere notably relates to development of international rules and standards. These not only prevent market fragmentation by creating the conditions for exchange across countries with different regulatory systems and preferences, but also ensure that important shared global policy objectives -- such as environmental sustainability and human rights --are respected. Various forms of international regulatory co-operation can help to reduce unnecessary trade costs, as well as align policy approaches to address common, international or global challenges that cannot be dealt by any single government alone.

130. A particular challenge facing policymakers is the need to promote a level playing field for competition, trade and investment, including addressing concerns about government support and state involvement in the economy -- concerns which pre-date, but which are set to increase in the wake of, COVID-19. In this case, effective international co-operation may require binding international rules, notably at the WTO.

131. More also needs to be done to ensure that global markets are reliable and predictable, including through access to critical raw materials and avoiding harmful practices that undermine trust, such as foreign bribery, illicit trade and other forms of economic crime. International co-operation on these issues involves standards and norms, but also new partnerships amongst like-minded countries. Promoting investment aligned with the SDGs globally, including through adherence to RBC principles, will play an important role in helping to build a resilient and sustainable global economy from which all can benefit.

132. These challenges and how to address them are the focus of the rest of this chapter.

3.3. Regulations and standards to reduce market fragmentation

3.3.1. An open, fair and resilient global economy rests on international co-operation on standards and regulations

133. While laws, regulations and standards are key tools of policy making at the national level, they can no longer be designed in isolation in today's interconnected world (see OECD, 2012a). International co-operation and co-ordination in their development is essential to understand and mitigate unnecessary trade costs for all parties, to prevent market fragmentation and to create the conditions for efficient (or indeed, any) exchange across countries with different regulatory systems and preferences. While these differences across systems impose costs, international trade is actually underpinned by, and relies on standards, which give confidence to consumers and support resilience by facilitating agility in supply chain. For these reasons, OECD analysis shows that standards, while increasing trade costs, also tend to be trade increasing and that there are significant gains for all countries from greater co-operation in this area.[30]

134. Moreover, the issue is not the regulatory objectives, which may in fact be shared across countries, but more often the application of different standards or methods to achieve those objectives, which can unnecessarily raise costs for businesses seeking to access more than one market. OECD work shows that, for most economies, the costs associated with non-tariff measures (NTMs, which include regulations and standards) are between two and 10 times the costs associated with tariffs (Cadot, Gourdon and van Tongeren, 2018). These costs may involve the costs of: (i) gathering information on regulatory requirements in target markets; (ii) adjusting the specification of goods and services to comply with different regulatory requirements; and, (iii) undertaking various conformity assessment procedures to demonstrate compliance (OECD (2017b). Higher costs than necessary can be especially burdensome for MSMEs. In the context of the COVID-19 crisis, the adoption of emergency measures by governments worldwide, often in short time-frames, have the potential to further increase trade costs due to regulatory fragmentation. Such costs may be particularly harmful when they slow the provision of essential food or medical goods (OECD, 2020a).

135. While trade costs related to standards and regulations (information, specification, conformity assessment) are unavoidable, they can be reduced without compromising regulatory objectives through international regulatory co-operation. Governments can take a number of measures as part of this co-operation, ranging from improving the transparency of standards and regulations and strengthening good regulatory practices more broadly (including whether regulations are consistently applied both to domestic and foreign firms; and whether they are based on the best available scientific evidence and other technical information, and proportionate to the goals being pursued), to promoting mutual recognition of conformity assessment and the adoption of international standards.

136. In the context of the COVID-19 crisis, momentum has grown for international regulatory co-operation to help tackle the crisis but also to strengthen the resilience of global supply chains and co-ordinate efforts towards recovery (see OECD [2017b] and OECD/WTO [2019]). International standards in particular have been used in different contexts precisely to promote the supply of critical products. The EU Commission, the European Committee for Standardization (CEN) and the European Committee for Electrotechnical Standardization (CENELEC) have made freely available 11 pre-existent European standards for medical devices and personal protective equipment, including masks, gloves, and other PPE (OECD, 2020a). Many private international standard setting organisations are also providing no-cost public access to relevant standards to promote the supply of critical products. For example, the International

[30] Reducing regulatory heterogeneity can reduce trade costs associated with non-tariff measures and allow strong, positive impacts on bilateral trade flows when countries cooperate to reduce unnecessary trade costs related to measures such as Sanitary and Phytosanitary (SPS) and Technical Barriers to Trade (TBT). See Gourdon, Stone and van Tongeren (2020) and OECD (2017b).

Organisation for Standardization (ISO) has made available 28 ISO standards related to medical devices (ISO, 2020), and has co-ordinated with the International Electrotechnical Commission (IEC) to make standards for critical care ventilators freely available (IEC, 2020).

137. The draft OECD *Best Practice Principles on International Regulatory Co-operation* will support governments in making better and more systematic use of the variety of international regulatory co-operation tools available to them. This includes supporting collective action among governments in the management of the global commons, favouring fluid international trade and strengthening the resilience of global value chains. As noted in Chapter 4, international regulatory co-operation is becoming ever more important in the context of the digital transformation, including to promote interoperability of regulatory approaches and learning across jurisdictions in the face of new regulatory challenges.

138. To best support governments in international regulatory co-operation, international organisations, and private standard-setting bodies in particular, must continuously strive for excellence in their governance and rulemaking processes, and develop standards that are transparent, inclusive, effective, evidence-based and coherent (see Box 3.1 above). Greater use of high-quality international instruments by national regulators to address today's policy challenges will play a key role in overcoming the costs and challenges posed by fragmentation of policy-making.

3.4. Ensuring a level playing field: government support and state owned enterprises

3.4.1. International action is needed to tackle market-distorting government support

139. While government support is not new, there are growing concerns about the role of such support in the global economy, notably in the context of economic models where the state plays a larger role in the economy. While support in agriculture is significant and longstanding, there is growing concern among firms in industrial sectors about competition from state-owned enterprises (SOEs) or firms that are otherwise benefitting from the resources of the state. These concerns have been prominent in sectors such as steel (OECD, 2018; OECD, 2020b), aluminium (OECD, 2019a) and shipbuilding (OECD, 2019b) where government support is distorting competition and leading to excess capacity by sustaining uneconomic plants or by encouraging investment in capacity that would not otherwise be built. But similar concerns are also now arising in high technology sectors, such as semiconductors (OECD, 2019c). The market imbalances caused by this support are leading to significant trade frictions and hurting the sustainability of the industries concerned. Moreover, these imbalances, including growing gaps between capacity and demand, have continued during the COVID-19 crisis, despite the severe demand downturn, and risk being further exacerbated by different speeds and rates of recovery around the world. Even as demand eventually recovers, this will not solve the underlying problems of excess capacity resulting from market-distorting government support measures.

3.4.2. Structural government support needs to be distinguished from emergency support

140. It is important to distinguish the kinds of long-term structural government support that is the focus of these concerns – and of the discussion below – from the emergency support that governments are, rightly, providing in the context of COVID-19. While the latter are necessary measures in the face of a historic economic crisis, the former represent ongoing distortions to global markets, with impacts on fair competition, jobs and ultimately faith in those markets. That said, how support is given, going in will affect whether and how that support ultimately ends (i.e. whether it becomes structural). Moreover, while government equity is an important and useful tool in a crisis, the "accidental" state ownership to which it

gives rise requires careful management if it is not to result in ongoing market distortions. This is discussed further in the context of SOEs below. Lastly, some of the support currently being granted has the explicit aim of creating new production capacity as part of industrial policy in certain sectors.[31]

141. Against the background of rising excess capacity in key sectors in the wake of the COVID-19 crisis, it will be even more important than ever to refrain from providing support that encourages companies to expand capacity or that hinders the exit of inefficient companies from the market in the long term. Governments therefore need to pay careful attention to the design of crisis-related support, and to the possible costs, including opportunity costs for scarce public resources, of such support.

142. Moreover, international co-operation that lays down ground rules for government support is also essential in ensuring that governments are able to provide the kind of support that is needed to address market failures and to support public goods, while at the same time enabling markets to play their role in sorting viable from unviable projects in order to boost productivity and living standards.

Tackling structural government support across sectors requires multilateral rules

143. International co-operation is essential to addressing government support in the global economy. Tackling government support effectively requires four things:

- transparency (understanding what's happening – how much support is being provided and in what form);
- predictability (agreement to prevent increases in support – such as by creating a standstill commitment against a baseline);
- reduction (starting with the most egregious forms of support); and
- prevention (of tomorrow's support, in tomorrow's sectors)

144. While the first three can be achieved in a variety of ways, including potentially bilaterally, only multilateral rules can deliver all four. Multilateral action also ensures that reformers are not penalised by the actions of others.

145. The OECD is playing a significant role in promoting the transparency of government support, across agriculture, fossil fuels, fisheries and industrial sectors. The *OECD Matrix of Government Support Measures*, setting out the numerous ways in which such support is provided (mechanisms and to whom it is granted, see Annex A), serves as a kind of "heat map"– some types of support are more important in some sectors than others, and some (such as tax breaks or budgetary transfers) are better understood and more easily measured than others. Work to measure government support across key industrial sectors has shown that such support is both pervasive and takes a variety of forms (Box 3.2).

[31] Additionally, the COVID-19 crisis has the potential to exacerbate protectionist tendencies. Keeping markets open during the crisis can help provide the right incentives to companies to use resources effectively, and to adjust output and capacity in ways that are aligned with true market forces and realistic expectations of future market developments.

Box 3.2. Measuring market-distorting support in industrial sectors

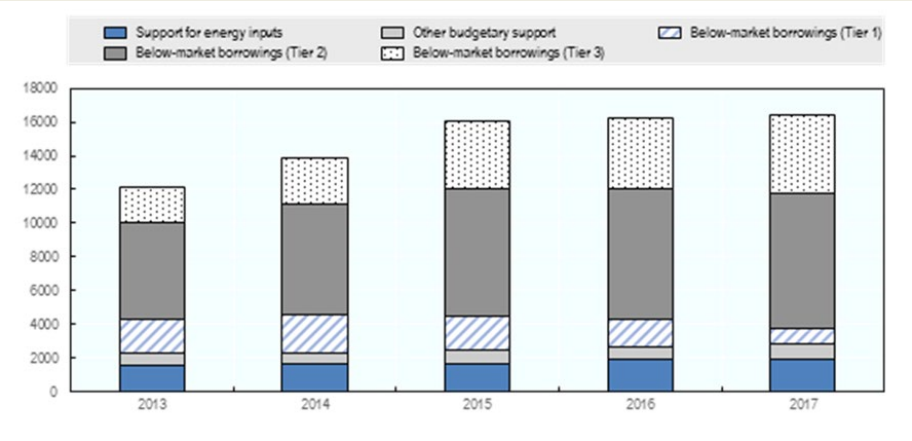
By analysing corporate filings, annual reports and other public sources of information, the OECD was able to identify and quantify government support benefitting companies that operate along the aluminium and semiconductor value chains, including a number of state enterprises. The support estimated includes budgetary support (e.g. grants and tax concessions); below-market credit (e.g. loans that state banks offer at below-market interest rates); and below-market equity returns in the particular case of firms in which governments hold sizable stakes (government-invested firms). Looking at individual recipients of support (firms) rather than providers (countries) was necessitated by a lack of transparency at the national level. A key finding is that most governments fail to disclose the amounts of support they offer to their aluminium and semiconductor producers. Moreover, this bottom up approach enabled the identification of a wider range of support, such as that provided at the subnational level, or indirectly through state-owned or directed firms.

Aluminium

Government support is non-transparent, concentrated (the top five recipients received about 85% of measured support), and large in the aluminium value chain, with total support for 17 large aluminium producers reaching USD 70 billion over the period 2013-17 (Figure B1). Aluminium multinationals obtain support in the different countries in which they operate, but large SOEs get most support from their home countries. Most support was provided to aluminium smelters by state enterprises (e.g. in the form of below-market energy from state utilities and below-market credit from state banks); this support is both non-transparent and challenging to measure. Coupled with export restrictions, government support builds through the entire value chain in the form of cheaper intermediate inputs for downstream producers of semi-fabricated products of aluminium.

Figure B1 Government support for 17 of the largest firms in the aluminium value chain reached USD 70 billion over the period 2013-17

(USD millions, current)



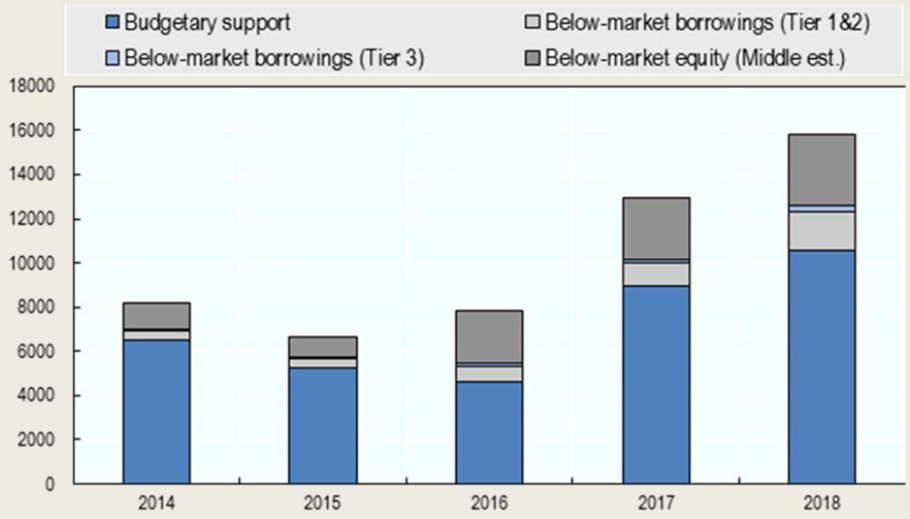
Source: OECD (2019a).

Semiconductors

Government support for 21 large firms along the semiconductor value chain exceeded USD 50 billion over the period 2014-18, with about a third of that support taking the form of below-market debt and equity (Figure B2). Another third, of all support for semiconductor firms was for research and development (R&D), which, while often beneficial for innovation, can nevertheless distort markets if poorly designed. While found in few jurisdictions, government actions that lower the cost of equity for semiconductor firms pose additional challenges for trade rules due to their complexity and opacity.

Figure B2. Government support for 21 of the largest semiconductor firms exceeded USD 50 billion over the period 2014-18

(USD millions, current)



Source: OECD (2019c).

Steel

Similar work is underway for the steel industry. The Global Forum on Steel Excess Capacity (GFSEC) allows for open and objective assessments of the challenge of excess capacity and market functioning in the steel sector to help countries work together on swift and tangible actions. Recognising that collective policy solutions and transparency are vital for market-based responses by the industry to changing conditions, there is a need for governments, on a reciprocal basis, to increase transparency through regular information sharing, analysis, review, assessment and discussion as well as regular exchanges about data and concrete policy solutions. The 2020 GFSEC Ministerial Report includes results of the GFSEC's information sharing and review (Global Forum on Steel Excess Capacity [2020]).

146. This work has also shed important new light on the nature of that government support and the implications in terms of gaps in the current international rulebook that would need to be addressed by possible new WTO rules. These key findings are:

- ***Improving transparency is fundamental for tackling government support***. Information on the nature and scale of current government support is essential to developing both baselines for reductions and effective rules to counter existing and potential new support. Yet such information remains limited. Although the WTO Agreement on Subsidies and Countervailing Measures (ASCM)

requires Members to report annually the subsidies they provide, this transparency obligation has not been well observed. In 2017, 78 Members out of 164 failed to submit subsidy notifications.[32] Moreover, there is significant variation in the extent and quality of information provided. Gaps in the rules mean that not all forms of identified government support currently fall under notification requirements. Greater transparency is also needed at the global level on the nature and extent of government ownership of commercially active firms (see below).

- ***A value chain approach is needed*** as support upstream can confer significant benefits downstream and vice-versa. Upstream support and export restrictions can serve to significantly lower input costs for downstream production, but these measures are not currently readily addressed under existing WTO subsidy rules. Additionally, production in global supply chains means that the ultimate beneficiary of government support is not always evident: that is, support to a domestic industry producing intermediate inputs for export may effectively subsidise the production of final products in another country. The effects of support in industrial sectors propagate through entire value chains that span multiple industries and countries. Measures that lower the cost of capital encourage construction of more plants than market conditions would warrant distort global markets, but may also end up benefiting suppliers of equipment to those plants. Support therefore matters not just for particular industries, but also for the entire global trading system, which points to the need for policy solutions that address the issue in a holistic fashion.
- ***State enterprises can be both significant recipients and providers of support***. While much attention has been focused on SOEs as recipients of government support, SOEs or state directed firms can also be significant providers of support, for example in the form of cheap power from state utilities or below-market loans from state directed financial institutions. It is unclear whether existing trade rules cover all of the support provided by government invested-firms; the WTO ASCM covers a financial contribution provided by a government or any "public body" but the definition of the latter in particular has been the subject of debate, notably in the context of firms with government involvement.[33]
- ***Support provided through the financial system (below-market loans and government equity injections) is significant in a number of sectors***. Such support is complex and hard to measure. That said, preliminary findings from current work to explore below-market finance (loans and equity) across a range of sectors shows that firms with government ownership of 25% or more have a significantly lower cost of debt than those with less than 25% government ownership, giving rise to concerns about possible government loan guarantees and interest-rate subsidies.
    - In many cases, for the purposes of WTO rules, the identification of below-market finance hinges on whether financing involves state actors – which again underscores the need for greater transparency on government ownership of firms. Such information is not always readily available, especially where government stakes are indirect and involve a chain of entities masking the government's beneficial ownership of industrial producers (OECD, 2019). WTO rules currently do not oblige governments to disclose the ownership structures of the firms in which they have invested. Soft law can also play an important role, by encouraging government-invested firms to enhance their corporate disclosure (as per the *OECD Guidelines on Corporate Governance of State-Owned Enterprises*, see below).

[32] WTO, G/SCM/W/546/Rev.10.

[33] SCM agreement, Art. 1.1(a)(1). In a past WTO case, the Appellate Body interpreted the meaning of "public body" as "an entity that possesses, exercises or is vested with government authority" (see Appellate Body Report, *United States - Definitive Anti-dumping and Countervailing Duties on Certain Products from China*, para 317, WT/DS379/AB/R (11 March 2011).

- ***Below-market equity (see Box 3.2) needs to be seen also as continuous support***, not just a one-off benefit. Current trade rules consider the subsidy benefit of the equity investment at the time it was made; however, continued acceptance of below-market returns by government equity investors confers an ongoing benefit in the form of a lower cost of capital. Additionally, government ownership itself can be a channel for the provision of other forms of support, such as implicit guarantees, or other firms self-selecting out of competing against firms with state ownership.[34]
- ***Disciplining below-market equity may require new rules on state ownership.*** It is unclear whether the various forms of support conferred by below market equity can be addressed by subsidy rules alone. Newer rules to discipline the behaviour of commercially active state invested firms may be required.[35].
    - In this respect, it may also be necessary to consider how to deal with the different domestic approaches to state-invested firms. OECD work on semiconductors has, for example, found that some authorities exercise significant influence over large semiconductor firms, even though these firms and their state owners may not always be formally considered SOEs by domestic legislation. This underscores the necessity to consider more than just ownership thresholds in disciplining state investments. Instead, scrutiny should extend to all government-invested firms by applying two lenses: (i) the nature of the investment (including size, but also presence of a golden share, appointment of Board members, presence of political committees); and (ii) the behaviour of the firm in the marketplace (the extent to which it is in line with commercial principles and practices).

3.4.3. Concerns are also arising in international investment

147. Concerns about the role of state-invested enterprises, and the need for greater transparency and disciplines on their behaviour goes beyond trade to investment. A particular focus of concern has been whether firms engaging in cross-border investments, notably mergers and acquisitions (M&A), are owned by a foreign government (also argued to be the source of their financial advantage in such deals). Concerns have been particularly strong about investments in high technology and other sensitive sectors, with fears about threats to their essential security interests leading many governments to introduce new or tighten existing FDI screening mechanisms (OECD, 2020c). All G7 countries strengthened their investment review mechanisms in 2020.

148. This trend is now being reinforced as a result of the COVID-19 crisis. In particular, there is now increased awareness of the need to protect health-related industries, in addition to those companies that are important to essential security and economically viable, but that temporarily suffer from financial stress and depressed valuations and could become takeover targets, including by foreign government-controlled investors (OECD, 2020d). Six G7 countries motivated some of the reforms to their review mechanisms in 2020 by referring to the pandemic, and added new sectors to the scope of the reviews, lowered trigger thresholds, or brought planned reforms forward.

149. While increased transparency on state ownership is essential, a very significant expansion of investment-screening mechanisms could however lead to overreach. Recommendations on policy principles such as the *OECD Guidelines for Recipient Country Investment Policies relating to National Security* and careful monitoring and accountability to the public can be effective means to counter this risk.

[34] It could also be argued that, in non-transparent systems, state ownership can also facilitate the provision of forced technology transfer to the firm by other firms, including joint venture partners. See Andrenelli et al (2019d).

[35] Some FTAs already include such disciplines. See, for example, the CPTPP, USMCA and the Japan-EU EPA.

3.4.4. A level playing field for SOEs is critical to maintain trust and openness in the global marketplace

150. Through trade and investment, state-owned enterprises (SOEs) play an increasingly prominent role in global value chains. While the ownership of enterprises per se needs not be a policy issue, this has nevertheless given rise to concerns because most SOEs are tasked with public policy obligations inducing them in some situations to act differently from private competitors. The challenge for regulators, and for the state as an enterprise owner, is maintaining competitive neutrality -- i.e. ensuring that SOEs are not put at a competitive advantage, or disadvantage, due to their ownership. In practice, this implies that the nature of any public policy obligations should be clarified, the costs quantified and the SOEs compensated adequately. Box 3.3 provides an overview of the main elements of competitive neutrality. Getting it wrong can have highly adverse consequences for the competition landscape. For instance, poorly designed compensation schemes could provide SOEs with incentives to expand their production, contributing to overcapacity and otherwise inefficient resource allocation.

151. Specific policy challenges may arise when SOEs' public policy objective have different impacts in the domestic economy and abroad. For example, SOEs may be provided with a shielded position in some domestic market segments, which may be leveraged into competitive advantages abroad, especially if the enterprise operates in sectors with economies of scale. A general lowering of SOEs' rate-of-return requirements or costs base can produce a similar effect. Such problems are further compounded if SOEs are explicitly tasked with carrying out tasks in their international operations that are aimed at benefiting domestic constituencies. This would include, for instance, the use of SOEs to acquire scarce resources or foreign proprietary technologies on terms that are not dictated by the acquirers' commercial interests. Such action could be seen by foreign governments as contrary to their national interest and might even trigger retaliation. To counter such scenarios a joint, multilateral commitment to competitive neutrality could be developed and enshrined in international rule-making.

Box 3.3. Ensuring competitive neutrality

According to an evolving consensus, governments wishing to obtain and enforce competitive neutrality need to focus attention on the following seven priority areas:

1. *Streamline government businesses either in terms of corporate form or the organisation of value chains*. An important question when addressing competitive neutrality is the degree of corporatisation of government business activities and the extent to which commercial and non-commercial activities are structurally separated. Separation of commercial and non-commercial activities makes it easier for commercial activities to operate in a market-consistent way. Incorporating public entities having a commercial activity and operating in competitive, open markets, as separate legal entities enhances transparency.
2. *Ensure transparency and disclosure around cost allocation*. Identifying the costs of any given function of commercial government activity is essential if competitive neutrality is to be credibly enforced. For incorporated SOEs, the major issue is accounting for costs associated with fulfilling public-service obligations (if applicable). For unincorporated entities, problems arise where they provide services in the public interest as well as commercial activities from a joint institutional platform.
3. *Devise methods to calculate a market-consistent rate of return on business activities*. Achieving a commercial rate of return is an important aspect in ensuring that government business activities are operating like comparable businesses. If SOEs operating in a commercial and competitive environment do not have to earn returns at market consistent rates, then an output from an inefficient producer may appear cheaper to customers than from an efficient one.
4. *Ensure transparent and adequate compensation for public policy obligations*. Competitive neutrality concerns often arise when public policy priorities are imposed on public entities which also operate in the marketplace. It is important to ensure that concerned entities are adequately compensated for any non-commercial requirements on the basis of the additional cost that these requirements impose.
5. *Ensure that government businesses operate in the same or similar tax and regulatory environments*. To ensure competitive neutrality government businesses should operate, to the largest extent feasible, in the same or similar tax and regulatory environment as private enterprises. Where government businesses are incorporated according to ordinary company law, tax and regulatory treatment is usually similar or equal to private businesses.
6. *Debt neutrality remains an important area to tackle if the playing field is to be levelled*. The need to avoid concessionary financing of SOEs is commonly accepted since most policy makers recognise the importance of subjecting state-owned businesses to financial market disciplines. However, many government businesses continue to benefit from preferential access to finance in the market due to their explicit or perceived government-backing.
7. *Promote competitive and non-discriminatory public procurement*. The basic criteria for public procurement practices to support competitive neutrality are: (1) they should be competitive and non-discriminatory; and (2) all public entities allowed to participate in the bidding contest should operate subject to the above standards of competitive neutrality.

Source: OECD (2016b).

3.4.5. The State as an unintended "owner": keeping emergency government support compatible with competitively neutral long-term outcomes

152. Ensuring a level playing field is also crucial in the context of a crisis. As in previous crises, in their policy responses to the COVID-19 crisis, a small number of governments have stepped in as "accidental" equity partners to avoid the collapse of systemically important enterprises (OECD, 2020e). More are likely to follow. Public assistance towards large corporations has so far focused mostly on loans and loan guarantees, but as the crisis continues, a number of companies may be unable to service their liabilities, and governments could be obliged to engage in debt-equity swaps to avoid onerous short-term fiscal impacts.

153. Such policy responses, while essential, should ensure competitively neutral outcomes to avoid long-term competition distortions. Support measures that apply to some firms in a sector but not others can harm competition and lead to significant distortions, hampering economic adjustment and resilience. Competitive neutrality is a crucial policy lens. Where state intervention for otherwise viable firms is needed to overcome the crisis in the short term, it should be targeted, proportionate, and subject to a clear exit strategy and conditions, especially where the state becomes an equity partner.

154. Enterprises with crisis-related government equity should be re-privatised as quickly as practically and economically feasible (bearing in mind the need to avoid significant public losses, or opportunities to recoup public investments) (OECD, 2019d), but, as experience shows, economies and capital markets may take longer to recover to bring value for money, and thus state ownership could persist over the medium term. Moreover, depending on the sector of activity, some governments may favour continued state involvement. This raises two concerns. The first relates to economic efficiency, as the public administration may not be adequately equipped to act as an active and informed enterprise owner. The second relating to maintaining a level playing field between public and private companies, becomes of heightened concern, especially if the state does not take care to separate its roles as shareholder from its policy making, regulatory and legislative capacities (OECD, 2012b).

155. Where the state becomes a temporary owner, institutions overseeing SOEs should act in line with internationally agreed best practices. *The OECD Guidelines on Corporate Governance of State-Owned Enterprises*, if fully implemented, safeguards market integrity and economic efficiency to the point where the ownership of the enterprises becomes largely irrelevant (OECD, 2015a). Moreover, if SOEs pursue other objectives than a private company would in like circumstances, such objectives should be clearly specified, financed in a transparent manner and not be allowed to affect other jurisdictions than the one owning the enterprises. (Box 3.4). When they participate in globalised supply chains and undertake foreign direct investments, SOEs and their owners should display a credible commitment to commonly agreed market principles, to maintain trust and openness in the global marketplace.

Box 3.4. Key principles for state intervention in times of crisis

Seven key principles to design support

1. Distinguish viable from non-viable firms.
2. Match tools to problems.
3. Consider equity assistance when suitable.
4. Safeguard integrity.
5. Ensure transparency.
6. Make financial support conditional on advancing public policy goals.
7. Strengthen government capacity to handle support to the private sector.

Governments need to manage their role in the economy carefully, especially if the state becomes an "unintended owner":

1. Plan for an exit.
2. Where governments need to stay, invest in effective state ownership.
3. Lead by example on responsible business conduct.
4. Governments must ensure that market competition is not distorted, including internationally, to uphold rules-based global trade.
5. Transparency will be key in global efforts to discipline government support.
6. Ensure coherence-of-government interventions and monitor the impact of the support measures.

Source: OECD (2020f)

156. Ensuring a level playing field in international markets rests not only on international co-operation but also on domestic policies. Economic resilience requires competitive markets and healthy business dynamism. Governments should pursue policies that enable the efficient allocation of resources and promote competition that is key for dynamic and resilient markets. For example, governments should ensure competition principles are integrated into the design of any state support measures so as to minimise competition distortions, remove unnecessary regulatory barriers to competition, reduce entry barriers in key sectors, and ensure the vigorous enforcement of competition laws that take due account of dynamic effects.

3.4.6. And governments need to address practices that undercut confidence and fair competition such as foreign bribery and illicit trade

157. Global markets are also weakened by **foreign bribery,** which distorts the level playing field and undermines good governance, in turn eroding public trust in leaders, institutions and businesses. Corruption, in short, makes economies less likely to withstand a crisis. The current COVID-19 crisis is a clear reminder of the importance of protecting trust in public institutions and business to mobilise government responses, and of fighting corruption to ensure effective access to and distribution of goods such as health and pharmaceutical products.

158. Sectors crucial to the response to COVID-19 have been historically vulnerable to foreign bribery (8% of foreign bribery cases occur in the health sector, 15% in the transport and storage sectors, and 10% in ICT) (OECD, 2014). Risks of corruption are also high in public procurement, with 57% of foreign bribery

cases involving public procurement (*ibid*). Bribery distorts these markets and can lead to the supply of inferior or fake products, costing billions of euros a year and putting further lives at risk. The extractive sector is one of the most affected, with 19% of foreign bribery cases occurring in that industry (*ibid*). Moreover, in a globalised world, bribery schemes have become increasingly complex and are often connected with other crimes such as money laundering, accounting fraud, tax evasion and extortion.

159. A strong anti-corruption framework can help keep global value chains clean and thus more resilient. The *OECD Anti-Bribery Convention* helps curb bribery in international business by establishing legally binding standards to criminalise bribery of foreign public officials.[36] It also requires its parties to sanction false accounting to disguise bribe payments, to make it an offence to launder the proceeds of foreign bribery and to deny the tax deductibility of bribe payments. The Convention is proof that international legal instruments can catalyse policy changes. Many of its 44 parties have adopted legislation ranging from the creation of the foreign bribery offence, to corporate legal liability, to whistleblower protection. The Convention, through its peer-review mechanism and government-endorsed legal guidelines, has also served as the driving force behind the promotion, development and implementation of compliance programmes, recognising that though companies participate in the problem, they can and must be part of the solution. As governments transition from addressing the immediate health crisis to focusing on economic recovery, it is crucial that countries stay the course and continue to uphold their obligations to fight transnational bribery.

160. Similarly, **illicit trade** is a serious economic crime that costs governments, societies and the private sector billions in foregone revenue and profits, translating into lost jobs, lower quality service delivery and higher inequality. Criminal networks are serious economic offenders, operating in the shadows of globalisation conducting illicit trade. For example, the OECD's latest research indicates that the global trade in counterfeit and pirated goods alone amounted to as much as USD 509 billion dollars, or 3.3% of world trade in 2016 (OECD/EUIPO, 2019). Another example is illicit trade in counterfeit and substandard pharmaceuticals and personal protective equipment (PPE), which is booming during the COVID-19 pandemic, and creating significant risks to patient health and safety (OECD/EUIPO, 2020).

161. Effective action to counter **illicit trade** and support for governance frameworks to lower the incidence of such trade are key policy concerns for governments as they support the promotion of economic prosperity. Governments have taken a range of actions to counter illicit trade, but their efforts have fallen short in many respects, as criminal networks are quick to adapt their operations to avoid detection and circumvent law enforcement. In response, governments need to enhance their efforts to counter the illicit trade, including:

- Strengthening the scope and intensity of international co-operation to counter illicit trade. This could also include leveraging the work of the *OECD Task Force on Countering Illicit Trade*, which offers an effective platform for the development of tailored policy instruments based on its rich evidence and expertise. A good example of such co-operation is the on-going implementation of the *OECD Recommendation on Enhancing Transparency in Free Trade Zones*.
- Developing and implementing national strategies to counter illicit trade, including furthering factual research on economic drivers, scale and policy gaps related to illicit trade. In this context the OECD is working on several upcoming thematic and country case studies, including illicit trade in fake pharmaceuticals, estimating the scale and economic impact of illicit trade, and gauging the relevant governance gaps.

[36] See OECD Convention on Combating Bribery of Foreign Public Officials in International Business Transactions and the OECD (2009) Recommendation for Further Combating Bribery of Foreign Public Officials, http://www.oecd.org/daf/anti-bribery/oecdantibriberyconvention.htm.

3.5. Ensuring reliable and predictable global markets

3.5.1. International co-operation is needed to ensure the supply of critical minerals

162. Trust in the global economy also means ensuring that global markets are reliable and provide predictable sources of supply. Particular concerns have arisen over critical minerals that are essential raw materials in high-technology electronic goods, national security equipment and environmental goods and services. Indeed, critical raw materials are essential for advancing the transition toward lower-carbon economies: electric cars use five times more minerals than conventional vehicles, and onshore wind plants use eight times more minerals than a gas-fired power plant of similar capacity and offshore wind turbines use about twice as many minerals as onshore turbines (Kim and Karpinski, 2020). Cobalt, lithium and nickel are used in energy-storing batteries; copper is used to transmit electricity; and some rare earth elements are used to make magnets for wind turbines and electric vehicles.

163. Greater demand combined with disruptions in demand and supply for minerals, including due to COVID-19, have resulted in strong price volatility in some minerals markets.[37] The price of cobalt, for example, increased by 400% between 2016 and 2018 (McKinsey, 2018), although prices for some larger-volume metals were lower in 2020 than in 2019 due to lower demand.[38]

164. Yet OECD data shows that more than half of the production of most critical raw materials takes place in three countries or fewer, and most of the known reserves of some critical raw materials (cobalt, lithium, rare earth elements)[39] used in high-technology and environmental goods are found in only a few regions. The top three producers of lithium, cobalt and rare earths account for more than 75% of global output. Moreover, processing of these minerals and metals is even more concentrated, oftentimes in China.

165. Some of this concentration reflects the difficulty of finding substitutes for minerals with very specific characteristics; substitution for cobalt has proven challenging while more success has been achieved in other cases (one example being diversification away from niobium). Finding alternative sources of the materials can also be challenging: 70% of production of cobalt is from the Democratic Republic of Congo, which holds over half of global known reserves, while many of the reserves in other countries are too small to be economically exploited. Diversification of sources of supply is also affected by environmental concerns: the significant environmental impact of extracting and refining rare earths has been a significant constraint on diversification.

166. This high concentration of minerals in a few countries means that their supply may be interrupted due to export restrictions, regulatory changes, closing of mine sites or even political instability. Concerns have particularly arisen over the role of export restrictions (e.g., quotas, taxes, non-automatic export licences) on critical raw materials, which reduce the supply of such materials on global markets. Export restrictions and taxes (which can be as high as 50%) are prevalent on industrial raw materials, harming the countries imposing them, increasing uncertainty for users, and undermining confidence in global markets. Regulatory instability, price volatility and unsustainable mining practices also negatively impact investment in the mining sector (Korinek and Kim, 2010). Since mining operations have long lead times – sometimes decades from initial exploration to production – lack of investment in the sector now has

[37] Metal Bulletin, Metals prices generally weaker as Covid-19 takes center stage again, December 2020; Akcil, A., Sun, Z., and Sandeep, P., Covid-19 disruptions to tech-metals supply are a wake-up call, 17 November 2020.

[38] US Geological Survey, **Mineral Commodities Summaries 2020**.

[39] Notwithstanding their name, rare earths are found in a number of locations. The constraint often relates to their concentration in the earth's crust and the feasibility of mining, as well as the significant environmental impact of extracting and mining rare earths.

consequences for the supply of raw materials for electric vehicles, wind turbines and other electronic technologies far into the future.

167. On the basis of OECD tracking of export restrictions, further global co-operation can focus on identifying possible chokepoints in supply of critical inputs, disciplining such restrictions and identifying diversification strategies.

- ***Disciplining export restrictions***. Export restrictions are subject to far fewer disciplines in international rulemaking and are monitored less extensively than import restrictions. Disciplines exist, however, in particular in plurilateral agreements, which could form the basis for efforts toward stronger monitoring, notification and disciplines on export restrictions on critical raw materials.
- ***Encouraging greater circularity.*** Ensuring continued access to non-renewable natural resources implies encouraging greater circularity in their use. Today, metal recycling almost entirely consists of large volume base metals such as steel, aluminium and copper. Enabling technological advances in material recuperation and recycling will be key. Reducing barriers to trade in end-of-life goods that contain critical raw materials will also be essential to reach the economies of scale needed to develop and exploit these technologies and achieve the potential of circularity. The recently launched European Raw Materials Alliance, which was created as part of an *Action Plan on Critical Raw Materials* aimed at developing resilient supply chains for EU industrial ecosystems and reducing dependency on primary critical raw materials through circular use of resources, sustainable products and innovation.[40]
- ***Increasing co-operation among likeminded countries.*** Co-operative efforts to ensure supply, including among like-minded countries, based on common standards of critical raw materials can provide an important source of confidence in global supply. Examples of such initiatives include a partnership between Australia and the United States on the *Action Plan for Critical Minerals*, under which Geoscience Australia and the United States Geological Survey will collaborate on critical minerals potential mapping and quantitative assessments and developing data analytics to better understand supply and demand scenarios. The Pentagon is also backing a project in Texas by an Australian company for rare earths processing.[41]
- ***Strengthening governance in extractive sectors***. Strengthening economic governance in resource-rich countries is an important step in ensuring sustainable supply of critical raw materials. Some critical raw materials are found in high-risk areas where there is a potential for mining activity to contribute to conflict. The *OECD Due Diligence Guidance for Supply Chains of Minerals from Conflict-Affected and High-Risk Areas* (*Minerals Guidance*) provides a framework for responsible supply chain management for firms that source their minerals in such areas.
- ***Responsible sourcing*** is increasingly becoming a factor of strategic security of supply. For instance, the EU Conflict Minerals Regulation, based on the OECD *Minerals Guidance*, expects implementation of supply chain due diligence for at least two EU listed critical minerals: tantalum and tungsten (European Commission, 2020a). This implies that consuming companies will need to factor in the imperative of establishing responsible sources of supply if they aim to sustainably

[40] ERMA will involve all relevant stakeholders, including industrial actors along the value chain, EU Member States and regions, trade unions, civil society, research and technology organisations, investors and NGOs. ERMA is supported by the European Institute of Innovation and Technology, a body of the European Union.

[41] See "US-China: Washington revives plans for its rare earths industry", *The Financial Times*, 14 September, 2020. Available at https://www.ft.com/content/5104d84d-a78f-4648-b695-bd7e14c135d6. Australia has extensive mineral deposits (it is ranked sixth in the world for rare earth deposits and is the world's third largest deposits of lithium), but rare earth production has been hampered by steep financial and environmental costs and also the hazardous processes involved. See "Rare earth mineral deal inked by US and Australia – what does that mean?", ABC News, 19 November 2019, available at https://www.abc.net.au/news/2019-11-19/australian-critical-mineral-supply-to-be-guaranteed-by-us/11716726.

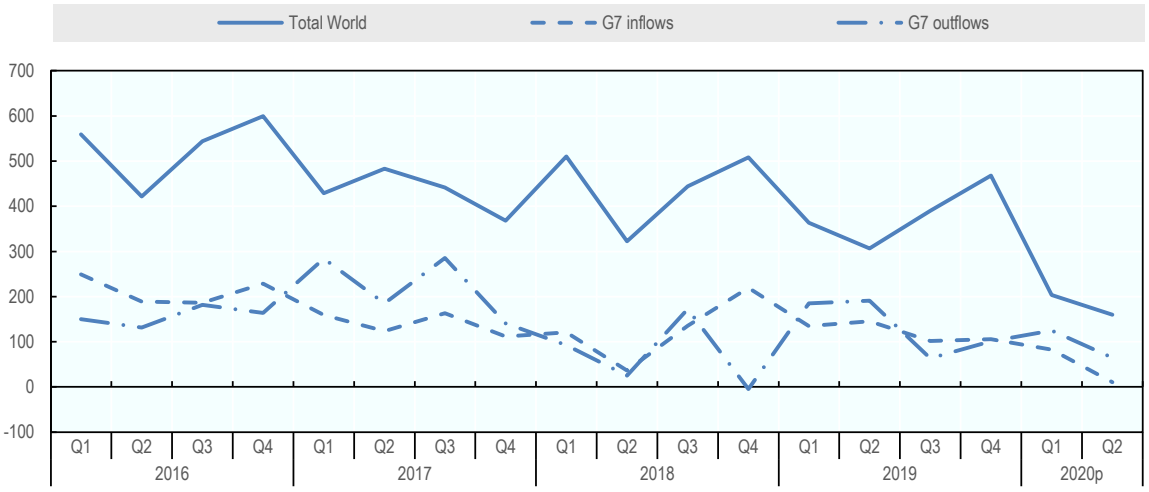
secure their sources of supply. The proposed EU regulation on battery minerals similarly expected due diligence for four additional mineral resources: cobalt, lithium, natural graphite and nickel (European Commission, 2020b). More broadly, the same applies to an increasing number of base metals covered by mandatory industry requirements (LME, 2019), most of which are crucial for the energy transition.

3.6. Sustainable investment for a resilient global economy

168. International investment has played a key role in creating a global economy in which more can participate and more have the potential to benefit. However, ensuring these benefits materialise and promoting investment aligned with the SDGs also requires efforts at international co-operation, from soft law principles and dialogue to international agreements.

169. Global FDI flows fell by almost 50% in the first half of 2020 compared to the first half of 2019 (Figure 3.1). In the G7, FDI inflows declined by 65% and outflows by 50% during the same period. The decline in greenfield FDI in 2020 reduced potential job creation by nearly 50%. Globally, more than 500 000 jobs that could have been created through FDI did not materialise (OECD, 2020g). If FDI stays low for longer, it could have widespread consequences on jobs and incomes. In addition to the enormous number of jobs lost worldwide in 2020, this would make it even more difficult to achieve the ambition of creating decent work and economic growth as outlined in the SDGs.

Figure 3.1. Global FDI flows, Q1 2016 – Q2 2020 (USD billion



Note: p: preliminary estimates.
Source: OECD International Direct Investment Statistics Database.

170. Open, non-distortionary and transparent investment policies can help restore trade and investment and ensure economic resilience in G7 and partner economies in the long run. A conducive investment climate, in line with the guidance provided by the *OECD Policy Framework for Investment* for example, can help increase investment flows during the recovery and beyond (OECD, 2015b). Using the *Policy Framework*, the G7 can help countries particularly, developing countries, reduce costs, risk and uncertainty for investors, for example in business regulations, the financial framework, and in tax, trade and labour market policies. The World Bank's 2019 *Global Investment Competitiveness* survey, which was conducted just before the pandemic struck, shows that almost 85% of multinational enterprises surveyed consider the legal and regulatory environment as important or critically important for their decisions to invest, ahead of

considerations such as low taxes and low input costs (World Bank, 2020). This is supported by recent OECD research showing that an open and coherent domestic and international legal framework for investment can also help to reduce divestment risks (Borga et al., 2020).

171. Negotiations are also ongoing at the WTO on Investment Facilitation for Development. A group of 105 WTO members (which includes all G7 countries except the United States) are part of discussions to develop a multilateral framework on investment facilitation, which progressed to the negotiating stage at the end of 2019. The objective is to agree on a set of practical measures to improve the transparency and predictability of investment frameworks, streamline procedures related to foreign investors, and enhance coordination and co-operation between stakeholders such as host- and home-country governments, foreign investors, and domestic corporations as well as societal actors.

172. However, open markets will not be sufficient to tackle the major societal and environmental challenges that, if not addressed, will jeopardise a prosperous and healthy future for people and the planet. Investment needs to contribute to sustainable economies and enhance resilience to future crises. For the G7, this means including SDG and Paris Agreement conditionality in recovery and stimulus packages, with particular attention to infrastructure (see Box 3.5) and embedding RBC principles and standards into all investment. It also means enhancing the qualities of FDI by ensuring that G7 investments create decent jobs[42] and skills and support the low-carbon transition, and ensuring that the international trade and investment regime facilitates sustainable development both with express provisions as well as more indirect implications.

Box 3.5. Sustainable investment in infrastructure

In the immediate term, it is critical that public infrastructure investments in recovery packages simultaneously support recovery of the economy and jobs in ways that minimise their environmental impact, as well as set the stage for future growth through green innovation. The IMF estimates that a 1% increase in public investment serves to crowd in private investment in construction by 13% (IMF 2020), demonstrating the importance of public investment in leading the way both in terms of the level and the direction of infrastructure investment.

The *OECD Recommendation on the Governance of Infrastructure* emphasises the importance of taking a life-cycle approach to the selection and management of infrastructure, providing insights for example that the maintenance and rehabilitation of existing infrastructure can both produce more jobs and reduce carbon footprint relative to new construction. Furthermore, the *Recommendation* demonstrates different mechanisms for the integration of the SDGs and green objectives into infrastructure planning and delivery, as appropriate for different political systems and arrangements, including the development of a national infrastructure strategy or an infrastructure commission to integrate the interests of different stakeholders. The *Recommendation* features as a key pillar in the *OECD Compendium of Policy Good Practices for Quality Infrastructure Investment* (OECD, 2020h), which seeks to promote implementation of the *G20 Principles for Quality Infrastructure Investment* (2019).

173. To meet these goals, the G7 could support and promote RBC principles, including on due diligence. Taking an "RBC approach", based on the *OECD Guidelines for Multinational Enterprises*, and using risk-based due diligence to identify and address adverse impacts, as described in the *OECD Due Diligence Guidance for Responsible Business Conduct* can enhance companies' capacity to build and increase resilience to supply chain disruptions (see also Chapter 2), and enhance their ability to access

[42] See ILO definition at https://www.ilo.org/global/topics/decent-work/lang--en/index.htm.

private and public finance. More generally, it would also contribute to achieving the SDGs (OECD (2019e) and other global social and environmental goals and commitments. In the short term, an RBC approach in the design and implementation of government measures to support the global economic recovery would also help ensure a fairer and more inclusive distribution of benefits.

174. Additionally, the forthcoming *OECD FDI Qualities Policy Toolkit* will provide guidance to governments to assess whether and how foreign investment contributes to sustainable development in their economy and what policy and institutional reforms would help to boost the qualities of investment in the areas of jobs, skills, gender equality, productivity and low-carbon transition.[43]

3.7. Conclusion

175. Across trade and investment, the global economy requires rules of the road. These can range from legally binding agreements negotiated in bodies such as the WTO, to soft law principles, standards and guidelines negotiated in forums such as the OECD, to more informal groupings to build consensus on issues and approaches.

176. This chapter has looked at the instruments of international economic co-operation to allow for an integrated, open and fair global economy. This includes international regulatory co-operation to promote integrated and trusted markets and facilitate agile and resilient global supply chains. It involves efforts to ensure that the benefits from international investment can materialise -- through international agreements to promote investment facilitation, through to co-operation on RBC and analytical tools to help governments assess their policies to boost the qualities of investment in the areas of jobs, skills, gender equality, productivity and low-carbon transition. It also involves co-operation to address concerns in the global economy -- from government support, to supply of critical minerals, to foreign bribery, highlighting where instruments exist and areas where there are gaps in the international rulebook that need to be addressed.

177. Underpinning efforts at global rule-making are good domestic practices and a political authorising environment for investments in global rules and co-operation -- that is, governments need to make the domestic case for global rules. In both cases, transparency is an essential starting point.

178. Nowhere is this more evident than in government support, particularly in the context of COVID-19 where such support is rightly increasing, but where how that support is designed now will have important implications in shaping the future global economy. Transparency is key in both ensuring that support provided is hitting its intended target and is effective,[44] and in enabling the analysis for more informed policy discussions on how best to tackle government support globally, including in a trade context. In the absence of transparency about the nature and scale of government support, businesses are reluctant to make new investments and trade tensions increase, which in turn brings further costs in terms of heightened uncertainty, reduced business investment and, ultimately, lower growth.

179. However, perhaps most importantly, transparency is essential to help distinguish benign forms of support needed to address market failures from the more harmful policies. Understanding who pays and who benefits from government support is critical at a time when the opportunity costs of scarce public resources are high, given needed public investments in education, social protection, digital infrastructure

[43] The OECD *FDI Qualities Policy Toolkit* is planned as a deliverable for the OECD Ministerial Council Meeting 2022.

[44] For example, of the USD 700 billion per year provided to agriculture, USD 536 billion goes in the form of direct support to producers (around two-thirds of it is market-distorting) and only USD 172 billion to needed investments in general services to the sector (such as R&D or extension services to farmers) and to consumers (e.g., for food assistance programmes). Moreover, direct support to producers is an inefficient way of transferring income to those producers, and comes at a high cost to consumers.

and, not least, health systems. In this way, international economic co-operation and rebuilding trust in the global rules-based system is about improving the lives of people at the national and local level.

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Annex A: OECD Matrix of Government Support Measures © OECD

			Statutory or Formal Incidence (to whom and what a transfer is first given)							
			Production							Consumption
						Costs of Value-Adding Factors				
			A: Output returns	B: Enterprise income	C: Cost of intermediate inputs	D. Labour	E. Land and natural resources	F. Capital	G. Knowledge	H. Unit cost of consumption
Transfer Mechanism (how a transfer is created)	**1: Direct transfer of funds**		Output bounty or deficiency payment	Operating grant	Input-price subsidy	Wage subsidy	Capital grant linked to acquisition of land	Grant tied to the acquisition of assets, including foreign ones	Government R&D	Unit subsidy
	2: Tax revenue foregone		Production tax credit	Reduced rate of income tax	Reduction in excise tax on input	Reduction in social charges (payroll taxes)	Property-tax reduction or exemption	Investment tax credit	Tax credit for private R&D	VAT or excise-tax concession
	3: Other government revenue foregone			Waiving of administrative fees or charges	Under-pricing of a government good or service		Under-pricing of access to government land or natural resources	Debt forgiveness or restructuring	Government transfer of intellectual property rights	Under-pricing of access to a natural resource harvested by final consumer
	4: Transfer of risk to government		Government buffer stock	Third-party liability limit for producers		Assumption of occupational health and accident liabilities	Credit guarantee linked to acquisition of land	Loan guarantee; non-market-based debt-equity swap and equity injection		Price-triggered subsidy
	5: Induced transfers		Import tariff or export subsidy; local-content requirements	Monopoly concession discriminatory government procurement	Monopsony concession; export restriction; dual pricing	Wage control	Land use control	Credit control (sector-specific)	Deviations from standard IPR rules	Regulated price; cross subsidy
		Including advantages conferred through state enterprises			Provision of below-cost electricity by a state-owned utility			Below-market loan by a state-owned bank		

Chapter 4. HARNESSING EMERGING TECHNOLOGIES FOR RESILIENT AND DYNAMIC ECONOMIES

180. Rapid advances in technology and scientific knowledge are among the key drivers of productivity, growth and progress in living standards. Digital technologies, such as high-speed broadband, have greatly contributed to economic resilience during the pandemic, enabling many businesses to continue their operations. More generally, strong capabilities for science, technology and innovation (STI) generate new business opportunities and knowledge that help develop solutions for resilience and other key policy challenges, including during crises, as demonstrated by the rapid development of vaccines in response to the COVID-19 pandemic.

181. At the same time, emerging technologies raise a number of challenges for economic resilience. The growing dependence of economies and societies on digital tools raises new vulnerabilities, e.g. to cyber-attacks, and heightens the urgency in addressing existing vulnerabilities such as digital divides in access to digital technologies and services. This requires resilient and trustworthy digital systems and infrastructure, and more generally points to a need for advanced digital, science and innovation strategies. This chapter explores the role of emerging and more mature technologies as an enabler of economic resilience and some of the challenges related to emerging technologies that require an effective policy response.

182. Most of these challenges are endogenous to the economic system, and reflect long-term structural (i.e. chronic) trends, e.g. digital divides or lacking capabilities in science and innovation. Some can also be acute, e.g. a cyberattack that disrupts strategic infrastructures or activities. However, addressing underlying structural issues can also help improve the ability of the economic system to respond to acute and exogenous shocks.

4.1. Digital transformation: implications for economic resilience

183. When the COVID-19 pandemic broke out at the start of 2020, citizens, businesses and governments were forced to move online, further accelerating the digital transformation that has been underway for decades. Many employees started working from home; firms adopted digital business models to maintain operations and preserve revenue flows; face-to-face government services moved to digital platforms; digital tools were introduced to help “track and trace” the development of the pandemic and enable appropriate policy responses (OECD, 2020a; OECD and World Bank, 2020); and researchers employed artificial intelligence (AI) to learn more about the virus and accelerate the search for vaccines and treatments. Due to this rapid shift, internet traffic in some countries increased by up to 60% following the outbreak (OECD, 2020b).

184. The pandemic has opened a new phase of digital transformation. Although some online activity may decline as COVID-19 vaccines and treatments emerge, thus enabling greater in-person interactions, it is likely to remain high in areas for which the pandemic has acted as a catalyst, including telework, e-commerce, e-health, digital government services and e-payments. Evidence from Italy shows, for example, that teleworking in key sectors fell from its peak during the lockdown but remained higher than before the

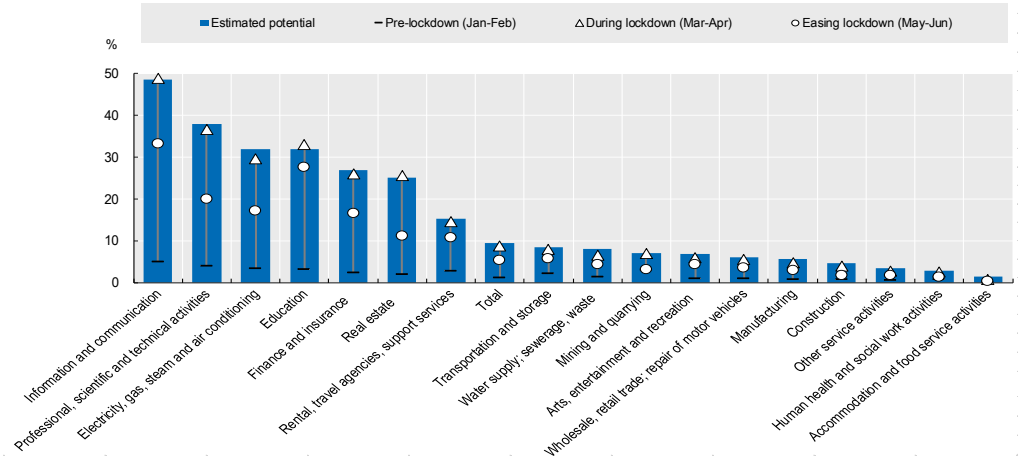
pandemic (Figure 4.1). A recent McKinsey study notes that teleworking will remain high in certain occupations and sectors, as the pandemic helped break through cultural and technological barriers that had prevented it in the past (McKinsey, 2020). Moreover, a July 2020 business survey for the United Kingdom suggests that many firms that adopted digital tools and processes during the pandemic expect to maintain these post-crisis (Riom and Valero, 2020).

185. Clearly, digital technologies have supported economic resilience during the coronavirus crisis, preventing large parts of the economy from coming to a complete standstill. However, this resilience is based on a range of digitalisation policies, some of which are still evolving, and many of which have implications at the international level. These policies will require even greater attention as the digital transformation deepens and economies become more reliant on it. A number of elements are key in ensuring that digital transformation continues to support economic resilience (OECD, 2019a).

186. The first is **fast, reliable and universal connectivity.** While the digital divide has long been recognised as an important challenge, the COVID-19 crisis further underscored the importance of digital technologies in facilitating interactions between people, organisations and machines, and in enabling the use of connected devices in critical contexts, including health, education, manufacturing and transport. Many of these uses require high-speed connections. However, by December 2019, high-speed fibre networks accounted for only 28% of all fixed broadband subscriptions in the OECD (OECD, 2020c). Japan was the only G7 country above the OECD average, at almost 80% of all connections. Important gaps in connectivity remain in all G7 countries, both across socio-economic groups, including age, income, education, and gender; and across regions, particularly in rural and remote areas; limiting the benefits of digitalisation and potentially deepening overall inequalities. Faced with a future where jobs, education, health, government services and even social interactions may be more dependent on digital technologies than ever before, it will be essential to ensure widespread, affordable, fast and trustworthy connectivity for all. This is also important at the international level, where connectivity can be an enabler of the development of the digital economy and a catalyst for inclusive growth, innovation and sustainable development. International initiatives involving all stakeholders are important to help accelerate global connectivity, especially for remote and rural areas, and for under-represented socio-economic groups, notably women.

Figure 4.1. Teleworking before and during the COVID-19 crisis in Italy, by industry

Estimated teleworking potential and teleworking shares as a percentage of employees by industry



Source: OECD (2020c), *Digital Economy Outlook 2020* based on ISTAT (2020), "Situation and perspectives of enterprises during the health emergency COVID-19".

187. Second, **greater diffusion and uptake of digital technologies across businesses and in the public sector**. These technologies offer a large potential for productivity growth, linked, for example, to business processes innovation, automation of routine tasks, more efficient interactions with suppliers and customers and the use of data in the innovation process. New digital business models are also important and can provide for greater agility and resilience. However, stark differences remain across countries and businesses, in particular between large firms and small and medium-sized enterprises (SMEs). For example, while more than one third of large firms in OECD countries engage in big data analysis, only just over 10% of small firms do (OECD, 2020c). Evidence for the United Kingdom suggests that the COVID-19 crisis accelerated the uptake of digital tools by firms (Riom and Valero, 2020). In the period from late March to late July 2020, over 60% of firms adopted new digital technologies and management practices, and around a third invested in new digital capabilities. Moreover, firms that had previously already adopted digital tools were more likely to adopt even more of them.

188. The risk is that the COVID-19 crisis may exacerbate existing gaps in uptake and use, in particular between large firms and SMEs, but also between sectors, regions and countries. If not addressed, such uneven diffusion may have important implications for firms' productivity performance as the pandemic continues to accelerate digitalisation. It could potentially widen the productivity gap between digital adopters and digital laggards, enhance the vulnerability of laggards, increase inequalities at the global level, and reduce overall economic resilience. Greater policy efforts will therefore be needed to boost adoption and diffusion of digital tools, in particular for SMEs, but also in the public sector and across countries. International development co-operation can play an important role; for example, the **OECD Global E-Leaders Initiative (GELI)** aims to help less digitally mature governments leapfrog stages of digital government development by benefiting from the experience of their more digitally advanced counterparts.

189. Third, given the growing reliance of the economy on digital tools, greater attention is needed to **ensure a safe and trustworthy digital environment**, notably with respect to digital security (see Chapter 1), but also for privacy, data and consumer protection. It is crucial that the on-going digital transformation, while being a fundamental element for resilience, does not become a new source of instability, e.g. through digital security incidents that could lead to massive disruptions to the economy.

190. Several scenarios could trigger large-scale systemic disasters. For example, a digital security vulnerability affecting a product on which most economic and social activities depend, including critical ones, could be exploited and cause chaos and considerable damage. Such a vulnerability could affect an operating system, as in the 2017 Wannacry and NotPetya attacks; widespread microprocessors or other hardware components, as illustrated by "Spectre" and "Meltdown" (Coldewey, 2018); or essential elements of the core Internet, such as the Domain Name System, Internet Exchange Points or Certificate Authorities. In another scenario, a digital security incident could act as the root cause of knock-on effects propagating a disaster along a chain of interdependent critical activities. For example, a digital security incident could disrupt the delivery of electricity, which in turn would disrupt transport systems, affecting the operation of hospitals, etc. (OECD, 2019b).

191. A digital security vulnerability affecting a single product could be mitigated if the vendor distributes a patch and users apply it. However, a vulnerability in a digital component embedded in numerous products from various vendors used in many different contexts could create a higher systemic risk because it would be much more difficult to mitigate because of the product's complex value chains. This scenario is not unlikely. For example, the 2019 and 2020 Urgent/11 and Ripple20 critical vulnerabilities that were discovered in software components and are embedded in millions of consumer and industrial Internet of Things devices, produced by many vendors, have not yet been addressed in all products (OECD, 2021a).

192. Digital security has long been a key challenge for the digital economy, but the COVID-19 outbreak increased the opportunities for cybercriminals and further raised its importance (OECD, 2020d).

Coronavirus-related scams and phishing campaigns have spread as malicious actors took advantage of the massive number of people and organisations switching to telework and using new tools for the first time without always adopting basic digital security hygiene (e.g. patching, use of strong and different passwords, regular backups, etc.).

193. In 2020, most governments in OECD countries had adopted whole-of-government digital security strategies. However, too often, these strategies lack an autonomous budget, evaluation tools and metrics, and are not integrated with overall national digital plans (OECD, 2020c). Overall, there is a need for policy makers to approach digital security more holistically to ensure the resilience of an increasingly digitalised economy, including in critical sectors such as the financial system (OECD, 2019c). Such holistic approaches could encompass policies in the areas of enhancing the digital security of products and of critical activities and critical infrastructures, encouraging innovation in digital security and developing digital security skills and a security culture in sectors such as health, banking, telecommunications or energy; for specific businesses, notably SMEs; and in the public sector. Governments have an important role to play in the detection and identification of significant potential threats, providing early warning to businesses and households, and working at the international level with other governments to address such threats. Partnerships among governments and the private sector are also key to share information on threats and vulnerabilities and agree on resilience measures to ensure continuity, especially in critical sectors (OECD, 2019c and 2019d).

194. Fourth, **data** increasingly underpin digital transformation and have become an important source of value, for example for decision-making and production. **Data access and sharing** have become fundamental for many social and economic activities. In the context of the COVID-19 crisis, leveraging and opening up data has been centre-stage in establishing effective frontline responses to the crisis. As data become a social and economic asset, policy makers are facing a number of issues from the perspective of economic resilience.

195. Data increasingly underpin trade in the digital age and any measures affecting data flows are likely to have trade consequences. Such measures may, for example, result from data-related regulation, such as local storage requirements, personal data protection agreements or trade agreements that cover cross-border data flows. A number of existing measures already make some cross-border data flows conditional or ban others altogether (Casalini and López González, 2019).

196. Protecting data also requires managing risk. The benefits of storing, using, accessing and sharing data come with potential risks that may arise from any of these activities, and risks need to be managed well to maximise benefits (OECD, 2015). This balancing act involves costs and legitimate private, national and public interests, in particular the rights and interests of the stakeholders involved in producing and using data. Privacy and Intellectual Property Rights (IPRs) need to be protected and enforced; otherwise incentives to produce and exchange data and to invest in data-driven innovation may be undermined, in addition to the direct harm that may occur to rights holders (OECD, 2019e).

197. Data may also not be equally distributed or accessible. Concentration of data is visible, for example, in countries with many domestically hosted sites and high numbers of co-location data centres, often countries with a large population and uniform policies. Concentration is also present at sectoral and/or firm level, with some companies holding disproportionally more data than others. The same companies also tend to concentrate the capacity needed to create value – information and knowledge – from data. Information and knowledge asymmetries may in turn affect the distribution of power, with shifts: 1) away from individuals to organisations (including consumers to businesses, and citizens to governments); 2) from traditional businesses to data-driven businesses; 3) from governments to data-driven businesses; and 4) from lagging economies to data-driven ones. These shifts in turn result in new divides, with implications for social cohesion and economic resilience (OECD, 2015).

198. National data strategies can help realise the potential of data, including through sharing and reuse. Strategies aimed at balancing the issues mentioned above and achieving a social contract that unleashes

the potential of data are uncommon today. However, some countries are in the process of developing such a strategy, and some data-related aspects are already addressed in open government data strategies as well as in national digital economy and/or security strategies, and others are on the verge of being addressed in emerging national privacy strategies (OECD, 2019e). Building on these existing strategies, governments could consider developing consolidated broader data strategies as a comprehensive and coherent approach to leverage the potential of data for value creation while addressing the related challenges (OECD, 2019a).

199. At the national and international levels, further policy initiatives are needed to boost data access and sharing, including across borders, while addressing challenges associated with the protection of privacy, intellectual property rights and data governance and stewardship (OECD, 2019e). Sharing data across borders can also facilitate collaboration between governments to improve their policy-making at international level. New policy measures can help strengthen collective commitment and efforts across borders to support greater public-sector transparency, contribute to addressing global challenges as defined for instance by the Sustainable Development Goals (SDGs) or during global pandemics.

200. Fifth, as more people and firms "go digital", governments must work to ensure that all workers can adjust to the changing work environment and are equipped with the **skills necessary to succeed in the digital economy**. Individuals with a well-rounded skill set in terms of literacy, numeracy and problem solving can use digital tools more efficiently, carry out more sophisticated activities on line, avoid online fraudulent activities and better adapt to digital transformations. There is also a growing consensus that transversal skills, such as thinking critically and creatively, making informed decisions while using technology and behaving collaboratively, are critical for the digital economy (OECD, 2019a). Investing in skills can help ensure that the benefits of digital technologies are widely shared and prevent workers from falling behind, thus helping address inequalities and contributing to economic resilience.

201. Sixth, the strength of the digital economy draws on **rapid, ongoing innovation** (as discussed further in section 4.2). Innovations in cloud computing, mobile applications, AI and elsewhere are booming and have played an important part in the response to COVID-19. Governments are also devoting much attention to innovative digital technologies such as distributed ledger technologies and 5G infrastructure, the latter of which is critical to support enhanced mobile broadband, growing communications between machines using Internet of Things (IoT) devices, and AI applications. Distributed ledger technologies, such as blockchain, are also attracting increasing policy attention and have the potential to transform many industries and markets. Quantum computing is another technology with great potential for the ongoing digital transformation, with the United States, China and the European Union leading on the relevant R&D expenditure.

202. The virtuous circle between digital innovation and digital transformation will be a fundamental driver of new business models and markets, and digital technologies hold the potential to strengthen the science and research systems that are proving so critical to countries' response and recovery from crisis situations like COVID-19. Moreover, they can support economic resilience. Yet countries are also recognising that the way in which these technologies are adopted can pose risks to human-centred values. This is giving added impetus to their efforts to set strategic direction, including at the international level, where the OECD's *AI Principles*, the recently established Global Partnership on AI, and the upcoming *Good Practice Principles for Data Ethics in the Public Sector* are just three examples of countries collaborating in ensuring the trustworthy development and use of technologies (as discussed further in section 4.3).

203. Seventh, **better and more innovation-friendly regulation**. Regulatory systems need to become more risk and outcomes-focused in order to respond to the rapid changes brought about by emerging technologies. This requires less rigid reliance on specific prescriptive rules and processes, more agility through risk-based discretion and increased emphasis on the professionalism of regulators. Such changes are particularly important to enable SMEs to adopt emerging technologies. In many jurisdictions this is

difficult due to regulatory barriers resulting from rigid, outdated rules and procedures, with which small businesses inherently have less ability to cope than larger ones. Regulatory systems thus need to become more proactive and future-focused. This will require a more cooperative relationship between regulators and the private sector. The large majority of businesses are collaborative and attentive to managing risks and improving outcomes; however, strong enforcement options must be retained for the few that are engaged in criminal or otherwise reckless conduct.

204. From the perspective of regulators, technology offers not only challenges, but also opportunities, e.g. to improve data gathering and analysis and to strengthen predictive analysis, experimentation and simulation that can help better assess regulatory impacts. Governments should also capitalise on opportunities offered by new technologies to improve monitoring of regulatory impacts, both in terms of accuracy and timeliness. This would take pressure off regulators and allow resource allocation that can detect (or with the assistance of new technologies, begin to predict) potential non-compliance.

205. Finally, **governance**. The COVID-19 crisis has revealed our dependence on digital technologies and their increasing importance and impact on the economy and society. Nonetheless, while many countries have a national digital strategy or an equivalent policy in place, most are still narrow in scope (OECD, 2020c). The growing role of digitalisation requires a whole-of-government policy approach to digital transformation, with comprehensive strategies to address a range of inter-related policy issues, ensuring coherence and coordination of policies. The COVID-19 crisis has amplified all aspects of the digital transformation, and, although the trajectory of the crisis and its consequences remain unclear, policymakers must nevertheless seize this opportunity to prepare for an increasingly digital future. In the public sector, this requires fostering a culture of openness to actively engage the public in digital service design, to attract and retain the digital talent needed to leverage the opportunities brought about by the digital age, and to focus on horizontal and joined-up approaches, rather than vertical decision-making. Governments should also consider data as a key strategic asset to secure the coherent and sustainable digital transformation of the public sector, and set up adequate data governance for this purpose.

206. For the public sector this means embracing new governance models which allow for the active exploration of possibilities, experimentation and continuous learning as part of broader public governance (OECD, 2020e). The use of tools and approaches such as regulatory sandboxes, speculative design, and sense-making can provide different, more flexible ways of informing government and delivering services. Matching the rapid pace of change requires a shift towards more proactive, real-time and iterative policy-making that can influence the design of solutions as they are developed.

207. In sum, regardless of how the crisis and its aftermath unfold, there is no doubt that digital technologies will continue to transform the way we live and work. Teleworking, for example, is likely to remain more common than before the crisis, with a potential to increase productivity (OECD, 2020f), although it also carries risks for innovation and worker satisfaction. To minimise the risks of more widespread teleworking harming long-term innovation and decreasing worker well-being, policy makers should ensure that teleworking remains a choice and is not pushed too far. Co-operation among social partners will be important to address concerns such as excessive working hours. To realise and improve the sustainability of the gains from more widespread teleworking for productivity and innovation, policy makers should promote the diffusion of managerial best practices, self-management and ICT skills, investments in home offices (and the associated housing), and fast and reliable broadband throughout each country.

208. At the same time, the emergence of 5G and the IoT will further accelerate the production of data, adding urgency to ongoing policy discussions around data governance, privacy and digital security, and coherent and strategic decision-making across the whole of government. This may become even more acute as firms weigh the costs and benefits of increasing automation, especially in manufacturing facilities, to increase resilience against future health crises and, in doing so, boost the importance of data flows

among firms. Moreover, governments also need to consider the implications for business dynamics and competition in the digital economy (see Chapters 1 and 3) and Box 4.1.

209. Progress in all of the areas discussed above will require increased international co-operation to strengthen the international policy and regulatory frameworks supporting the digital economy, such as those related to data governance, privacy and digital security, and ensure their interoperability. Progress at the international level can also help ensure that standards, rules, regulations and norms are agreed and implemented across borders as consistently as possible, enhancing trust, reducing fragmentation and supporting common values.

Box 4.1. The importance of competitive digital markets for economic resilience and recovery

COVID-19 has demonstrated the critical importance of reliable and broadly accessible digital infrastructure for the continuation of economic activities in the face of severe restrictions to mobility. The pandemic has indeed accelerated the transition to e-commerce and led to greater adoption of digital services and platforms in communications, retail, entertainment and food service sectors, among others.[1] Digital markets have played a key role in these developments, notably by facilitating economic adjustments and innovation across our economies. For rapid progress in digitalisation to continue, and for households and businesses to harness the full potential, it is important that competition in digital markets be protected and promoted. Anticompetitive conduct or mergers contributing to the emergence or entrenchment of non-contestable market power will have the opposite effect, undermining prospects for economic recovery and the dynamism necessary for economic resilience.

Some trends over the past several years are raising concerns in this regard. For instance, prior to the COVID-19 pandemic, several indicators suggested that competitive intensity in digital markets was on the decline (see Box 1.5). In particular, mark-ups (a measure of market power) were on the rise, start-up creation had fallen, and the share of large firms' revenues in digital sectors was growing.[2] The competition policy community in discussions at the OECD and elsewhere has identified several characteristics of digital markets that may raise specific challenges for competition analysis, and which may exacerbate the effects of anticompetitive conduct, namely strong network effects, economies of scale and scope, barriers to switching or user lock-in, and consumer behavioural biases, among others.

In response to these concerns, several G7 jurisdictions have undertaken studies to assess whether existing competition policy and regulatory frameworks should be adapted to digitalisation. This has culminated in specific reform proposals, which include:

- the creation of new regulatory regimes for digital markets (such as new competition measures focused on certain "gatekeeper" firms), with due consideration of the different business models;
- more aggressive enforcement of some harms (such as abuses of dominance through self-preferencing);
- new enforcement approaches (such as shifting the burden on dominant firms to show that certain types of conduct is not harmful);
- adjustments to merger control (for instance changing merger notification thresholds to capture anticompetitive acquisitions of nascent competitors, putting more focus on potential and dynamic competition);
- adaptations of analytical tools and a particular focus on promoting innovation, consumer choice and quality competition.

Tackling digital competition concerns will require close international co-operation among competition policymakers, given the novel issues raised as well as the cross-border scale of the digital sector. Beyond discussion of the policy options and the sharing of experiences with reform proposals (including with policymakers in other areas), competition authorities would benefit from enhanced enforcement co-operation, for example to facilitate the sharing of information during investigations. Along with the International Competition Network, the OECD has recently completed an assessment of the state of international enforcement co-operation among competition authorities.[3] Going forward, there is a range of opportunities to enhance this co-operation and remove existing legal barriers. In addition to greater information sharing, these opportunities include providing investigative assistance and other enhanced agency co-operation, such as pooling of resources to tackle digital issues, and seeking efficiencies in co-ordinating decision-making.

[1] See, for instance, OECD (2020), E-commerce in the time of COVID-19, http://www.oecd.org/coronavirus/policy-responses/e-commerce-in-the-time-of-covid-19-3a2b78e8/.

[2] See, for instance, https://oecdecoscope.blog/2019/05/31/competition-in-the-digital-age/.

[3] See http://www.oecd.org/competition/oecd-icn-report-on-international-cooperation-in-competition-enforcement-2021.htm.

4.2. Advanced science, technology and innovation systems in support of resilience

210. Digital technologies have stood out during the COVID-19 crisis, but they are not the only technologies that matter for economic resilience. Strong capabilities for science, technology and innovation (STI) play an even more fundamental role. They enable countries to improve productivity and incomes; enhance well-being; and generate new knowledge that can help develop innovative solutions to key policy challenges brought about by shock events, such as pandemics. The COVID-19 crisis has highlighted the importance of STI for resilience, e.g. as shown by the high speed with which the genome of the virus was sequenced by scientists, already in January 2020, and the velocity at which promising vaccines and treatments are currently being developed and deployed, in several cases using new techniques. Moreover, scientific advice plays a prominent role in informing policy responses to crises, as well as helping to identify and anticipate future crises, as demonstrated by the work of the Intergovernmental Panel on Climate Change (IPCC) since 1988 (OECD, 2018).

211. At the same time, the COVID-19 crisis has also highlighted some of the challenges STI systems face today – for example, the lack of high-risk and interdisciplinary research funding, or rigid career structures that discourage mobility between academia and other public and private sectors. More agile and responsive policies for STI will therefore be needed to support resilient, dynamic, open and forward-looking economies.

212. Such agile and responsive policies will be even more important as questions are being raised about the declining **productivity of scientific research** (Bloom et al., 2017). An example is Moore's Law, which states that the density of computer chips doubles every two years. This law has underpinned the increasing power of computing for many decades and has enabled the productivity benefits of digital technologies. Today, however, the number of researchers required to achieve this doubling is more than 18 times larger than the number required in the early 1970s. Similar relationships hold in other areas, such as drug discovery and agronomic research. This challenge is just one illustration that the contribution of STI to knowledge creation, innovation and economic resilience cannot be taken for granted. It requires public and private investment and appropriate policy action. Four areas, in particular, are important.

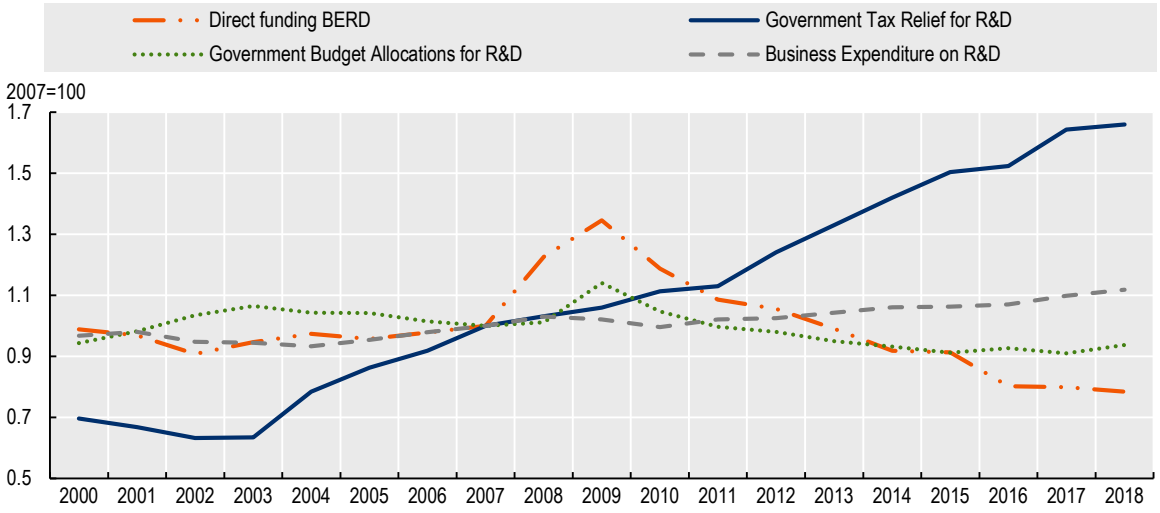
213. The first is **ensuring that STI systems can respond rapidly to critical, and sometimes unexpected, policy challenges**, such as health, energy security or climate change. The COVID-19 crisis led to a wide range of STI activity across the world, from both the public and private sector, benefiting from increased funding, dedicated research and development projects, greater sharing of data, increased collaboration, more intensive use of digital tools and increased experimentation (OECD, 2021c). It also built on years of investment in crucial basic research. However, the responsiveness of the global STI system to other urgent and critical policy challenges has been mixed. For example, despite the growing importance of energy security and climate change, the share of public R&D devoted to these challenges has not increased over the past decades (IEA, 2020) and the share of low-carbon inventions in all patenting has fallen in recent years (OECD, 2020f). Chapter 1 already discussed the challenges in developing new antimicrobial drugs. Another example related to health is dementia; while public investment in dementia

research has increased considerably since the 2013 G8 Dementia Summit, it is still low relative to the large economic and social costs of dementia, estimated at USD 1 trillion in 2018, or compared with other major diseases. More generally, despite the large number of public policy challenges, government-financed R&D has declined to just under 0.6% of GDP in 2018 for the OECD as a whole, and now accounts for less than 25% of total R&D expenditure, down from more than one-third in the early 1990s. The question is whether this scale of public investment is sufficient to underpin sound, productive and resilient STI systems in the future, recognising that other demands on public spending are unlikely to diminish.

214. A second challenge is how to **guide the direction of innovation in the private sector to support public policy goals**, such as sustainability or health. Market-based incentives and regulations, such as carbon taxes or the removal of subsidies on fossil fuels, can play an important role in guiding innovation. Government support for business R&D also plays an important role, and OECD governments have moved towards a greater use of R&D tax incentives in recent years (OECD, 2021c). However, OECD analysis finds that well-designed direct grants for R&D are better suited to supporting longer-term, high-risk research, and to targeting innovations that either generate public goods (e.g. in health) or have a significant potential for knowledge spillovers (OECD, 2020h). At the same time, R&D tax incentives are better suited to boost R&D that is already close to its application in the market, i.e. experimental development (the D in R&D) rather than research (the R). The change in the overall funding mix for R&D over the past two decades – with stagnating government budgets for R&D and a broad shift to R&D tax incentives -- may thus limit the ability of governments to influence the direction of innovation towards the delivery of public goods and the use of innovation as a tool to address key policy goals (Figure 4.2).

Figure 4.2. Shift in the policy mix for R&D support, 2000-18

Government funding of R&D in the OECD area, indexed values for key figures normalised by GDP, 2007=1



Note: For general and country-specific notes on the estimates of government tax relief for R&D expenditures (GTARD), see http://www.oecd.org/sti/rd-tax-stats-gtard-ts-notes.pdf. Direct support estimates include government R&D grants and public procurement of R&D services, but exclude loans and other financial instruments that are expected to be repaid in full.
Source: OECD R&D Tax Incentives Database, http://oe.cd/rdtax, November 2020.

215. To guide the direction of innovation, governments can also link their support for innovation more closely to broader public policy missions, for example in the context of so-called **mission-oriented innovation policies** (MOIPs) (OECD, 2021b). One approach is *national mission-oriented strategic frameworks*, which provide concrete and ambitious targets within an overall strategic framework, e.g. Japan's *Moonshot R&D Programme*. An important challenge for such frameworks is to engage a wide

range of actors without broadening or multiplying the missions, and enlisting high-level political actors without sacrificing the missions' long-term time horizon and boldness. Another approach is *challenge-based programmes*, which focus on solving specific technological or scientific problems and are implemented by dedicated agencies or programmes, e.g. the United Kingdom's Industrial Strategy Challenge Fund. These programmes embed support for selected projects throughout the innovation chain, from research to market introduction, to increase the chance of innovation success and accelerate development through closer linkages among researchers, business firms and users (e.g. patients). Several of these programmes are implemented by funding agencies and draw on the well-known experience of DARPA in the United States. Designing and endowing mission-oriented policies with the proper resources and governance structures takes time, however. As government recovery packages start to embrace longer time horizons, some MOIPs are now turning to COVID-19 and post-COVID-19 challenges.

216. Most MOIP initiatives in OECD countries are still experimental (OECD, 2021b). However, some lessons are starting to emerge. First, no MOIP initiative has started from scratch; they all build on previous policies. They often result from a gradual process with dedicated effort to make the previous policies better oriented and coordinated, either 'from the inside' (e.g. improvement of a scheme to make it more challenge-oriented and cross-sectoral) or 'from the outside' (most often by adding a governance layer to coordinate various existing interventions). Second, MOIPs do not replace existing policies, but are complementary. They can push further their mission-orientation features and goals when they benefit from an additional and dedicated budget, rather than just a reallocation of existing resources. Third, the success of MOIPs will depend to a significant extent on the adequacy of the underpinning institutional setting. However, in addition to their possible contribution to solving societal challenges, MOIPs can allow for significant organisational and institutional learning that will help alleviate some of the long-standing challenges in national innovation systems (such as weak ability to direct innovation, lack of coordination, fragmented policy mixes, etc.).

217. The third challenge is **fostering innovation within the STI system** itself and ensuring it can effectively respond to the policy objectives it is supposed to address. If the productivity of research is falling, new tools and processes will be needed to help enhance productivity, e.g. through a greater use of digital technologies such as AI. Moreover, reforms are required to tackle incentive structures in science that discourage high-risk and interdisciplinary research, inhibit data sharing and reduce career mobility (OECD, 2021c). The disciplinary and hierarchical structures that have served science so well in the past may also need to be adjusted to enable and promote trans-disciplinary research that engages different science fields and sectors to address complex challenges like climate change or pandemics. A new cohort of digitally skilled research-support professionals and scientists will also need to be trained and integrated in academia if research is to benefit fully from the opportunities provided by digital tools. New and more attractive career paths that provide greater security and alternative options for mobility across academia and other public- and private-sector institutions will also be required.

218. Governments will also need to invest in preparedness measures, including agile technology platforms, infrastructures and collaborative networks that improve countries' abilities to detect, make sense and respond effectively to a diverse range of risks. Many 21st century challenges are global in nature, and solutions require international co-operation (OECD, 2018). The pandemic has created momentum that offers opportunities to establish effective and sustainable global mechanisms to support the range and scope of R&D necessary to confront a wider range of global challenges.

219. To seize these opportunities, governments will need to build trust and define common and shared values to ensure a level playing field for scientific co-operation and an equitable distribution of resulting benefits. This will need to address concerns about a lack of openness and reciprocity in some of these collaborative relationships, involving some governments and non-state actors, as that may threaten their future. Focusing STI collaboration efforts on global challenges will also require a paradigm shift in research priorities towards global public goods, as well as more effective governance of multi-stakeholder partnerships.

220. Addressing the challenges described above will also require that governments strengthen capabilities within the public sector, including skills, organisational capacities and processes. They will have to equip themselves with the mechanisms, instruments and capabilities to orient innovation efforts, particularly in areas where government is a primary user or customer of innovations. Policy will also need to prepare more effectively for future shocks, by assessing developments around key uncertainties and their implications for STI. It will be important to engage stakeholders and non-experts in these efforts, reflecting their knowledge and values. Increasingly, these new capabilities will need to address rapidly changing environments.

221. A final and closely related challenge is how **governments can promote innovation within government** in support of economic resilience, including through advanced digital government strategies. The crisis has illustrated the potential innovation that can be unlocked when the circumstances are right -- yet governments cannot afford to wait for a crisis to drive needed change. A deliberate, consistent and systemic approach is required, one that recognises and supports innovation activity as a core endeavour of how the public sector achieves its effectiveness. As illustrated by the various technological solutions implemented across countries to improve regulatory capacity during the COVID-19 crisis, digital technologies hold the potential to help resource-constrained governments and regulators improve regulatory capacity, service delivery and crisis management, and implement agile, resilient and data-driven policy approaches, including regulatory frameworks. This involves ensuring that regulations, policies and processes do not unnecessarily hinder the public sector in adopting innovative technologies and solutions. Just as regulations applicable to the private sector need to be focused on outcomes and risks, and allow for appropriate flexibility, the same approach needs to be followed for rules applicable to the public sector.

222. To help promote innovation within government, the *OECD Recommendation on Digital Government Strategies* (OECD, 2014) and *Digital Government Policy Framework* (OECD, 2020i) endorse the development of holistic strategies to embed digital government and data practices at the heart of policy and service design. The strategic access to and sharing of data and the availability of digital enablers, including a strong ecosystem of digital suppliers, can foster innovation in support of economic resilience within and outside the public sector, equipping entrepreneurs with tools to create innovative solutions to societal problems.

223. The *OECD Declaration on Public Sector Innovation* (OECD, 2019f) recognises the benefits that can come from enabling experimentation in core systems (such as the use of digital technologies and more agile and flexible structures and methods), which can enable system resilience and lead to the development of more responsive services. Governments that can develop explicit and deliberate innovation portfolios can ensure that they have options when the unexpected occurs, thereby helping to avoid the risk of being driven purely by reactive pressures which are likely to result in costly and sub-optimal solutions, with the brunt of the learning curve being undertaken *during* a crisis, rather than before.

4.3. Governance of emerging technologies and economic resilience

224. As noted in the previous section, science and technology are key drivers of economic growth and well-being, and are essential to address shared policy challenges, including pandemics, sustainability, energy security or age-related diseases like Alzheimer's. However, traditional means of governing science and technology, whether through institutionalised research ethics, regulation or market mechanisms, are increasingly ill-equipped to capture the pace and depth with which innovations are reshaping economies and societies. Traditional regulatory instruments – e.g. risk assessment, product-based standard-setting, export controls and liability – tend to focus on managing the immediate or readily quantifiable consequences of emerging technology, or are put into play only after key decisions about technology design have been made. Yet, many of the issues raised by emerging technologies are more fundamental and long-term in nature.

225. The governance of emerging science and technologies poses a well-known puzzle: the so-called Collingridge dilemma (Collingridge, 1980) holds that early in the innovation process — when interventions and course corrections might still prove easy and cheap — the full consequences of the technology and hence the need for guidance and policy intervention might not be fully apparent. Conversely, when the need for intervention becomes apparent, changing course may be expensive, difficult and time-consuming. Uncertainty and lock-ins are at the heart of many governance debates.

226. In recent years, new approaches to technology governance have emerged, which aim to anticipate possible societal concerns, address them through open, agile and inclusive processes, and embed basic values of open societies, such as freedom, open and trusted markets, pluralism and the protection of human rights, early on in the development of new technologies. Within this context, values and rights linked to the digital economy are increasingly important, e.g. privacy protection and data protection, but also values linked to the use of artificial intelligence, such as transparency. Moreover, within this perspective, technology governance is not a constraint on innovation and technological freedoms, but an enabler for realising desired futures and responding to the needs of society. By reducing uncertainty for businesses and building trust with consumers, this new approach to technology governance helps underpin a more flexible and agile business environment that strengthens economic resilience. The approach can involve several stages, ranging from the development of norms, principles and guidance early in the development of an emerging technology, to the establishment of regulation and technical standards at a later stage.

227. A recent example of norms and principles for emerging technologies is the development of the OECD's *AI Principles*, the first intergovernmental standard on AI (OECD, 2019g). These principles recognised that, although the nature of future AI applications and their implications may be hard to foresee, the trustworthiness of AI systems would be a key factor for their diffusion and adoption. Moreover, they recognise that given the rapid development and implementation of AI, there is a need for a stable and resilient policy environment that promotes a human-centric approach to trustworthy AI that fosters research, preserves economic incentives to innovate and applies to all stakeholders. The OECD's *AI Principles* are therefore flexible and intended to stand the test of time.

228. Another example of norms and principles is the 2019 *OECD Council Recommendation on Responsible Innovation in Neurotechnology* (OECD, 2019h). This technology has great promise for improving mental health, but also raises a range of unique ethical, legal and societal questions, e.g. regarding (brain) data privacy, the prospects of human enhancement and the vulnerability of cognitive patterns for commercial or political manipulation. The *Recommendation* seeks to anticipate these concerns by providing a set of high-level values, building institutional capacity and establishing processes that can help guide the future development of this technology.

229. Such principles, including a possible *Recommendation on Blockchain and other Distributed Ledger Technologies* that is currently being developed at the OECD, can be the first step in the process of technology governance that will typically involve other practices, rules and standards as the technology develops, applications emerge and its implications become more apparent. For example, work is currently underway at the OECD to help identify promising ideas and good practices for implementing the OECD principles for trustworthy AI systems, described above. Such practices may include codes of conduct, guidelines, standards, certifications, corporate governance frameworks, risk management approaches, technical research, software tools, as well as capacity and awareness-building tools. At the current stage of AI development, where applications are emerging in many areas, the objective is to identify practical guidance and shared procedural approaches to help AI actors and decision-makers implement trustworthy AI, where tools and approaches may vary across different AI systems and operational contexts.

230. Going beyond norms and principles, the COVID-19 crisis has magnified the regulatory challenges raised by emerging technologies and reinforced the need for a fundamental rethink of the way governments regulate. In particular, it has accelerated the use of emerging technologies to support the public health response by reshaping the way in which services are provided and goods produced. The COVID-19 crisis

has also exposed the drawbacks of governance and regulatory frameworks that have not been agile enough to respond to the changing environment. As stated by OECD (2020j), the COVID crisis has clearly highlighted that "*one of the most salient concerns facing regulatory management tools in the future is the ability to develop new, timely responses to fast changing economic, technological and public health environments; and the need to ensure the resilience of the regulatory system to future systemic threats"*.

231. As governments and businesses seek to rebuild afresh, governments must ensure that the innovation that will power economic growth and solve the world's most pressing social and environmental challenges is not held back by regulations designed for the past. In that perspective, the OECD is in the process of developing Principles for agile regulatory governance to harness technological innovation that will support governments in establishing more effective and innovation-friendly rulemaking. Beyond the critical necessity to adopt a more anticipatory approach to identify innovations and their implications at an early stage of the policy-making process, governments should pro-actively reform regulatory policy along four main avenues:

- **Adapting the governance and institutional set-up to enable the development of agile and future-focused approaches to regulation**. The uncertainty surrounding technological developments raises a need to create space for experimentation to foster policy learning and adaptation and help governments choose the right regulatory (or alternative) approach. In order to encourage innovation, and enhance flexibility and resilience, regulatory systems should, where relevant, be more outcomes-focused rather than rule-based. Developing agile approaches to regulation also involves harnessing the opportunities provided by soft-law approaches including regulatory guidance, self-regulation, co-regulation, voluntary standards and ethical business regulation to complement other regulatory instruments. In addition, as digital technologies as well as other emerging technologies frequently cut across administrative and sectoral boundaries, co-ordination is essential in this new paradigm. More than ever, governments also need to foster coherence and joined-up approaches between supranational, national and sub-national levels of government;
- **Adjusting regulatory management tools to ensure regulations are fit for purpose**, by means of a "whole-of-government" approach to rulemaking, active engagement with a broad and diverse range of stakeholders early in the policy-making process, risk-based analysis of both *ex ante* and ex post regulatory assessments on a systematic basis. Given the dynamics of innovation-driven transformation, regulatory responses cannot afford to be static and need periodic adaptations to keep pace with the transformative changes. Continuous monitoring of the stock of regulations could help governments assess whether regulations remain fit for purpose, effective and fulfil the policy objectives and enable them to undertake regulatory revisions when necessary;
- **Stepping up international regulatory co-operation (IRC)**, which holds the key to addressing the transboundary nature of emerging technologies. IRC offers regulators various avenues for governments to strengthen the resilience and relevance of their regulatory frameworks for innovation. Turning rulemaking on emerging technologies "outwards" can be done through a variety of IRC approaches, schematically ranging from "unilateral" efforts embedding international considerations in domestic rulemaking and regulatory management tools, to "bilateral", "regional" and "multilateral" forms of co-operation, all potentially complementing each other. In line with this objective, seven countries (Canada, Denmark, Italy, Japan, Singapore, the United Arab Emirates and the United Kingdom) recently adopted an "Agile Nations" charter, affirming their commitment to foster international regulatory co-operation towards more agile governance and rulemaking in the current context of rapid technological progress.
- **Adapting enforcement methods and practices to the new normal, through more outcomes-oriented and risk-proportional approaches**. This involves in particular leveraging data through improved analytical methods (e.g. machine learning) to better target control resources, have a more flexible and responsive approach to enforcement, etc. This also involves

better engagement with all stakeholders – both regulated businesses, as well as consumers, to achieve more effective regulation of markets that are increasingly transnational and transformed by the direct trading relationships offered by e-commerce platforms.

232. Today, a large number of technologies are emerging, including new digital technologies, biotechnologies, energy and environmental technologies, advanced materials and many others (OECD, 2016).[45] Governments and stakeholders therefore continuously need to assess when and what norms, principles, standards and regulations will be needed for these emerging technologies. Foresight studies and horizon scanning can help anticipate technology opportunities and challenges, and provide opportunities for stakeholders to identify and discuss those technologies that may be particularly challenging from a governance perspective.

233. The examples of the OECD's *AI Principles* and the *Council Recommendation on Responsible Innovation in Neurotechnology* suggest that technologies that have a direct relationship with core human values may be particularly challenging from the perspective of technology governance. Other technologies that have proven challenging in the past are those involving the manipulation of genetic resources, e.g. gene editing, or of biology itself, e.g. synthetic or engineering biology. Advanced digital technologies such as quantum computing, the Internet of Things, virtual reality or blockchain, may also raise particular challenges for technology governance, given their growing power and impact, e.g. for areas such as privacy and digital security. At the same time, many new technologies are disruptive and potentially have both positive and negative impacts on the economy and society, possibly requiring new approaches to their governance. For example, the United Kingdom's Regulatory Horizons Council is exploring a wide range of emerging technologies by examining their potential benefits for the economy and society, the need for and potential advantages of regulatory change, and the degree of uncertainty in the market (UK Government, 2020). It also recommends actions to reform regulation in anticipation of such technologies.

234. Good governance should enable, rather than constrain, technology. In creating a responsible innovation system, some elements are increasingly gaining traction in innovation policy (Figure 4.2):

- ***Directionality*.** As noted in section 4.2, there is a growing understanding that policy plays a role in better aligning research, commercialisation and societal needs. This implies promoting "mission-oriented" and "purposive" technological transformations to better connect innovation to public policy needs. At the same time, the resulting innovation and industrial policies need to be transparent, open and well-designed so they do not distort competition.
- ***Inclusivity*.** Greater emphasis on public engagement and process inclusivity can help align science and technology with societal goals and needs. This includes the involvement of stakeholders, citizens and actors typically excluded from the innovation process (e.g. small firms, remote regions, certain social groups, e.g. minorities, etc.). The private sector, in particular, has a critical role to play in governance. Firms are on the front line of product development, regulation, diffusion and marketing, and should therefore be closely engaged in the development of socially responsible innovation frameworks.
- ***Anticipation*.** From an innovation perspective, governance approaches that engage at a late stage of the innovation process can be inflexible, inadequate and even stifling. Governments and policy makers are currently experimenting with test beds, sandboxes, new technology assessment methods and foresight strategies.

235. Given the global, trans-border nature of technology, developing governance in these areas implies a need to build consensus between governments and stakeholders seeking to mitigate risks while

[45] These are broad areas where new technologies are emerging. More specific examples of emerging technologies and technology trends are published by many organisations, e.g. Gartner (2020).

harnessing emerging technologies as a key driver of growth and well-being. This requires closer co-operation between countries and their stakeholders, including through existing channels and international organisations.

236. Such co-operation could benefit from dedicated discussions on technology governance, e.g. in the G7, the OECD and beyond, where these issues could be further explored and guidance could be provided on ways forward. This could also be an opportunity for countries to work together to improve horizon scanning and scenario analysis at the international level, involving a wide range of stakeholders, so as to better anticipate technology opportunities and challenges, and develop shared visions that can spur collective action.

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