

Executive summary

Climate change represents a severe, pervasive and potentially irreversible threat to people, ecosystems, public health, infrastructure and the global economy. Left unabated, it could undo much of the progress made over recent decades in development, poverty reduction and prosperity creation. Developing countries – in particular small-island developing states and least-developed countries (LDCs) – are likely to suffer the most, due to their greater exposure and vulnerability to climate risks and natural disasters, and their more limited capacity to adapt to climate change. Leveraging trade to tackle climate change presents several development and growth opportunities and will require significant policy actions to advance a just transition towards a low-carbon, inclusive and resilient future.

In the face of this existential threat, the 2022 *World Trade Report* explores the multifaceted relationship between international trade and climate change. It looks at how international trade might exacerbate climate change, how the consequences of climate change might alter trading patterns and relationships, and how trade could be a force multiplier for the global response to the climate crisis. The report spells out various ways international trade cooperation, fostered by the WTO, could support and lower the cost of implementing the Paris Agreement and fulfilling the Glasgow Climate Pact's goal of net-zero greenhouse gas (GHG) emissions by mid-century (IPCC, 2022a). The report's core message is clear: trade is a critical point of leverage for transforming the global economy and putting the planet on a sustainable trajectory.

Climate change is a problem of the global commons. Markets do not suffice to address the threats from GHG accumulation in the atmosphere because firms and consumers often do not directly face the costs of the emissions they cause. To correct these market failures, carefully constructed climate change mitigation policies are needed to incentivize behavioural change and increased investment in energy efficiency and climate-friendly technologies.

Ambitious GHG mitigation policies face a wide range of challenges, including conflicting economic and development priorities, divergent energy strategies and geopolitical competition. Fragile economic recovery from the COVID-19 pandemic, rising inflationary pressures, increasing food security challenges and the war in Ukraine have added further

uncertainties. While the transition to a low-carbon economy entails substantial short-term investment and adjustment costs, it will yield major economic dividends and create wide-ranging opportunities for more sustainable and fair development. A well-managed low-carbon transition can limit climate risks, promote biodiversity and improve food security. Investments in clean energy also promise better air quality, public health and quality of life for people across the world. Bold climate actions could yield a cumulated economic gain of US\$ 26 trillion between 2018 and 2030 (Garrido et al., 2019). The low-carbon transition could also create millions of new jobs in clean energy and energy-related sectors and support a more inclusive economy, not least because more women work in the renewable energy sector than in the fossil fuels sector (IRENA, 2021).

Because the existing build-up of GHGs in the atmosphere makes some degree of climate change unavoidable, adaptation strategies are also required to make communities more resilient in the face of sea level rise, more intense storms and changed rainfall patterns leading to more floods, droughts and wildfires as well as significant effects on agricultural productivity. These consequences will profoundly impact international trade and coping with them requires adaptation efforts to identify, prevent and reduce climate risks, and minimize unavoidable losses and damages (IPCC, 2022b).

The report makes clear that trade and climate change are deeply intertwined, and that more effective responses to mitigate and adapt to climate change will require stronger and better international trade cooperation.

The report makes three key points. First, while climate change can have profound negative impacts on international trade, trade and trade policies are essential elements of sound climate change adaptation strategies. Second, although trade generates GHG emissions, trade and trade policies can foster the transition to a low-carbon economy by providing access to and spurring innovation in low-carbon technologies, disseminating best practices and helping clean energy investments achieve the greatest reach at the lowest cost. Third, improving the ambition and effectiveness of climate action requires greater international trade cooperation at the WTO.

Even though climate change can have profound negative impacts on international trade, trade and well-designed trade policies are essential elements of sound climate change adaptation strategies.

Climate change can cause productivity losses, supply shortages and transport disruptions, severely impacting trade. Because these impacts will differ across regions, some economies will be at a disadvantage. Export growth of agricultural products and light manufacturing from LDCs have been found to decrease, on average, by between 2 and 5.7 per cent in response to a rise in the country's temperature by 1°C (Jones and Olken, 2010).

Extreme weather events can also affect key transport corridors and infrastructure, potentially creating vulnerabilities in the global trade network. Maritime transport – which accounts for 80 per cent of world trade by volume – is particularly exposed to climate change, while other modes of transport can also be impacted. Small economies and landlocked countries, which trade through a limited number of ports and routes, can suffer major trade bottlenecks from climate-related disruptions. For instance, the Paraná River transports 90 per cent of Paraguay's international trade of agricultural goods, but recurrent droughts have in recent years frequently lowered water levels, diminishing the weight barges can carry, causing congestion and delays.

Climate-induced disruptions tend to be more severe in heavily concentrated global value chains (GVCs) where intermediate inputs are difficult to replace in the short run. For example, in 2011, flooding in Thailand disrupted the global electronic and automotive industries, causing an estimated 2.5 percentage point decline in the rate of growth of global industrial production (Kasman, Lupton and Hensley, 2011). Climate-induced supply chain risks are often exacerbated by firms' limited capabilities to assess climate risks and implement risk management strategies.

Without significant reduction in GHGs, climate change is likely to alter countries' comparative advantage and trade patterns by changing endowments in natural resources or altering the efficiency with which land, labour, capital and other production factors can be deployed to produce goods and services. Commodity dependence and lack of diversification can exacerbate vulnerabilities to climate change, underscoring the need to support efforts to accelerate economic diversification.

Agriculture, tourism and some manufacturing sectors are particularly vulnerable to climate change. Agriculture is the most exposed and vulnerable sector to changes in temperature and precipitation, raising serious concerns about future food security. Sub-Saharan Africa and South Asia are expected to experience larger adverse agricultural yield shocks than other regions; and given their high share of agricultural employment, they may face more severe labour market disruptions. Changes in climate might also reduce the touristic appeal of long-favoured destinations, while sea level rise and extreme weather events could permanently damage tourism infrastructure. Manufacturing sectors dependent on climate-sensitive inputs, such as food processing, could suffer from reduced access to raw materials. Labour-intensive production could also be adversely affected as rising temperatures diminish capacity to work and raise risks of accidents and heat exhaustion.

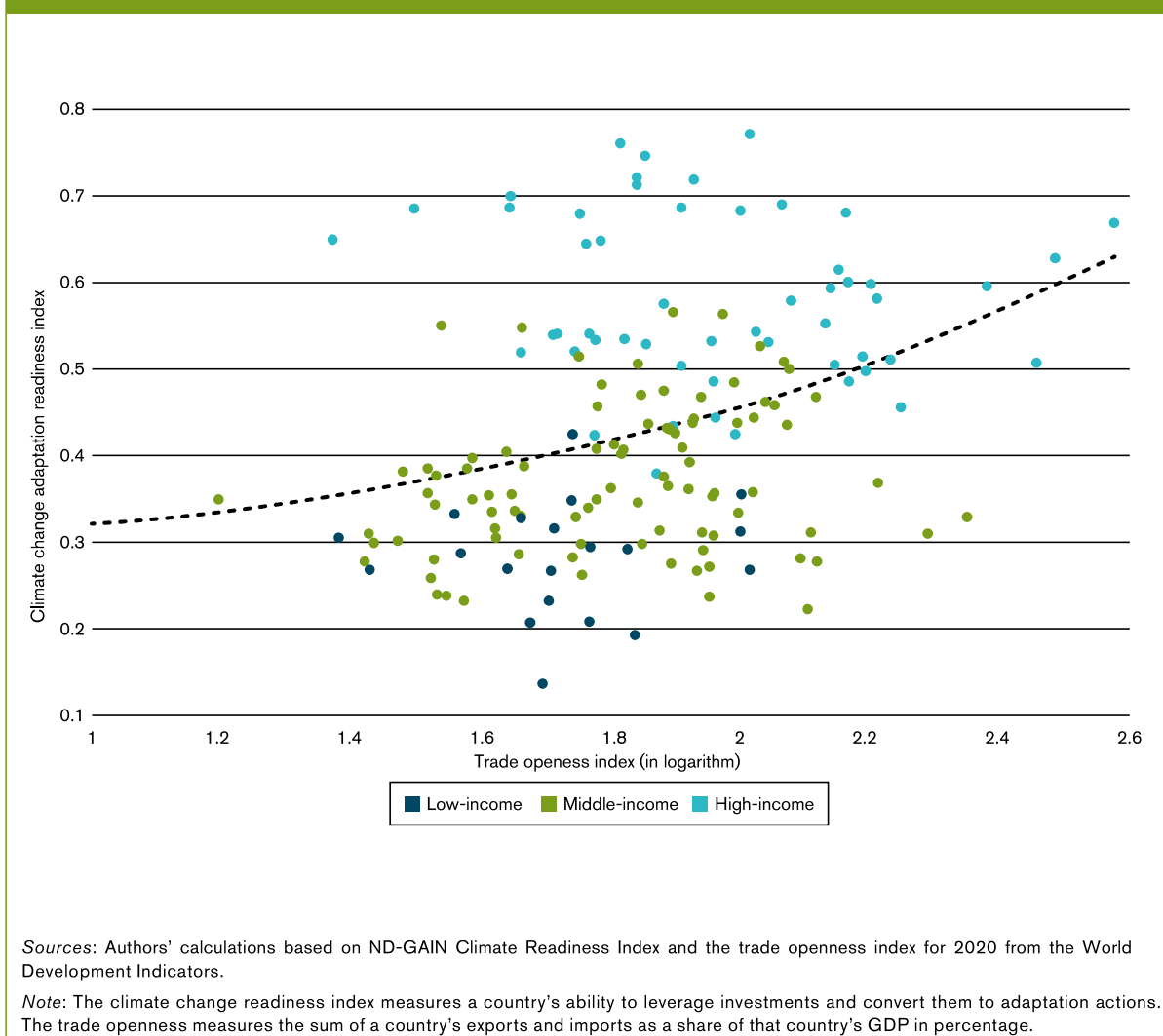
Adapting to climate change is a sustainable development imperative. Without understating how costly and disruptive adaptation will continue to be, trade can make an important contribution to climate risk prevention, reduction and preparedness.

Trade can facilitate the development and deployment of pro-adaptation technologies, such as climate-resistant crop varieties, early warning systems and water conservation and storage systems. By fostering higher economic growth, trade can generate additional financial resources to invest in adaptation strategies such as climate-resilient infrastructure. Trade openness also allows for wider access to services that help prepare for climate-related shocks, such as weather forecasting, insurance, telecommunications, transportation, logistics and health services.

Access to imported essential goods and services, such as food and medical supplies, can help economies cope and recover after an extreme weather event hits. Facilitating imports of construction materials can contribute to post-disaster reconstruction. Allowing trade to resume faster after climate-induced shocks can also support economic recovery. Even in the absence of extreme weather events, long-term shifts in weather patterns can still cause crop yields to fall, and trade can help alleviate food insecurity by allowing regions to import food to fill demand gaps. Overall, countries more open to trade tend to have a greater capacity to adapt to climate change (see Figure 1).

The role of trade in coping with climate change underlines that trade policies must be an integral

Figure 1: Greater capacity to adjust to climate change tends to be associated with greater openness to trade



part of climate change adaptation strategies. A small but increasing number of trade measures notified by WTO members between 2009 and 2020 are related to climate change adaptation, though these measures – which mostly take the form of support in the agricultural sector – account for less than 4 per cent of all notified climate-related trade measures (161 out of 4,629).

Trade and trade policy are, however, not a panacea to adapt to the highly disruptive consequences of climate change. Addressing the factors and conditions underpinning the vulnerabilities and exposures to climate risks is essential. In addition, well-functioning markets, including in the areas of infrastructure, finance, food and labour, are important to facilitate adjustment.

Although trade generates GHG emissions, trade and trade policies can be part of the solutions to support a low-carbon transition.

Trade, like most economic activities, emits GHGs. The world share of carbon dioxide (CO₂) emissions embodied in world goods and services exports peaked in 2011 and was estimated to account for around 30 per cent of global carbon emissions in 2018. This share indicates the close relationship between production, trade, consumption and the consequent emissions under current technologies and production processes.

International trade has complex effects, both positive and negative, on GHG emissions, going well beyond the emissions released during the production and

transportation of the exported goods and services. The overall impact of trade on carbon emissions depends, among others, on the sector and countries involved as well as the energy sources, production methods and modes of transport.

On the positive side of the ledger, international trade increases the worldwide diffusion and deployment of lower-emission goods, services, capital equipment and know-how. It also reduces the costs of these products through efficiency improvements, economies of scale and learning-by-doing. For instance, the cost of solar electricity has plunged by 97 per cent since 1990. A significant part of the cost decline of solar panel systems has been attributed to GVCs, which have enabled producers to lower production costs and reap economies of scale by locating different production stages in different countries (WTO and IRENA, 2021). Market opportunities for low-carbon exports can also spur more investment and innovation in new low-carbon technologies and encourage efforts to better adapt these technologies to local conditions.

In addition, trade opening can reduce the carbon intensity of economic output by shifting resources to more productive and cleaner firms, as firms engaged in international trade tend to be more competitive and energy efficient than purely domestic firms. The higher incomes typically associated with greater integration into global trade also give individuals the space to demand higher environmental quality and to pressure governments to adopt more stringent climate regulations and provide additional financial resources for environmental protection.

International trade in renewable energy and electricity has also the potential to help compensate for the uneven geographical distribution of usable sunlight and wind, though this will hinge on important technological breakthroughs – notably in energy storage. More developing countries are already moving to harness their abundant renewable energy potential. For instance, Morocco hosts the world's largest solar power station, while Egypt is building a solar photovoltaic park touted to become the world's largest.

On the negative side of the ledger, trade opening raises GHG emissions by increasing the production, transportation, consumption and disposal of products. The fragmentation of production represented by GVCs involves more transport and therefore more emissions. Trade may – in the absence of relevant policies – incentivize emissions-boosting deforestation.

Changes in the sectoral composition of production – a standard result of trade opening – can also increase or reduce GHG emissions, depending on whether the country in question has a comparative advantage in carbon-intensive industries, which in turn depends on factors including resource endowments, technological level and environmental and energy policies (WTO, 2021a).

Rising concern about trade-related GHG emissions has led to calls to limit imports in favour of producing and consuming local goods and services. But if countries close their borders to trade, meeting demand for previously imported goods and services would cause domestic production and associated GHG emissions to rise; while foregoing the broader gains from trade would cause living standards to fall.

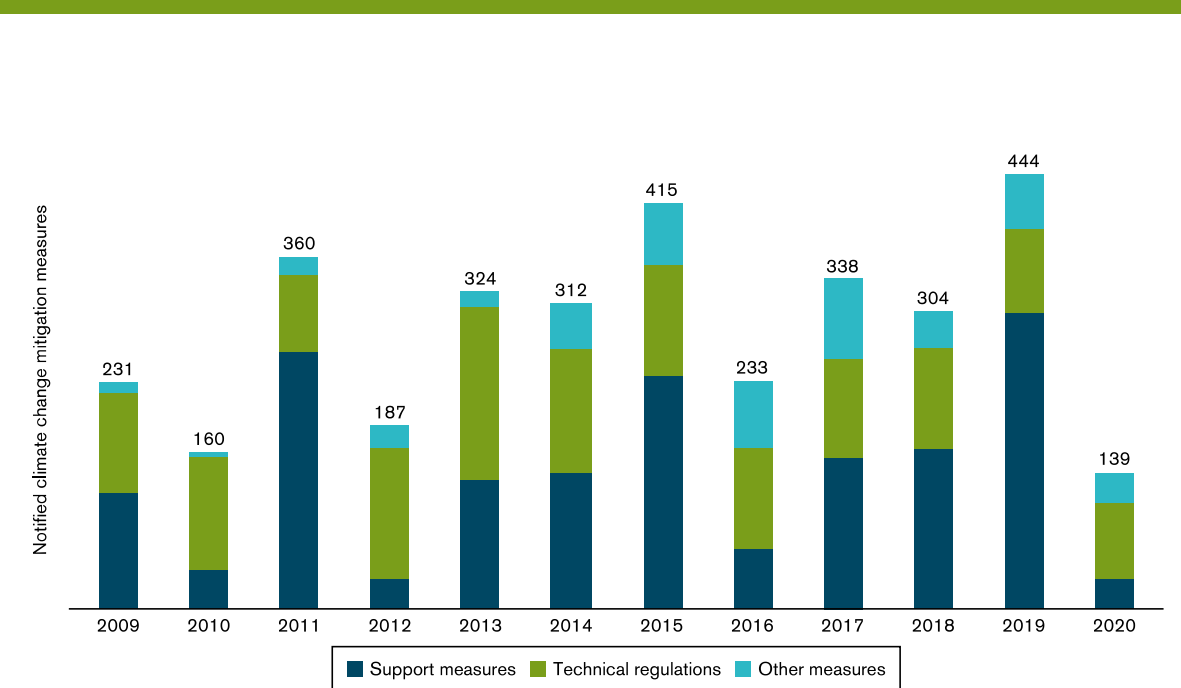
Instead of re-shoring, the low-carbon transition would be better supported – and accelerated – by cleaner trade, which would involve reducing the carbon intensity of production, transportation and GVCs, developing and deploying climate-friendly technologies and promoting trade in climate-friendly goods and services. Major decarbonization pathways for international transport include switching to lower-carbon fuels, improving vehicle efficiency and phasing-out carbon-intensive vehicles.

Well-designed trade policies must support the role of trade in deploying and disseminating climate mitigation technologies. Trade and trade policies are an integral part of a limited but increasing number of countries' plans to achieve carbon emission-reduction targets under the Paris Agreement's nationally determined contributions. Complemented by other policies, trade policies can help countries diversify away from reliance on carbon-intensive sectors, create new jobs and increase the ambition of mitigation efforts. Between 2009 and 2020, WTO members notified 3,460 trade-related climate change mitigation measures explicitly addressing climate change mitigation, energy conservation and efficiency, and alternative and renewable energy. Support measures and technical regulations are the main types of notified trade-related climate change mitigation measures (see Figure 2).

Despite the benefits of opening trade in the environmental industry, barriers to trade in environmental goods and services remain significant. In addition, tariff and non-tariff barriers tend to be lower in carbon-intensive industries than in clean industries (Shapiro, 2021).

Removing barriers to trade in environmental products can contribute to addressing climate change. WTO

Figure 2: Support measures and technical regulations are the most common trade-related climate change mitigation measures



Sources: Authors' calculation, based on the WTO Environmental Database.

Note: The category "technical regulations" includes conformity assessment procedures. One notified measure can cover more than one type of policy.

simulation analysis suggests that eliminating tariffs and reducing non-tariff measures on some energy-related environmental goods and environmentally preferable products could increase global exports in these products by US\$ 109 billion (5 per cent) and US\$ 10.3 billion (14 per cent), respectively, by 2030. The resulting improvements in energy efficiency and renewable energy adoption are estimated to reduce net carbon emissions by 0.6 per cent, while the knock-on effects of accelerating the spread of environmental innovation would do much more, including increasing the demand for ancillary services relating to the sale, delivery, installation and maintenance of environmental technologies.

That said, harnessing the full potential of international trade in renewable energy and other environmental goods and services also requires ambitious climate policies and actions to upgrade power-generation, transmission and distribution infrastructure as well as to build a well-functioning quality infrastructure.

Improving the ambition and effectiveness of climate change action requires greater international trade cooperation.

Addressing climate change requires global cooperation on all fronts, and international trade cooperation, at the WTO and elsewhere, is an integral part of the efforts.

The bottom-up international climate regime, with nationally determined contributions and mitigation actions, encourages broad-based participation and underlines the urgency of climate action. But it also results in widely varying levels of climate ambition across jurisdictions, with the attendant risks of carbon leakage and competitiveness loss, especially in carbon-intensive and trade-exposed sectors. These risks have prompted some countries to consider border carbon adjustment measures. Uncoordinated trade-related climate policies, however, could give rise to trade tensions and heighten marketplace uncertainty in ways that discourage much-needed

low-carbon investment. Avoiding such outcomes calls for leveraging every opportunity at the WTO and elsewhere for improving cooperation on the trade-related aspects of climate change policies.

At the regional level, a limited but increasing number of trade agreements, namely 64 out of 349 notified regional trade agreements (RTAs), explicitly contain climate change-related provisions. Some of these RTAs commit parties to effectively implement the Paris Agreement and adopt climate change policies, including carbon pricing, while a few others remove some trade and investment barriers to climate-friendly goods, services and technologies.

At the global level, as noted above, the open and predictable international markets underpinned by the multilateral trading system already facilitate access to environmental technologies, food and other critical supplies. WTO members notify climate-related measures and discuss potential concerns, as well as the underlying environmental rationale, in various WTO bodies such as the Committee on Trade and Environment. These discussions are also a venue for exchanging national experiences and practices.

The WTO agreements expressly recognize the rights of members to adopt measures to protect the environment, so long as they are not applied arbitrarily and are not more restrictive than necessary to meet the objective in question. Climate objectives, rather than the protection of domestic producers, must be the central rationale for the development and implementation of trade-related climate policies. Trade-related climate policies should also consider their impact on other nations' climate efforts. The protection and enforcement of intellectual property rights, as provided by WTO rules, is also essential to support innovation in environmental technologies while promoting the transfer of technology.

But WTO members can do much more to enhance the contribution of trade and trade policy to their climate objectives.

First, with the increasing number of trade-related climate measures being taken nationally, there is a strong case for strengthening the role of the WTO as a forum for coordination and dialogue, and for identifying potential action on trade and climate change. The committee process could be used to identify transparency and knowledge gaps, opportunities for coordination, capacity needs and perspectives of developing countries, and areas for further work, including potential negotiations. At the 12th Ministerial Conference in June 2022, WTO members concluded an agreement that prohibits

certain types of fisheries subsidies. Continuing work on additional provisions for a comprehensive agreement on fisheries subsidies would further contribute to sustainable management of marine resources and biodiversity.

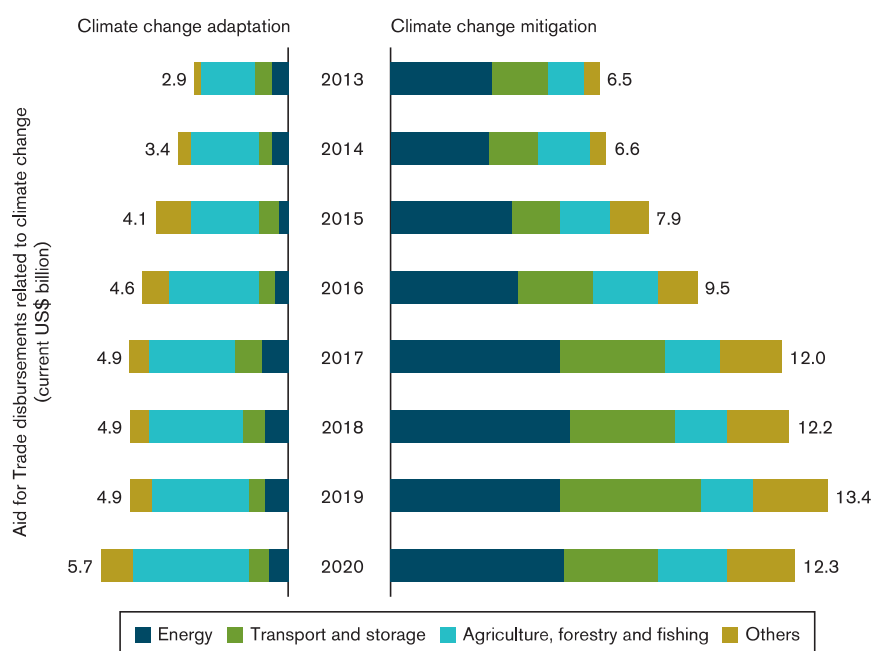
Second, members are already beginning to pursue a new generation of sustainability driven initiatives aimed more at using trade as a means to help achieve global public goods than at correcting a particular trade distortion. These initiatives include the Trade and Environmental Sustainability Structured Discussions, the Informal Dialogue on Plastics Pollution and Environmentally Sustainable Plastics Trade, and the Fossil Fuel Subsidy Reform initiative.

Some of these discussions focus on traditional fare for trade negotiators, namely tariff and non-tariff policies. For instance, removing trade barriers on environmental goods and services would lower costs, expand markets and boost the deployment of climate-friendly technologies. Pursuing greater alignment on low-carbon standards would lower compliance costs and encourage greater scale and investment.

Other initiatives focus instead on generating new knowledge that can inform and improve governments' efforts to integrate trade into their environmental and climate change strategies. This could involve a better understanding of the environmentally harmful impacts of subsidies or of trade-related linkages with the circular economy. Finding a balance between support incentives for low-carbon technologies while minimizing negative spillovers on trading partners would also provide more predictable and credible market signals for low-carbon investment and consumption. The dialogue on plastics seeks to generate knowledge on plastic trade flows in order to support negotiations on an international plastics treaty under the auspices of the United Nations Environment Programme.

Third, WTO members could work on supply side factors to enhance the climate resilience of their supply chains. Deepening and diversifying supply and transport networks would not just help reduce vulnerability to the kinds of supply chain disruptions seen since the start of the pandemic; it would also enhance resilience in the face of localized climate events. Stronger information sharing and monitoring would help food and energy security for all members, while helping them manage risks related to supply chain bottlenecks. An example of how this might work in practice is the Agricultural Market Information System, which is a platform of international agencies, including the WTO, which tracks the supply of key agricultural commodities and provides a forum for

Figure 3: Aid for Trade disbursements related to climate change have increased over the past decade



Sources: Authors' calculations, based on Organisation for Economic Co-operation and Development DAC-CRS (Development Assistance Committee Creditor Reporting System) Aid Activities Database.

Note: Only projects with an explicit objective of adapting to or mitigating climate change and projects identifying climate change as important but secondary objective are considered as climate change-related official development assistance. Projects can be cross-cutting and have both adaptation and mitigation objectives.

coordinated policy responses when needed to prevent markets from seizing up. At the 12th Ministerial Conference, WTO members vowed to address the global food security challenges by exempting from export restrictions food bought by the World Food Programme for humanitarian purposes and pledging to facilitate trade in food, fertilizers and other agricultural inputs. Implementing these decisions could contribute to managing the knock-on effects of surging food prices during a crisis, thus increasing food security.

Fourth, improving the ability to understand and manage climate-related risks and investment opportunities would improve the synergies between climate finance and Aid for Trade. Climate finance to developing countries continues to fall short of the US\$ 100 billion goal for 2020 (OECD, 2022a) and has not achieved the balance between adaptation and mitigation finance set out in the Paris Agreement (UNEP, 2021a, 2021b). However, the

Aid for Trade initiative, supported by the WTO and other organizations, can help developing countries, particularly LDCs, to build climate-resilient trade capacity and infrastructure, and support trade policies to foster a low-carbon transition. Between 2013 to 2020, Aid for Trade disbursements related to climate action totalled US\$ 96 billion, with a larger share of the disbursements directed at climate mitigation (see Figure 3).

Finally, reinforcing the WTO's existing cooperation with international and regional organizations, including in the areas of climate risk prevention, climate-induced disaster relief, transport decarbonization and climate finance, is important to advance trade cooperation on climate change. Over the past few years, WTO members have started to address some of these issues. However, the scale and urgency of the climate crisis demand additional efforts in support of a more inclusive and just transition to a low-carbon economy and a more resilient future.