
Food and Agriculture
Organization of the
United Nations
2022
THE STATE OF
AGRICULTURAL
COMMODITY
MARKETS
THE GEOGRAPHY OF FOOD
AND AGRICULTURAL TRADE:
POLICY APPROACHES
FOR SUSTAINABLE DEVELOPMENT

This flagship publication is part of **The State of the World** series of the Food and Agriculture Organization of the United Nations.

Required citation:
FAO. 2022. *The State of Agricultural Commodity Markets 2022. The geography of food and agricultural trade: Policy approaches for sustainable development*. Rome, FAO.
https://doi.org/10.4060/cc0471en

ISSN 2663-8207 (print)
ISSN 2663-8215 (online)
ISBN 978-92-5-136373-7

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THAILAND. Rice fields in Chiang Mai during harvest.

ISSN 2663-8207

2022

THE STATE OF AGRICULTURAL COMMODITY MARKETS

THE GEOGRAPHY OF FOOD AND AGRICULTURAL TRADE: POLICY APPROACHES FOR SUSTAINABLE DEVELOPMENT

Food and Agriculture Organization of the United Nations
Rome, 2022

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FOREWORD

Since its first edition in 2004, the Food and Agriculture Organization of the United Nation's (FAO) flagship report *The State of Agricultural Commodity Markets* (SOCO), has addressed emerging developments, long-term trends and structural changes in food and agricultural markets. While this goal still stands, and has been reinforced by new developments, the world has changed significantly over the past 18 years.

The global food and agricultural market has expanded since 1995. While all nations have strengthened their participation in the global market, emerging economies and developing countries are playing a greater role. Trade, originally viewed as purely economic exchange, has today become an essential tool used to advance economic, social and environmental outcomes.

The outbreak of the COVID-19 pandemic in early 2020 demonstrated how a robust and well-integrated global agrifood system could help countries withstand unprecedented challenges. Indeed, global trade in food and agricultural products proved to be remarkably resilient to the disruptions caused by the pandemic. Disruptions were striking but generally short-lived, proving that by working together we are stronger.

The war in Ukraine is affecting a region of significant importance for global food security and nutrition. With the situation protracting, there is much uncertainty around Ukraine's ability to farm, harvest and trade crops in both the current and upcoming agricultural seasons. For trade, the impending risk of fragmenting global food and agricultural markets poses additional threats to world food security.

Such events emphasize the need for more breakthrough research, a deeper understanding of trade networks, and better approaches to facilitate integration and promote well-functioning food and agricultural markets. Currently, the trade policy environment is characterized by a deadlock in multilateral trade negotiations under the World Trade Organization (WTO) and by a proliferation of more profound regional trade agreements that, in addition to market access, aim to promote convergence in domestic policies and regulation among their signatories. The 2022 edition of SOCO examines how mutually reinforcing multilateral and regional efforts can address the sustainable development challenges of today and those of the future.

The 2030 Agenda for Sustainable Development recognizes international trade as an engine for inclusive economic growth and poverty reduction, and as an important means to achieve the Sustainable Development Goals. Trade can contribute to building a better world, free of hunger and malnutrition.

Trade can move food from where it can be produced at a relatively low cost to where it is needed. In this way, trade can promote world food security and healthy diets – it helps many countries in the world meet their food requirements in terms of both quantity and diversity at levels above those which their domestic production could sustain. Trade could help agriculture across the world to use natural resources, such as land and water, more efficiently. It can also be an avenue to diffuse knowledge worldwide. Global value chains create opportunities for technology transfer and can promote agricultural productivity improvements. Increasing productivity is important for developing countries.

There is no doubt that open, rules-based, predictable and well-functioning global markets benefit all countries. In the aggregate, global markets improve efficiency in agriculture and offer consumers a wider choice of food at more affordable prices. At the same time, food and agricultural trade can result in negative environmental or social outcomes. Producing for export can result in more pollution, deforestation and greenhouse gas emissions. Cheaper food

FOREWORD

imports could leave smallholder farmers in developing countries unable to compete. Women farmers who have limited access to capital and inputs could be affected the most. Trade policies alone cannot, and should not, be expected to fully address the trade-offs among economic, environmental and social objectives. They must be complemented by other, more targeted measures.

How we decide on trade policies and the complementary measures that can promote sustainable agrifood systems is also important. Multilateral trade rules provide the most fundamental pillars of global food and agricultural trade. Often, deeper and extensive regional trade agreements are built on the multilateral framework to promote further trade integration. These agreements can promote regional food and agricultural value chains by allowing for additional norms for cooperation and harmonizing food regulation and standards. The importance of trade agreements does not only emanate from economic gains. Trade integration can also reduce the probability of conflict. For example, when it was created in 1958, the European Common Market aspired to unite Europe and preserve peace in a continent torn by successive wars.

Today, global food and agricultural markets are more integrated than ever; however, with the increasingly complex challenges we face, our primary focus should be on safeguarding the essential and beneficial functions of those markets. A fragmentation of global food trade could threaten food security in many parts of the world. At times of crises, export restrictions can add to extreme price volatility and harm low-income food-deficit countries, particularly those that depend on global markets for their food security. They can also have adverse medium-term impacts.

SOCO 2022 examines multilateral and regional approaches to agricultural trade policy in terms of agrifood systems resilience, economic growth and environmental outcomes. Multilateral and regional trade integration can be mutually supportive in making food and agricultural trade an engine for growth. But when it comes to global challenges such as climate change, it is multilateral cooperation that will be effective with trade policies that help climate mitigation efforts to have global reach. Global challenges require global solutions.

Food and agricultural trade policies should aim to safeguard global food security, help to address the trade-offs between economic and environmental objectives, and strengthen the resilience of the global agrifood system to shocks, such as conflicts, pandemics and extreme weather. This report offers timely and invaluable insights for policymakers and other key actors to assist them in taking concrete actions.

Qu Dongyu
FAO Director-General

METHODOLOGY

Work on *The State of Agricultural Commodity Markets 2022* (SOCO 2022) began in January 2021. The research and writing team, assembled at that time, was composed of six staff members of the Food and Agriculture Organization of the United Nations (FAO) who were responsible for the data analysis, research and writing of the report.

FAO conducted an econometric modelling exercise to analyse the statistical relationship between bilateral trade flows, relative prices and geographic barriers, and to identify the key drivers of trade such as absolute advantage, comparative advantage and trade costs. In addition, a group of external experts were engaged to support the writing team in developing this edition of the report. The external experts performed two additional analytical exercises: a trade network analysis, and a computable general equilibrium model simulation to estimate the effects of different liberalization and trade cost reduction scenarios. An external expert also produced a critical review of the impacts of trade on the environment.

In April 2022, the manuscript was sent to external reviewers, who provided substantive comments and advice on the analysis of the report. The report was also reviewed by multiple experts across FAO, who provided valuable comments.

The report was reviewed and discussed by the management team of the FAO Economic and Social Development Stream in April 2022. The content and findings of SOCO 2022 will be presented to the Committee on Commodity Problems (CCP) at its meeting in July 2022.

ACKNOWLEDGEMENTS

The *State of Agricultural Commodity Markets 2022* (SOCO 2022) was prepared by a multidisciplinary team of the Food and Agriculture Organization of the United Nations (FAO) under the direction of Boubaker Ben-Belhassen, Director of FAO's Markets and Trade Division, and George Rapsomanikis, Senior Economist and Editor of SOCO 2022. Overall guidance was provided by Máximo Torero Cullen, FAO Chief Economist, and by the management team of the Economic and Social Development Stream.

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Internal Reviewers
The writing team is grateful for the valuable comments received from the following reviewers: Aikaterini Kavallari, Andre Croppenstedt, Angélica Jácome Daza, Benjamin Davis, Bruno Cammaert, Caroline Merle, Davide del Prete, Ekaterina Krivonos, El Mamoun Amrouk, Emiliano Magrini, Ewald Rametsteiner, Gala Dahlet, Georgios Mermigkas, Guenter Hemrich, Jakob Rauschendorfer, Jamie Morrison, Jippe Hoogeveen, Lauren Phillips, Lourdes Orlando, Lynnette Neufeld, Marco Sánchez Cantillo, Máximo Torero Cullen, Monika Tothova, Nancy Aburto, Piero Conforti, Sergio René Araujo Enciso and Tomislav Ivancic.

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Administrative Support
Angela Towey, Marika Panzironi, Martina Guerra and Valentina Banti provided administrative support.

Translations were delivered by the Language Branch (CSGL) of the FAO Governing Bodies Servicing (CSG).

The Publishing Group (OCCP) in FAO's Office of Communications provided editorial support, design and layout, as well as production coordination and printing services for editions in all six official languages.

Confidential Data Access
FAO thanks the World Bank's International Comparison Program (ICP) for providing access to the ICP 2017 food and agricultural products price database for use in the econometric modelling exercise.

ABBREVIATIONS AND ACRONYMS

ACCTS	Agreement on Climate Change, Trade and Sustainability
AfCFTA	African Continental Free Trade Area
AoA	Agreement on Agriculture
ASEAN	Association of Southeast Asian Nations
CEPA	Comprehensive Economic Partnership Agreement
CETA	Comprehensive and Economic Trade Agreement
CITES	Convention on International Trade in Endangered Species
CO_2	Carbon dioxide
COMESA	Common Market for Eastern and Southern Africa
COVID-19	Novel coronavirus disease
CPTPP	Comprehensive and Progressive Agreement for Trans-Pacific Partnership
DCFTA	Deep and Comprehensive Free Trade Areas
EFTA	European Free Trade Association
ERP	Environment-related provisions
ESCAP	Economic and Social Commission for Asia and the Pacific
FAO	Food and Agriculture Organization of the United Nations
GATT	General Agreement on Tariffs and Trade
GDP	Gross domestic product
GHG	Greenhouse gas
ICP	World Bank's International Comparison Program
ICTSD	International Centre for Trade and Sustainable Development
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IMF	International Monetary Fund
ITC	International Trade Centre
LLDC	Landlocked Developing Country
MEA	Multilateral environmental agreements
Mercosur	Southern Common Market
MFN	Most favoured nation
NAFTA	North American Free Trade Agreement
NTM	Non-tariff measures
OECD	Organisation for Economic Co-operation and Development
RCEP	Regional Comprehensive Economic Partnership
RSPO	Roundtable on Sustainable Palm Oil
RTA	Regional Trade Agreements
SADC	Southern African Development Community
SDG	Sustainable Development Goals
SIDS	Small Island Developing States
SoyM	Soy Moratorium
SPS	Sanitary and phytosanitary
TBT	Technical barriers to trade
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Program
UNECA	United Nations Economic Commission for Africa
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climate Change
USMCA	United States of America–Mexico–Canada Agreement
WAEMU	West African Economic and Monetary Union
WFP	World Food Programme
WHO	World Health Organization
WTO	World Trade Organization

EXECUTIVE SUMMARY

The outbreak of the COVID-19 pandemic in early 2020 and the measures taken to contain it across countries put global food and agricultural markets to a test. National agrifood systems stretched but continued to provide adequate, nutritious and safe food worldwide. Despite the significant restrictions on people's movements and the uncertainty that settled upon the world, international trade continued to link food surplus areas with those in deficit, which safeguarded food security and nutrition globally. Unlike what happened during the 2008 global food price crisis, global cooperation was sustained, and this allowed agricultural trade policies to support well-functioning global markets.

Today, conflict in one of the breadbaskets of the world threatens global food security in multiple ways, including through the disruption of global food and agricultural markets. The war in Ukraine has not only resulted in a severe humanitarian crisis and a looming increase in global food insecurity, but also in the potential break-up of global cooperation in trade.

Global cooperation in agricultural trade policies can address global challenges, such as economic crises, pandemics, conflicts and climate change, and it can contribute towards food security and healthy diets for all. Since 1995, the establishment of the World Trade Organization (WTO) and its multilateral trade rules have provided a freer, fairer and more predictable trade environment and, together with a plethora of regional trade agreements, have promoted food and agricultural trade and economic growth.

At the same time, the increasing globalization of food and agricultural markets has raised concerns about the potential impacts of trade on the environment and on societies. International trade in food and agriculture is viewed as contributing towards the depletion of natural resources, driving deforestation and biodiversity loss, accelerating changes in lifestyles and diets, and widening inequality.

Currently, the trade policy environment is characterized by a deadlock in multilateral trade negotiations under the WTO and a proliferation of deeper regional trade agreements (RTAs) that, in addition to market access, aim to promote convergence in domestic policies and regulations among their signatories. Multilateral trade liberalization and regional trade agreements have been evolving in parallel since the end of the twentieth century, generating gains from trade and promoting economic integration.

The 2022 edition of *The State of Agricultural Commodity Markets* (SOCO 2022) considers the ways in which trade policies based on both multilateral and regional efforts can address today's challenges for sustainable development while strengthening the resilience of the global agrifood system to shocks, such as conflicts, pandemics and extreme weather.

THE GEOGRAPHY OF TRADE

This report looks at different cooperation approaches in trade integration for sustainable growth by providing a systematic framework to assess the geography of food and agricultural trade. The analysis focuses on the patterns of food and agricultural trade across geographic space, their drivers and their role in shaping today's trade policy environment.

Looking at the geography of trade offers numerous valuable insights for analysing sustainable development. First, mapping food and agricultural trade makes it easier to understand the evolution of trends such as globalization and regional integration and their relationship with economic growth. These trends can also help assess the resilience of global food and agricultural markets to shocks, such as the current war in Ukraine, and its implications for food security and nutrition.

Second, the geography of trade highlights the significant gaps that exist across countries. Global wealth has grown, but the share of this wealth claimed by low-income countries is not

much changed. The agricultural productivity gap is also enormous. Relative differences in agricultural productivity across countries can determine the influence of comparative advantage in food and agricultural markets and can shape trade patterns. Trade costs, which are also shaped by geography, are significant and can partly insulate low-income countries, limiting opportunities for growth and development.

Third, looking at trade through a geographical lens reveals the uneven distribution of natural resources. Land and water are key factors of production that also contribute to shaping comparative advantage. Although trade helps regions with low resource endowments, such as water-stressed countries, to ensure food security, it can also affect the environment. With food being increasingly consumed far from where it has been produced, trade can generate environmental externalities across the world. Production for exports can add pressure to already depleted natural resources and affect forests and biodiversity.

This analysis of the geography of food and agricultural trade sheds light on the trade-offs between different sustainable development objectives and helps discuss a complex policy environment. Multilateralism, as reflected by the WTO Doha Round of negotiations, has stalled and deeper regional trade blocs are on the rise. Both approaches aim to promote trade integration and economic growth, while addressing the impacts of trade on the environment. Within these approaches, SOCO 2022 examines the effectiveness of trade policies for addressing today's global challenges.

GLOBALIZATION AND REGIONALIZATION

Food and agricultural trade expanded rapidly in the new millennium, catalysed by trade liberalization at multilateral and regional levels. Today, more countries trade with each other. Emerging economies have become important players and low-income countries are better integrated into global markets. Although this process of globalization has brought about important changes in the structure of the global food and agricultural market, it has lost steam since the financial crisis of 2008.

Globalization stalled in 2008 but today more countries trade with each other, and the global food and agricultural market is less concentrated and more balanced than in 1995

The global food and agricultural market has become less concentrated and more decentralized. In 1995, a few large players dominated the global market. Over time, the number of large traders increased, while their dominance weakened. These structural changes reflect a relatively even playing field and a global food market that can be conducive to economic growth. For example, low- and middle-income countries are more likely to trade with high-income economies today than they were two decades ago. This is important as trade facilitates the diffusion of technology and knowledge and promotes productivity and overall growth.

Trade intensity is higher within rather than across regions, and the regionalization of food and agricultural trade is relatively more pronounced

However, within this global context, regional markets continue to play an important role. The regionalization of food and agricultural trade – the tendency of countries to trade more within a region than with countries outside the region – has become more pronounced. Countries form trade clusters, which may be regional or expand to include countries across regions and within which they tend to trade more. Such clusters are often shaped by geographic proximity and economic integration forged by trade agreements. Many of these clusters are relatively stable, such as a cluster including countries in Northern and Latin America and the Caribbean. Others tend to be less stable; for instance, African countries appear to trade more with partners off the continent.

The global food and agricultural market has become more resilient, but many countries remain vulnerable to trade shocks and should diversify their import sources to safeguard their food security

As countries have increased the number of their trading partners, the global food and agricultural market has become denser. This has strengthened the market's buffer capacity and resilience to shocks relative to the beginning of the twenty-first century. However, only a few countries still account for most of the value traded and only some countries source a large variety of food and agricultural products from many different exporters. The imports of most countries are concentrated on a few products from a limited number of trade partners, making them vulnerable to shocks occurring in the exporter markets. To strengthen their resilience and ensure food security and healthy diets, countries should aim to diversify the products they import and to increase the number of their trading partners.

THE FUNDAMENTAL DRIVERS OF TRADE IN FOOD AND AGRICULTURE

Trade in food and agriculture has been an essential part of our history and is important to societies. Countries engage in trade to export what they can produce at a lower cost relative to other countries, while importing what is relatively more expensive to produce domestically. For a country, many factors can influence trade in food and agricultural products, but the most influential factor is comparative advantage – a country's ability to produce a particular good at a lower opportunity cost than its trading partners.

Differences in agricultural productivity between developed and developing countries can be very large, with low-income economies facing significant constraints in adopting better technologies

The productivity gap in agriculture is huge. On average, the top 10 percent of the richest countries produce about 70 times as much agricultural value added per worker as countries in the bottom 10 percent of the income distribution. Many lower middle- and low-income countries face significant constraints in technology adoption and access to modern inputs. Many other factors, including the small average farm size and limited access to insurance, credit and education, especially for women, contribute to lower agricultural productivity in the developing world.

In the global market, the higher the heterogeneity in relative productivities across countries, the stronger the influence of comparative advantage

Relative differences in productivity but also the uneven distribution of natural resources lead to food price differences across countries and determine the influence of comparative advantage in the global market. On average, the higher the heterogeneity in relative productivities across countries, the stronger the influence of comparative advantage, and the higher the trade. The principle of comparative advantage implies that all countries become better off as a result of trade.

The role of comparative advantage in shaping global food and agricultural trade can be weakened by trade policies and the costs of trade

However, this is not always the case. Trade policies affect the relationship between comparative advantage and trade. For example, export subsidies, which have been eliminated for agricultural products by the 2015 WTO Ministerial Conference in Nairobi, could potentially reverse the relationship between comparative advantage and trade, causing goods that would have otherwise been imported to be exported, and vice versa. Trade costs also inhibit the influence of comparative advantage.

Trade costs can be significant – for low-income countries high trade costs can hinder trade integration and affect the structural transformation of the economy

Trade can be costly, and distance generally increases transport costs. There are also other costs related to insurance, export and import procedures

and time delays at the borders. On average, a food product faces eight different non-tariff measures and standards, and compliance significantly increases the cost of trade. In low-income countries, trade costs are estimated to be up to 400 percent in *ad valorem* equivalent. Such high costs inhibit trade integration.

For example, in sub-Saharan Africa, the weak influence of comparative advantage and high trade costs result in a low intensity of intra-regional trade. Countries in the region trade more with countries outside the region than among themselves. High trade costs could also result in a country not trading as much as it would if trade costs were lower. Especially for low-income countries, which are characterized by relatively low agricultural productivity, high trade costs and less trade could result in an expanded agricultural sector relative to other sectors of the economy, necessary to meet the population's food subsistence needs. This could hinder the structural transformation of the economy.

Increasing productivity, lowering tariff barriers and reducing trade costs can increase the gains from trade but complementary policies are necessary to reduce inequalities that may arise

Policies should aim not only to improve agricultural productivity but also to reduce trade costs to reap the benefits of trade. Measures taken to increase trade integration in the context of the African Continental Free Trade Area (AfCFTA) will be important for economic growth and development in the region. Lower trade costs will make a country more open to trade and let comparative advantage play out, resulting in gains from trade. However, in countries with low agricultural productivity, trade openness could also entail losses especially by those smallholder farmers who are not able to increase their efficiency and compete in more open markets. Complementary policies will be needed to improve access to technology and modern inputs, as well as to facilitate the reallocation of labour to other sectors through labour markets.

THE ENVIRONMENTAL IMPACTS OF FOOD AND AGRICULTURAL TRADE

Natural resource endowments, such as land and water, contribute to the comparative advantage in food and agriculture. For countries with low natural resource endowments and where climate conditions are unfavourable to agricultural production, trade contributes to food security and nutrition in terms of food quantity and diversity at levels above what domestic production could sustain. Globally, trade and comparative advantage strengthen the efficiency of natural resources use. Trade helps allocate agricultural production to regions where the amount of water and land used per unit of food is relatively lower. For example, a study estimates that food and agricultural trade could generate between 40–60 m^3 of annual water savings per capita.

Globally, food and agricultural trade can enhance the efficiency of land and water use but can also result in negative environmental impacts

Although open global food and agricultural markets can help alleviate the pressure on natural resources, production for exports can generate negative environmental externalities, such as unsustainable freshwater withdrawals, pollution, biodiversity loss, deforestation and greenhouse gas emissions (GHG). For example, agricultural production of cattle, soybeans and palm oil – all products with sustained global demand – accounted for 40 percent of tropical deforestation between 2000 and 2010.

Most of trade's environmental externalities arise due to local conditions, and trade policies will have to be complemented by specific environmental measures to address them

Often, these negative environmental impacts arise due to local conditions and a poorly regulated environment. This means that trade policies, on their own, cannot easily tackle environmental externalities. Multilateral trade rules, such as

the WTO framework, together with national regulation, can address the trade-offs between economic and environmental objectives. The scope of trade agreements is also evolving to include environmental provisions. Between 1957 and 2019, out of 318 agreements that were concluded, 131 included at least one environmental-related provision and 71 of the agreements incorporated provisions that displayed the interaction between the environment and agriculture. Such agreements provide incentives to producers to adopt sustainable practices to gain and maintain access to markets.

Multilateral trade rules and increasingly regional trade agreements allow for environment-related provisions, which, when legally binding, can help tackle the environmental impacts of trade

In general, several studies suggest that environmental provisions in RTAs have a positive effect in addressing environmental externalities generated by trade when these are due to local conditions. Deeper trade agreements foster policy convergence in signatory countries on many issues, including the environment. These often establish specific mechanisms to discuss and oversee the implementation of environment-related commitments.

Trade agreements can encourage trade partners to adopt sustainable practices when environmental provisions is legally binding and trade between signatories are equipped by well-developed institutions, such as dispute settlement procedures and environmental impact assessments.

MULTILATERAL AND REGIONAL TRADE POLICIES FOR SUSTAINABLE GROWTH

Since the beginning of the new millennium, globalization and regionalization have evolved in parallel, with each process complementing the other. Today's trade policy environment in food and agriculture, as shaped by the WTO, has discouraged unfair practices, reduced uncertainty and facilitated coordination between countries. This multilateral framework is also complemented by a multitude of RTAs. Both multilateral and regional trade liberalization have contributed to expanding global trade.

Multilateral trade negotiations are in a deadlock, while extensive regional trade agreements, which increasingly include food and agriculture, are on the rise

Although WTO members agreed on eliminating agricultural export subsidies following the Tenth Ministerial Conference held in Nairobi in 2015 and established the Trade Facilitation Agreement, which entered into force in February 2017, among others, several areas related to agriculture, such as the treatment of public food stockholding and domestic agricultural support, contributed to stalling the negotiations. At the same time, the number of RTAs in force have multiplied from fewer than 25 in 1990 to more than 350 in 2022. This has raised concerns about whether discrimination in the global market has increased and is leading toward the fragmentation of global trade in competing blocs.

Regional trade agreements promote participation in regional value chains and growth, but may exclude low-income countries

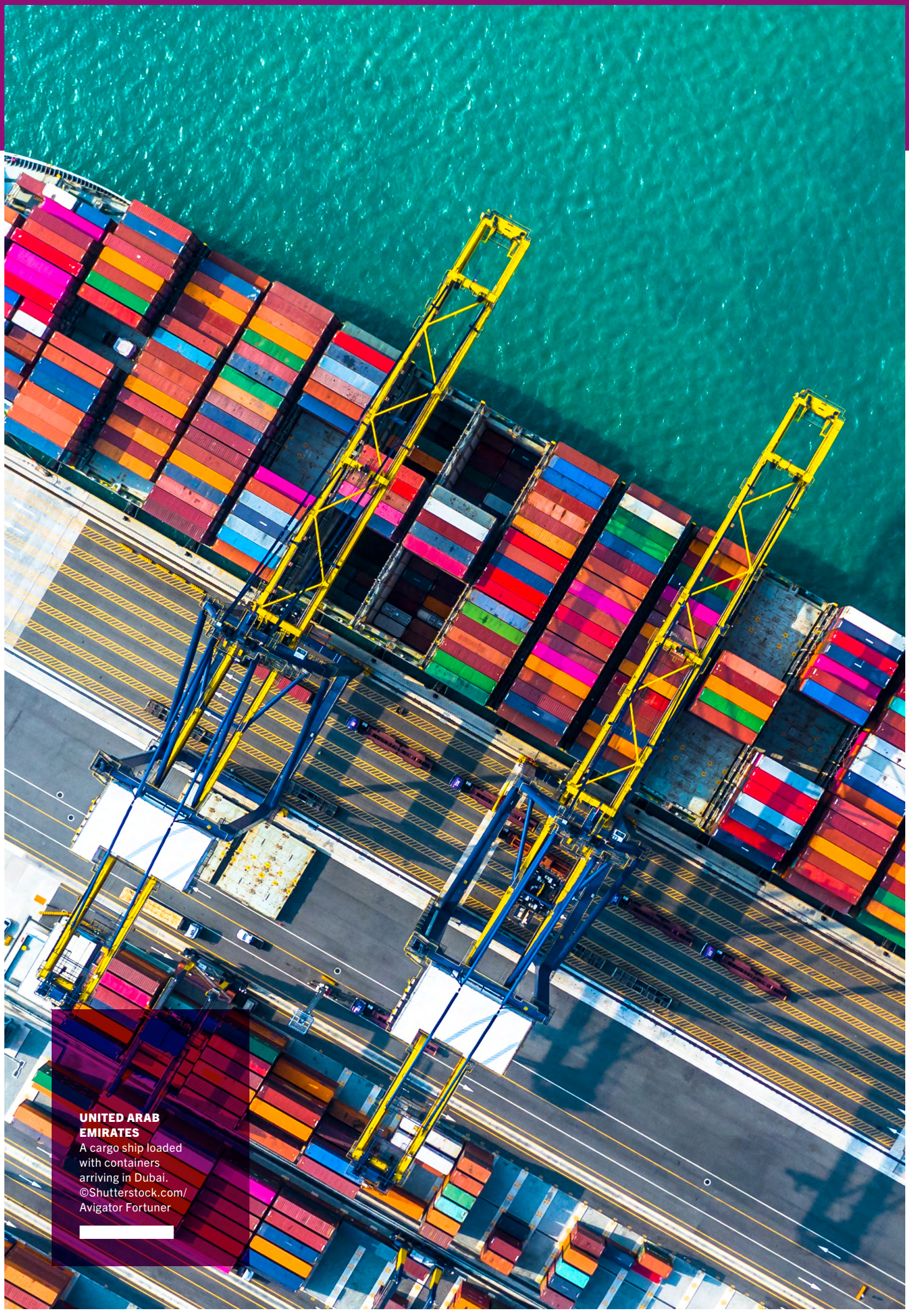
RTAs create trade between the signatories but can also divert trade from non-members. For their signatories, deeper trade agreements improve market access through preferential tariffs and reduce trade costs through domestic regulation convergence and harmonization of standards. This can promote regional value chain development and spur growth. Although RTAs, on average, can generate gains globally, some countries may lose. Particularly, low-income countries with a limited capacity to negotiate and implement complex trade provisions may be left out of the regional trade integration process. Multilateral trade liberalization can result in larger gains globally

and can be the most efficient way to promote market access and economic growth for all.

Multilateral trade liberalization and multilateral cooperation in addressing global environmental externalities can bring growth, ensure food security and better nutrition for all, and make trade work for sustainable development

Although comparative advantage appears to be more conducive multilaterally, it would be difficult to address the trade-offs between economic and environmental objectives in the same way. Environmental externalities generated by trade, when localized, can be addressed by trade policies complemented by regulation at the national or regional level.

Unilateral or even regional actions will not be effective when these externalities are global, such as with climate change. A multilateral agreement will be necessary, but it may be challenging to achieve consensus mainly due to the diverging views held by countries on the impact of GHG emissions and their cost to society. Nevertheless, global environmental externalities can only be addressed effectively through multilateralism with trade rules helping to expand the reach of policies that take into account the social costs of such externalities. ■



UNITED ARAB EMIRATES
A cargo ship loaded with containers arriving in Dubai.
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PART 1
GLOBAL AND REGIONAL TRADE NETWORKS

KEY MESSAGES

➔ Food and agricultural trade expanded rapidly in the 2000s. The network of food and agricultural trade became denser, with more countries trading with each other and greater participation of low- and middle-income countries. One of the catalysts for this process of globalization was trade liberalization at the multilateral and regional levels. Since the financial crisis in 2008, the globalization process has been stagnant.

➔ The structure of the global network of food and agricultural trade became more decentralized between 1995 and 2019. In 1995, a few large trading hubs dominated the trade network. Over time, together with the expansion of trade and the emergence of new players, the number of hubs increased and the dominance of individual hubs weakened.

➔ Regionalization of food and agricultural trade – the tendency of countries to trade more within a region than with countries outside the region – has increased between 1995 and 2019. Within the global food and agricultural trade network, countries tend to form particular trade clusters and to trade more within them. These clusters may be regional or they may expand to include countries across regions. They are often shaped by geographic proximity and economic integration fostered by trade agreements.

➔ The global network of food and agricultural trade became more balanced. Today, more countries are connected to more trade partners, which can strengthen the buffer capacity and resilience of the network. Nevertheless, only a few countries still account for most of the value traded and only some countries source a large variety of food and agricultural products from many different exporters.

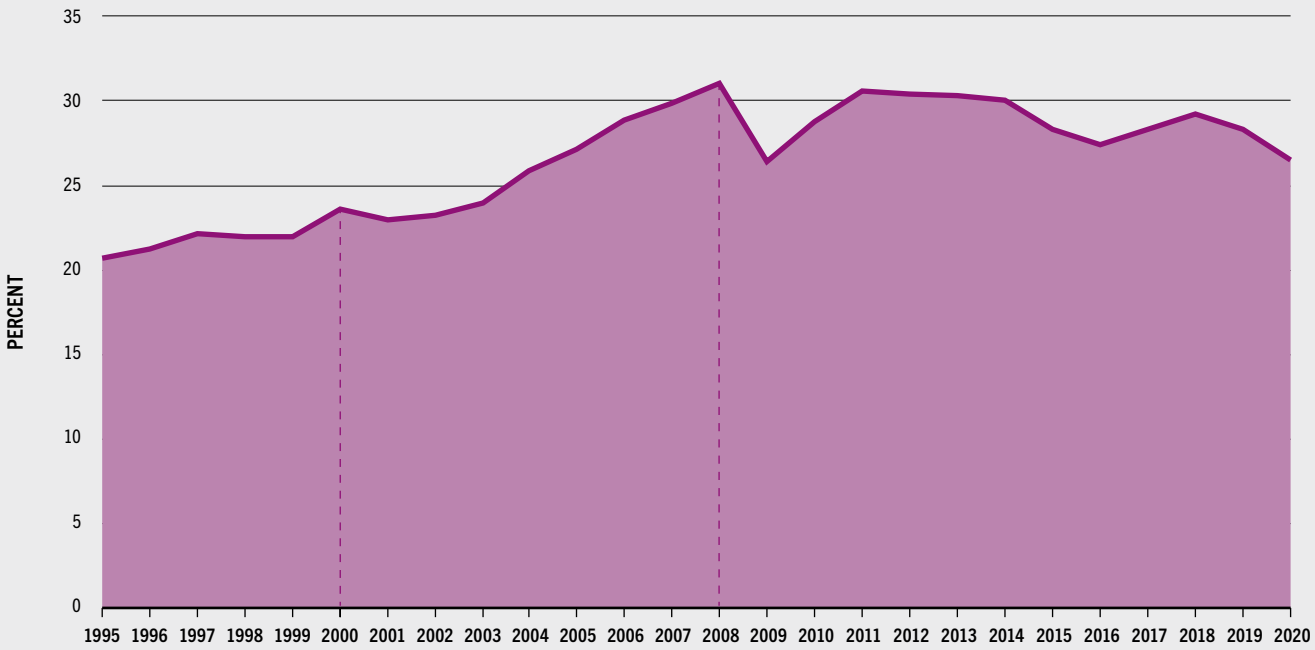
➔ The imports of most countries are concentrated on a few products from a limited number of trade partners, making them vulnerable to shocks in exporter markets. To improve their resilience and ensure food security and healthy diets, countries should aim to diversify the products imported and to increase their number of trade partners.

THE GLOBALIZATION OF FOOD AND AGRICULTURAL TRADE

Trade connects agrifood systems and people. It plays an important role in providing consumers worldwide with sufficient, diverse and nutritious food, and it generates income and employment for farmers, workers and traders in the entire agricultural and food industry across countries. Since 1995, food and agricultural trade has more than doubled in volume and calories. The use of natural resources for the production and export of food and agricultural products, such as land and water, has also increased.[1, 2, 3, 4, 5, 6]

In general, trade in goods and services became more important in the world economy and the share of production traded increased rapidly between the first years of the new millennium and 2008. However, this process of globalization, as measured by the share of goods and services exports in world gross domestic product (GDP), came to a halt after the financial crisis in 2008 (Figure 1.1).[7, 8]

FIGURE 1.1 GLOBALIZATION PATTERNS IN GOODS AND SERVICES, 1995–2020



NOTE: The figure shows the evolution of the ratio of goods and services exports to global gross domestic output.
SOURCE: World Bank Group.

Although manufactures are still more intensively traded than food and agricultural products, the globalization in food and agriculture resembles overall globalization patterns.[a, 9] The total value of food and agricultural products traded grew strongly between 2000 and 2008, but this trend was abruptly interrupted in 2009 as a result of the financial crisis. Although growth in trade resumed in 2010 and 2011, it has since stagnated (Figure 1.2).[b, 10] Trade taking place within food and agricultural global value chains evolved along similar patterns and has remained at 35 percent of the total value since 2008.[11]

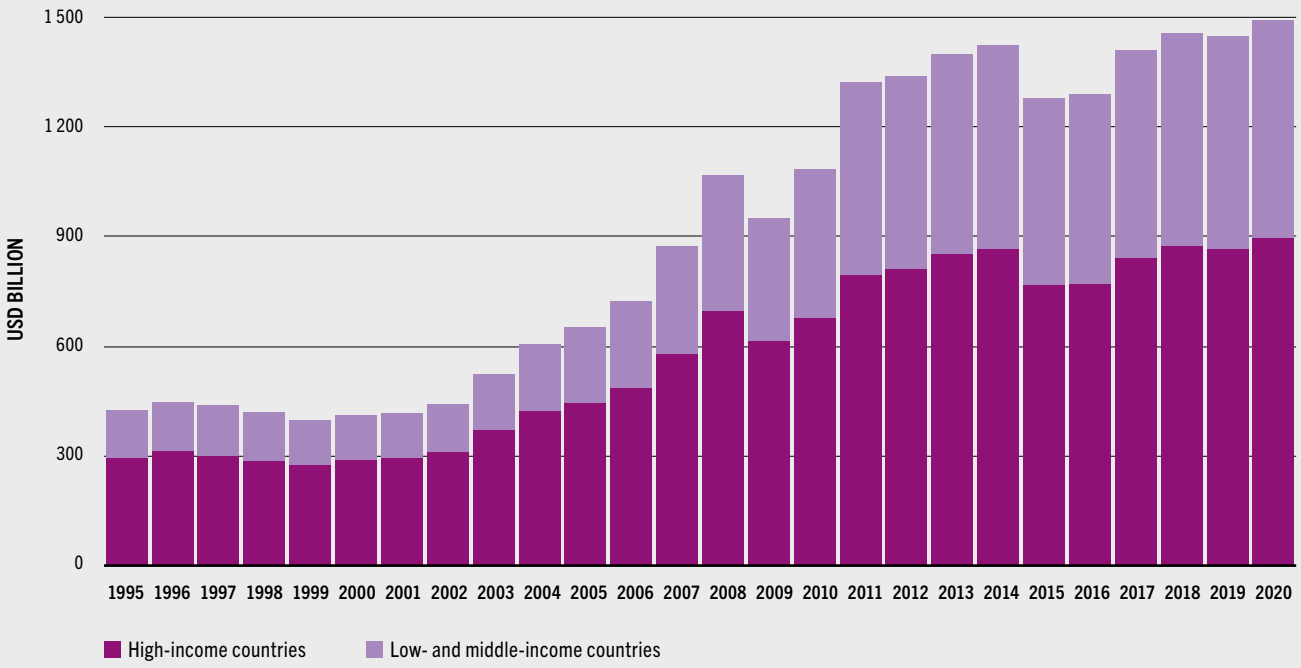
Globalization, the expansion of food and agricultural trade and the evolution of global value chains were catalysed by a series of trade agreements, at multilateral and regional levels, which reduced tariffs and other trade barriers (Box 1.2). Although trade in manufactures was gradually liberalized after the General Agreement on Tariffs and Trade (GATT) in 1947, it was not until the negotiations of the Uruguay Round (1986–1994) and the subsequent World Trade Organization (WTO) Agreement on Agriculture (AoA) in 1995 that agriculture as a sector was explicitly included in the liberalization process at the multilateral level.[12]

Food and agricultural products were traded more intensively after 2000, reflecting the implementation period for country-specific

a In 2019, global exports of manufactures were eight times greater than food and agricultural exports, although the contribution of manufacturing to world GDP was only four times greater than the contribution of food and agriculture. These relations are roughly comparable to those in the mid-1990s (see also Part 2).

b The definition of food and agricultural trade in this report follows the definition of trade in agricultural products in FAOSTAT, that is the aggregate of food and agricultural trade includes trade data of all food and agricultural products, excluding fishery and forestry products.

FIGURE 1.2 **THE EVOLUTION OF GLOBAL FOOD AND AGRICULTURAL TRADE, 1995–2020**



NOTE: The figure shows the evolution of the value of exports of food and agricultural products.
SOURCE: FAO.

commitments under the AoA and China's accession to the WTO in December 2001.[c] Emerging economies, such as Brazil and China, have increased their market shares since the early 2000s and play an increasingly important role in global agricultural and food markets.[13] The share of global exports originating in low- and middle-income countries increased from around 30 percent in 1995 to 40 percent in 2011, and since then remained constant with high-income countries making up 60 percent of the share of exports (Figure 1.2).[d]

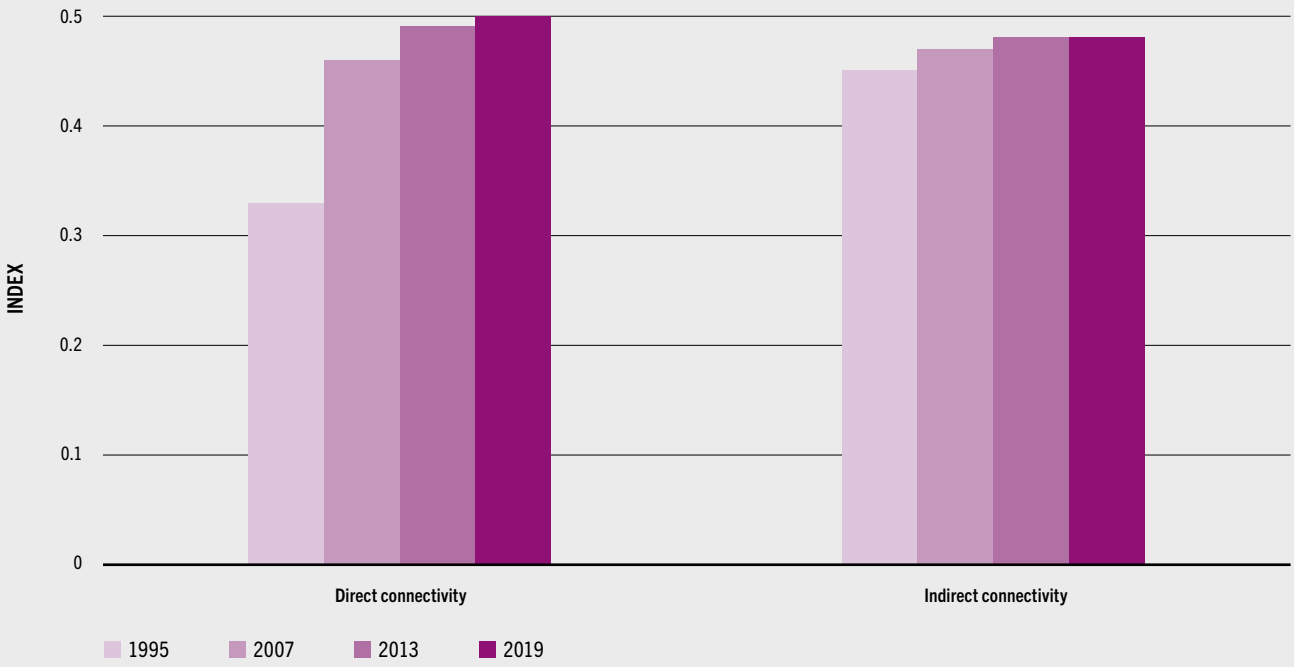
Declining GDP growth and weak aggregate demand in the aftermath of the financial crisis, together with the stalemate in the WTO negotiations for further liberalization at the global level, contributed to the deceleration of globalization.[14, 15]

The growth in food and agricultural trade in the first decade of the new millennium was also due to increased connectivity between countries. More countries expanded their participation in global food and agricultural trade and the landscape and geography of trade has changed. The specific patterns in which countries trade with each other give rise to a "network" of trade which reflects the relative position of each country but also important features of the global market. Countries that are connected with many trade partners and trade at a high intensity are located closer to the core of this trade network. Countries with few trade partners and a low trade

c The implementation period for country-specific commitments under the AoA was six years for developed and up to ten years for developing countries.

d Similar levels are reported for imports. The share of imports from low- and middle-income countries increased from 29 percent in 1995 to 40 percent in 2020. This means 71 percent of all imports in 1995 were destined for high-income countries. In 2020, this share was reduced to 60 percent.

FIGURE 1.3 AVERAGE CONNECTIVITY BETWEEN COUNTRIES IN THE GLOBAL FOOD AND AGRICULTURAL TRADE NETWORK, 1995–2019



NOTE: The higher the connectivity index, the more countries are connected to each other (direct connectivity) and to countries that are themselves connected to many other countries (indirect connectivity). Measured on the basis of the number of trade links.
SOURCE: Jafari, Y., Engemann, H. & Zimmermann, A. 2022. The evolution of the global structure of food and agricultural trade: Evidence from network analysis. Background paper for *The State of Agricultural Commodity Markets 2022*. Rome, FAO.

intensity are located at the network's periphery. A variety of indicators can be used to analyse the trade network and its evolution (see Box 1.1).[e, 16]

In 2019, a country was 50 percent more likely to form a direct trade link with another country than in 1995 (Figure 1.3 – direct connectivity). The probability that these direct trade partners trade more with other countries also increased (Figure 1.3 – indirect connectivity). These indicators also suggest that the global network of food and agricultural trade evolved mainly between 1995 and 2007, with marginal developments taking place between 2007 and 2019 in line with overall globalization patterns.[f]

Globally, the number of trade links, that is the number of trade flows between countries, increased from around 11 000 in 1995 to more than 17 000 at the end of the second decade of the millennium (Figure 1.4). Over time and leveraging the increasing openness of the global market, low- and middle-income countries increased

e The network analysis for this report was conducted by Jafari, Y., Engemann, H. & Zimmermann, A. 2022. The evolution of the global structure of food and agricultural trade: Evidence from network analysis. Background paper for *The State of Agricultural Commodity Markets 2022*. Rome, FAO. Most network indicators were calculated based on import flows of food and agricultural products. The analysis suggests that the export and import flows of the countries are highly correlated, which allows for (some) generalization to overall trade patterns.

f Four milestone years were chosen as snapshots for the network analysis. These years are 1995 as the year in which the WTO was established, 2007 as the year when the global food price crisis started and before the financial crisis, 2013 as the year when further growth of the value of global food and agricultural trade had already plateaued, and 2019 as the most recent year for which data was available at the time the analysis was conducted.

BOX 1.1 TRADE NETWORK ANALYSIS

An increasing number of studies rely on techniques borrowed from network analysis to analyse the patterns of trade flows. Examples include the analysis of integration and regionalization in merchandise trade,[59] the analysis of trade networks of various food and agricultural products[60, 61, 62] and the analysis of specialization patterns and transmission of shocks in food and agriculture.[63, 64]

Network analysis comprises a set of techniques that are applied to analyse complex systems. It aims to depict relations among actors, in this case countries, and to analyse the structures that emerge from these relations.[65] A multitude of network measures can be used to describe the connectivity patterns of countries, their relative importance within the network, how many other countries they are connected to, how close their relationships with other countries are, or whether they are intermediaries between others.[66]

Network indicators as used in this report include:

Links: Links represent import or export flows between countries. Links are measured at the country level for aggregate food and agriculture. The number of links indicates the number of countries with which a specific country trades. Box 1.3 also refers to links that are measured by country and product.

Trade intensity: This is the value of import or export flows of a country. The trade intensity measure used in this report is normalized so that it is defined between zero and one. A zero value indicates that a country does not trade at all, and a value of one implies the maximum observed trade intensity.

Connectivity: The higher the connectivity, the more countries are connected directly with each other (direct connectivity) and with countries that are themselves connected to many others (indirect connectivity). Connectivity can be measured by the number of links, or by the value of products that are traded through these links.

Closeness: The closeness index indicates how "close" a country is to all other countries in the network. It is measured by counting the shortest paths, where each short path is defined as the strongest link, that is the link with the highest trade intensity, between two countries. The higher the closeness index, the more central a country is located in the network and the "closer" it is to all other countries.

Hubs: The structure of the trade network in terms of hubs and a core-periphery relationship in this report is determined based on the network indicator known as "betweenness". Betweenness measures the number of times a country connects to other countries that are not directly connected with each other. High values of this index identify countries that are trade hubs.

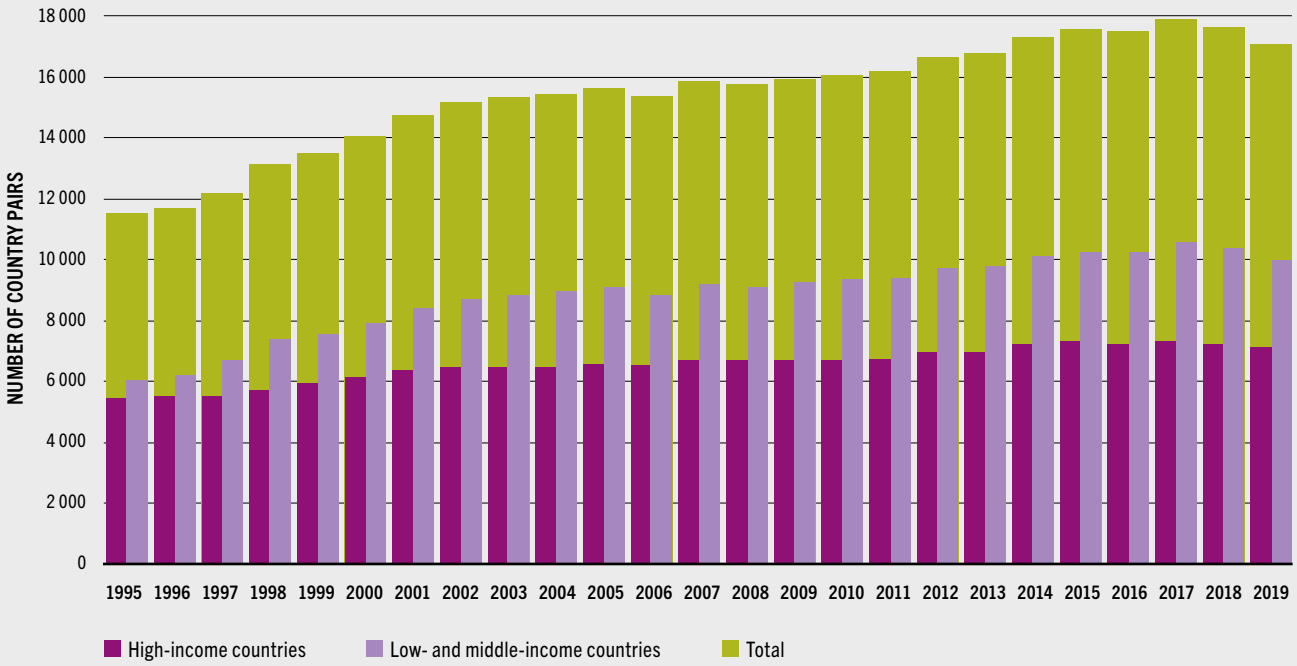
Centralization: Centrality measures at country level show the position and relative importance of a country within the global food and agricultural trade network. There are different centrality measures that refer to different aspects of the network. This report uses the centrality with respect to direct and indirect trade links. Averaging individual country centrality indices across countries and comparing over time can give an indication of centralization/decentralization tendencies in the trade network. A decreasing index of centralization can indicate the evolution towards a more even trade network with a high connectivity across countries and decentralized trade structures.

Assortativity: Assortativity describes the extent to which countries in a specific group (for example, countries in the same region, or countries with similar income per capita) trade with each other within the group. The assortativity index ranges from 1 showing that countries within a specific group trade with each other (assortative network) to -1 showing the reverse (disassortative network).

Trade clusters: Groups of countries that trade relatively more intensively within the group and less with countries of other groups.

A more detailed description of the network indicators is provided in Jafari, Y., Engemann, H. & Zimmermann, A. 2022. *The evolution of the global structure of food and agricultural trade: Evidence from network analysis*. Background paper for *The State of Agricultural Commodity Markets 2022*. Rome, FAO.

FIGURE 1.4 THE EVOLUTION OF FOOD AND AGRICULTURAL TRADE LINKS, 1995–2019



SOURCE: Jafari, Y., Engemann, H. & Zimmermann, A. 2022. The evolution of the global structure of food and agricultural trade: Evidence from network analysis. Background paper for *The State of Agricultural Commodity Markets 2022*. Rome, FAO.

their connectivity more rapidly than high-income countries, accounting for around 60 percent of global trade links in 2019.

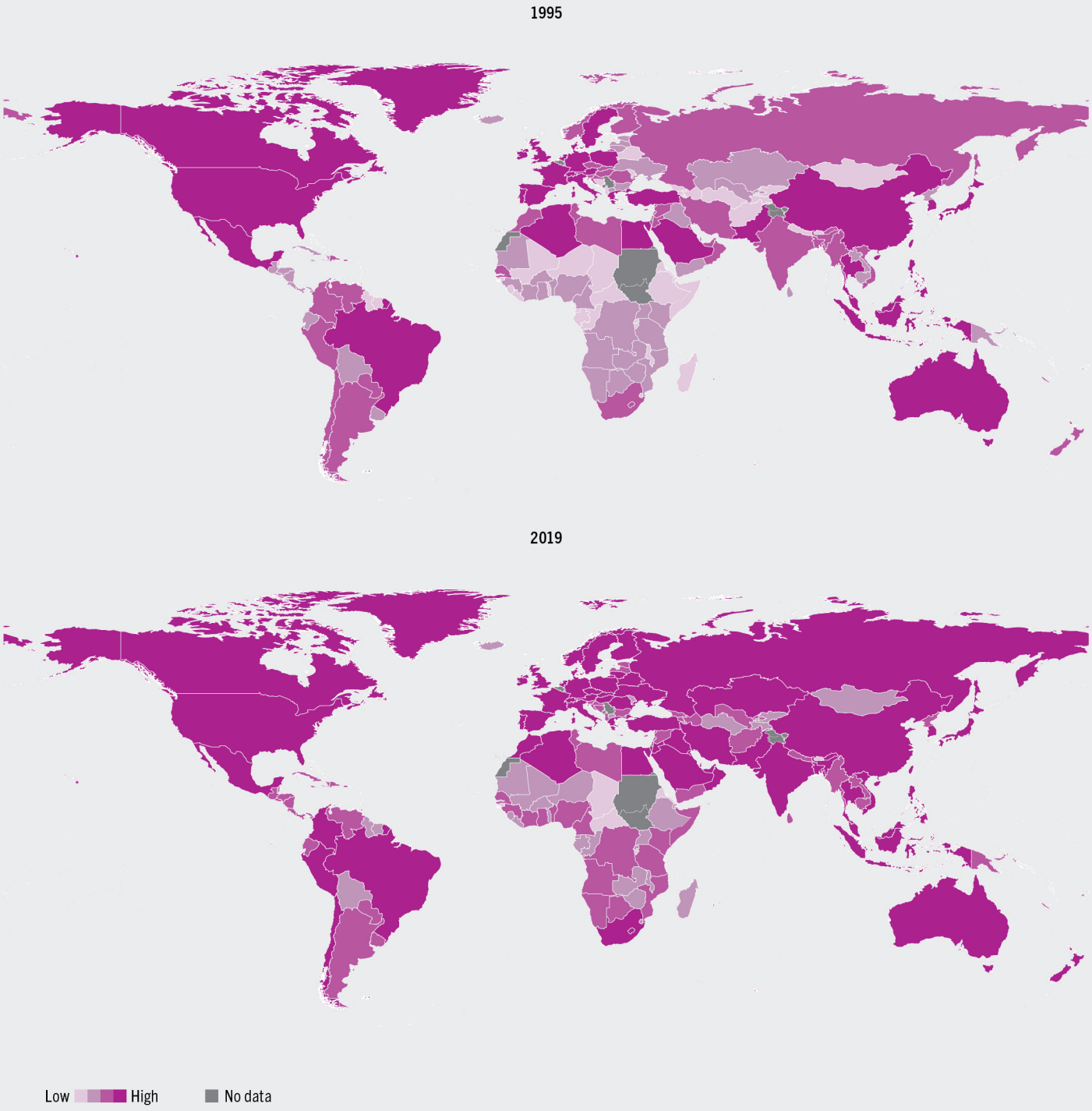
Looking at the evolution of connectivity in terms of trade intensity – that is in terms of the value of food and agricultural products traded through these trade links – provides additional insight into the global network (Figure 1.5). While many high-income countries and major emerging economies have already been well connected to the global trade network since 1995, most countries around the world increased their trade intensity by 2019. Countries in Eastern Europe and Central Asia experienced an abrupt breakdown of their trade network during and after the dissolution of the former Soviet Union. After 1995, they re-established their trade links and by 2019 they were among the expanding group of most-connected countries globally. In sub-Saharan Africa, some countries continue to remain less connected (Figure 1.5).[g]

g Often, a part of the food and agricultural trade of African countries, especially intra-African trade, is not formally reported, which may amplify this effect.

Between 1995 and 2007, countries moved "closer" to each other by establishing more direct trade links among themselves and by increasing the value traded through these links (Figure 1.6). During this period, both high-income and low- and middle-income countries moved closer to other countries in the global network, thus shortening the paths to these countries. Despite this trend, low- and middle-income countries are still less connected to other countries in the global trade network than high-income countries. This means that on average, as compared to high-income countries, they have formed fewer trade links and the value of food and agricultural products traded through these links is lower.

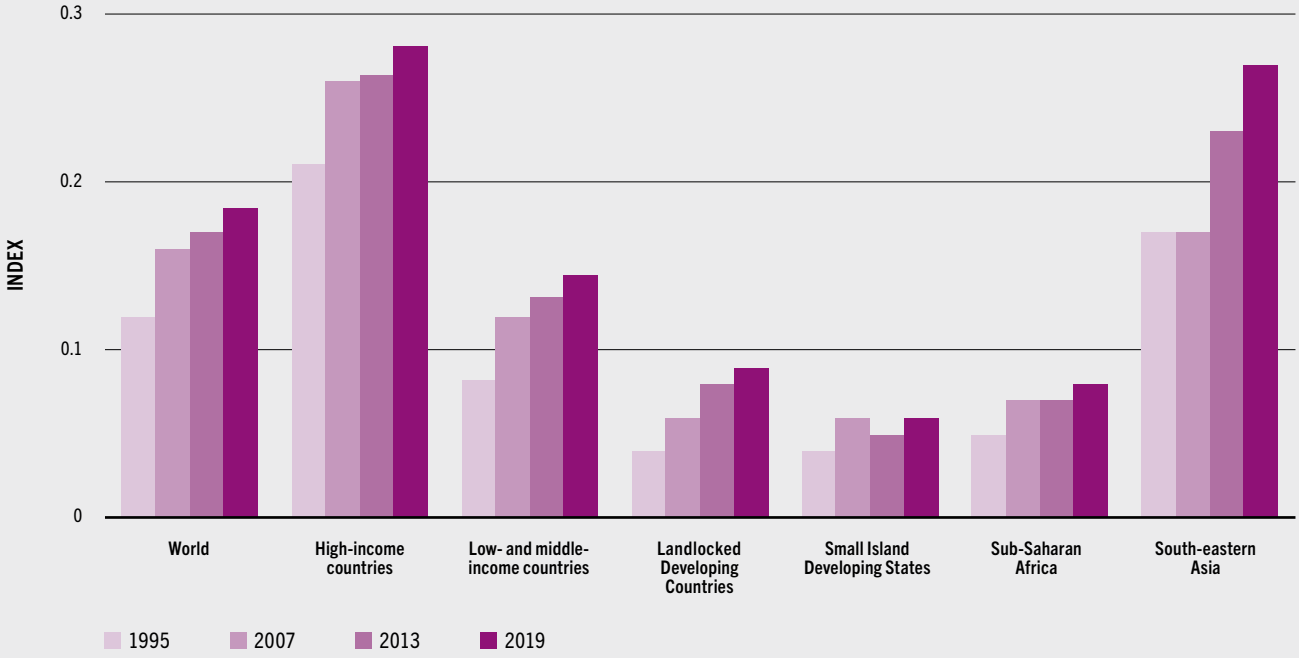
Countries that are relatively more remote in terms of their geographic conditions exhibit even lower levels of connectivity to the global food and agricultural trade network. This is true of the group of Landlocked Developing Countries and Small Island Developing States, for example (Figure 1.6). Countries in sub-Saharan Africa are relatively less connected to other countries in the global network, while, between 2007 and 2019, the

FIGURE 1.5 FOOD AND AGRICULTURAL TRADE INTENSITY, 1995 AND 2019



NOTE: The darker the colour, the higher the trade intensity of a country. Measured on the basis of imports.
SOURCE: Jafari, Y., Engemann, H. & Zimmermann, A. 2022. The evolution of the global structure of food and agricultural trade: Evidence from network analysis. Background paper for *The State of Agricultural Commodity Markets 2022*. Rome, FAO. Conforms to Map No. 4170 Rev. 19 United Nations (October 2020).

FIGURE 1.6 AVERAGE CLOSENESS CONNECTIVITY BY COUNTRY GROUP, 1995–2019



NOTE: The higher the closeness index, the more central countries of a group are located in the trade network and the better they are connected to all other countries, on average. The country groups are not mutually exclusive. Measured on the basis of trade intensity.
SOURCE: Jafari, Y., Engemann, H. & Zimmermann, A. 2022. The evolution of the global structure of food and agricultural trade: Evidence from network analysis. Background paper for *The State of Agricultural Commodity Markets 2022*. Rome, FAO.

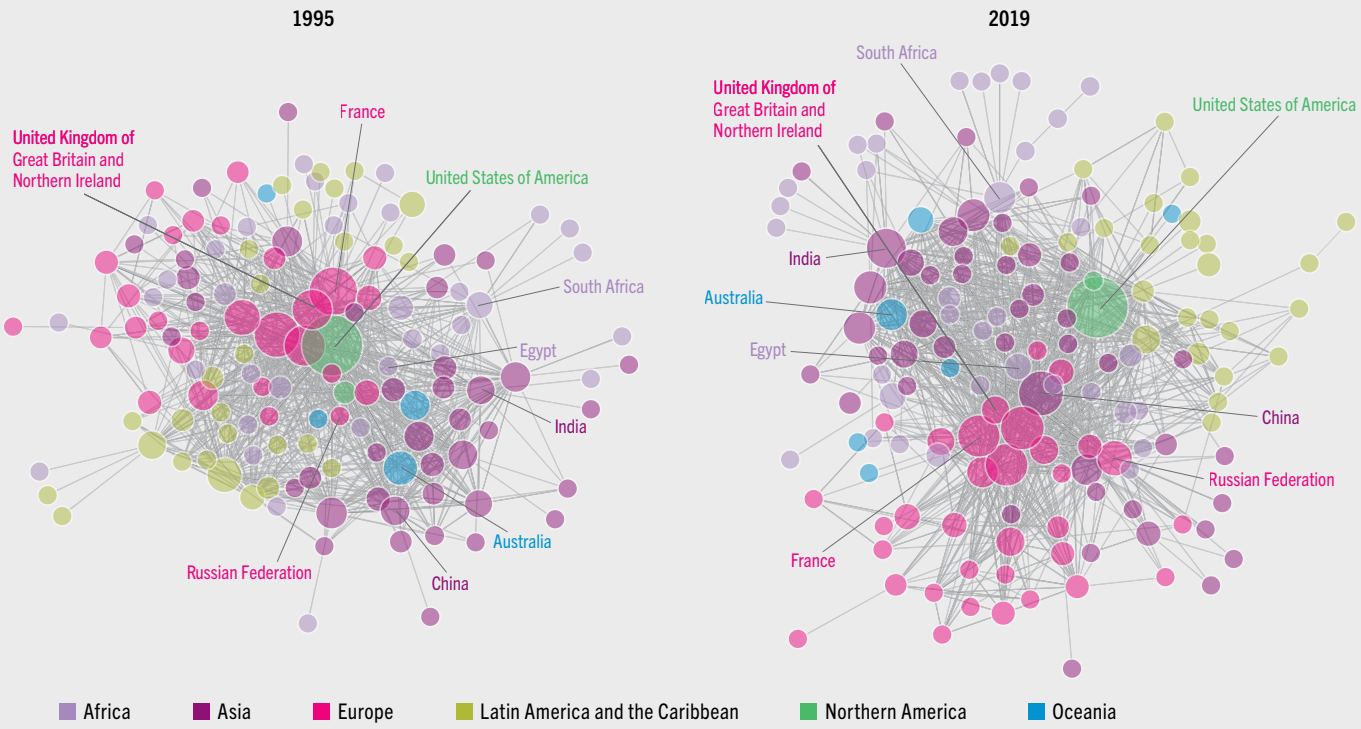
group of South-eastern Asian countries shows a strong acceleration in forming trade links and trading more intensively with other countries (see Part 2 for a deepening of the discussion of trade and its drivers in sub-Saharan Africa). ■

STRUCTURAL CHANGES IN THE GLOBAL NETWORK OF FOOD AND AGRICULTURAL TRADE

The expansion of food and agricultural trade and the emergence of new players in global markets has changed the structure of the trade network. In 1995, there were a few large trading hubs – that is countries that are connected to many trade partners and characterized by a large number of trade links, many of which are of high value (Figure 1.7). Over time, together with the expansion of trade and the emergence of new players, the number of hubs increased while the dominance of the individual hubs weakened.

In terms of trade intensity, the United States of America was the most significant hub in 1995 and remained so in 2019. Following its accession to the WTO in 2001 and the rapid growth it experienced, China evolved from being a relatively small hub in 1995 to the second largest hub in 2019, moving from the periphery of the network to become one of its central players.[17] Several Northern and Western European countries that were among the top ten hubs in 1995 were reduced in relative importance and gave way to emerging economies such as India, the Russian Federation and South Africa (Figure 1.7). Emerging economies became more globalized and, at the same time, developed as important regional hubs, linking smaller countries in their regions to the global market.[18, 19]

FIGURE 1.7 THE FOOD AND AGRICULTURAL TRADE NETWORK AND TRADE HUBS IN 1995 AND 2019



NOTE: The circles denote countries. Large circles can be trade hubs. When trade hubs are located in (outside) the core of the network, the network is more centralized (decentralized). Countries with trade values lower than 0.01 percent of the overall trade are excluded. Measured on the basis of trade intensity.
SOURCE: Jafari, Y., Engemann, H. & Zimmermann, A. 2022. The evolution of the global structure of food and agricultural trade: Evidence from network analysis. Background paper for *The State of Agricultural Commodity Markets 2022*. Rome, FAO.

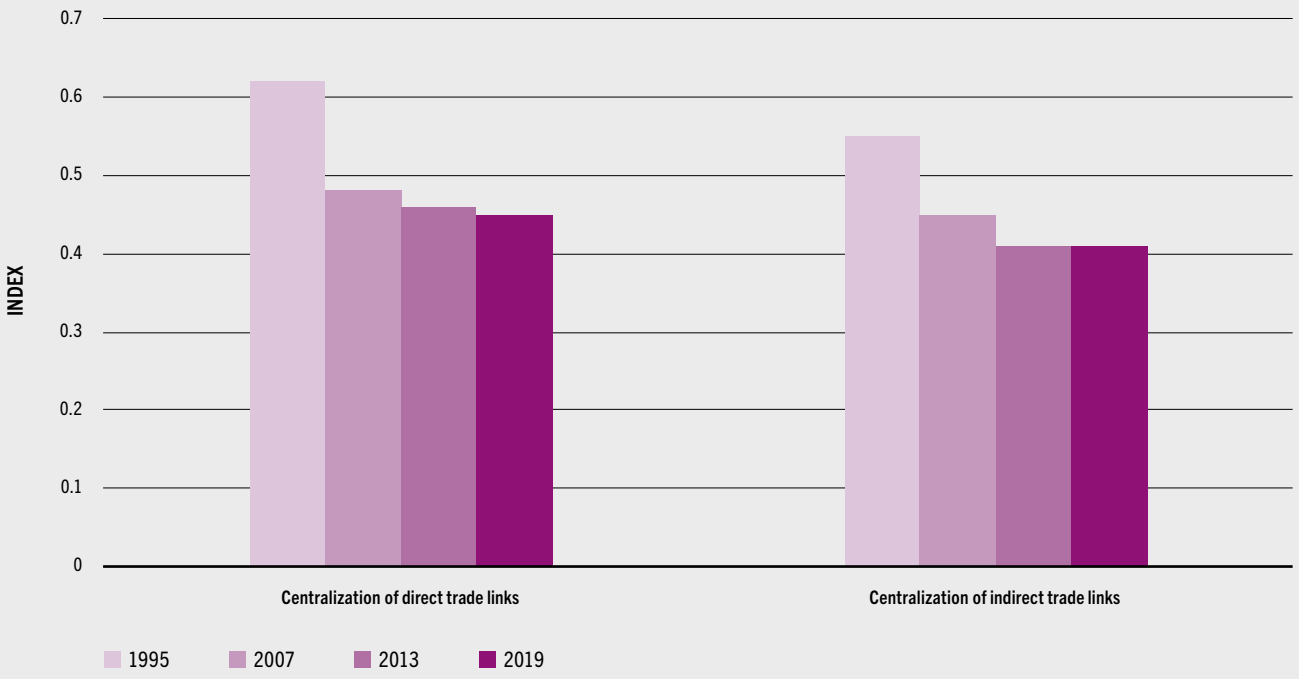
Indeed, the structure of the global food and agricultural trade network evolved to become more decentralized, with a greater number of hubs that are less dominant. This suggests that in 2019, trade links were more equally distributed across individual countries compared with 1995. Resembling overall globalization patterns, the largest part of this decentralization process occurred between 1995 and 2007, while its momentum has since slowed down considerably (Figure 1.8).

Along with increasing connectivity globally, the food and agricultural trade network became more balanced between 1995 and 2007. In 1995, the trade network had a pronounced core-periphery structure with few traders in the core and many less connected countries in the periphery. With more, though less dominant, trade hubs, there was a change to a more balanced structure, characterized by smaller core-periphery sub-networks (Figure 1.7). Similar structural changes characterized by a tendency towards decentralization are also observed in the merchandise trade network.[20, 21] ■

FROM GLOBALIZATION TO REGIONALIZATION?

The production of food and agricultural products depends on a multitude of agroclimatic conditions, such as climate, soil characteristics, altitude and the availability of land and water (see Part 3). Natural resource endowments are

FIGURE 1.8 THE DECENTRALIZATION OF FOOD AND AGRICULTURAL TRADE LINKS, 1995–2019



NOTE: A decreasing index of centralization can indicate the evolution towards a more even trade network with high connectivity among countries and decentralized trade structures.
SOURCE: Jafari, Y., Engemann, H. & Zimmermann, A. 2022. The evolution of the global structure of food and agricultural trade: Evidence from network analysis. Background paper for *The State of Agricultural Commodity Markets 2022*. Rome, FAO.

distributed unevenly across the world and, together with differences in technology shape trade flows (for a discussion on the key drivers of trade see Part 2).

Demand for food is increasing fastest in regions where population and income growth are strongest, as in emerging economies and developing countries in Africa and Asia.[22] However, in many of these regions, agricultural productivity is relatively low (see Part 2) and countries may be challenged to produce sufficient food for their growing population.

Globally, trade can help balance food supply and demand by moving food from surplus to deficit areas. It also contributes to ensuring dietary diversity as foods that cannot be produced domestically can be imported from other countries, and this can help promote healthy diets.[23, 24, 25, 26] The increasing risks to agricultural production from climate change reinforce the role of global trade in ensuring food security and nutrition.[27] At the same time, most empirical evidence shows that those countries that are similar in terms of economic size or are located close to each other tend to trade more between them, as compared with countries of different relative sizes or countries that are geographically more remote.[h]

Trade costs play an important role in shaping trade flows and they depend on many factors (see Part 2). Costs incurred from transportation and logistics tend to increase with distance

h See for example Feenstra, R.C. 2015. *Advanced International Trade: Theory and Evidence.* Second Edition. Princeton, Princeton University Press; and Anderson, J.E. & van Wincoop, E. 2003. Gravity with Gravitas: A Solution to the Border Puzzle. *American Economic Review*, 93(1): 170–192.

and this makes long-distance trade more costly, favouring trade between countries that are nearer each other. Infrastructure is linked and trade procedures are often similar among neighbouring countries, and these countries are often closer in terms of culture and preferences, which leads to more trade between them.[28, 29]

Trade is also proportional to the economic size of a country, reflecting production capacity, but also purchasing power and preferences associated with income levels. Richer countries can more easily leverage gains from specialization by trading with other rich countries.[30, 31] Trade policies also have significant influence on trade flows. When tariffs are low and non-tariff measures harmonized, countries trade more with each other. Regional trade agreements (RTAs) that reduce tariff and non-tariff barriers generate significant trade activity, fostering economic development.[32]

International trade negotiations in the WTO have set the framework conditions which contributed to opening global markets and reducing barriers on food and agricultural trade globally (see Part 4). The process of globalization is evident in the acceleration of trading activity in the 2000s, the higher participation of countries in the global trade network and the increased connectivity between countries worldwide. While governments come together at the WTO to negotiate the "rules of globalization",[33] this process has been complemented and reinforced by an increasing number of RTAs.[34] An important question remains related to whether the structural change of the food and agricultural trade network and the emergence of new hubs has been associated with the regionalization of trade.

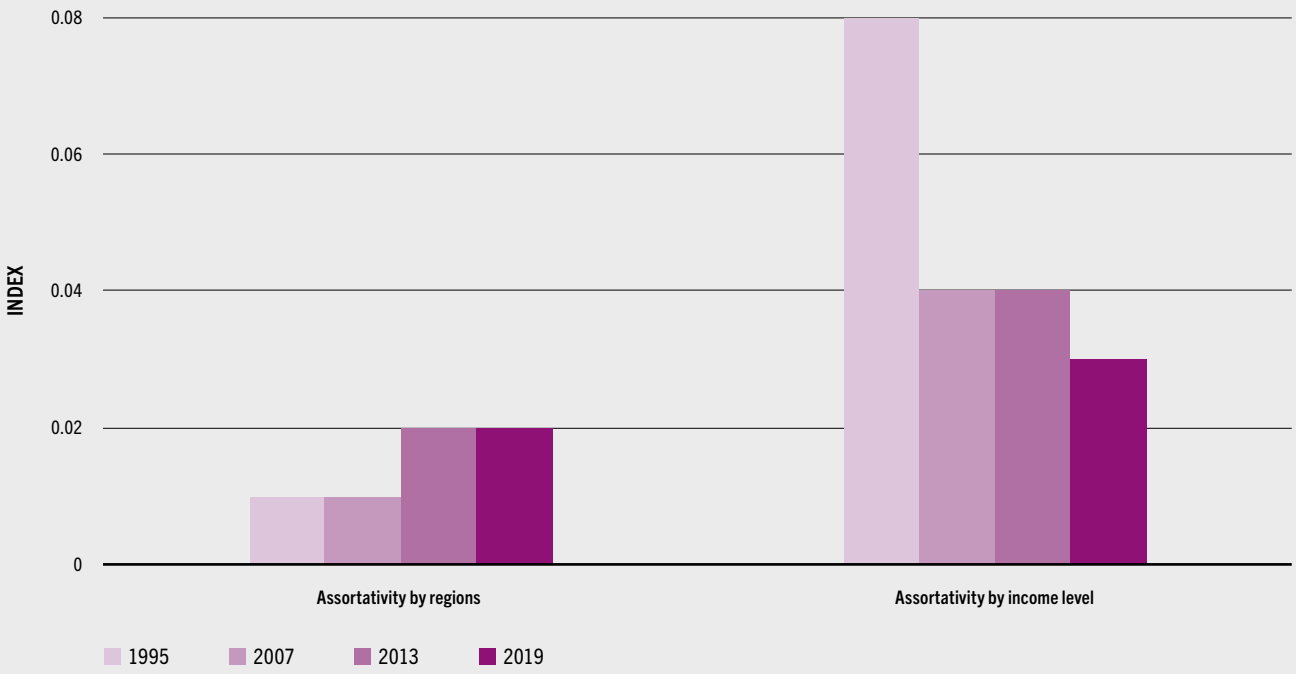
Network indicators, such as the assortativity index, suggest that countries within a region tend to trade more with each other than with countries in other regions (Figure 1.9). On average, countries within the same region have relatively more trade links with each other and the intensity of trade between them is higher than with countries outside the region. Possibly reflecting regionalization tendencies fostered by RTAs worldwide, the analysis suggests that during the 1995–2019 period not only globalization, but also the tendency of countries to trade with partners within the same region increased. When globalization came to a halt after 2008, countries appeared to trade more within their regions (Figure 1.9, see also Box 1.2 for a discussion of RTAs and trade within and between regions).

In general, income levels also play a role in choosing a trade partner. According to some analysts, countries with similar income per capita tend to trade more between each other because income levels can reflect similar tastes and preferences. High-income countries also tend to trade with rich partners due to a comparative advantage in the production of high-quality goods.[35] In 1995, the food and agricultural trade intensity of countries within the same income group was higher than the trade intensity of countries in different income groups. However, with the increasing participation of low- and middle-income countries in global food and agricultural markets, this relationship between similar income levels and trade has weakened over time (Figure 1.9). In 2019, countries were much more likely to have a high trade intensity with countries of a different income group than in 1995.

The increase in trade between countries with different income levels is quite important for development. Trade between countries at different stages of development promotes not only efficiency gains but also the diffusion of technology and knowledge. This results in productivity gains in agriculture, contributing to economic growth; at the same time, it can increase inequality within a country (see Box 2.5 for a discussion of trade openness impacts on growth, productivity and inequality).

Income levels, geography, differences in natural resource endowments and technology and trade policies, all influence the choice of a trade partner. Within the global food and agricultural trade network, countries are observed to form different trade clusters within which they tend to trade more. These clusters may be regional or can expand to include trade partners across regions. During the period 1995–2019 and in terms of trade intensity, the analysis suggests that countries traded within a pronounced cluster structure. Over time, some clusters became even firmer, as trade increased within

FIGURE 1.9 THE TENDENCY OF TRADING FOOD AND AGRICULTURAL PRODUCTS WITHIN REGIONS AND INCOME GROUPS, 1995–2019



NOTE: Assortativity describes the extent to which countries in a specific group trade with each other. The assortativity index ranges from 1 showing that similar countries trade with each other (assortative network) to -1 showing the reverse (disassortative network). Measured on the basis of trade intensity. Over time and in relative terms, countries appear to have increased trade within their respective regions, but decreased trade within their income groups (thus trading relatively more with countries in other income groups).
SOURCE: Jafari, Y., Engemann, H. & Zimmermann, A. 2022. The evolution of the global structure of food and agricultural trade: Evidence from network analysis. Background paper for *The State of Agricultural Commodity Markets 2022*. Rome, FAO.

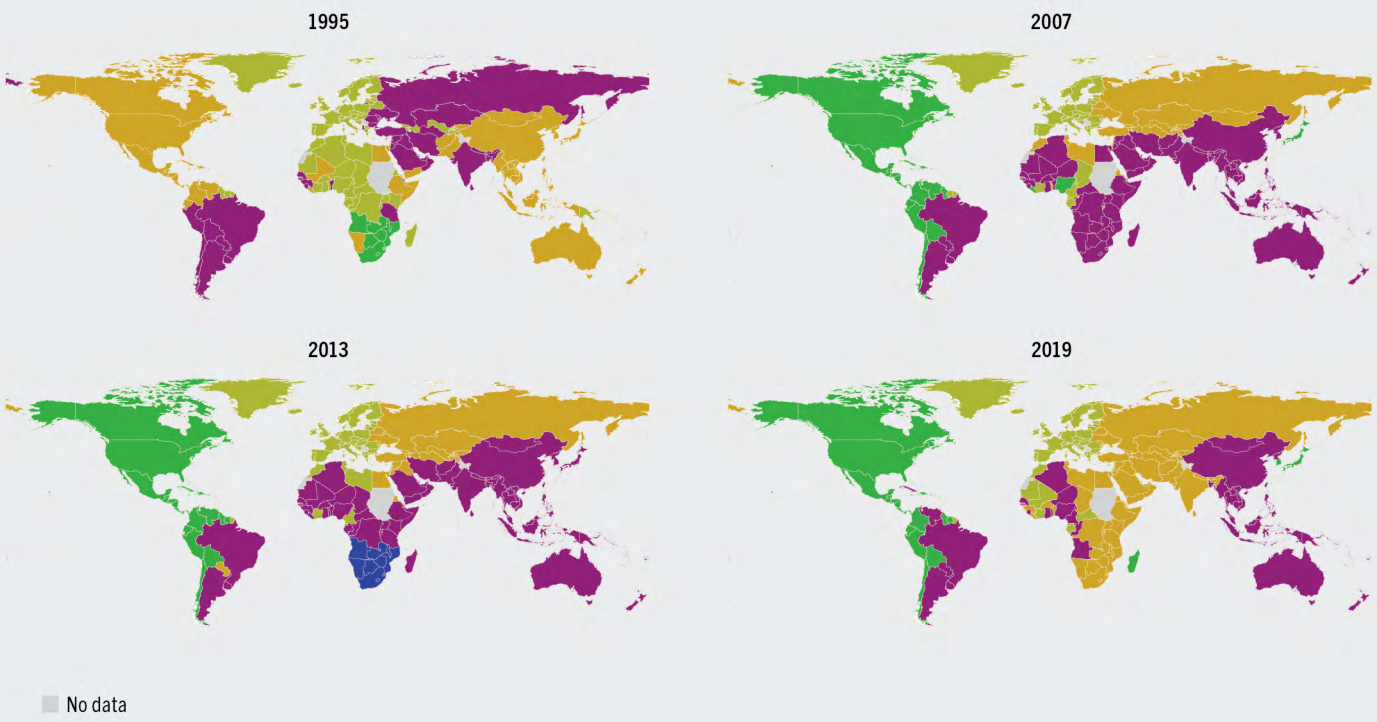
them. Some other clusters remained regional and stable in terms of country participation, while others expanded across regions with a country composition that changed frequently (Figure 1.10).

For example, a stable cluster includes the signatories of the North American Free Trade Agreement (NAFTA) and its successor the United States of America–Mexico–Canada Agreement (USMCA) and some of their trade partners across Latin America and the Caribbean. The intensity of food and agricultural trade between the three signatories of the agreement was already high in 1995 and remained significant to 2019. In 1995, this cluster already included Central American countries beyond Mexico. Over time, trade links of significant value were formed with South American countries and the cluster expanded to include Northern America and countries from Central America and South America except Argentina, Brazil, Paraguay and Uruguay, which are members of the Southern Common Market (Mercosur) and, together with countries in Eastern Asia, South-eastern Asia and Oceania, tend to trade globally rather than within the region (Figure 1.10).

Other mainly regional clusters include the European Union, where the Common Market has led to high levels of trade intensity between members and a cluster based on strong trade ties between former Soviet Union countries.

Over time these clusters expanded to other regions and, although Africa did not form a

FIGURE 1.10 REGIONAL FOOD AND AGRICULTURAL TRADE CLUSTERS, 1995–2019



NOTE: Trade clusters are indicated by different colours, and countries with the same colour belong to one trade cluster. Measured on the basis of trade intensity of imports and exports.
SOURCE: Jafari, Y., Engemann, H. & Zimmermann, A. 2022. The evolution of the global structure of food and agricultural trade: Evidence from network analysis. Background paper for *The State of Agricultural Commodity Markets 2022*. Rome, FAO. Conforms to Map No. 4170 Rev. 19 United Nations (October 2020).

stable regional cluster during the 1995–2019 period, African countries were shown to have a high rate of entries into and exits from other clusters (Figure 1.10). In 1995, the cluster around the European Union also included many Northern African and several sub-Saharan countries. In 2007 and 2013, the food and agricultural trade links of African countries with other countries across the southern hemisphere became more evident. In 2019, countries located at the eastern parts of Northern Africa and of sub-Saharan Africa formed relatively strong trade links with the Eastern European and Central Asian cluster and countries in Western and Southern Asia.

These changes in trade cluster participation may not necessarily imply a re-orientation of food and agricultural trade of African countries. Instead, they might reflect the fact that the trade intensity of African countries is generally low, their trade relationships are often less stable, and that the trade of African countries tends to be underreported.[36, 37] Although these characteristics could confound the identification of clear trade patterns, the lack of a stable regional cluster in Africa suggests that the intensity of intra-regional trade is low and that countries in the region tend to form many trade links outside Africa, despite various economic communities that have been established between countries in the region to promote integration (see also Box 4.3).

Overall, clusters shaped by regional proximity and trade agreements are clearly evident

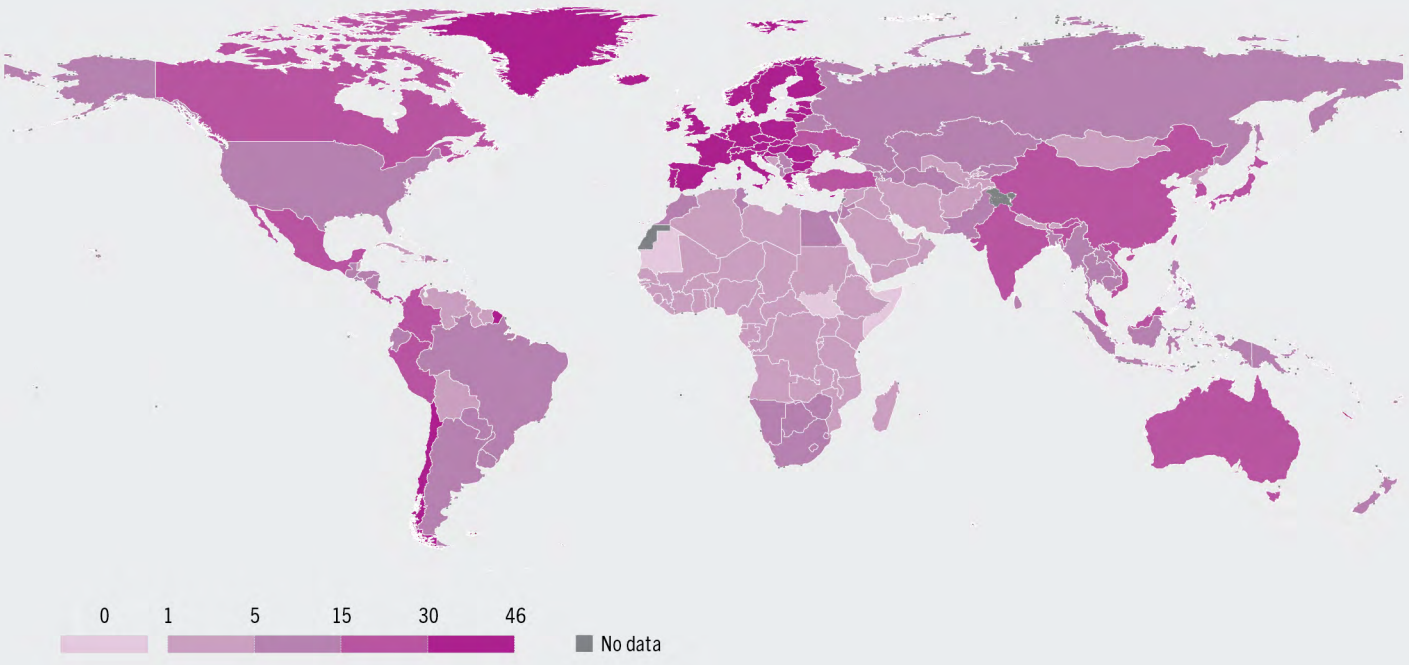
BOX 1.2 THE ROLE OF REGIONAL TRADE AGREEMENTS

Over the last decades, most countries have concluded trade agreements both within the multilateral framework of the WTO, as well as regionally. Since 1990, and in parallel to the multilateral trade negotiations, the number of regional trade agreements (RTAs) in force grew from fewer than 25 to more than 350 in 2022 (this number includes only RTAs in force that have been notified to the WTO, not all RTAs have been notified to the WTO).[67]

Counting RTAs can only approximate regionalization patterns as RTAs, broadly defined as "trade agreements of a mutually preferential nature", can include bilateral, regional and inter-regional agreements.[68] Depending on the number and economic size of the signatories, RTAs can be of varying significance and their number can be biased upwards or downwards by the formation of larger integrated areas (for example, the expansion of the European Union resulted in the loss of validity of previous agreements between current European Union members) or the breakup of previously integrated areas (for example, the withdrawal of the United Kingdom of Great Britain and Northern Ireland from the European Union and subsequent renegotiation of bilateral agreements). Also, the extent of the economic integration negotiated in each of the RTAs can vary considerably from loose declarations of intent to economic/customs unions and common markets.

Nevertheless, some broad parallels in the patterns of RTAs and those of trade can be highlighted. For example, countries with a stronger connectivity to the global trade network (Figure 1.5) also tend to be signatories to a larger number of RTAs (Figure 1.11). African countries, which tend to be weakly connected to the trade network have, so far, concluded only a few RTAs that have been notified to the WTO.

FIGURE 1.11 THE NUMBER OF REGIONAL TRADE AGREEMENTS BY COUNTRY, 2022



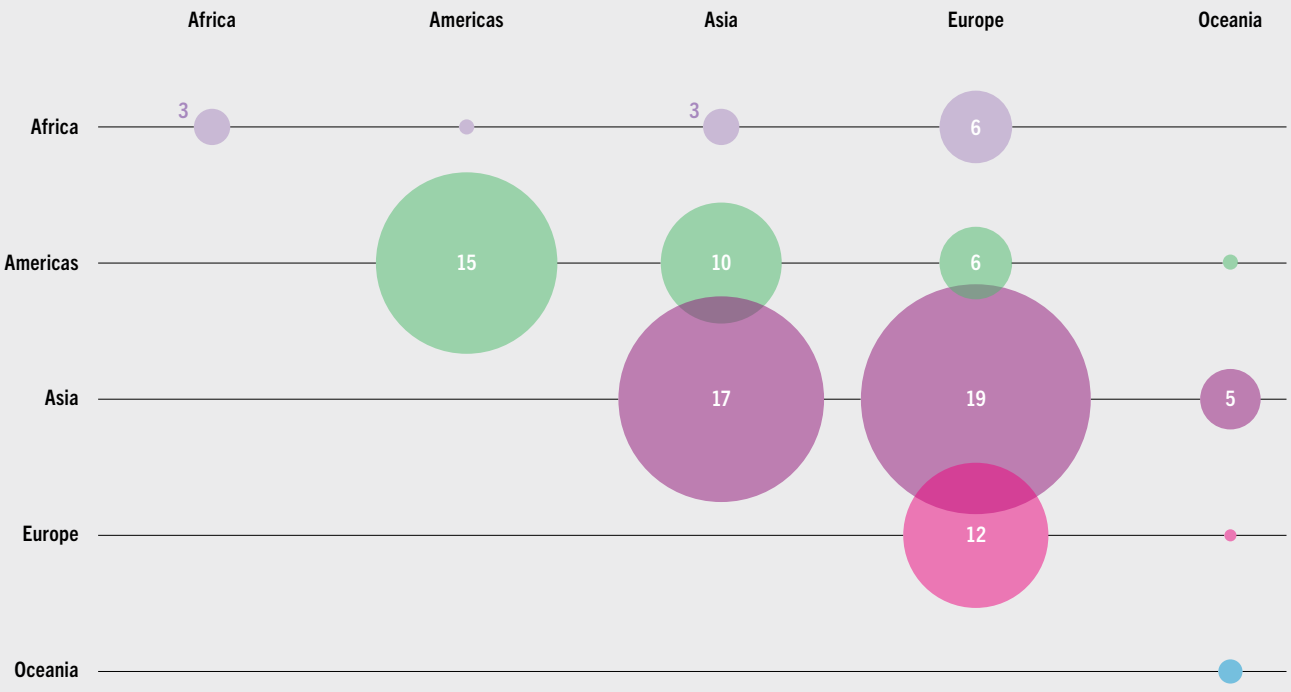
SOURCE: WTO Regional Trade Agreements Database. Conforms to Map No. 4170 Rev. 19 United Nations (October 2020).

BOX 1.2 (Continued)

The role of RTAs in promoting regional trade integration is reflected in the fact that almost half the RTAs currently in force were concluded between countries in the same region (Figure 1.12). Most other RTAs (around 50 percent of the total) cover countries in two different regions and only 1 percent of those include countries in three or more regions. Only Africa and Oceania have relatively few RTAs covering only countries within their respective regions. Less than 3 percent of the (notified to the WTO) RTAs cover only African countries. Indeed, both regions tend to trade more globally and less within the region (Figure 1.13). African countries form varying trade clusters with countries in other southern and northern regions, while Oceanian countries trade intensively with countries in Eastern and South-eastern Asia.

In the past, RTAs were usually concluded between neighbouring countries or countries that share a common history. However, new approaches include RTAs among countries from different continents and mega RTAs with many countries accounting for large shares of world trade.[69]

FIGURE 1.12 REGIONAL TRADE AGREEMENTS BETWEEN COUNTRIES BY REGIONS (PERCENT), 2022



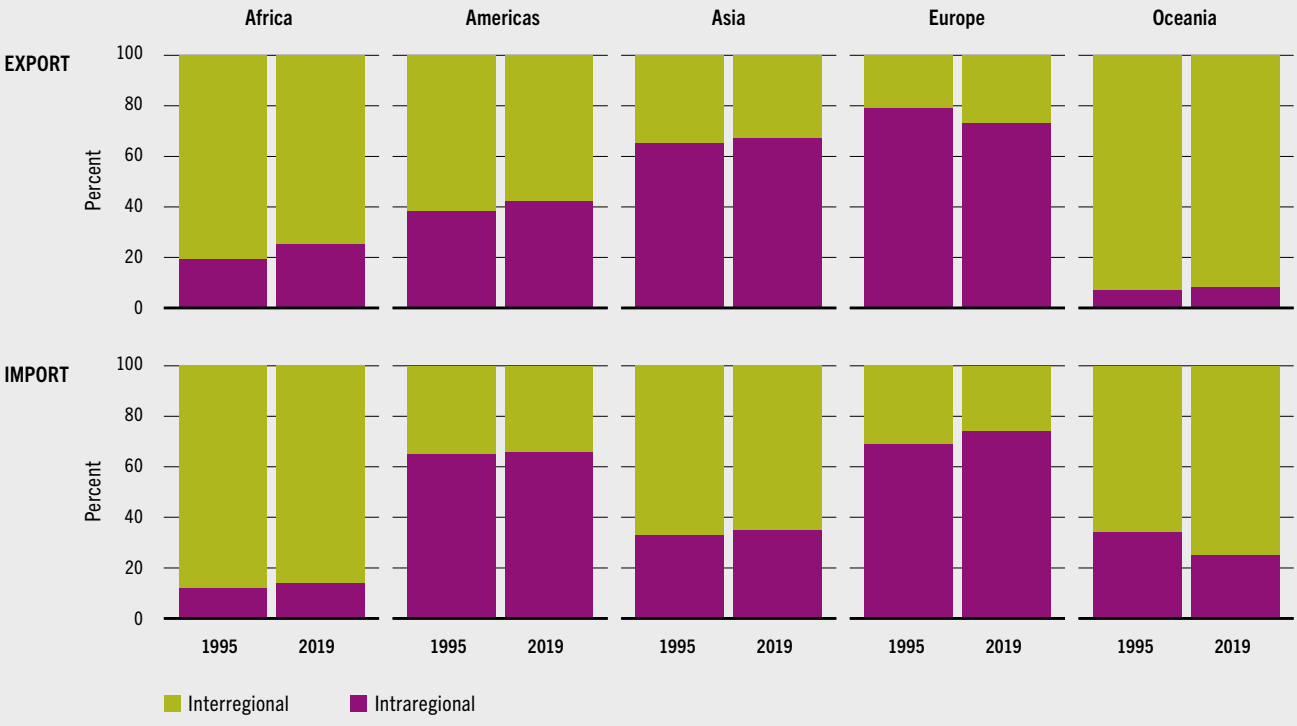
NOTE: The figure considers only regional trade agreements that include countries in the same or two different regions. Participation of multiple countries in the same region in one trade agreement is not considered explicitly. Regional trade agreements between countries in three or more regions (not shown) make up around 1 percent of all regional trade agreements. Only regional trade agreements in force that have been notified to the WTO are considered.
SOURCE: WTO Regional Trade Agreements Database.

BOX 1.2 (Continued)

Examples include the African Continental Free Trade Area (AfCFTA) and the Regional Comprehensive Economic Partnership (RCEP) (see Part 4 for a discussion of the potential effects of these RTAs on trade flows and economic development).

By limiting the number of countries involved and focusing on their strategic interests, RTAs can be more targeted and can be concluded more easily than multilateral negotiations.[70] Therefore, and as many RTAs overlap, their proliferation is sometimes seen as "building blocks" towards multilateral trade liberalization. However, by creating new trade links among their signatories, RTAs can also divert trade away from non-signatories and thus hinder further integration.[71, 72] This discussion is also relevant in the agricultural sector,[73] for which also the depth of many RTAs and thus their potential to impact the trade of their signatories has been called into question.[74] Part 4 of this report deepens the discussion of new trends in trade agreements and elaborates on the rationale for global versus regional trade and trade agreements in food and agriculture.

FIGURE 1.13 FOOD AND AGRICULTURAL TRADE WITHIN AND BETWEEN REGIONS, 1995 AND 2019



SOURCE: FAO.

SOURCE: Adapted from FAO. 2022. *Agricultural trade in the Global South: An overview of trends in performance, vulnerabilities, and policy frameworks*. Rome, FAO.

(see Box 1.2 for a discussion of RTAs).[i] There also appears to be a trend towards a rise in regionalization with increasing trade in food and agricultural products within regions (also indicated by Figure 1.9). In fact, some country and regional groups are more intra-regionally oriented in their trade, while others tend to trade more globally (see Box 1.2).[38] ■

HOW RESILIENT IS GLOBAL FOOD AND AGRICULTURAL TRADE TO SHOCKS TO THE SYSTEM?

The outbreak of the COVID-19 pandemic tested the resilience of the network of trade in food and agriculture in 2020 and 2021.[j] The pandemic, and the measures taken by governments worldwide to contain it, posed a simultaneous shock to all aspects of the agrifood system. This shock affected demand, supply, logistics and the trade of food and agricultural products and their production inputs. On average, and despite the multiple challenges, the food and agricultural trade network proved remarkably resilient to the shock. In fact, the only visible effects at the global level were short-lived disruptions of trade at the beginning of the pandemic and when the worldwide restrictions in movement were imposed during March–April 2020.[39, 40, 41]

Increased connectivity among countries can strengthen the buffer capacity of the global food and agricultural trade network. Countries that are well-integrated in the global market and have a high number of trade links can benefit from trade by leveraging their comparative advantage globally (see Part 2). This would promote food security, better diversity of foods supplied and economic growth, alleviating pressure on the natural resource base (see Part 3). Higher connectivity would contribute to resilience to domestic production shocks and localized shocks in exporting countries.

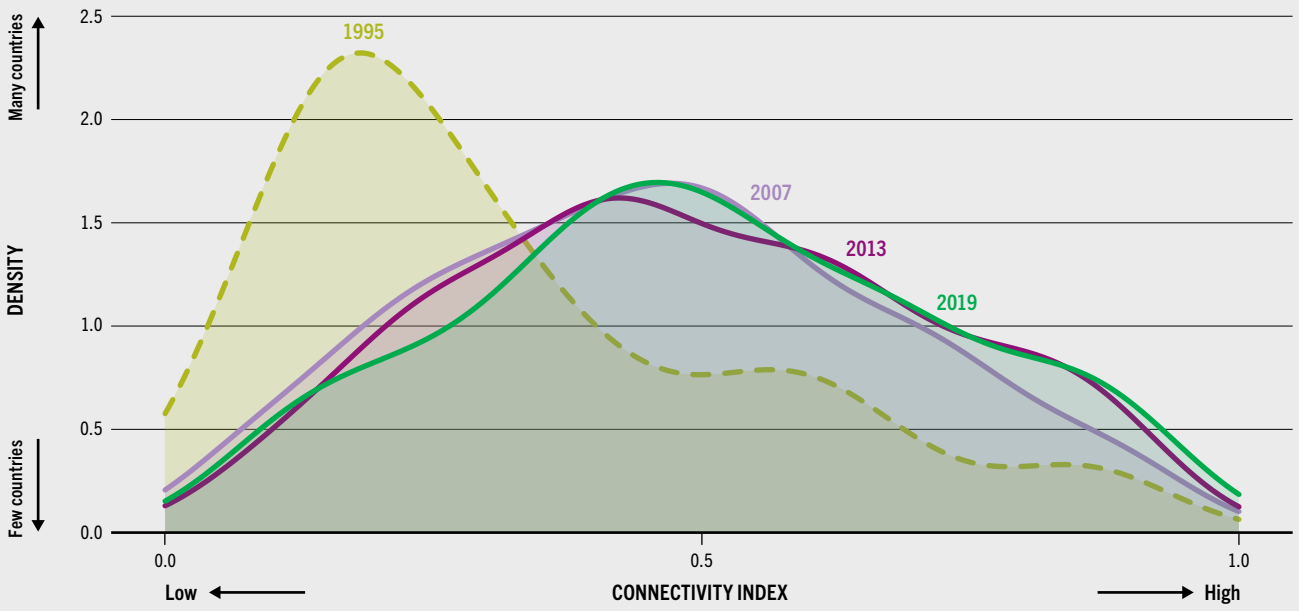
For a country, domestic food production shocks, such as those arising from extreme weather events or geopolitical crises, can be effectively buffered by adjustments in the quantities traded, ensuring food security.[42] In this way, shocks that are specific to individual countries or regions can be partly cancelled out at the global level. Trade is, therefore, a potentially powerful engine to even out supply fluctuations across the world and as a result to reduce price volatility. Nevertheless, there are also concerns that, with increasing import-dependency, greater connectivity between countries through trade may also act as an avenue to transmit negative shocks and increase vulnerability, rather than contribute to resilience.[43, 44, 45, 46] The effects on importing countries can be aggravated and lead to self-propagating trade disruptions if other countries in the network react by imposing export restrictions or other measures, thus exacerbating price spikes.[47, 48, 49, 50] Still, countries with a high dependency on food and agricultural imports from only a few major trading partners are more vulnerable to shocks impacting one of their partners than are those countries that are better connected and which can more easily source foods from other places.[51]

At the global level, the extent to which countries are vulnerable to external trade shocks depends on many factors. An important determinant is the structure of the trade network. If a few large players dominate the network and many other countries are connected to these hubs, but are not connected among each other, shocks affecting these large players can easily transmit through the whole network and possibly be magnified by global value chains (see Box 1.3 on the potential

i Clusters formed on the basis of regional proximity and regional trade agreements have also been identified in an analysis of global meat trade networks by Chung, M.G., Kapsar, K., Frank, K.A. & Liu, J. 2020. The spatial and temporal dynamics of global meat trade networks. *Scientific Reports*, 10(1): 16657; and for several food and agricultural products independently by Torreggiani, S., Mangioni, G., Puma, M.J. & Fagiolo, G. 2018. Identifying the community structure of the food-trade international multi-network. *Environmental Research Letters*, 13(5): 054026.

j Resilience in this context can be defined as the ability of countries in the food and agricultural trade network to sustainably ensure food imports, and thus availability and access to sufficient, safe, and nutritious food, in the face of any disruption occurring in the network. These disruptions can affect food and agricultural production, supply chain and trade logistics in one or more countries of the network or impact the shipment of food and agricultural products during delivery. For broader analysis on resilience see also FAO. 2021. *The State of Food and Agriculture 2021. Making agrifood systems more resilient to shocks and stresses.* Rome, FAO.

FIGURE 1.14 DISTRIBUTION OF CONNECTIVITY ACROSS COUNTRIES, NORMALIZED, 1995–2019



NOTE: Countries with high connectivity are located on the right tail, those with low connectivity are on the left tail of the curves. In 1995, very few countries were highly connected. Since 2007, many more countries are well-connected and the food and agricultural trade network has become more symmetric.
SOURCE: Jafari, Y., Engemann, H. & Zimmermann, A. 2022. The evolution of the global structure of food and agricultural trade: Evidence from network analysis. Background paper for *The State of Agricultural Commodity Markets 2022*. Rome, FAO.

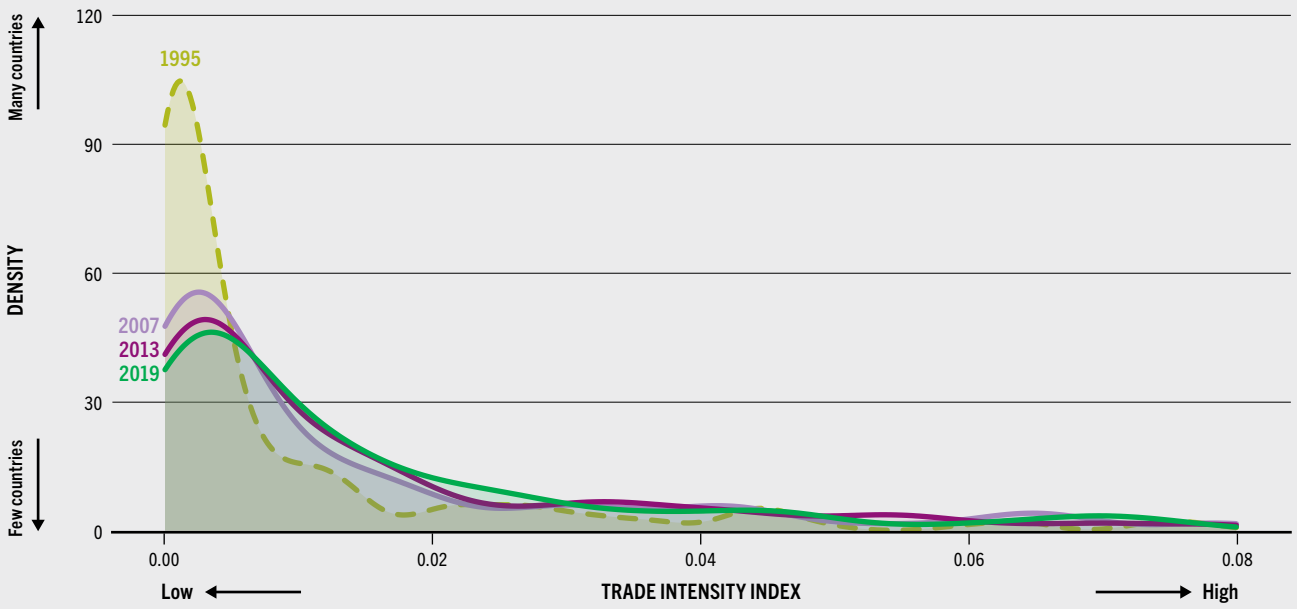
implications of the war in Ukraine on food security). A shock to the system can dissipate when all (or many) countries in the network are connected to many trade partners.[52, 53, 54, 55]

Network analysis can shed light on the extent to which the global food and agricultural trade network is vulnerable to shocks by assessing the connectivity of countries and the distribution of connectivity across the world. In 1995, only a few countries were highly connected to the trade network and these are shown by the long tail on the right-hand side of the distribution curve in Figure 1.14. Most countries – shown by the left-hand side of the distribution – were not well-integrated into global markets and remained in the periphery of the trade network.

Between 1995 and 2007, as the process of liberalization took hold, more countries increased their direct and indirect trade links with a larger number of other countries. As a result, the distribution of global trade links became much more even – the 2007 distribution curve in Figure 1.14 is flatter and both tails are symmetric resembling the shape of a bell. Over a period of 12 years, the trade network moved from a pronounced core-periphery structure to a more symmetric, balanced and resilient system. Between 2007 and 2019, the structure of the network remained stable, and there have been no major changes.

Considering not only the number of trade links per country globally but also taking into account the value of trade through these links – the trade intensity – provides additional insight into the structure of the global food and agricultural trade network and its resilience. Between 1995 and 2007 trade intensity became more evenly

FIGURE 1.15 DISTRIBUTION OF TRADE INTENSITY ACROSS COUNTRIES, NORMALIZED, 1995–2019



NOTE: Countries with high trade intensity are located on the right tail, those with low trade intensity are on the left tail of the curves. Food and agricultural trade was highly concentrated on a few countries in 1995 with the majority of the countries having low trade intensity in this year. Since 2007, more countries have increased their trade intensity, but the trade network is still relatively concentrated.
SOURCE: Jafari, Y., Engemann, H. & Zimmermann, A. 2022. The evolution of the global structure of food and agricultural trade: Evidence from network analysis. Background paper for *The State of Agricultural Commodity Markets 2022*. Rome, FAO.

distributed across countries (the curve in Figure 1.15 becomes flatter in 2007), yet the trade network did not become significantly more balanced (the tails of the distribution curve are not symmetric). While many countries participate in international food and agricultural trade, few countries account for most of the value traded.

The distribution of trade intensity across countries also suggests that the evolution towards a more stable trade system stalled in 2007. Some measures even indicate an increase in concentration between 2013 and 2019.[56] In 1995 and 2019, most of the best-connected countries with the highest trade intensity were located in Europe, Northern America and Eastern Asia. Most countries with low connectivity and low trade intensity (these countries are located at the left end of the curves in Figure 1.14 and Figure 1.15) are Small Island Developing States or Landlocked Developing Countries. As these countries are small and geographically remote, they are more vulnerable to shocks in their domestic markets and in those of their trade partners.

Trade clusters are also important, as they affect how a shock in one country could spread within the global network of trade. For example, if the epicentre of a shock is within a regional cluster, countries in that cluster would be more directly affected than outside countries as they would face reduced supply from their trading partners and higher prices. Countries outside the epicentre cluster would be indirectly affected through increasing international prices and possible trade interventions by their own trading partners.[57]

Overall, there is strong evidence that the trade network became more connected and more diversified between 1995 and 2007, suggesting

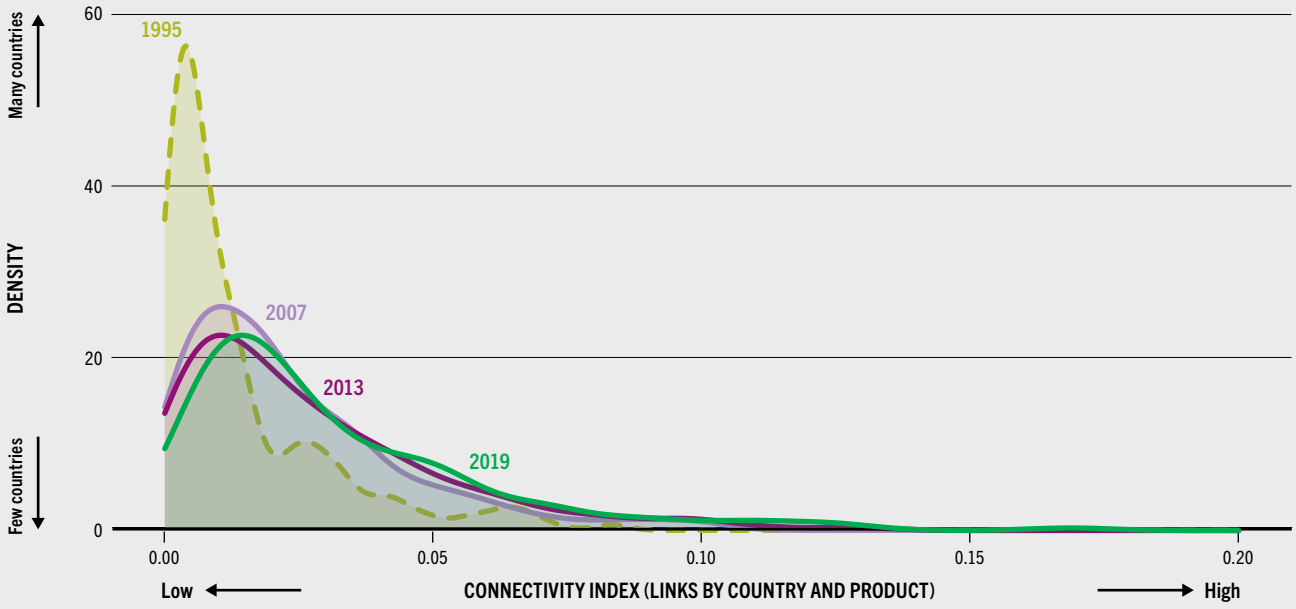
BOX 1.3 THE WAR IN UKRAINE AND THE RESILIENCE OF THE GLOBAL FOOD AND AGRICULTURAL TRADE NETWORK

At the aggregate level, for all food and agricultural products, resilience to disruptions in a major exporter can be better balanced through increased imports from other countries than at the individual product level. For a single product, such as wheat, only a few countries have a comparative advantage and are main exporters, which may imply a high dependency of other countries in the network on these key exporters.[75]

While global food and agricultural trade became more balanced and resilient on the aggregate, there are still considerable dependencies at the product level, especially in staple foodstuffs. Figure 1.16 shows that, despite an increase in resilience between 1995 and 2007, trade links at the product level are still much less evenly distributed than aggregate trade links at the country level (as shown by Figure 1.14). Only a few countries source a large variety of food and agricultural products from many different exporters. The imports of most countries are more concentrated on a fewer number of products from a limited number of trade partners.

Figure 1.17 shows that countries in Africa and Latin America and the Caribbean tend to have relatively few trade links in terms of food and agricultural products. While many countries in Latin America and the Caribbean are net food exporters, countries in Africa tend to be net food importers, especially those located in Northern Africa. For these countries, relying on imports of a small range of products and from few exporters can pose a risk to their resilience to supply shocks in the exporting countries.

FIGURE 1.16 DISTRIBUTION OF CONNECTIVITY ACROSS PRODUCTS AND COUNTRIES, NORMALIZED, 1995–2019



NOTE: Countries with many links by country and product, which source a large variety of food and agricultural products from many different exporters, are located on the right tail of the curves, and those that source their imports from fewer exporters are located on the left tail. Trade was highly concentrated on a few products and countries in 1995. Since then, import resilience at the country and product level has improved, but dependencies still exist.
SOURCE: Jafari, Y., Engemann, H. & Zimmermann, A. 2022. The evolution of the global structure of food and agricultural trade: Evidence from network analysis. Background paper for *The State of Agricultural Commodity Markets 2022*. Rome, FAO.

BOX 1.3 (Continued)

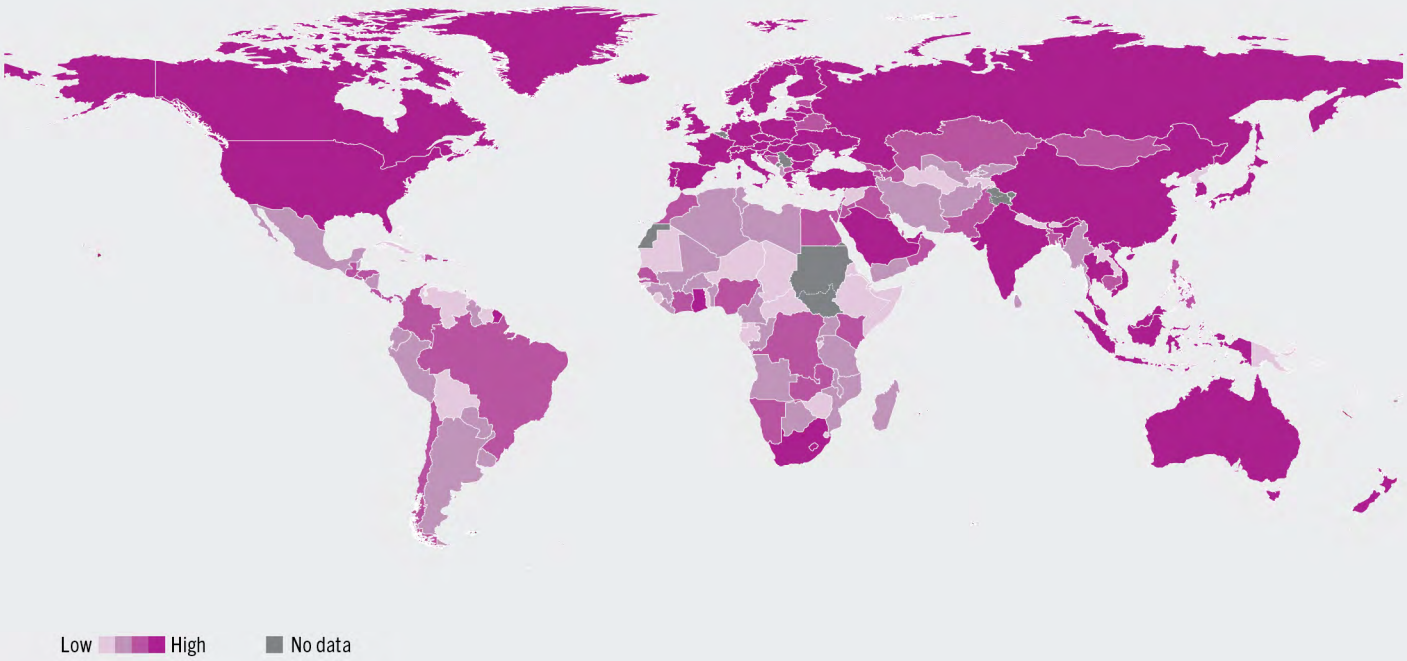
Relying on a few trade partners can lead to imbalances and vulnerabilities to shocks in both importing and exporting countries. A study found that countries are least resilient to disruptions in the grain trade network, which consists of only a few major exporters, and this was the case during the 2007–2008 world food crisis and the high-price phase during 2010–2011 when several major producers imposed export restrictions.[76]

In fact, the wheat trade network has been identified as one of the most vulnerable trade networks at the product level if shocks occur in one of the major exporters, such as Ukraine, the Russian Federation and some Northern American and Western European countries.[77]

Analyses of the global wheat network have shown that its resilience increased between 2009 and 2013, but some developing countries became more import-dependent and thus more vulnerable to the shocks in exporting countries. Countries in Northern Africa and Western and Eastern Asia were found to be most sensitive to supply shocks in wheat. For example, heatwave-induced yield losses in the Russian Federation and resulting export restrictions are thought to have contributed to increased wheat prices, which were associated with social unrest in some of these countries in the early 2010s.[78, 79, 80]

The Russian Federation and Ukraine are among the most important exporters of some agricultural products in the world. In 2021, either the Russian Federation or Ukraine (or both) ranked among the top three global exporters of wheat, barley, maize, rapeseed and rapeseed oil, sunflower seed and sunflower oil. The Russian Federation was also one of the world's top three exporters of fertilizers. This sparked concerns about the risks of the war in Ukraine, which began in February 2022, spreading beyond the region.

FIGURE 1.17 CONNECTIVITY ACROSS PRODUCTS AND COUNTRIES AT COUNTRY LEVEL, 2019



NOTE: The darker colours indicate countries with many product-country links, which source a large variety of food and agricultural products from many different exporters. A lighter shade indicates countries that source a narrower range of products from fewer exporters.
SOURCE: Jafari, Y., Engemann, H. & Zimmermann, A. 2022. The evolution of the global structure of food and agricultural trade: Evidence from network analysis. Background paper for *The State of Agricultural Commodity Markets 2022*. Rome, FAO. Conforms to Map No. 4170 Rev. 19 United Nations (October 2020).

BOX 1.3 (Continued)

By the end of March 2022, the war had already caused extensive damage and loss of life in key population centres in Ukraine, had spread across rural areas and had caused massive displacement. While the violence escalated rapidly, it remains extremely difficult to predict the evolution of the conflict and its effect on lives, livelihoods, food security and nutrition. At the time of writing this report, it was also uncertain whether Ukraine would be able to harvest existing crops, plant new ones or sustain livestock production as the war evolves. The war has already led to port closures, the suspension of oilseed crushing operations and the introduction of export restrictions for some crops and food products. All of these are taking a toll on the country's exports of grains and vegetable oils.

Much uncertainty also surrounds the Russian Federation's export prospects, given sales difficulties that may arise as a result of economic sanctions imposed on the country and their impact on future planting decisions.

The Russian Federation and Ukraine are key suppliers to many countries that are highly dependent on imported foodstuffs and fertilizers. Several of these countries fall into the Least Developed Country group, while many others belong to the group of Low-Income Food-Deficit Countries.

For example, Eritrea sourced the entirety of its wheat imports in 2021 from both the Russian Federation (53 percent) and Ukraine (47 percent). Many countries in Northern Africa and Western and Central Asia are also highly dependent on wheat imports from the Russian Federation and Ukraine. Overall, more than 30 net importers of wheat are dependent on both countries for over 30 percent of their wheat import needs.

Many of these countries were already grappling with the negative effects of high international food prices before the war. Globally, if the war results in a sudden and prolonged reduction in food exports by Ukraine and the Russian Federation, it will exert additional upward pressure on international food prices to the detriment of economically vulnerable countries in particular.

The war is also set to increase humanitarian needs in Ukraine, while deepening those of millions of people who, prior to its escalation, were already displaced or requiring assistance due to the more than eight-year conflict in the eastern part of the country. By directly constraining agricultural production, limiting economic activity and raising prices, the war has further undercut the purchasing power of local populations, with consequent increases in food insecurity and malnutrition. Humanitarian needs in neighbouring countries, where displaced populations are seeking refuge, have also increased substantially.

Ensuring and enhancing market transparency is crucial to providing timely information on potential bottlenecks and shortcomings and for offering alternative solutions. Policy dialogue should be strengthened to ensure that global food and agricultural markets continue to function properly and that trade in food and agricultural products flows smoothly. Countries that depend on food imports from Ukraine and the Russian Federation must find alternative export suppliers. They should also use existing food stocks and enhance the diversity of their domestic production bases.

SOURCE: Adapted from FAO. 2022. *The importance of Ukraine and the Russian Federation for global agricultural markets and the risks associated with the war in Ukraine*. Information Note. 10 June 2022 Update. Rome, FAO; FAO. 2022. *Ukraine: Note on the impact of the war on food security in Ukraine*. 25 March 2022. Rome, FAO; Torero, M. 2022. Op-Ed: Russia's invasion of Ukraine should not cause a hunger crisis. *Los Angeles Times*, 4 March 2022.

increased resilience within the system to shocks in terms of aggregate food and agricultural products. Mixed evidence for the period 2013 to 2019 suggests a slight drop in the resilience of the trade network. This may be due in part to the increase in regionalization, but also due to reduced trade between major economies as a result of trade tensions.[58] However, when exports of individual basic foods are highly concentrated in only a few countries and shocks occur in the exporting countries (for example caused by extreme weather events or military conflicts), this can have serious implications for the food security of their trading partners (see Box 1.3).[k]

Food and agricultural trade networks can be highly concentrated due to a number of reasons. Geographical proximity plays an important role. Production is concentrated in relatively few countries due to comparative advantages, trade policies, trade costs and natural resource endowments that, when combined, enable some countries to engage in trade more than others (see Part 2 and Part 3). ■

k Similar conclusions are drawn by Sartori, M. & Schiavo, S. 2015. Connected we stand: A network perspective on trade and global food security. *Food Policy*, 57: 114–127; and Campi, M., Dueñas, M. & Fagiolo, G. 2021. Specialization in food production affects global food security and food systems sustainability. *World Development*, 141: 105411.

BRAZIL
Açai fruit at a market in Belém.
©Shutterstock.com/ Dado Photos

PART 2
THE FUNDAMENTAL DRIVERS OF TRADE IN FOOD AND AGRICULTURE

KEY MESSAGES

➔ Comparative advantage, trade policies and trade costs shape global food and agricultural markets. These fundamental drivers determine trade partners and the trade flows between them, the value of food and agricultural products traded and the gains from trade.

➔ In agriculture, the influence of comparative advantage is significant relative to other sectors of the economy. Across countries, large differences in relative agricultural productivity strengthen the role of comparative advantage and increase the incentives to trade and the potential gains from trade.

➔ High trade costs in food and agriculture can offset the influence of comparative advantage. These costs can be significant due to the bulk and perishability of food and the high costs of compliance with non-tariff measures, such as sanitary and phytosanitary standards.

➔ Low-income countries face significantly higher trade costs than high-income economies. This affects the role of trade in ensuring food security and facilitating structural transformation and growth. Countries that face high trade costs tend to have expanded agricultural sectors to meet their food requirements.

➔ The interplay between comparative advantage and trade costs shapes the geography of trade and countries select their trade partners balancing the gains from trade with its costs. Within sub-Saharan Africa, low strength of comparative advantage and high trade costs translate into low levels of intra-regional trade. Improving productivity and reducing trade costs are key for market integration and development.

The expansion of trade in food and agriculture since the beginning of the twenty-first century has strengthened the interdependence of agrifood systems across the world. New players have emerged as important exporters in the global market while several countries depend on imports from other regions. More food and agricultural products cross borders and trade is facilitated by multilateral and regional agreements. The globalization of food has provoked lively debates on what outcomes global markets generate and has raised significant concerns about the impact of trade on the environment, society, changing lifestyles and diets. Opponents of globalization maintain that trade is harmful to sustainable development. Switching to locally produced food and reducing trade is seen by many as providing better environmental and social outcomes.

Nevertheless, trade in food and agriculture has been an essential part of our societies and the discussions on the globalization of food often overlook the fundamental drivers that shape global food and agricultural markets. People have been trading food since the Neolithic period or possibly earlier. Archaeological evidence suggests that around 6 000 BCE, when agriculture was replacing the hunter-gatherer economy in southern Europe, wheat – a crop that was initially domesticated and farmed in Mesopotamia – was imported into the British Isles through social networks and trade routes that connected our ancestors. At that time, although it was consumed, the hunter-gatherer communities in Britain did not cultivate wheat. It took about 2 000 years more, for arable farming and the wheat cultivation technology to arrive in mainland Britain.[81] ■

WHY DO COUNTRIES TRADE?

Nowadays, technology differences across countries still drive international trade in food and agricultural products. Technology underpins a country's absolute advantage in trade – it determines how the factors of production, such as land and labour, are combined, making them more productive and reducing costs. In food and agriculture, technology includes anything that can influence the transformation of production factors into outputs. Improved seeds, fertilizers and machinery, digital technologies, innovations in organization and farm management practices and improvements in education and extension make up agricultural technology and shape absolute advantage (see Box 2.1 for definitions of absolute and comparative advantage).

Countries engage in trade to export what they can produce at a lower cost relative to other countries, while importing what is relatively more expensive to be produced domestically. While a country's *absolute advantage* is determined by its productivity level, *comparative advantage* reflects the opportunity costs of production and entails a comparison both across countries and across products. With food and agricultural trade increasing twofold in real value terms since 1995, with more countries participating more actively in global markets and more trade flows among them, the principle of comparative advantage is increasingly relevant in the modern economy (see Part 1 for a discussion on trends in international trade in agricultural products and food).

Together with technology differences, the uneven allocation of natural resource endowments across countries forms another key determinant of comparative advantage in food and agricultural trade.[I] Land and water are crucial factors in food production, and their availability can influence the relative cost of agricultural products and shape comparative advantage. For example, water-stressed countries rely on the import of water-intensive foods to complement domestic production and ensure food security. Countries with abundant land or water can export food and agricultural products that use these factors more intensively and capture large shares of global trade (Part 3 discusses the role of land and water in determining food and agricultural trade).

Given the available technologies and resource endowments, countries specialize in agricultural products in which they are relatively more productive. And by engaging in trade, countries can gain by exporting these products for which they possess a comparative advantage, while importing products in which they have a comparative disadvantage. This does not mean that countries should only produce and export the products for which they enjoy a high comparative advantage, but that they tend to produce and export relatively more of these products, as markets provide incentives to specialize in the form of price differentials.[82]

The gains from food and agricultural trade can be significant. Differences in technologies and the natural resources necessary for agricultural production, such as land and water, are substantial across countries. For example, agricultural land per capita in the United States of America is approximately 25 times higher than in Japan. Recent studies looking at how market integration helps allocate agricultural production according to comparative advantage, suggest that gains from trade can be significant. Without trade, such large differences would result in extremely high food prices in countries with few natural resources per capita and extremely low prices in countries with larger endowments of land and water.[83] This would also have significant implications for food security (see Box 2.2 for a discussion on the linkages between trade, food security and nutrition).

I David Ricardo, a classical economist, developed the principle of comparative advantage in his work *On the Principles of Political Economy and Taxation* published in 1817. While Ricardo focused on the comparative advantage in terms of technology differences across countries, Eli Heckscher and Bertil Ohlin, at the Stockholm School of Economics in 1933, analysed the role of factor endowments, such as capital, land and labour, in determining trade. Combinations of both theoretical models in explaining comparative advantage and trade patterns are discussed by: Helpman, E. & Krugman P.R. 1985. *Market Structure and Foreign Trade, Increasing Returns, Imperfect Competition and the International Economy.* Cambridge, MA: MIT Press; Trefler, D. 1995. The Case of Missing Trade and Other Mysteries. *American Economic Review*, 85:1029–46; and Harrigan, J. 1997. Technology, Factor Supplies, and International Specialization: Estimating the Neoclassical Model. *American Economic Review*, 87:475–494.

BOX 2.1 ABSOLUTE ADVANTAGE AND COMPARATIVE ADVANTAGE IN TRADE

The principles of absolute advantage and comparative advantage are central in the theory of international trade.

Absolute advantage refers to a country having higher productivity or lower cost in producing a good compared to another country. In other words, it shows a country's ability to produce a good at a lower price than its competitors and is one of the simplest measures of economic efficiency.

However, absolute advantage is neither necessary nor sufficient for shaping trade patterns that benefit all countries. For example, a country may have an absolute disadvantage in all goods compared to another country, yet it can engage in trade with other countries and gain from it, due to comparative advantage in some goods vis-à-vis other countries.

Comparative advantage is the ability of a country to produce a particular good at a lower opportunity cost than its trading partners. Even if a country has an absolute advantage in all goods compared with other countries, it will benefit from importing the good in which it has the higher opportunity cost – that is the good that uses more resources in production compared with other goods that are produced domestically. By importing the higher opportunity cost good, the country can allocate more resources to produce and export the goods that are characterized by lower opportunity cost and gain from this. In theory, the principle of comparative advantage implies that all countries become better off as a result of trade.

Both absolute and comparative advantage are determined by differences in the level of technology and the resource endowments in each country, but while the former refers to higher (absolute) productivity, the latter has to do with relative (comparative) productivity.

Nevertheless, the gains from food and agricultural trade are not distributed evenly. Trade affects the prices of foods and production factors, including labour, and can result in winners and losers. In agriculture, a major concern relates to the ability of smallholder farmers in developing countries to compete effectively in global markets. For these farmers, market failures, such as poorly functioning land and labour markets and limited access to technologies, credit and insurance can erode any comparative advantage and dissipate the gains from trade.[84]

Analysing comparative advantage – the key determinant of food and agricultural trade – in a world of many countries and many products is difficult and it may not be possible to measure it precisely. Traditionally, practitioners measure the export performance of a country in a particular product relative to the global market to reveal comparative advantage.[m] Since a country with a comparative advantage can produce a good relatively more cheaply than its trade partners, high comparative advantage relative to the rest of the world would be associated with exports and low comparative advantage would be associated with imports.

However, using observed data in this way does not adequately reflect the fundamental comparative advantage. This is because agricultural and trade policies distort markets and relative prices and the observed trade patterns of a country are determined on the basis of these distorted prices, rather than by underlying relative productivity levels and the availability of resources. Developments in quantitative trade models provide a better connection between the theory and the data and, although they do not measure comparative advantage for each country, they explore its role in shaping trade flows between countries. In these modelling frameworks, the influence of comparative advantage is assessed by the heterogeneity of relative productivities across trade partners, which, in turn, can generate price differentials and thus provide incentives for trade. For example, in the global market the

m See Balassa, B. 1965. Trade liberalisation and "revealed" comparative advantage. *The Manchester School*, 33(2): 99-123. A country is said to have a revealed comparative advantage in a given commodity when its ratio of exports of this commodity to its total exports of all goods exceeds the same ratio for the world as a whole.

BOX 2.2 TRADE, FOOD SECURITY AND NUTRITION

Trade in food and agriculture can help balance food supply and demand globally by moving food from surplus to deficit areas. Higher food imports can increase the availability of calories and nutrients in a country with limited natural resources to produce adequate food. Food prices would fall through increased food supply, thus improving access for net consumers. Decreasing food prices induced by import competition can also affect the incomes and livelihoods of domestic farmers (net producers). For a country, trade also allows for better access to the markets of other countries and promotes exports of agricultural products to these markets, thereby creating and expanding employment opportunities and raising farmers' incomes.[119, 120]

At times of shortages, which might, for example, be caused by natural disasters or seasonal growing patterns, trade can also contribute to more stable food supplies and prices and thus to the stability dimension of food security. The exchange of foods produced under specific climate, soil and other natural conditions, can contribute to the diversity of diets[121] and improve food utilization.[122, 123]

Although the theoretical pathways of how trade can affect food security and nutrition are well-established, the linkages between trade and food security and nutrition are complex and some of the impacts can offset each other. This makes the identification of the effects in empirical assessments difficult. In fact, there has been only scant empirical evidence on these relationships.[124, 125]

A relatively new strand of literature contrasts trade openness with direct nutritional outcomes, such as undernourishment. At the global level, it was shown that agricultural trade openness has, on average, a positive net impact on food security measured as dietary energy supply adequacy. It also increased dietary diversity measured as the share of calories from non-staple foods and protein consumption.[126] However, the exact mechanisms and impacts can vary by context and stage of development.[127] For example, in a sample of 52 developing countries, food trade openness was associated with an increase in the prevalence of undernourishment. In fact, it was found that food supply increased because of increased trade openness but, in net food-importing countries, the negative effect on agricultural producers caused by import competition prevailed. This result could point to technology and efficiency constraints in net importing countries with large agricultural sectors.[128]

Among the most-researched relations within the area of agricultural trade and food security are the linkages between trade and price volatility. Price volatility, that is episodes of large, unexpected price changes, can intensify and contribute to risks to food security. In particular, the food price crisis of 2007/08 has triggered a plethora of studies on its causes. While a whole set of macroeconomic and sector-specific drivers for the price surges have been identified,[129] it is now well-established that trade restrictions that were imposed by many countries in response to rising food prices exacerbated food price volatility.

To insulate from sudden food price surges, countries tend to impose new or heighten existing export restrictions and/or lower import barriers so that the domestic price will rise less than the world market price with the effect that world markets become even thinner, market uncertainty increases and international food prices become more volatile.[130, 131] Export restrictions, especially when applied by major exporters, can significantly harm their trading partners, in particular, net food-importing developing countries. For example, export restrictions implemented by various countries between 2006 and 2011 increased international price volatility for wheat and rice. In fact, the contribution of export restrictions to price volatility appeared to be in the same order of magnitude as that of key macroeconomic variables.[132]

Diet diversity is important for the adequate provision of nutrients and human health. As natural conditions do not allow for producing all foods everywhere, trade is an important means for diversifying diets. Since the beginning of the 1960s, trade in crops has expanded and diversified, and this process has been identified as the main driver of a globally diversifying supply of vegetable products.[133] In fact, the diversity of foods produced is a strong predictor of food supply diversity only in low-income countries, which are less integrated into global markets. In middle- and high-income countries, food supply diversity was shown to be independent of production diversity, and other factors including international trade contributed more to a country's supply diversity.[134]

Although lower-income countries are often not well integrated in global markets, a study found

BOX 2.2 (Continued)

that they still tend to improve their nutrient supply through trade, in particular the supply of energy, protein, zinc, calcium, vitamin B12 and vitamin A.[135] However, in another study it was found that, while trade distributes substantial volumes of nutrients, its role in bridging the nutrient adequacy gap was only marginal in low- and lower-middle income countries. International trade helped close the nutrient gap in most high- and upper-middle income countries, even where domestic production ensured only a very low nutrient adequacy.[136]

Combined, the evidence shows that trade is indispensable to ensure food security and nutrition. Without trade, the availability and accessibility of foods and nutrients would be more unevenly distributed, any form of domestic production disruptions would cause serious concern for food security, and diets would be less diverse. However, increased competition through rising imports may be challenging for farmers in developing countries that are characterized by low efficiency and productivity constraints associated with poor physical infrastructure, weak institutions and low skills.

SOURCE: Adapted from Zimmermann, A. & Rapsomanikis, G. 2021. Trade and Sustainable Food Systems. Food Systems Summit Brief prepared by the Research Partners of the Scientific Group for the United Nations Food Systems Summit.

higher the heterogeneity of relative productivities across countries, the stronger the influence of comparative advantage.[n]

Agricultural and trade policies, such as subsidies and border measures, can weaken the underlying role of comparative advantage in determining trade flows. They could even reverse the relationship between comparative advantage and trade, causing particular goods that would have otherwise been imported, to be exported and vice versa.[85] For example, this could happen with policy measures such as export subsidies, which have been eliminated for agricultural products by the Tenth WTO Ministerial Conference held in Nairobi in 2015 (see Part 4).

Other policies, such as non-tariff measures (NTMs), including sanitary and phytosanitary standards, could also affect the influence of comparative advantage on trade flows. Although many NTMs aim to improve the safety and quality of food, address environmental and health issues, or support social norms, they can increase costs related to trade as exporters have to comply with different standards in order to export to different destination markets. The increasing prevalence of NTMs in food and agriculture means increasing costs for trade but, at the same time, weaker regulations could result in negative environmental, health or social outcomes.[86]

Trade costs, in general, strongly influence trade flows. Transport costs are significant, increase with distance and influence food and agricultural trade between countries (see the discussion on regional trade flows in Part 1). Other costs include search and communication costs, or costs associated with documentation, procedures and clearance delays at the border. Trade costs are likely higher for agricultural products and perishable foods, such as fruit and vegetables. They are also significantly higher in developing countries where transport and communication infrastructure are relatively poor, thus limiting the opportunities to trade that would potentially arise due to comparative advantage.[87, 88] ■

n The analysis of the influence of comparative advantage on trade across countries has been developing over the years. See Dornbusch, R., Fischer, S., & Samuelson, P. A. 1977. Comparative advantage, trade, and payments in a Ricardian model with a continuum of goods. *American Economic Review*, 67(5): 823–839; Dollar, D. 1993. Technological differences as a source of comparative advantage. *American Economic Review*, 83(2): 431–435; Eaton, J. & Kortum, S. 2002. Technology, Geography, and Trade. *Econometrica*, 70(5): 1741–79; Eaton, J. & Kortum, S. 2012. Putting Ricardo to work. *Journal of Economic Perspectives*, 26(2): 65–90; and Costinot, A., Donaldson, D., Vogel, J. & Werning, I. 2015. Comparative advantage and optimal trade policy. *Quarterly Journal of Economics*, 130(2): 659–702.

COMPARATIVE ADVANTAGE, TRADE POLICIES AND TRADE COSTS

In 2019, global value added in food and agriculture amounted to USD 3.7 trillion, four times less than that in manufacturing (USD 13.7 trillion). For the same year, the value of food and agricultural exports was USD 1.5 trillion, eight times less than that of manufacturing (USD 12.7 trillion). This significant difference between the value added and trade in these sectors implies that food and agricultural products are not traded as intensively as manufactures.

Another interesting point is that in low-income countries, the share of food and agricultural imports in consumption is low relative to food that is produced domestically (see Figure 2.10). There are many reasons that explain why some food products are produced and consumed locally, but as low-income countries are, in general, characterized by low agricultural productivity relative to high-income countries, one would expect that they would be relatively larger importers of food.

Both of the above observations have led analysts to refer to the "puzzle" of missing trade in food and agriculture.[o] Looking at this puzzle offers an insight into how comparative advantage determines trade flows in food and agriculture, as well as into the role of trade policies and trade costs in lessening comparative advantage's strength.

Productivity and comparative advantage

Across countries, productivity differences in agriculture are significant compared to other sectors of the economy. Figure 2.1 suggests that agricultural productivity per worker – measured as value added per worker – is much lower than in non-agriculture for most countries (as most observations lie above the diagonal line). The data also suggest that, across countries, the heterogeneity of productivities per worker in agriculture is much higher than in the non-agriculture sectors (Table 2.1).[p]

The top 10 percent of the richest countries produce 70.4 times as much agricultural value added per worker as countries in the bottom 10 percent of the income distribution. For example, in the United States of America, agricultural value added per worker in 2019 amounted to USD 100 062 (measured in 2015 prices) as compared with an average of USD 944 in sub-Saharan African countries, including Burkina Faso, the Democratic Republic of Congo, Ethiopia, the Gambia, the Niger and Mozambique.

Productivity differences in the non-agriculture sector are also pronounced but their heterogeneity is significantly smaller relative to agriculture (Table 2.1). On average, countries in the top 10 percent of the world income distribution produce 40.2 times as much non-agriculture value added per worker as the bottom 10 percent countries.

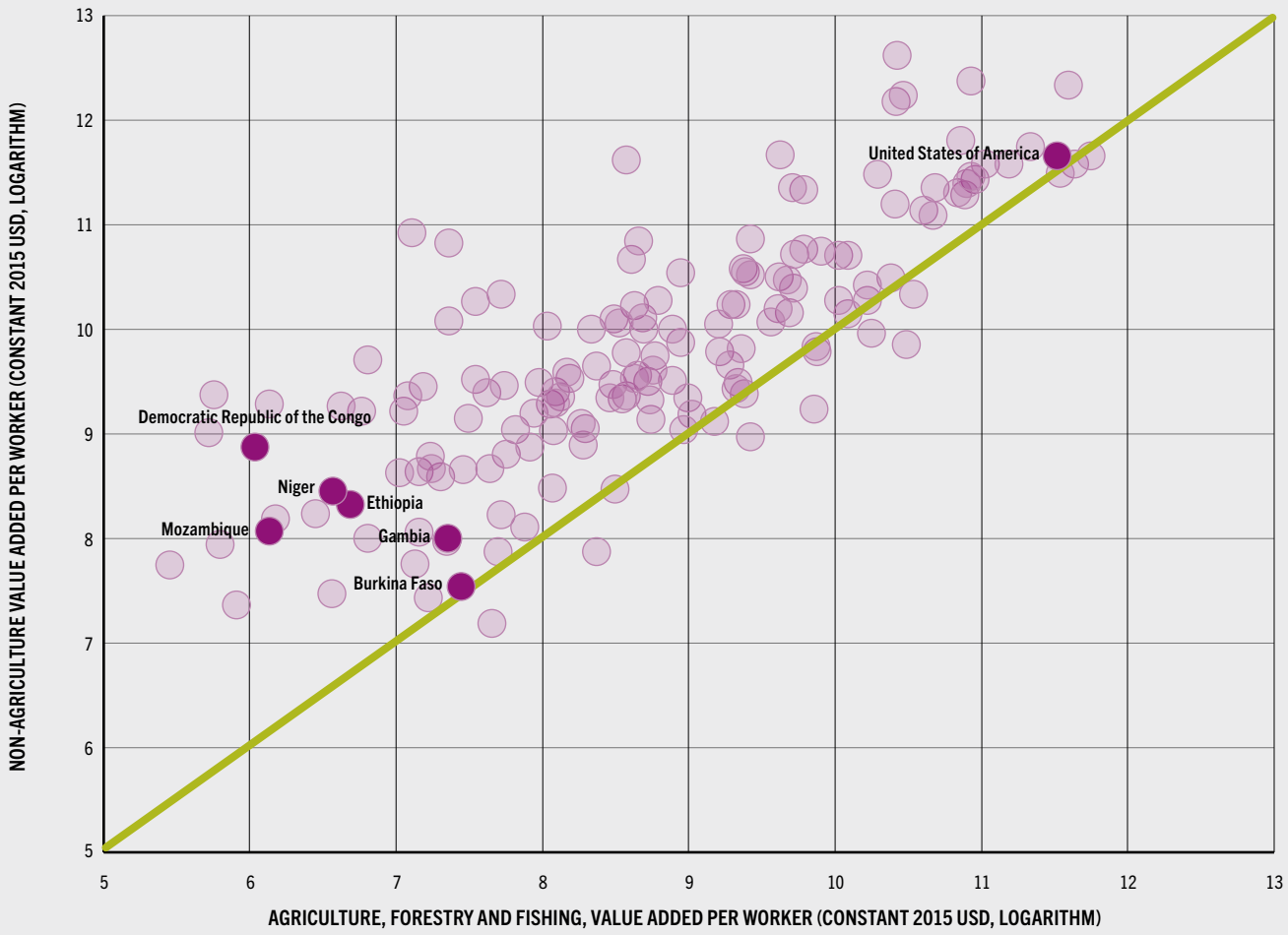
Across countries, the heterogeneity of productivities per worker in agriculture is much greater than in non-agriculture, reflecting a potentially powerful influence of comparative advantage on trade flows. Nevertheless, food and agricultural products are not traded as intensively as non-agricultural ones.

Agriculture is unique in that, on average, technology accounts for about three-quarters of productivity growth at the global level, while increases in the factors of production, such as land, make up for one-quarter of productivity growth.[89] However, the agricultural productivity gap between high- and low-income countries is vast (see Figure 2.2) and these cross-country productivity differences in agriculture have been the subject of much research. Researchers suggest

o See Tombe, T. 2015. The missing food problem: Trade, agriculture, and international productivity differences. *American Economic Journal: Macroeconomics*, 7(3): 226–58; and Xu, K. 2015. Why are agricultural goods not traded more intensively: High trade costs or low productivity variation?. *The World Economy*, 38(11): 1722–1743.

p Value added per worker is a measure of labour productivity. It denotes the value of the gross output per worker less the value of intermediate goods and services consumed in production before accounting for consumption of fixed capital in production. Agriculture also includes forestry and fisheries. Non-agriculture includes manufacturing, mining and quarrying, construction and utilities.

FIGURE 2.1 PRODUCTIVITY IN AGRICULTURE AND NON-AGRICULTURE SECTORS, 2019



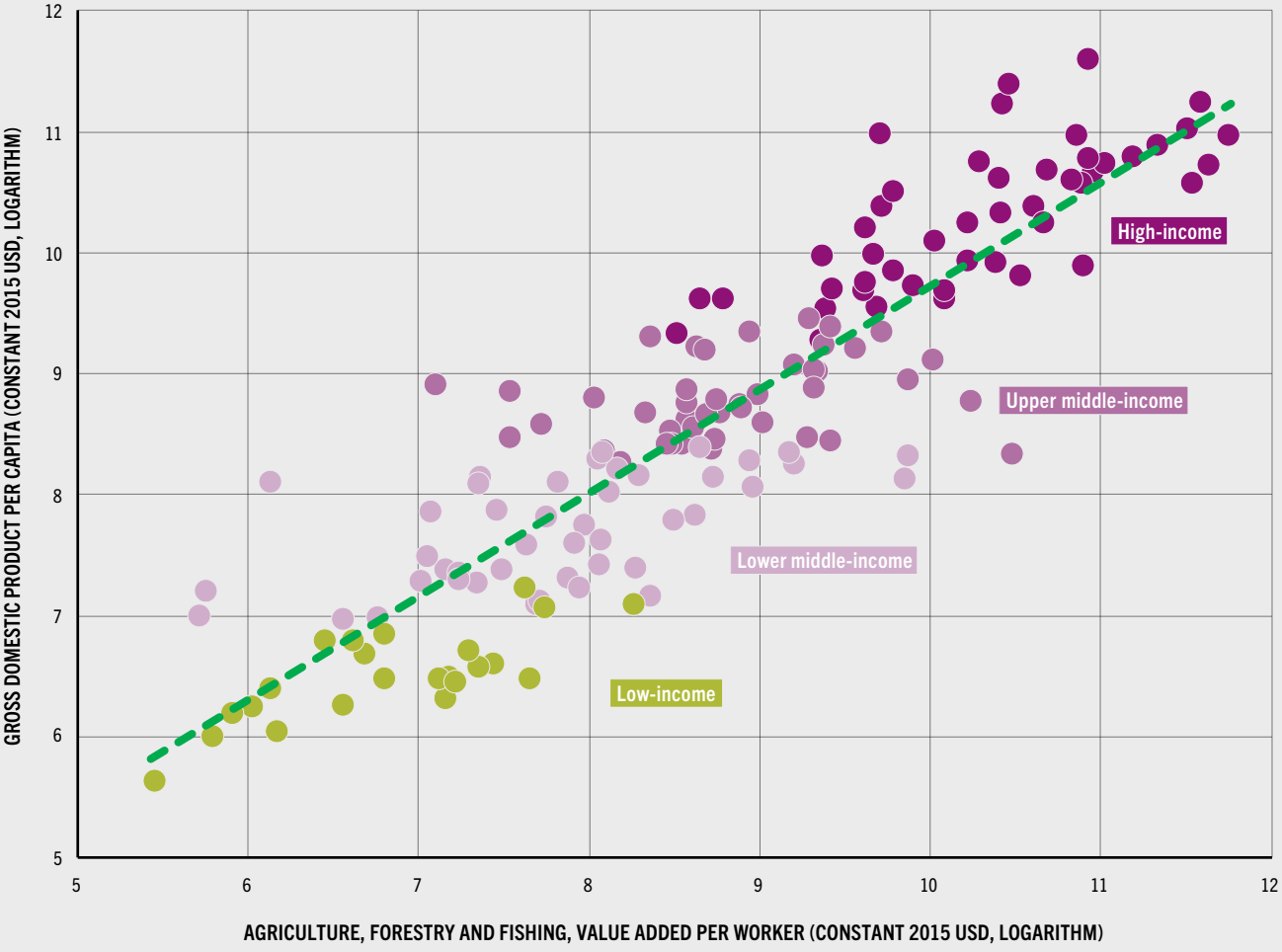
NOTE: Relationship between value added per worker in agriculture, forestry and fishing and non-agriculture, that includes manufacturing, mining and quarrying, construction and utilities, across countries.
SOURCE: World Development Indicators, World Bank Group.

TABLE 2.1 PRODUCTIVITY DIFFERENCES IN AGRICULTURE AND NON-AGRICULTURE SECTORS BETWEEN THE 10TH AND 90TH PERCENTILE OF THE WORLD INCOME DISTRIBUTION, 2019 (CONSTANT 2015 USD PER WORKER)

	Agriculture, forestry and fishing, value added per worker	Non-agriculture, value added per worker
Average of value added per worker, countries in the 10th percentile of income distribution (lowest-income countries)	957	3 645
Average of value added per worker, countries in the 90th percentile of income distribution (highest-income countries)	67 414	146 556
Ratio of 90th and 10th percentile averages	70.4	40.2

NOTE: Non-agriculture includes manufacturing, mining and quarrying, construction and utilities.
SOURCE: World Development Indicators, World Bank Group.

FIGURE 2.2 AGRICULTURAL PRODUCTIVITY AND GROSS DOMESTIC PRODUCT PER CAPITA, 2019



NOTE: Relationship between value added per worker in agriculture, forestry and fishing and gross domestic product per capita across countries.
SOURCE: World Development Indicators, World Bank Group.

that the large productivity gap in agriculture can be due to significant barriers to technology adoption and limited access to modern inputs.[90]

In low-income countries, market failures can inhibit technology adoption. High transaction costs result in thin markets and as farmers' participation in markets is low, they face only localized demand, which becomes quickly satisfied with small increases in production.[91] This provides weak incentives to farmers to adopt new technologies and increase productivity.

Uncertainty also affects the decision to adopt new technologies. Smallholder farmers, for whom the additional cost of modern technology would make up for a significant share of their income, are risk-averse and prefer to use traditional technologies.[92] Farm size plays an important role in shaping farmers' attitudes to risk and technology adoption, and the differences in farm size between high- and low-income countries could also explain a large part of the agricultural productivity gap.[93, 94] Incomplete insurance markets also result in low rates of technology

adoption. Farmers in developing countries tend to use fewer modern inputs, such as fertilizers, because of uninsurable risks.[95]

Women farmers face even greater disadvantages than their male counterparts, as they have less access to knowledge and social capital, which are additional factors that determine productivity.[96]

Economy-wide factors also contribute to low agricultural productivity per worker in low-income countries. Poorly functioning labour markets together with a lack of education and low skills in rural areas can inhibit the reallocation of labour from agriculture to other sectors of the economy, thus contributing to the agricultural productivity gap.[97, 98] Fewer agricultural workers would translate into additional gains in productivity per worker, but for this to happen labour markets should function well.

Trade policies

Domestic support and trade policy measures in food and agriculture address a broad array of objectives. For example, domestic support, such as input subsidies, aim to improve farmers' access to inputs. Direct income support measures contribute toward maintaining a level of farm income that keeps pace with the income trends in other economic sectors. Tariffs can be used to protect local farmers from international competition, reduce import dependence and promote self-sufficiency in staple foods. Export restrictions can lower the domestic price of food and contribute towards food security in the short term. Both tariffs and export taxes provide an important source of government revenue. Such policies can distort prices and influence trade.

NTMs are effectively trade policy measures in the sense that they can have an economic effect on trade, changing quantities traded or prices or both. NTMs include sanitary and phytosanitary (SPS) measures that ensure food safety and protect animal or plant health, as well as other technical regulations and standards, referred to as technical barriers to trade (TBT), that relate to objectives such as environmental protection, labour health and safety, and prevention of deceptive practices (see, for example, the discussion on environmental measures in Part 3).

The relationship between NTMs and trade is complex. Many NTMs may restrict trade but address important issues that improve welfare. At the same time, they can also expand trade as they strengthen the demand for a product through better information on its health and sanitary characteristics.

In the context of trade policy literature, both tariffs and NTMs contribute to trade costs and could partly offset the influence of comparative advantage on trade flows between countries (see Box 2.3 for a definition of trade costs and a discussion on their measurement).

Tariffs

With the Uruguay Round agreements, including the AoA in 1995, members of the WTO committed to not restricting imports by any means other than tariffs, and to keep their rates within set thresholds determined for each country. Many countries apply lower tariffs than the maximum permitted level. This unilateral reduction in tariffs, instigated by the AoA, together with concessions made in regional agreements, resulted in a substantial liberalization of trade.

The reduction in applied tariffs has been significant. Multilateral, unilateral and regional concessions are estimated to have contributed to a reduction of about 27 percent in average food and agricultural tariff levels worldwide. These reductions brought greater market openness and promoted trade significantly (see Part 1).

Nevertheless, the extent of tariff reduction in low- and middle-income countries was less than in high-income economies (Figure 2.3). Analysts suggest that this process of reduction in applied tariffs by low- and middle-income countries became less significant after the 2008 financial crisis.[99]

The process of lowering tariffs was more effective in non-agriculture sectors. On average, tariffs applied on industrial goods are significantly lower than on agriculture (Figure 2.4). Many low- and middle-income countries lowered trade barriers for manufactures and other industrial products to promote participation in global value chains. Agricultural tariffs remain relatively higher, especially in low- and middle-income

BOX 2.3 TRADE COSTS AND HOW THEY ARE MEASURED

In the context of the trade literature, all factors that drive a wedge between prices in exporting and importing countries give rise to trade costs and influence trade flows. This definition of trade costs includes trade policies, such as tariffs and NTMs. Although tariffs, both *ad valorem* and specific, are directly observed and their impact on trade flows can be assessed relatively easily, the costs and trade effects of other trade policies, such as NTMs, are difficult to observe. For example, the application of a maximum residue level for pesticides to imports may increase or decrease trade or could result in a rejection of shipments, depending on whether imports comply with the regulation. Other trade costs, such as transport costs, administration and transaction costs, and costs arising due to border delays are also inherently difficult to observe, or the data available is not adequate to support measurement. Distance, common language, information availability and regulation enforcement also play a role in determining trade costs.

Observable costs, such as freight rates and tariffs, can be assessed without difficulty but in order to measure costs that relate to informational and institutional factors and NTMs, analysts turn to economic models. These models link trade flows to observable variables, such as price differentials, common language or common borders, distance or participation in a trade agreement, and they take into account the unobservable costs by linking trade flows to their theoretically predicted values.[137, 138] Often, these modelling approaches capture a wide range of trade costs, including tariffs, as an *ad valorem* equivalent.

An important initiative by the Economic and Social Commission for Asia and the Pacific (ESCAP) and the World Bank Group uses modelling frameworks to estimate trade costs. The analysis in this report also uses price data and modelling to assess trade costs in food and agriculture. On the basis of these models, analysts conclude that trade costs are high and play an important role in shaping trade. For example, the assessment suggests that trade cost declines explain roughly 33 percent of the post-World War II trade boom.[139]

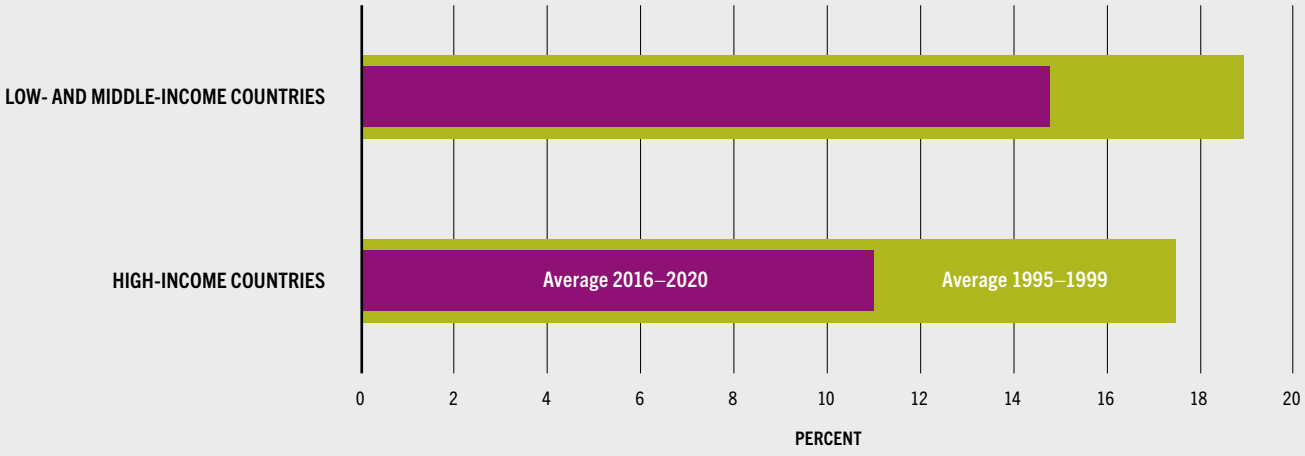
countries, implying a relatively higher rate of protection for the sector and, a potentially larger negative impact on the influence of comparative advantage (see Box 4.1 on the political economy of protection of food and agriculture).

Non-tariff measures

NTMs are more prevalent in agriculture compared with other sectors and this contributes to relatively higher trade costs in agriculture.[100] Food and agricultural trade is subject to the highest incidence of NTMs, both at the intensive and at the extensive margin – that is, in terms of total trade value and the number of products traded respectively. Almost 100 percent of food and agricultural imports are subject to NTMs compared to an average of 40 percent for all other sectors. Food and agricultural products are heavily regulated and subject to the highest number of NTMs per product. On average, a food product faces eight different NTMs compared to just under two NTMs for products of all other sectors.[101]

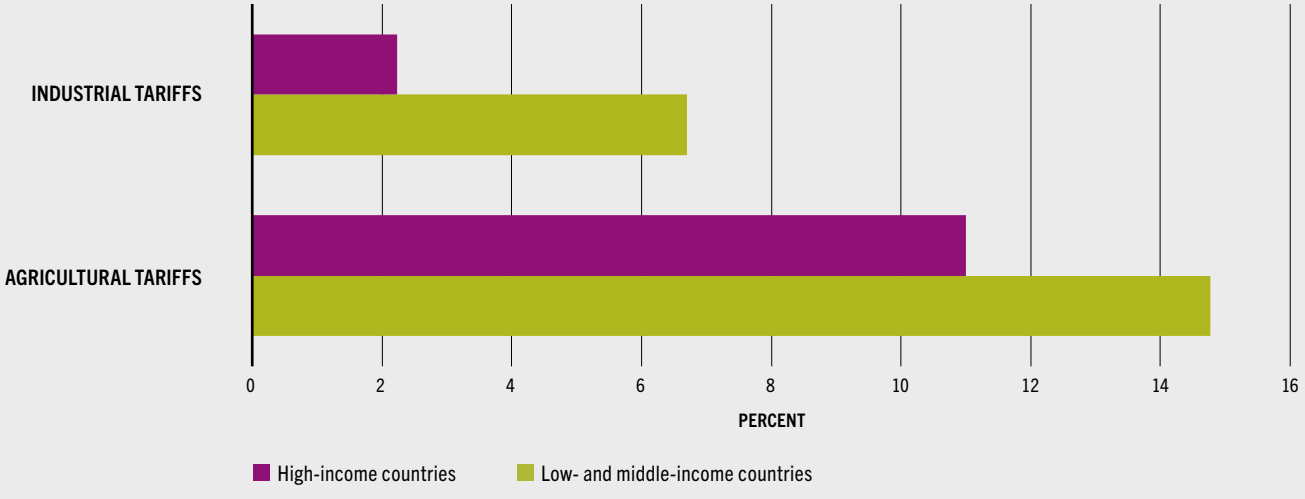
NTMs increase the cost of trade, particularly if the importing country applies different regulations than those applied by the exporter. In this case, exporters face additional trade costs related to: identifying and processing information on the relevant requirements in the import markets; adjusting the production process to these requirements; and proving that these requirements are met.[102] Recent evidence from the analysis of regulations in 110 countries suggests that the trade costs associated with NTMs can increase import prices of agricultural products by nearly 15 percent in *ad valorem* equivalent.[103] There are also implicit costs that are associated with NTMs. Firms that export to different destination markets and face different standards, as for example, different labelling requirements, must produce different versions of their products, which incurs significant costs in terms of efficiency and foregone economies of scale.[104, 105]

FIGURE 2.3 APPLIED TARIFFS IN AGRICULTURE, 1995–1999 AND 2016–2020



NOTE: Average of effectively applied tariffs.
SOURCE: UNCTAD-TRAINS data from World Integrated Trade Solution.

FIGURE 2.4 APPLIED TARIFFS IN AGRICULTURE AND MANUFACTURING, AVERAGE 2016–2020



NOTE: Average of effectively applied tariffs.
SOURCE: UNCTAD-TRAINS data from World Integrated Trade Solution.

Low-income countries face much higher NTM-related costs than high-income countries. NTMs are widespread in food and agriculture and food and agricultural products make up a significant part of exports by low-income countries. Poor transport and communication infrastructure, low organizational and technical capacities make the cost of compliance with standards higher in low-income countries than in developed economies. It is estimated that in low-income countries, NTMs result in an additional 3 percentage points in *ad valorem* trade cost equivalent compared with high-income countries.[106]

While SPS and TBT provisions raise trade costs, they can also enhance trade by strengthening the demand for imported products. In food and agriculture, compliance with SPS measures – essential for ensuring the health of consumers, animals and plants and the protection of the environment – increases consumer confidence in imported products.[107] Harmonizing NTMs across countries is important to reduce their costs and to enhance trade. Often, RTAs include provisions for deeper cooperation in regulation and standards to promote trade among their members (see Parts 3 and 4).[q]

Other trade costs

A large body of analytical work focuses on the costs that capture frictions in trade. In addition to the costs related to the NTMs, these include direct costs, such as freight and insurance costs, and indirect costs, such as costs related to export and import procedures, legal and regulatory fees, expenses associated with the use of different currencies and different languages and time delays at the border.[108] These trade costs are rarely measured directly, as they are not observable as tariffs, but are typically estimated and inferred from models (see Box 2.3).[r]

Despite the focus on globalization, a significant part of trade takes place between countries that are geographically close to each other (see Part 1). Physical distance increases trade costs and makes trade with neighbouring countries relatively cheaper. Empirical research on a wide range of distance effects suggests that, on average, a 10 percent increase in distance results in a decrease of about 0.9 percent in trade flows.[109] Distance matters, and its role in determining trade costs and trade flows is significant. Although this negative relationship between distance and trade is persistent, trade costs vary significantly across both goods and countries.

Trade costs tend to be much higher for food and agriculture than for other products, such as manufactures. For example, bilateral trade flows between Kenya and Uganda – low- and middle- income countries that share borders in sub-Saharan Africa – are subject to an *ad valorem* trade cost equivalent of 130 percent for agricultural products and of 78 percent for manufactures.[s] Differences in trade costs between agricultural products and manufactures are also observed in high-income countries. For example, the *ad valorem* trade cost equivalent in agricultural products between France and Germany – two neighbouring members of the European Union – amounts to 65 percent, while the corresponding value for manufactures is 31 percent.

Such high trade costs can inhibit international trade, and, unsurprisingly, trade intensities between food and agriculture and manufactures differ. Low value-to-weight ratios of food and agricultural products result in higher trade costs than manufactures. It takes much more fuel and stowage to move an amount of wheat worth USD 1 000 than shipping USD 1 000 of mobile phones and, therefore, the increase in the import price of wheat due to freight costs relative to that of mobile phones is much higher.

There are also implicit costs that are difficult to measure. For perishable agricultural products, border delays can be particularly costly. On average, estimates suggest that for food

q See for example, Devadason, E.S., Chandran, V.G.R. & Kalirajan, K. 2018. Harmonization of food trade standards and regulations in ASEAN: The case of Malaysia's food imports. *Agricultural Economics*, 49(1): 97–109.

r See for example, Novy, D. 2013. Gravity redux: Measuring international trade costs with panel data. *Economic inquiry*, 51(1): 101–121.

s Bilateral trade costs have been estimated by the ESCAP-World Bank Trade Cost Database (https://www.unescap.org/resources/escap-world-bank-trade-cost-database#) and refer to the latest year available. These trade costs are expressed as *ad valorem* equivalent (as the percentage increase of the import price) and take into account direct, indirect and implicit costs excluding tariffs.

and beverages, a delay at the border of one day is equivalent to a 3.1 percent *ad valorem* trade cost, compared with 2 percent for consumer and capital goods.[110] Another study finds that delay-related import costs for agriculture in low-income countries could amount to up to 400 percent *ad valorem* equivalent as compared with 30 percent for high-income countries.[111]

In general, poor infrastructure, weak institutions and market failures result in high trade costs in many low-income countries. For example, a poorly developed transport network results in high transport costs, while low administration capacity and information asymmetries can give rise to significant costs related to delays at the border. The difference in trade costs between low-income and high-income countries can be significant. Trade costs tend to be not only higher for food and agriculture relative to other sectors, but low-income countries face even higher agricultural trade costs than high-income countries. ■

UNPACKING THE IMPACT OF COMPARATIVE ADVANTAGE AND TRADE COSTS

Analysing the interplay between comparative advantage, trade policies and trade costs helps in trying to solve the "puzzle" of missing food and agricultural trade. Why is trade intensity higher in manufactures than in agriculture? Why do low-income countries not engage in food and agricultural trade as much as high-income economies? Addressing these questions can help explain why some regions trade more than others and explain how they choose their trade partners. This can also shed additional light on issues related to agricultural development and the structural transformation of the economy.

The assessment of how comparative advantage overcomes the barriers posed by trade policies and costs and shapes trade flows is complex. An econometric modelling study carried out for this report helps explain how food and agricultural trade is determined in a market with many countries, uncovering the influence of comparative advantage, estimating trade costs and laying out the geography of trade.[t, 112]

More specifically, the modelling study provides estimates for the key drivers of food and agricultural trade, namely: (i) the competitiveness of a country that is reflected by its absolute advantage in agricultural productivity per worker adjusted for input costs; (ii) the influence of comparative advantage, which is captured by the heterogeneity of technology and agricultural productivity per worker across countries and regions; and (iii) bilateral trade costs that, for each country-pair, comprise direct and indirect costs such as tariffs, NTMs, transport and documentation costs, and other factors such as common language, sharing a common border or being party to a regional trade agreement (see Box 2.4 for a discussion on the econometric model).

Competitiveness and absolute advantage

A country with better technology and abundant natural resource endowments, such as land and water, can be more productive and can enjoy absolute advantage. This, together with input costs, determines competitiveness. High productivity per worker and lower input costs mean that a country can be more competitive in the global food and agricultural market (see Figure 2.6).

High-income countries, such as Canada, France, Germany, Spain and the United States of America are estimated to be among the more competitive in the global food and agricultural market. Emerging economies, such as Argentina,

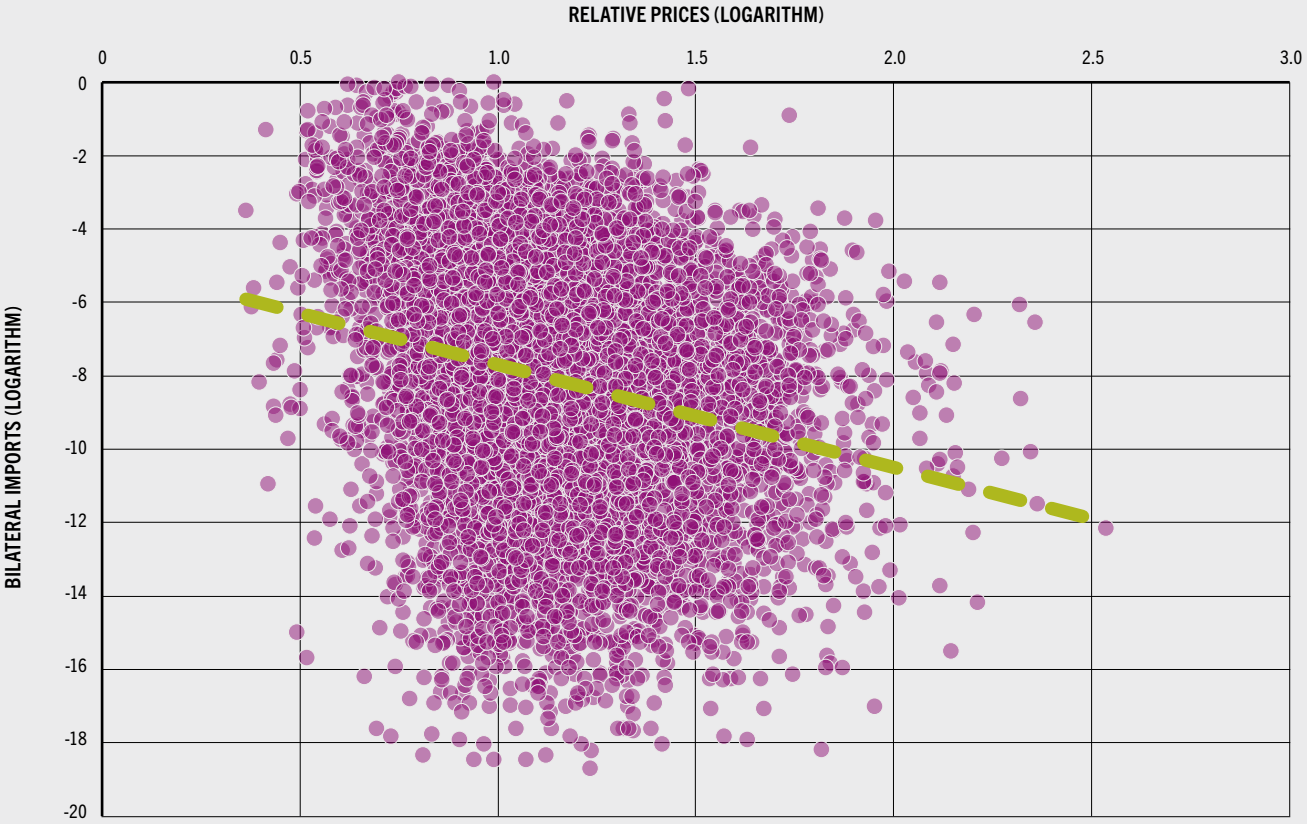
t The study is based on the modelling framework developed by Eaton, J. & Kortum, S. 2002. Technology, Geography, and Trade. *Econometrica*, 70(5): 1741–79. Eaton and Kortum developed a tractable model expanding the traditional Ricardian comparative advantage that relied on two countries and two goods to many countries and many goods. Previous attempts to generalize the comparative advantage framework were made by Dornbusch, R., Fischer, S. & Samuelson, P.A. 1977. Comparative advantage, trade, and payments in a Ricardian model with a continuum of goods. *American Economic Review*, 67(5): 823–839; and by Wilson, C.A. 1980. On the general structure of Ricardian models with a continuum of goods: Applications to growth, tariff theory, and technical change. *Econometrica*, 48(7): 1675–1702. There are few applications in agriculture, such as Xu, K. 2015. Why are agricultural goods not traded more intensively: High trade costs or low productivity variation?. *The World Economy*, 38(11): 1722–1743; and, novel approaches, such as that by Heerman, K.E. 2020. Technology, ecology and agricultural trade. *Journal of International Economics*, 123: 103280.

BOX 2.4 STRUCTURAL GRAVITY MODELS AND THE FUNDAMENTAL DRIVERS OF TRADE

Econometric models are based on economic theory and rely on statistical inference applied to available data. The gravity model has been a workhorse of empirical trade analysis since the beginning of the 1960s.[140] In its basic form, it is based on the notion that bilateral trade flows are proportional to the economic mass of countries (population and GDP) and is inversely related to distance (which is a proxy for trade barriers), very much like Newton's law of universal gravitation from which it derives its name. Modern structural gravity models quantify the effects of the fundamental drivers of trade. The intuition of structural gravity models relies on how relatively more productive countries with lower input costs can overcome trade costs and export their products. The model portrays the relationship between bilateral trade flows, relative prices and trade cost proxies for each pair of trading partners and estimates a range of indicators that help uncover the fundamental drivers of trade. These are:

Competitiveness and absolute advantage: For each country, competitiveness in the global market reflects its productivity per worker – that is its absolute advantage – adjusted for input costs. A more competitive country is a cheaper source of food and agricultural products and can better overcome trade costs.

FIGURE 2.5 BILATERAL TRADE FLOWS AND RELATIVE PRICES



NOTE: Bilateral imports are calculated as the normalized import share, which is the exporter's share in the importer's market relative to the exporter's share in its domestic market. The higher value of the normalized import share denotes a higher trade intensity between the exporter and the importer. Relative prices show what the price levels would be in the importing country if it decided to import all of its food and agricultural requirements from a given exporter, relative to the actual domestic price level of the importer.
SOURCE: Kozłowska, M.K., Rapsomanikis, G. & Zimmermann, A. 2022. Comparative advantage and trade costs in a Ricardian model of global food and agricultural trade. Background paper for *The State of Agricultural Commodity Markets 2022*. Rome, FAO.

BOX 2.4 (Continued)

Comparative advantage: In the modelling framework, the influence of comparative advantage is reflected by the estimated heterogeneity or variation in relative agricultural productivities per worker across countries. When productivities per worker are similar between countries, price differences are negligible and the possibility of gaining from trade is limited, as the opportunity cost of production domestically may not be different from elsewhere. Therefore, there is no incentive to trade. In other words, for a country, trade can enlarge the set of productivities, and thus prices, that are available from other countries and if prices are not different across countries, trade flows will not be significant. Thus, the greater the variation in relative productivity per worker and prices across countries, the stronger the influence of comparative advantage and the more the trade. In the modelling framework, the influence of comparative advantage can be measured at the global and regional levels.

Trade costs and openness: For each country, trade costs can erode its competitiveness in the global market. Trade costs can also partly offset the influence of comparative advantage. In the model, trade costs are estimated for each pair of trading partners using price levels. The higher the trade costs, the stronger the influence of comparative advantage (the larger the price differences) that would be necessary to make trade possible. An indicator for openness to trade can also be estimated for each country based on its location and average price level.

The econometric analysis, based on 2017–2018 data on bilateral trade flows among 112 countries in the world and 321 food and agricultural products, supports the above intuition. For example, Figure 2.5 illustrates the relationship between bilateral imports and relative prices between trade partners. Relative prices between trade partners measure their relative competitiveness but as countries are located across the geographical space, they also reflect trade costs due to distance and other factors. The higher the relative price between exporter and importer, the lower the bilateral trade flow, as either the exporter is not competitive or faces higher trade costs.

Brazil, China, India, Indonesia, Malaysia, the Russian Federation and South Africa are also estimated to be more competitive. The least competitive countries tend to be low- and lower middle-income countries, such as Cabo Verde and the Gambia in sub-Saharan Africa, and Bangladesh and Myanmar in Asia, for example.

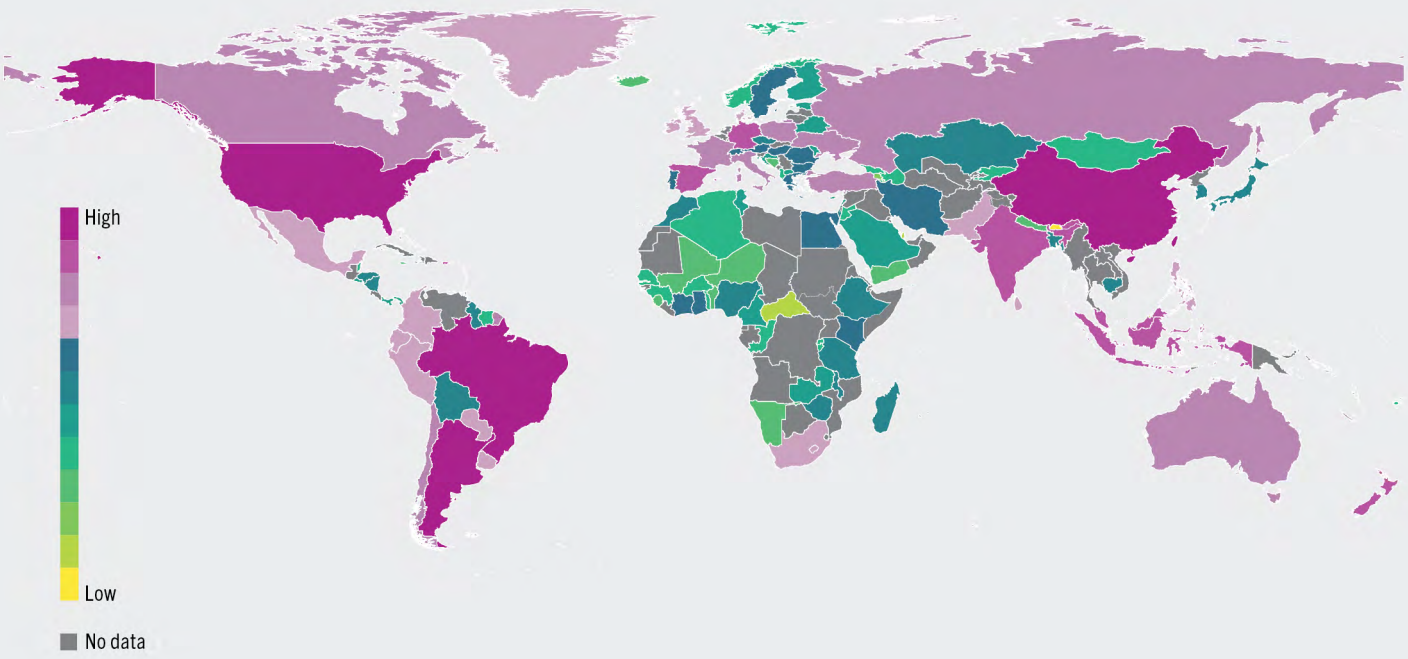
These results underline the importance of technology and agricultural productivity per worker in determining competitiveness. Low-income countries, characterized by low agricultural productivity rates and high transaction costs that inhibit technology adoption, are, on average, among the least competitive in the global market.

The role of natural endowments and geography in shaping productivity and competitiveness is also evident. High-income countries, such as Finland and Norway, with large areas north of the Arctic Circle, are found to be less competitive in the global food and agricultural market. Small Island Developing States (SIDS), such as Antigua and Barbuda and Vanuatu, are also less competitive due to scarce natural resource endowments. Land Locked Developing Countries (LLDCs), where the geographical location inhibits integration in the global market, are also among the least competitive countries.

Perhaps, the most striking result that links geography to trade is that in three regions of the world, landlocked countries are among the least competitive traders of food and agricultural products. The Central African Republic appears to be less competitive in Africa; in Asia, less competitive countries include Armenia, Bhutan, Mongolia and Nepal; and, in Europe, it is Bosnia and Herzegovina.

Despite improvements in transport, landlocked countries find themselves behind their maritime neighbours in economic growth and trade.

FIGURE 2.6 COUNTRY COMPETITIVENESS IN THE GLOBAL FOOD AND AGRICULTURAL MARKET, 2018



NOTE: The competitiveness indicator is an econometric estimate. A more competitive country is a cheaper source of food and agricultural products and can better overcome trade costs.
SOURCE: Kozłowska, M.K., Rapsomanikis, G. & Zimmermann, A. 2022. Comparative advantage and trade costs in a Ricardian model of global food and agricultural trade. Background paper for *The State of Agricultural Commodity Markets 2022*. Rome, FAO. Conforms to Map No. 4170 Rev. 19 United Nations (October 2020).

For food and agriculture, this may reflect low rates of knowledge and technology transfers. While this could be attributed to their distance from the coast and the related transport costs, researchers argue that the dependence of landlocked countries on their neighbours' infrastructure and on their administrative practices are also important factors.[113]

Comparative advantage

Whereas competitiveness and absolute advantage are determined by agricultural productivity per worker and input costs and reflect the state of technology and the resource endowments in each country, it is the variation of agricultural productivity per worker across countries that uncovers the influence of comparative advantage. The greater the variation in relative productivity across countries, the stronger the influence of comparative advantage, and the more the trade.

The results of the econometric modelling exercise undertaken for this report shed light on the role of comparative advantage in determining trade flows. For the global food and agricultural market, where all countries compete, the variation in relative agricultural productivity per worker, estimated as a relative standard deviation, amounted to 18.3 percent (Table 2.2).[u] This is higher than a standard deviation of 15 percent, estimated for a large part of the global manufactures trade, suggesting that the influence of comparative advantage in food and agriculture is greater than in the non-agriculture sectors. Nevertheless, despite the stronger influence of comparative advantage in food and agriculture

u The standard deviation is a statistic that measures the dispersion of a dataset relative to its mean. Low standard deviation means that the data are clustered around the mean, and high standard deviation indicates data are more spread out.

TABLE 2.2 THE STRENGTH OF COMPARATIVE ADVANTAGE IN FOOD AND AGRICULTURAL MARKETS

Region	Estimated standard deviation of productivity per worker Percent
Europe	22.5
Asia	18.7
Sub-Saharan Africa	15.0
Latin America and the Caribbean	19.9
World	18.3

NOTE: The standard deviation of agricultural productivities per worker is an econometric estimate.
SOURCE: Kozłowska, M.K., Rapsomanikis, G. & Zimmermann, A. 2022. Comparative advantage and trade costs in a Ricardian model of global food and agricultural trade. Background paper for *The State of Agricultural Commodity Markets 2022*. Rome, FAO.

relative to manufactures, trade intensity in food and agriculture is lower.[v]

There are marked differences in the influence of comparative advantage across regions. For example, within Europe the estimated standard deviation of agricultural productivities per worker is 22.5 percent. This suggests that comparative advantage exerts a strong influence on intra-regional trade. Within Asia and Latin America and the Caribbean, the strength of comparative advantage is relatively lower. The estimate for sub-Saharan Africa is 15 percent, indicating that the variation of agricultural productivities per worker across countries in the region is relatively low and suggesting that the influence of comparative advantage in shaping intra-regional trade flows between sub-Saharan African countries is weak. It is not only that countries in the region are characterized by low absolute advantage reflecting low productivity per worker (see Figure 2.6), but the variation of these productivities is also small. This gives rise to a reduced role for comparative advantage in shaping trade within the region and, on average, provides little incentives for sub-Saharan African countries to trade with each other.

These results on the influence of comparative advantage within regions are in line with the findings on regional trade clusters discussed in Part 1, which pointed to relatively increased trade between countries in the same region except for Africa (see also Figure 1.10).

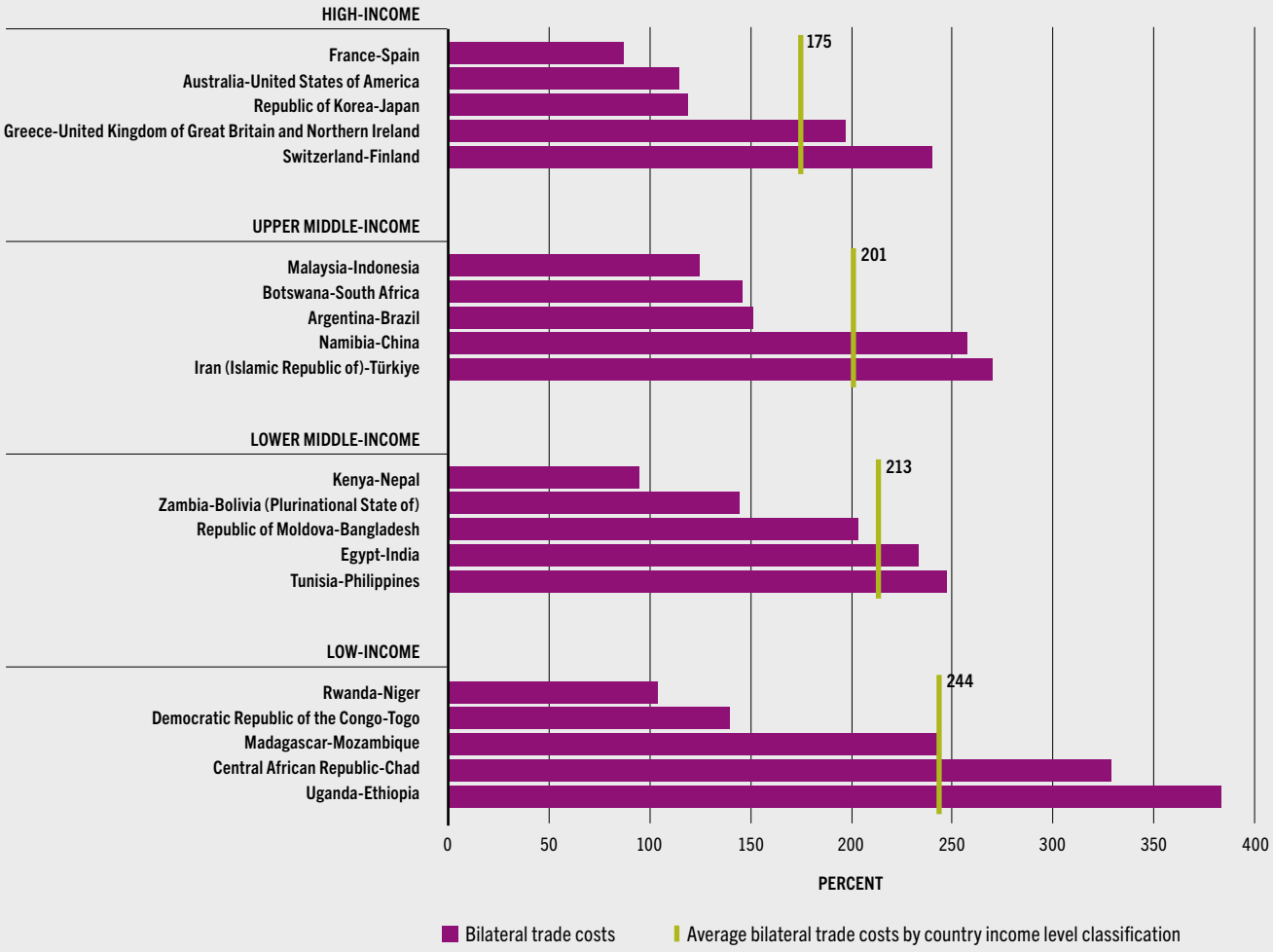
Trade costs and openness

Together with competitiveness and comparative advantage, estimates of food and agricultural trade costs add to the analysis of the fundamental drivers of trade. The results of the econometric exercise suggest that distance matters: with other factors that give rise to trade costs being the same, trade between countries that are more than 6 000 miles apart face a trade barrier that is 100 percent higher than that between countries that share borders or are in close proximity of each other (separated by up to 375 miles).

The role of geographical distance in increasing food and agricultural trade costs remains significant, despite improvements in transport technology and the adoption of digital technology that allows traders everywhere in the world to access enhanced information on products. Digitalization has not brought about the "death

v The standard deviation estimate for manufactures is from Eaton, J. & Kortum, S. 2002. Technology, Geography, and Trade. *Econometrica*, 70(5): 1741–79. There are very few studies that estimate the influence of comparative advantage in trade. Comparisons between standard deviation estimates by different studies and for different sectors of the economy are made only for indicative purposes. This is because different studies are conducted at different times, include different sets of countries in their analysis and use different data. For example, the standard deviation in merchandise trade (including food products) has been estimated at 31 percent (by Simonovska, I. & Waugh, M.E. 2014. The elasticity of trade: Estimates and evidence. *Journal of international Economics*, 92(1): 34–50), and at 23 percent (by Waugh, M.E. 2010. International trade and income differences. *American Economic Review*, 100(5): 2093–2124). The results for agriculture are less commonly available. For a sample of 10 large countries, a standard deviation for agriculture was estimated at 31 percent, higher than an estimate of 28 percent in manufactures (Tombe, T. 2015. The missing food problem: Trade, agriculture, and international productivity differences. *American Economic Journal: Macroeconomics*, 7(3): 226–58).

FIGURE 2.7 BILATERAL TRADE COSTS ACCORDING TO COUNTRY INCOME LEVEL CLASSIFICATION, SELECTED TRADE PARTNERS AND AVERAGE COSTS PER COUNTRY INCOME CLASSIFICATION (*AD VALOREM* EQUIVALENT), 2017



NOTE: Trade costs are estimates, refer to food and agricultural trade and are expressed in an *ad valorem* equivalent of the price index in the destination country (the importer - first in the country pair label). They denote the cost associated with purchasing all food and agricultural products from a given source (the exporter - second in the country pair label).
SOURCE: Kozłowska, M.K., Rapsomanikis, G. & Zimmermann, A. 2022. Comparative advantage and trade costs in a Ricardian model of global food and agricultural trade. Background paper for *The State of Agricultural Commodity Markets 2022*. Rome, FAO.

of distance"; however, there is some evidence on its impact on merchandise trade. Based on information available both online and offline, a study suggests that while trade flows decrease with distance, distance may matter less online.[114, 115]

Bilateral trade costs in food and agriculture are significant (Figure 2.7). For example, the *ad valorem* trade cost of importing food from the United States of America to Australia – two high-income countries located in different regions – amounts to 115 percent. Imports by Uganda from Ethiopia – two low-income countries near each other – are subject to a 383 percent trade cost in *ad valorem* terms. These estimates reflect all trade costs, including tariffs, costs arising due to NTMs and

other costs, such as transport or time delays at the border. They also consider distance, differences in institutions that regulate trade, the efficiency of export and import procedures between borders, or whether the trade partners are signatories to the same trade agreement.

Despite the multitude of factors that give rise to trade costs, the estimates reveal that trade costs are decreasing with the level of development as measured by income per capita. For example, food and agricultural trade between all high-income countries across the world is subject, on average, to a 175 percent *ad valorem* trade cost equivalent. Average trade costs between all low-income countries are approximately 1.4 times higher, amounting to a 244 percent *ad valorem* equivalent. Differences in transport infrastructure and in the efficiency of the regulatory institutions between high- and low-income countries, among other factors, account for the large differences in average trade costs.

In terms of intra-regional trade, food and agricultural trade costs in sub-Saharan Africa are estimated to amount to 237 percent *ad valorem* equivalent on average, compared to 152 percent for Europe (Figure 2.8). Indeed, sub-Saharan African countries face the highest costs when they trade between themselves and within the region. Intra-regional trade in Asia and Oceania – a region with many countries spread over wide geographical area – is subject to an average of 202 percent of *ad valorem* trade costs equivalent.

Openness to trade is important for economic growth. Trade facilitates technology and knowledge spillovers across countries, improving productivity and promoting growth (see Box 2.5). Openness to trade depends on the country's location and the geographic barriers it faces, as well as its average price level relative to that of its trade partners that also reflects trade policies.

On average, high-income countries tend to be the most open to trade (Figure 2.9). For example, Germany's location and price level makes it an attractive market for trade partners to export to, especially members of the European Union. New Zealand, although relatively remote, is characterized by price levels that are close to the regional average, making it an open market for exporters to compete in.

Several SIDS are found to outrank many richer nations in terms of openness to trade. Despite their geographic remoteness and low connectivity, small islands, such as Maldives and Saint Kitts and Nevis, leverage trade to meet food security and nutrition objectives. These countries have limited natural resources to produce adequate food and agricultural products, yet they are open to trade and they exploit their comparative advantage in fisheries and tourism to finance food imports. Many sub-Saharan countries are found among the least open countries.[w]

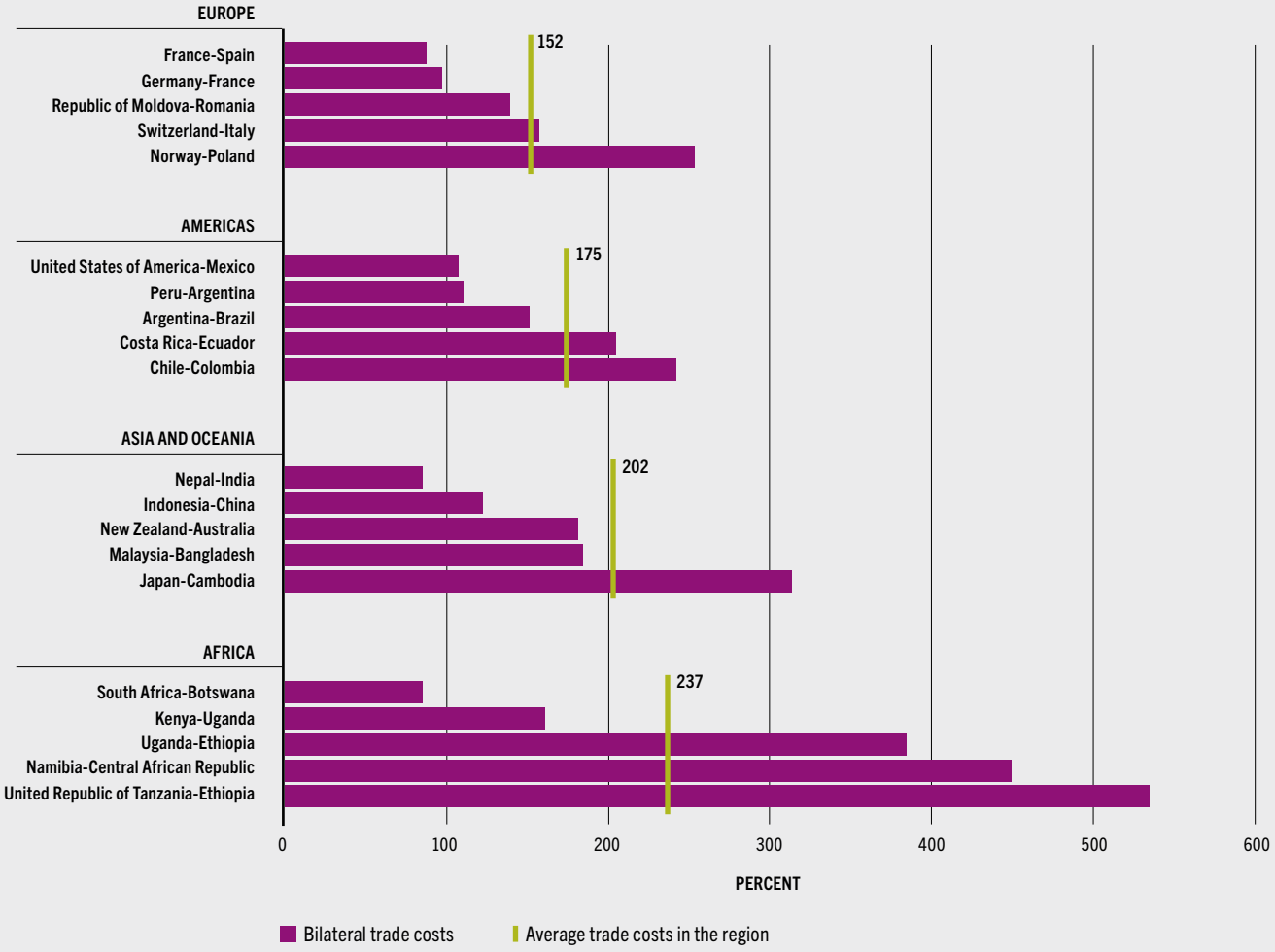
Putting the pieces of the food and agricultural trade puzzle together

Comparative advantage and trade costs determine trade flows across countries. Although the influence of comparative advantage is stronger in food and agriculture (see Table 2.1), food and agricultural products are not traded as intensively as manufactures. Tariffs are relatively higher for food and agriculture, but they make up for a small part of total trade costs that are significant and combine to weaken the role of comparative advantage in the sector (see Figure 2.4). The analysis suggests that trade costs in agriculture are often twice as high as in manufactures. A low value-to-weight ratio but also the perishability of food and agricultural products result in high trade costs. Costs related to compliance with non-tariff measures, such as standards, are also higher in food and agriculture. The importance of trade costs in hindering food and agricultural trade has significant policy implications and efforts should be made to target measures in reducing them (see the discussion on trade facilitation in Part 4).

Trade costs make up for an important missing piece of the food and agricultural trade puzzle. Although low-income countries are characterized by low agricultural productivity per worker and low competitiveness in the global market

w The patterns of competitiveness and openness strongly resemble the findings of Part 1. Countries that are more remote in terms of geographic conditions, in particular landlocked countries, SIDS and countries in sub-Saharan Africa, are less connected to the global food and agricultural trade networks.

FIGURE 2.8 BILATERAL TRADE COSTS AND INTRAREGIONAL AVERAGES (*AD VALOREM* EQUIVALENT), 2017



NOTE: Trade costs are estimates, refer to food and agricultural trade and are expressed in an *ad valorem* equivalent of the price index in the destination country (the importer - first in the country pair label). They denote the cost associated with purchasing all food and agricultural products from a given source (the exporter - second in the country pair label).
SOURCE: Kozłowska, M.K., Rapsomanikis, G. & Zimmermann, A. 2022. Comparative advantage and trade costs in a Ricardian model of global food and agricultural trade. Background paper for *The State of Agricultural Commodity Markets 2022*. Rome, FAO.

relative to high- and middle-income countries (see Figure 2.2 and Figure 2.6), on average, they are less open to trade and a large part of their consumption is met by food that is produced domestically (Figure 2.10). Low-income countries import about 14 percent of their food consumption on average, while high-income economies trade much more intensively and rely on the global food markets to meet about 60 percent of their food needs.

Once more, the high trade costs faced by low-income countries can help explain differences in trade intensity across countries. Estimates suggest that low-income country imports from high- and upper middle-income countries are, on average, subject to trade costs of approximately 220 percent and 208 percent in *ad valorem* equivalent. Such high trade costs partly insulate countries and inhibit trade. As a result, countries that face high trade costs choose

BOX 2.5 TRADE OPENNESS IMPACTS: GROWTH, PRODUCTIVITY AND INEQUALITY

Most economists would agree that openness to international trade promotes economic growth.[141] Trade results in efficiency gains as resources are allocated in line with comparative advantage. In agriculture, where differences in land and water endowments and climate are significant across countries, gains from openness and market integration can be large.[142] These gains can add to the rate of growth of the economy but are difficult to estimate.

In addition to the effect of efficiency gains, trade facilitates technology and knowledge spillovers across countries, promoting growth by improving the production process, increasing product quality and resulting in new products. Since 1995, the growth in food and agricultural trade has taken place together with increases in agricultural productivity per capita, particularly in emerging and developing countries.[143]

Many practioners are questioning this conventional wisdom on the effects of trade openness on growth and productivity. Trade results in winners and losers and its effect on income redistribution may be large. A handful of studies focus on the impact of trade openness on agricultural productivity – the underlying hypothesis being that trade facilitates the diffusion of technology and knowledge spillovers. Focusing on how agricultural productivity in 44 countries – both developed and developing – converges at higher levels, a study finds that openness to trade increases labour productivity growth rates in agriculture within an analytical framework that also accounts for the costs of technology diffusion and adaptation.[144]

Additional evidence suggests that trade openness can have a short-run negative impact on agriculture's efficiency.[145] However, in the long run, it is found to increase efficiency in agriculture, reflecting the ability of the sector to adapt to global markets and increased competition through technology adoption, but also through the exit of inefficient farms from the sector. In Chile – a country that liberalized trade in the 1990s after a period of import-substitution policies – an analysis of 70 000 farms suggests that trade openness is positively related to farm yields.[146]

Downstream, a study of more than 20 000 food firms in France and Italy suggests that import penetration in both final food products and intermediate inputs systematically contributes to firm-level productivity growth.[147] Participation in agricultural and food global value chains, either through imports of inputs or exports of intermediate products, is also found to promote agricultural labour productivity.[148, 149] The main mechanism for this lies on how value chains unbundle the production process, allowing farms and firms to leverage their comparative advantage in global markets and facilitate the transmission of improved technology, leading to better farm practices and improved labour productivity.

These linkages between trade openness and technology are unwrapped by a micro-level data study of the impact of trade in agricultural inputs on the productivity of 1.1 million fields across 65 countries. Since the 1980s, trade openness in agricultural inputs was found to result in significant shifts from traditional farm technologies to modern ones, thus having distributional implications for productivity and welfare across the world.[150]

Trade openness, either by intensifying competition or by fuelling the structural transformation process, can promote growth and affect income distribution and inequality. A recent analysis of the impacts of eliminating tariffs on agricultural products across low- and middle-income countries pointed to increases in both income and inequality.[151] The results suggest that liberalizing agricultural trade would increase household incomes on average.

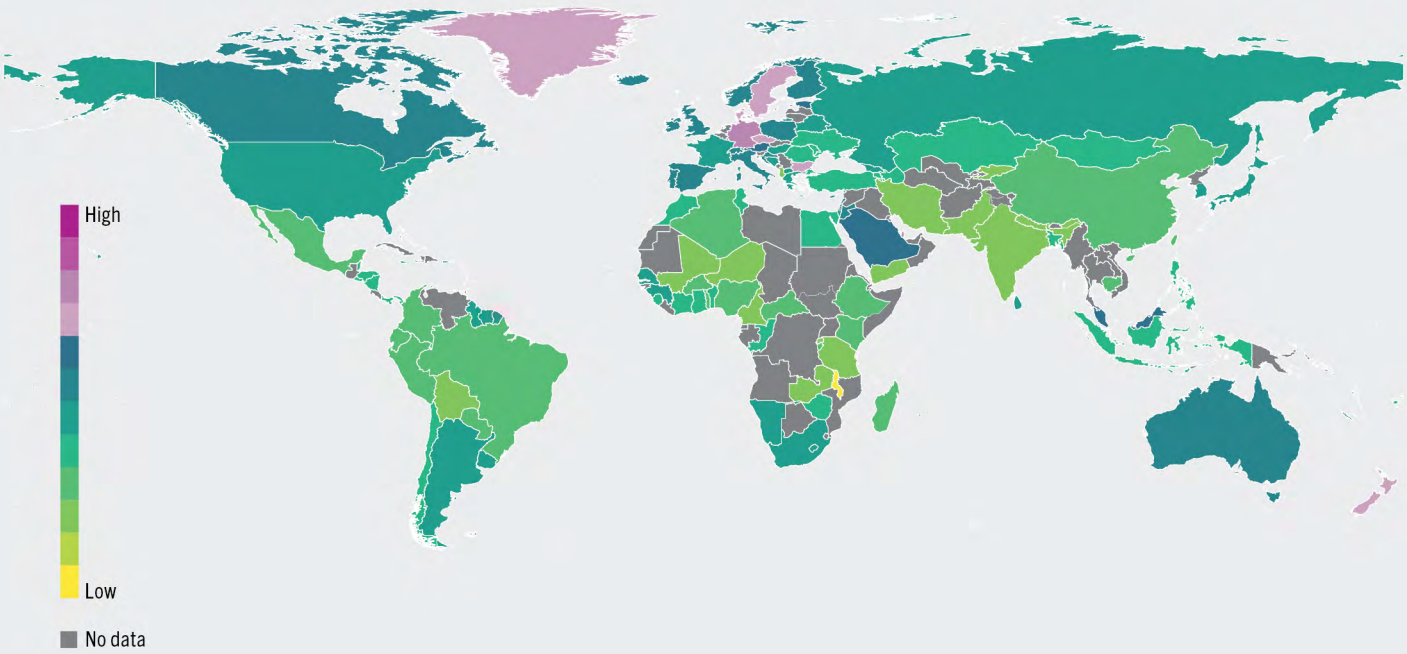
At the same time, eliminating import tariffs was found to have highly heterogeneous impacts across and within countries and across households. In most countries, the top 20 percent of the richest households would gain more from liberalization than the bottom 20 percent, thus exacerbating relative inequality.

Trade openness may have different impacts across genders. The evidence suggests that trade liberalization had heterogeneous effects on the agricultural sector, negatively affecting female workers in Africa, but benefiting the ones in Latin America.[152] In developing countries, women have less access to education than men and openness to trade will affect gender inequality through its impact on the allocation of labour across sectors and through wages. In Ethiopia, for example, women left agriculture faster and entered into the service sector following a reduction in tariffs. However, the low levels of education of female workers meant that women moved to low value-added sectors.[153]

In the context of agrifood systems, trade openness highlights the trade-offs between promoting economic efficiency and generating positive social outcomes. Integrating smallholder farmers in global markets is challenging. Policies that promote trade openness often tend to underplay market failures and complementary actions are needed to address inequality. Inclusive business models, such as contract farming, can address the constraints farmers in developing countries face when entering markets and global value chains.[154] But a range of public policies and investments, such as carefully designed input subsidies targeted at smallholder farmers, skills upgrades and education, gradually removing labour market rigidities, as well as improvements in infrastructure and regulation, can complement the market mechanism and promote a fair structural transformation.

SOURCE: Adapted from Zimmermann, A. & Rapsomanikis, G. 2021. Trade and Sustainable Food Systems. Food Systems Summit Brief prepared by the Research Partners of the Scientific Group for the United Nations Food Systems Summit.

FIGURE 2.9 TRADE OPENNESS, 2018



NOTE: The trade openness indicator is an econometric estimate and depends on the country's location and its relative price level.
SOURCE: Kozłowska, M.K., Rapsomanikis, G. & Zimmermann, A. 2022. Comparative advantage and trade costs in a Ricardian model of global food and agricultural trade. Background paper for *The State of Agricultural Commodity Markets 2022*. Rome, FAO. Conforms to Map No. 4170 Rev. 19 United Nations (October 2020).

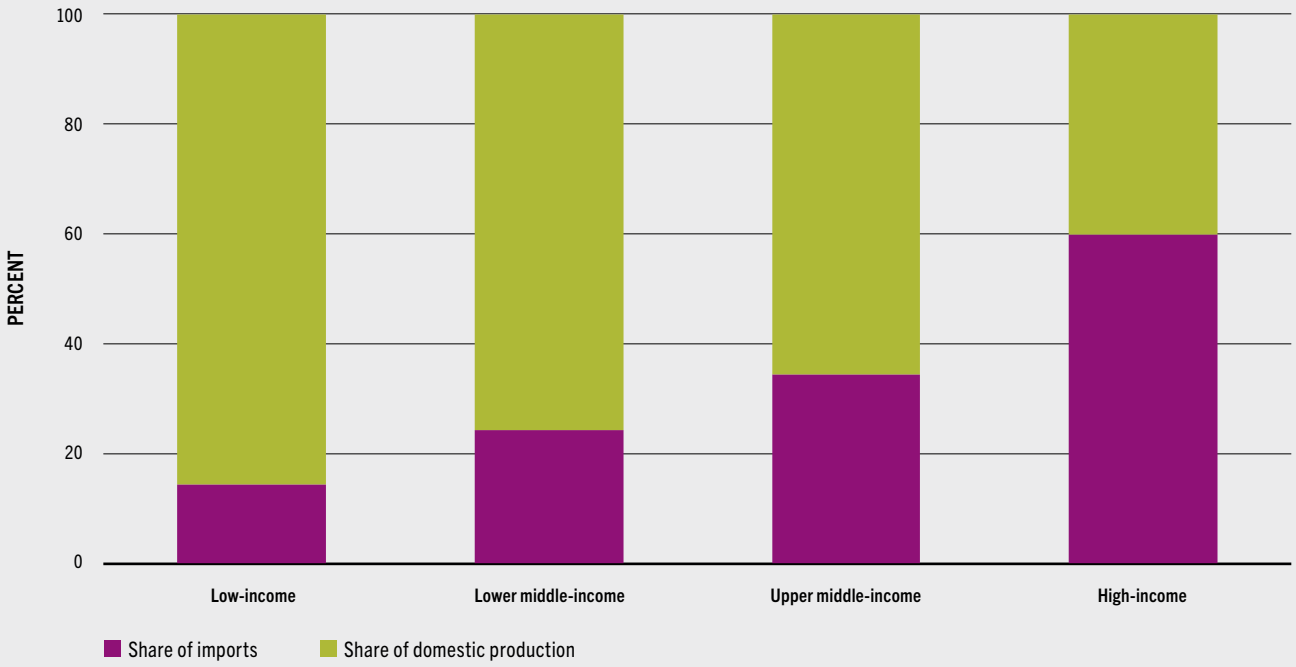
to meet a large part of their food consumption requirements with domestic production, even if they were characterized by relatively low agricultural productivity per worker. If trade costs were lower, low productivity countries could gain significantly by importing a larger part of their food needs at lower prices.

The interplay between comparative advantage and trade costs in determining trade and its geography is most evident in sub-Saharan Africa. The modelling exercise suggests that the region is characterized by a low strength of comparative advantage (Table 2.2), and by high intra-regional trade costs (Figure 2.8). Indeed, Africa is characterized by a very low share of intra-regional trade (Figure 1.13). The African Continental Free Trade Area that aims to accelerate intra-African trade should specifically focus on policies and measures that target trade costs to promote trade in food and agriculture (see Part 4).

Trade costs also have important implications for the structural transformation of developing countries. High trade costs in food and agriculture can translate into less trade and expanded agricultural sectors. Food is a necessary good and in low-income countries, low food imports may result in a large proportion of labour and other resources being allocated to food production to meet the country's food subsistence requirements. For example, in low-income countries in 2019 where they face high trade costs, the share of agriculture in total employment is very high at 59 percent on average.

Lowering trade costs promotes trade, and countries characterized by low agricultural productivity per worker would increase food

FIGURE 2.10 SHARE OF IMPORTS AND DOMESTIC PRODUCTION IN TOTAL FOOD CONSUMPTION, 2018



NOTE: Total food consumption is defined as gross agricultural production minus exports plus imports.
SOURCE: FAO.

imports. This would help meet food subsistence requirements and release workers from agriculture to other more productive sectors of the economy. With flexible and well-functioning labour markets, this reallocation of labour would result in increasing agricultural productivity per worker and contributing to economic growth.[116] More trade would also help the diffusion of knowledge and technology, adding to productivity gains (see Box 2.5). Nevertheless, with more and cheaper food imports, this process of structural transformation would also entail losses especially by farmers who are unable to increase their efficiency and compete in more open markets.

Empirical evidence at the farm level sheds light on the relationship between trade costs, agricultural productivity and food subsistence requirements. For example, in Peru trade cost reductions, resulting from improvements in road infrastructure, raised agricultural productivity by 5 percent. At the same time, about 20 percent of farmers were found to be worse-off as the reduction in trade costs allowed the entry of other sellers into the market and strengthened competition.[117]

Another study in Mexico suggests that higher inter-regional costs for fruits as compared with maize, in conjunction with food subsistence constraints, prevents farmers from specializing in cash crops such as fruits. Trade costs account for a large part of the relative employment between maize and fruit and a lower productivity in agriculture. A reduction of inter-regional trade costs in Mexico to a level that is prevalent in the United States of America would increase the cash crops to a staples employment ratio by 15 percent and could generate a 13 percent increase in agricultural productivity per capita.[118] ■

INDIA
Tea plantations in southern India.
©Shutterstock.com/ Storm Is Me

PART 3
AGRICULTURAL TRADE AND THE ENVIRONMENT

KEY MESSAGES

➔ Natural resource endowments, such as land and water, contribute to shaping comparative advantage in food and agriculture. Trade ensures food security and helps countries overcome constraints in land and water, meeting their food requirements in terms of quantity and diversity at levels above what domestic production could sustain.

➔ Trade helps allocate the production of food and agricultural products to countries with relatively higher resource use efficiency. Globally, trade can result in water and land savings, as production takes place in regions with relatively more efficient water and land use.

➔ Trade can generate negative environmental externalities, as production for exports can result in unsustainable freshwater withdrawals, pollution, biodiversity loss and greenhouse gas emissions. However, negative environmental impacts often depend on local conditions and are more pronounced in poorly regulated settings.

➔ In the long run, as production will have to increase to meet growing food demand, policies that promote open global food and agricultural markets can help alleviate pressure on natural resources. But trade policies alone cannot easily address environmental externalities. Multilateral trade rules, such as those provided by the WTO framework, together with national regulation, can help address trade-offs between economic and environmental objectives.

➔ RTAs are increasingly used to foster sustainable practices through environment-related provisions and to encourage trade partners to adopt third-party voluntary sustainability certification schemes. To effectively address environmental externalities, RTAs should be equipped with legally binding environmental provisions and well-developed institutions.

Natural resources form an integral part of a country's factors of production and while agriculture also relies on labour, machinery and technology improvements that can help producers cope with resource constraints, land and water remain fundamental inputs. In general, for agriculture and at the global level, trade can be efficiency-enhancing in the use of natural resources. Increases in food production can be achieved with a smaller ecological footprint, compared to a hypothetical situation in which countries would not trade, relying only on their own land and water to produce food.

Resource-use efficiency is not sufficient to ensure environmental sustainability. Negative environmental externalities associated with the agricultural sector can occur both at the local and global levels and trade can also provide an economic incentive for unsustainable practices. Trade agreements can help address environmental externalities. Environmental-related provisions are foreseen under multilateral agreements, such as those under the WTO, and have been increasingly embedded in RTAs. RTAs have evolved from a means to secure market access into a tool to frame deeper ties that expand to other areas, including the environment. Such policies need to be equipped with a robust political and legal framework to be effective in preventing adverse environmental impacts. ■

NATURAL RESOURCES, COMPARATIVE ADVANTAGE AND TRADE

Countries can gain from trade by producing and exporting goods for which they have a relatively lower opportunity cost of production than their trade partners, and by importing those goods for which they have no such advantage. In analysing comparative advantage, economists look at various drivers such as technology and resource availability. For agriculture, differences in natural resource endowments across countries contribute to determining comparative advantage and to shaping trade patterns.[x] Countries tend to export the goods for which they have a relative abundance of the factors of production needed to produce them and they import those goods for which they face a relative factor scarcity.

For a country, agroclimatic conditions and land and water availability contribute towards determining the volume and composition of agricultural production and its engagement in trade as an exporter or importer of agricultural products. The role of natural resource endowments in shaping trade is exemplified by the concept of "virtual water", coined in the early 1990s.[y, 155] Virtual water is the volume of water used to produce a good, and virtual water trade refers to the amount of water embedded in internationally traded products.[z] Virtual trade can be thought of as the international exchange of factors of production embodied in the goods traded, for example, land and water, and thus helps understand how the relative availability of natural resources contributes to comparative advantage.[156]

A study estimates that at the global level, 37 percent of land use and 29 percent of water withdrawals are embedded in the international trade of food and agricultural products.[157] Trade accounts for part of the resources used for agricultural production, with the larger part being used to meet domestic demand. For water, the concept of virtual trade is best reflected by a positive association between agricultural trade flows and the relative abundance of renewable water resources. Countries with relatively high-stress levels of renewable water resources tend to import relatively more water-intensive goods and, thus, are net-importers of agricultural products (see Figure 3.1).[158]

For example, Egypt is a net-importer of food, faces critical water stress and imports a significant share of its cereal needs. This relationship between water stress and net trade position holds for most countries in Northern Africa and the Near East. Nevertheless, this generalization may not be applicable to all countries. Other factors of production – particularly land, but also capital or climatic conditions – can play a crucial role in determining the product-mix and the net trade position.[aa, 159, 160] For example, Sri Lanka – a country that faces water stress – is shown to have had a net-exporting position in 2019, which is driven by its tea exports. Other countries – such as Finland, Norway and Sweden – do not face water stress, but can feature as net importers due to agroclimatic conditions, a relatively low per capita cropland availability, or both (Figure 3.1). Finally, water stress conditions can vary significantly within countries, and this is

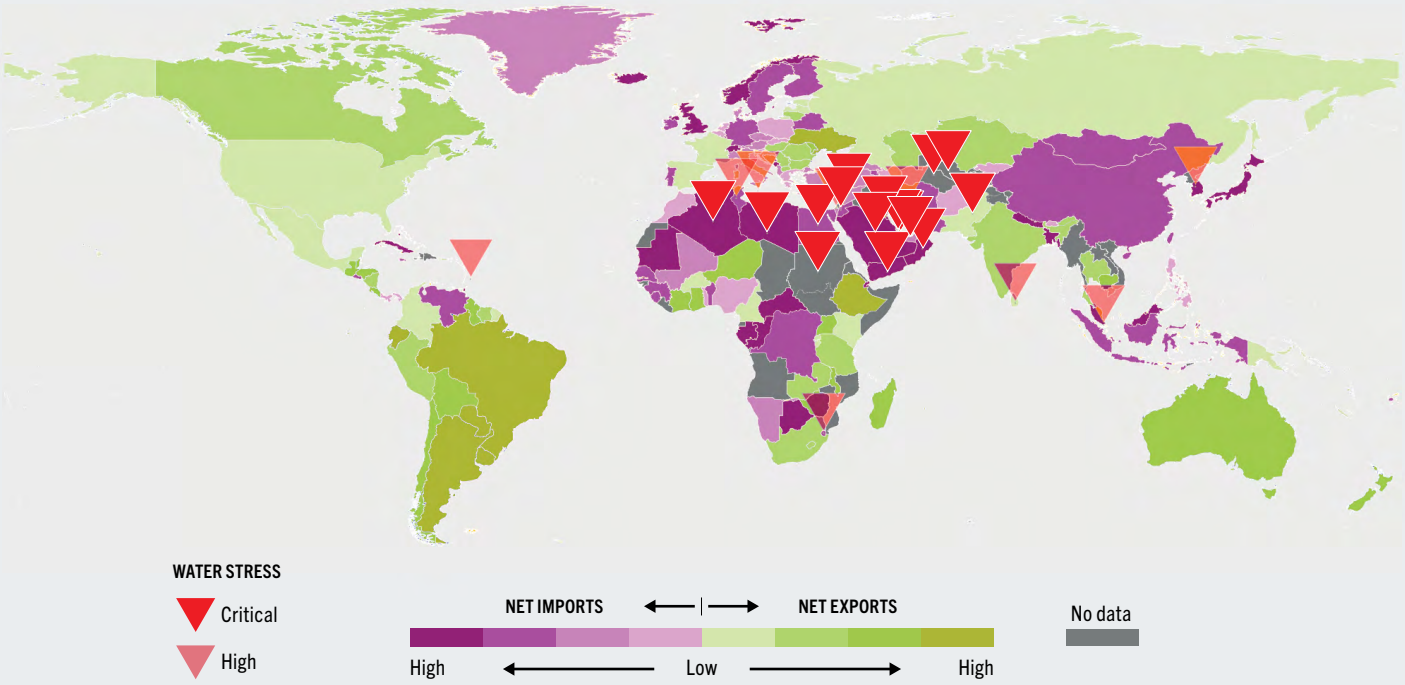
x See Part 2 for an analysis of differences in technology as the source of comparative advantage. In this section, the discussion is inspired by the Heckscher-Ohlin model that focuses on trade patterns and relative factor endowments. Heckscher, E. 1919. The Effects of Foreign Trade on the Distribution of Income. In: *Readings in the Theory of International Trade*, Howard S. Ellis and Lloyd M. Metzler, eds. Philadelphia: Blackstone, 1949. Ohlin, B. 1933. *Interregional and International Trade*, Cambridge, MA: Harvard University Press.

y The virtual water concept was coined by Professor Tony Allan, who said that the Near East countries could access (otherwise unavailable) water by purchasing water-intensive commodities in international markets.

z For the principles in assessing virtual water, see Renault, D. 2002. *Value of virtual water in food: Principles and virtues*. Rome, FAO.

aa Some water-stressed countries could export water-intensive products, being overall net food importers. The literature is also rich in diverging views. This derives from the fact that some studies use relative factor endowments, whereas others use absolute availability. In addition, differences in endowments should be reflected in the different opportunity costs of factors of production – and thus in prices. However, market prices may not reflect the allocation of resources, scarcity or competing uses. See Schiavo, S. 2022. International (Food) Trade and Natural Resources. Background paper for *The State of Agricultural Commodity Markets 2022*. Rome, FAO.

FIGURE 3.1 THE RELATIONSHIP BETWEEN WATER STRESS AND NET TRADE POSITIONS, 2018 AND 2019



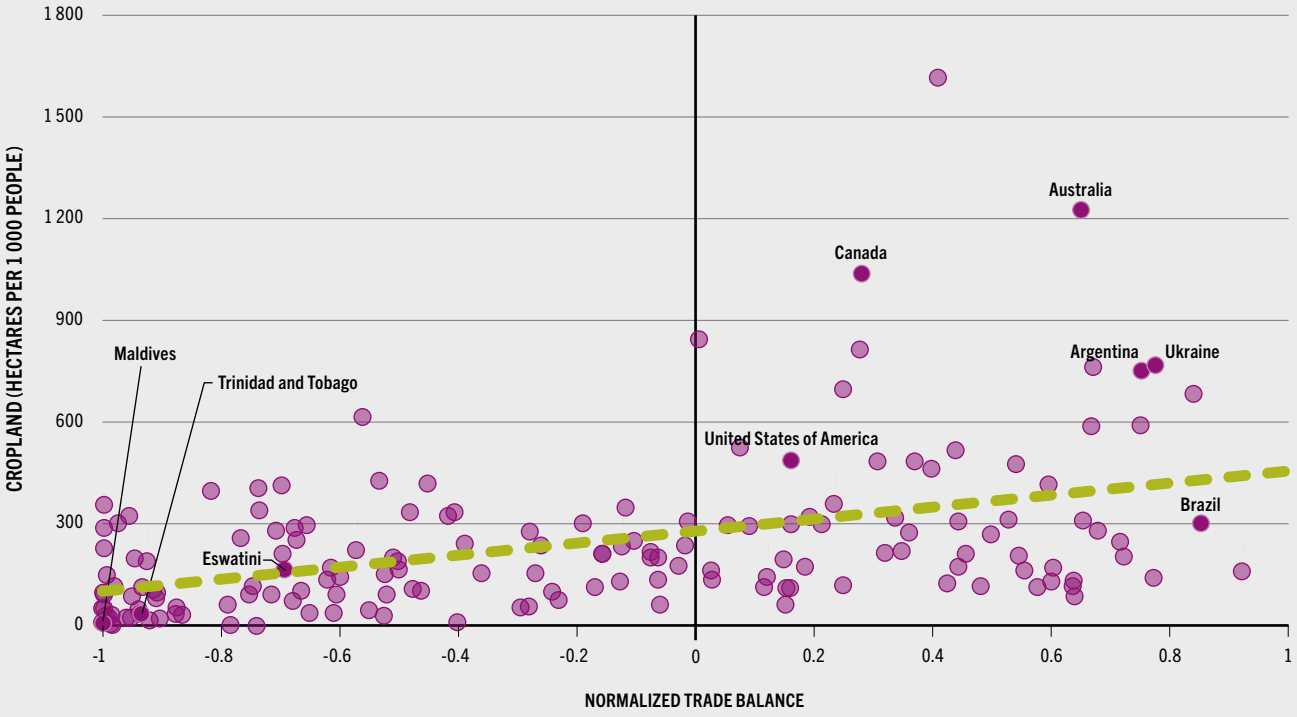
NOTE: This figure depicts only high and critical water stress levels based on 2018 data. The level of water stress is determined by the share of freshwater withdrawals from available freshwater resources and is reported by FAO under Sustainable Development Goal indicator 6.4.2. Net trade refers to the trade of primary crops. This figure shows net trade positions (exports minus imports) normalized by total trade (exports plus imports) based on 2019 data.
SOURCE: FAO. Conforms to Map No. 4170 Rev. 19 United Nations (October 2020).

particularly the case for those countries with very large territories.

A positive endowment effect is also found between trade flows and land availability, indicating that abundant land can also constitute a source of comparative advantage. On average and across countries, low relative availability of land tends to relate to a net-importing position in agricultural trade (Figure 3.2). For example, Small Island Developing States, such as Maldives and Trinidad and Tobago, where per capita arable land endowments are limited and insufficient to meet national needs, are net-importers of food and agricultural products. Low per capita arable land endowments in conjunction with low land productivity could also relate to a net-importing position. Few countries have significant per capita land resources in the world, such as Australia, Brazil, Canada, the United States of America and Ukraine, and they feature consistently as net exporters.[161]

While the evidence on virtual land transfers is scarce, findings point to a strong complementarity role between land and water resources in positioning a country as a net food exporter or importer in terms of virtual land and water trade. This is partially due to green water – the part of rainfall that is stored in the soil and available for the growth of plants – that is a key factor of production for many crops destined for export.[162] Thus, countries with abundant land resources can also tap into abundant green water resources, which are invaluable in rainfed agriculture.

FIGURE 3.2 RELATIONSHIP BETWEEN CROPLAND AND NET TRADE POSITIONS, 2019



NOTE: Land used to cultivate crops. Cropland includes the total areas under permanent crops and temporary crops, meadows and pastures, and land with temporary fallow. Permanent meadows and pastures are excluded. Net trade refers to the trade of primary crops. This figure shows net trade positions (exports minus imports) normalized by total trade (exports plus imports).
SOURCE: FAO.

When supported by adequate policies, trade can help alleviate land and water constraints of countries, meeting their food requirements in terms of quantity and diversity at levels above those that domestic production could sustain. Analysing virtual resource trade flows helps understand the role of water and land in shaping trade patterns. This approach is not without limitations. It can misrepresent complex realities, as surface and groundwater are often not priced as a factor of production, and pricing precipitation or green water is not possible. Similarly, land allocation is not always determined based on market prices. Often, in developing countries, property rights are not well defined, impeding land markets from functioning well. This means that important factors of production may not be adequately priced, which affects the analysis of comparative advantage across countries.[163] ■

THE ROLE OF TRADE IN WATER AND LAND USE

By 2050, agriculture will need to produce almost 50 percent more food, fibre and biofuel than in 2012 to meet growing demand, driven by population and income growth.[164] Yet, the distribution of land and water resources over the world does not necessarily favour countries where future demand is expected to increase. Some countries with a rapidly growing demand for food, such as China and India, are already facing land or water constraints.[165] As the current trends of population growth, urbanization and dietary changes progress, regions that are already affected by increasing land or water scarcity are likely to increase their reliance upon trade as a tool to safeguard food security.

Analysts suggest that virtual land and water trade in agricultural products is expected to increase in the decades to come. A study estimates that inter-regional virtual water trade could triple by the end of the twenty-first century.[166] Modelling frameworks that trace the complex inter-relationships between agriculture and water resources project that agricultural trade could increase between 74 and 178 percent by 2050, with up to 50 percent of global demand for food being met through trade.[167] Production increases to meet growing demand will exacerbate the pressure on water resources, and relying on trade would not only ensure adequate food quantities for countries that have low water resources but could also lead to water savings, compared with a hypothetical alternative in which demand for food is met entirely by domestic production.[168]

Although global water withdrawals are projected to rise due to increased production, trade openness could progressively shift the origin of exports towards water-abundant regions, easing the pressure on water-scarce countries. Trade could also help allocate production to regions that are characterized by relatively high water productivity – that is, regions that use relatively lower amounts of water per unit of output.[169] In this way, more trade in food and agricultural products would foster water savings at the global level. A study estimates that trade could generate between 40 and 60 m^3 of annual water savings per capita.[170] To date, the evidence already suggests that trade volumes between regions with different water productivities have increased over time, underlining the role of trade in enhancing the efficiency of water use.[171]

Similarly, trade can also contribute to better use of land globally. This occurs when trade facilitates the flow of agricultural products from countries characterized by higher yields per hectare, to countries that are relatively less productive.[172] For example, trade in cereals is estimated to enable annual land savings in the magnitude of 50 million hectares.[173] As land and water endowments are complementary in agricultural production, trade contributes to saving both land and water.[174]

While a stronger demand for exports can contribute to local resource depletion in important ways, at the global level, trade is efficiency-enhancing in resource use. A study suggests that, in the absence of trade, many countries would need to double their water consumption, cropland area, or both, to produce nationally the food and agricultural products they currently import.[175] Yet, many countries are already constrained by their natural resource base and would not meet their food demand without trade. This would also force countries to pursue production in marginal areas with less favourable growing conditions, potentially increasing the pressure on already vulnerable ecosystems and aggravating resource depletion and land degradation at the local level. ■

THE NEGATIVE EXTERNALITIES OF TRADE

Trade can also generate negative environmental externalities, as production for exports can result in unsustainable freshwater withdrawals, pollution, biodiversity loss and deforestation. Trade channels economic incentives to producers across countries and, combined with weak or inadequate regulatory frameworks, can lead to negative environmental outcomes.

Trade policies can be used as tools to address such shortcomings. Environmental protection is foreseen as a legitimate justification for trade measures under the WTO rules and many recent trade agreements embed environmental clauses in an attempt to balance economic and environmental trade-offs.

Unsustainable freshwater withdrawals

Nearly all water on the earth's surface is found in the oceans, ice caps or glaciers, and only 1 percent is available freshwater.[176] Agriculture accounts for 72 percent of freshwater withdrawals worldwide, mainly for irrigation, and contributes to water stress. About 1.2 billion people live in areas where severe water scarcity challenges agriculture.[177] In sub-Saharan Africa, water availability per capita declined by 40 percent over the past decade, and most of the African continent reached per capita water levels considered insufficient to meet water demand for food and other sectors.[178]

Agricultural production is a key driver of resource use and can lead to unsustainable water withdrawals. Because trade channels economic incentives to producers across countries to expand crop production, many observers postulate a relationship between trade and unsustainable water use. About 11 percent of groundwater depletion is estimated to be embedded in the international trade of crops.[179] Another study estimates that between 2000 and 2015, food trade grew by 65 percent, while the share of unsustainable irrigation embedded in agricultural exports increased proportionally less, by 18 percent.[180] This suggests that trade is not necessarily the leading driver of water scarcity and that, although it can generate a negative environmental impact, it is also efficiency enhancing, as unsustainable irrigation increased much less than agricultural exports.

Pollution

Agricultural intensification and the increased use of fertilizers and pesticides have contributed to soil pollution. Using nitrogen and phosphorous in excess of what is needed for optimal plant growth causes soil pollution and leads to soil acidification, salinization, and the contamination of groundwater and surface water bodies. Pesticides can also harm the environment and soil health, particularly when overused or applied using poor practices.[181]

Trade enables countries to outsource their pollution by importing agricultural products rather than producing them. A study using virtual grey water flows to explore the globalization of agricultural pollution points to wide differences across countries in terms of pollution distribution through trade.[ab] While the grey water concept is not widely used, the study provides interesting insights, indicating that pollution is rising and increasingly concentrated in relatively few countries, and notes a positive relationship between increases in trade and increases in pollution. Importantly, the study suggests that external pollution footprints (that is, due to trade) are small compared to internal footprints (due to domestic production), indicating that local conditions are the key drivers that frame farmers' practices.[182]

Biodiversity loss and deforestation

Biodiversity loss is strongly linked to land use changes and, as markets do not account for its cost, insufficient regulation and law enforcement in the producing region can result in negative outcomes (see Box 3.1). Forests host most of the world's terrestrial biodiversity, and reductions in forest cover imply a significant biodiversity loss. Forests contain over 60 000 different species of trees. They are habitats for 80 percent of the world's amphibian species, 75 percent of bird species and 68 percent of mammal species. Tropical forests contain about 60 percent of all the world's vascular plants.[183]

Landscape transformation affects the natural habitat of fauna and flora, and while some species may adapt to such changes, many will not. A projection exercise on species extinction due to changes in land use (including the increase in cropland, pastures and urbanization) estimates that 25 percent of projected global extinctions could be due to changes in land use for agricultural production to meet export demand.[184]

Two-thirds of global forests are located in only ten countries (Figure 3.3). This implies that the vast majority of global biodiversity is hosted by only a few countries, making local contexts the focus of discussion to secure global biodiversity. Nearly half the world's forests are tropical (45 percent).[185] Humid tropical forests contain the highest biological density and stand out as highly significant reservoirs of global biodiversity. In the tropics, the conversion of forestland into other uses accelerated throughout the twentieth century, driven by demographic growth, technological innovation and economic development. In recent decades, increased market integration has also played a role in this process.

The sourcing of agricultural products can strongly impact local biodiversity and species conservation. Products originating from biodiversity hotspots

ab Grey water refers to the water needed to dilute pollutant concentrations to acceptable levels.

BOX 3.1 TRADE AND BIODIVERSITY: THE IMPORTANCE OF REGULATION

Poorly regulated markets are more prone to generating negative environmental externalities through trade.

A study demonstrates the profound effects of strong and sustained international demand on biodiversity, in this case, the North American Bison.[242] The analysis focuses on how market factors interacted and led to the near extinction of the North American Bison in the late 1800s through trade. First, technological innovation in Europe enabled calf hides to be substituted for buffalo hides in production, and it strengthened significantly the demand for the latter. Second, the global market allowed for the demand for buffalo hides in Europe to be met by imports from the United States of America, which caused widespread hunting of the relatively small American buffalo herd. As a free, open-access resource, the North American Bison herd was nearly entirely captured by the late 1880s.

Another study[243] explores the causal effect of trade on the collapse of fish stocks. The analysis shows that the collapse of fish stocks in Japan led to increased sourcing of fish from the international market to meet domestic demand. At sufficiently high domestic prices, international markets serve as a transmission channel, and contribute to the collapse of fish stocks in other countries when these stocks are an open or poorly regulated resource. The study also finds that sustainably managed fishery resources do not collapse due to an increase in global prices, supporting the argument for adequately regulating catches.

These examples underline that **adequate regulatory frameworks** are necessary to ensure the sustainable use of natural resources, and national legislation is crucial to delimit the actions of market agents. At the same time, multilateral cooperation is indispensable in the case of mobile resources (such as transboundary fish stocks) or shared resources (such as the global atmosphere).

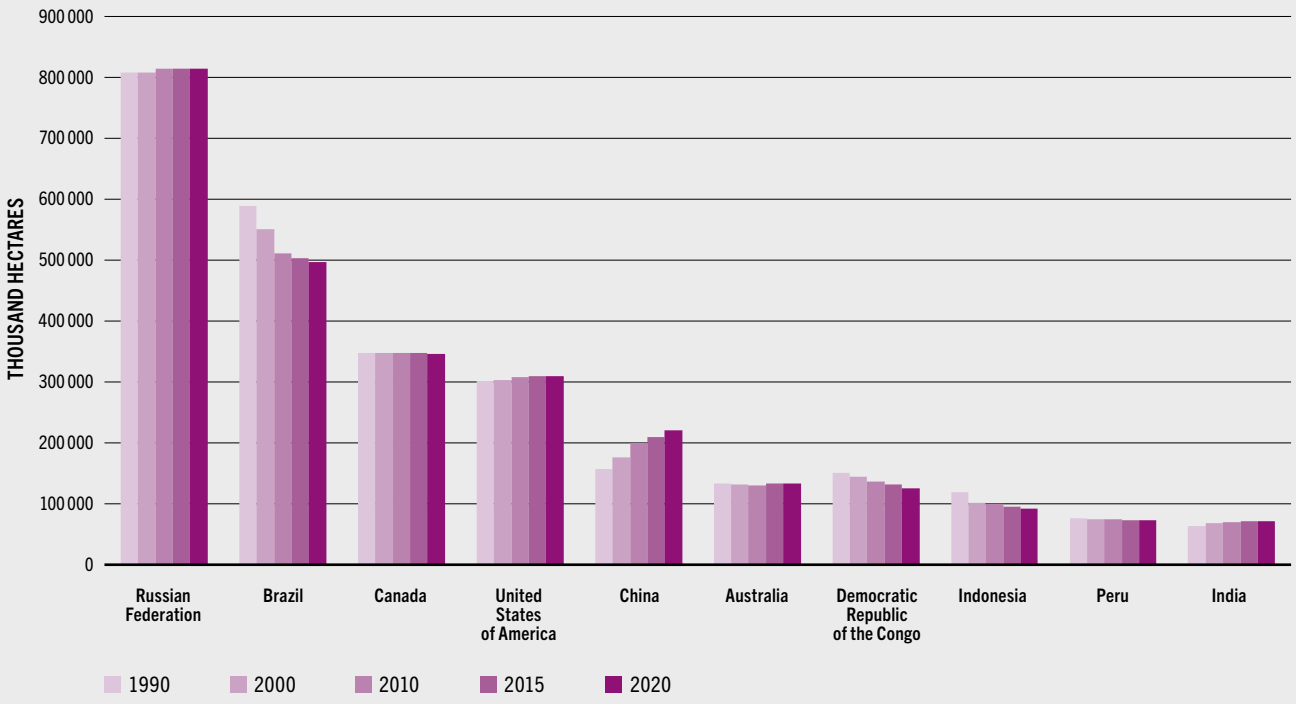
have a disproportionate impact on local biodiversity and species conservation. A study estimated the biodiversity impact of soy exports originating from the Brazilian Cerrado by tracing the product to its origin down to the municipality level. The findings suggest that soy imports by the European Union had a significant impact on the habitat loss of the maned wolf and the giant anteater in the Mato Grosso region of Brazil between 2000 and 2010.[186] The impact of exports to the European Union on the habitat loss of these species was nearly as large as the impact linked to soy exports to China, despite the significant difference in terms of volume between them. This occurs because the exports destined for the European Union were sourced from locations that were richer in terms of biodiversity, and underlines the importance of local context in generating trade-induced environmental externalities.

Globally, the annual rate of forest area reduction has been declining from 0.19 percent during the period 1990–2000 to 0.12 percent between 2010 and 2020.[187] The unprecedented level of connectivity between economies places some of the economic drivers of land use changes beyond national borders, with global markets channelling the incentives for the expansion of agricultural land and land use change, including at the expense of forestland.[188]

Agricultural expansion is seen as the leading cause of deforestation, and the literature on the interlinkages between trade, agricultural expansion and deforestation is vast.[ac] Agricultural production of cattle, soybeans and palm oil – all products with sustained international demand – accounted for 40 percent of tropical deforestation between 2000 and 2010.[189] In some cases, an increase in agricultural exports can lead to decreases in forest cover, although the size of this

ac For example, on the drivers of Amazon deforestation, see, Nepstad, D.C., Stickler, C.M. & Almeida, O.T. 2006. Globalization of the Amazon Soy and Beef Industries: Opportunities for Conservation. *Conservation Biology*, 20(6): 1595–1603. On the relationship between trade openness and deforestation, see, for instance, Faria, W.R. & Almeida, A.N. 2016. Relationship between openness to trade and deforestation: Empirical evidence from the Brazilian Amazon. *Ecological Economics*, 121: 85–97.

FIGURE 3.3 EVOLUTION OF FOREST AREA IN SELECTED COUNTRIES, 1990–2020



SOURCE: FAO.

effect depends on local conditions.[190] For example, a study focusing on Argentina, Brazil and Paraguay estimated that as much as 50 percent of agricultural land increase in these countries was driven by trade but the remaining half of the associated deforestation was tied to production destined for domestic markets.[191] In addition to agricultural exports, the level of development and population pressures are also found to be drivers of deforestation. Trade openness contributes to amplifying economic activity, accelerating other trends that put pressure on land resources, such as income and demand growth, and urbanization and dietary changes.

Agrifood systems fare as the second-largest greenhouse gas emitting sector after the energy sector, and in 2019 accounted for 31 percent of global greenhouse gas emissions. Land use changes alone, including deforestation and peatland degradation, accounted for 7 percent of global greenhouse gas emissions in 2019.[192] A recent global study on the linkages between trade and deforestation indicates that a portion of tropical deforestation-related emissions can be linked to trade (up to 39 percent).[193]

Forests are an important part of the solutions to climate change. Through the process of photosynthesis, forests remove carbon dioxide (CO_2) from the atmosphere and integrate it into their mass, acting as CO_2 sinks when they grow.[194] Deforestation leads both directly to increased greenhouse gas emissions because the carbon stocked in trees is released when they are removed, and indirectly because of the loss of carbon sinks as land is geared towards other uses with lower carbon-storing capacity. Although deforestation takes place at the local level, climate systems are interconnected and the impacts of greenhouse gas emissions extend beyond national borders, making climate change

a global externality. The international community has been addressing climate change for decades, but progress has been uneven across countries, in part because aligning global objectives with national priorities remains an extraordinary challenge (see Part 4).[195] In the last two decades, countries, subnational governments, civil society and the private sector have adopted the objective of reducing, halting and reversing forest loss, including through commitments and initiatives such as Sustainable Development Goal (SDG) 15, the Global Forest Goals, the New York Declaration on Forests, the Consumer Goods Forum Resolution, the Amsterdam Declarations, the United Nations Secretary General's initiative on Turning the Tide on Deforestation and, more recently, the Glasgow Leaders' Declaration on Forests and Land Use. Many of these initiatives define specific goals for decoupling agricultural production from deforestation.

Many importing countries are aware of their environmental footprints and have taken measures to reduce their role in deforestation and forest degradation pressures. The 2013 European Timber Regulation, for instance, disallows the commercialization of illegal timber and its derived products in the European Common Market. In 2021, the European Commission put forward a legislative proposal to ensure that palm oil, soy, wood, cocoa, coffee, cattle and their derived products entering the European Common Market are all "deforestation-free", regardless of the legality of the related deforestation in the country of origin (see Box 3.2). As the location from which exports are sourced can determine the impact on the environment, the proposed legislation includes provisions for traceability and geo-referencing. Digital technologies can facilitate the traceability of products throughout the value chain, and better traceability can promote trust and foster the adoption of sustainable practices.[196]

Many tropical countries are making efforts to curb deforestation and forest degradation, as well as to strengthen legal compliance and verification. The private sector sourcing in these countries is also increasingly engaged in finding solutions to weaken incentives for deforestation. The Soy Moratorium (SoyM) in Brazil serves as an example of private sector commitment to support the public sector in halting deforestation in the Brazilian Amazon. The SoyM is a permanent commitment by the major soybean traders in Brazil not to commercialize soybeans produced in areas deforested after 2006 in the Brazilian Amazon. The agreement was highly successful, and contributed, among other measures, to a significant decrease in deforestation in the Amazon between 2006 and 2014.[197] However, deforestation levels in the Amazon remain a concern and are difficult to address. For instance, there is indication that reductions in deforestation rates within the Brazilian Amazon increased deforestation pressure on neighbouring countries with less stringent regulation, accelerating forest loss in Colombia, Paraguay and Peru.[198] ■

TRADE AND THE ENVIRONMENT: POLICY RESPONSES

Trade and the rules that promote openness in global markets can contribute to negative externalities and calls are made for measures that reduce trade. Nevertheless, reducing trade would result in a change in the allocation of production across countries, generating different pressures on natural resources and the environment than the ones the world is experiencing today. It could also reduce trade's efficiency-enhancing role in the use of natural resources.

Trade policy approaches are being revisited, a process that presents challenges and opportunities. A part of the ongoing debate about globalization and sustainable development revolves around how to ensure that trade policies and environmental protection are mutually supportive. Under the WTO rules, members can adopt trade-related measures aimed at protecting the environment.

The scope of RTAs is also evolving.[ad] RTAs have progressively advanced from facilitating purely economic exchanges to promoting deeper integration and are becoming an instrument to

ad RTAs are "trade agreements of a mutually preferential nature" and include bilateral, regional and inter-regional free trade agreements, economic unions, customs unions and common markets.

foster policy convergence in partner countries, such as better labour standards, human rights and environmental conservation (see also Part 4). Many RTAs have included extensive environmental provisions to provide incentives to producers to adopt sustainable practices in order to gain and maintain access to new markets.[199] Other methods are also being pursued, for instance, by enacting national legislation to ensure that imports do not generate negative environmental externalities (see Box 3.2).

Multilateral principles and World Trade Organization rules

The 1992 United Nations Conference on Environment and Development adoption of the Rio Declaration underscores that to achieve sustainable development, environmental protection should constitute an integral part of the development process and countries should cooperate to transferring any harmful activities that may cause severe environmental degradation.[ae] Similarly, the United Nations 2030 Agenda for Sustainable Development in 2015 emphasizes the role of trade in promoting inclusive economic growth and as an important means to achieve the SDGs. The United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement reiterates that an open international economic system can strengthen the global response to the threat of climate change in the context of sustainable development.

Efforts to address the linkages between trade and the environment are concerted by the WTO at the multilateral level. Sustainable development, protection and the preservation of the environment are key objectives of WTO agreements. The Marrakesh Agreement sets out the WTO's aim to reduce trade barriers and eliminate discriminatory treatment in trade, and it also identifies trade as a tool to help countries achieve important public policy goals, including the sustainable use of the world's resources and environmental protection.

Within the WTO agreements, countries carry a significant degree of autonomy in determining their environmental objectives and the environmental legislation they enact and implement, to the extent that it respects the WTO principles (see also Part 4).[200] For example, non-discrimination, a guiding principle of the WTO, specifies that a country shall not discriminate between "like" products from different trading partners, giving them equally most favoured nation (MFN) status as noted in GATT Article I. In addition, non-discrimination means that a country must provide "national treatment" and shall not discriminate between its own and "like" imported products, as contained in GATT Article III.[af, 201]

WTO rules allow members to adopt trade-related measures for the protection of the environment, including through Article XX of GATT on General Exceptions, which allows members to take all necessary measures to protect morals, human, animal or plant life or health, or relating to the conservation of exhaustible natural resources.[ag] Trade-related measures that protect the environment may not be implemented if they restrict trade in a way that is arbitrary and results in unjustifiable discrimination between countries. The WTO rulings in the Shrimp-Turtle and the Brazil-Retreaded Tyres cases, as shown in Box 3.3, illustrate the multilateral mechanism that addresses trade-offs between trade and environmental objectives.[202]

Regional trade agreements and the environment

RTAs have rapidly increased in terms of number and regulatory coverage and evolved directly referencing sustainable development and including environment-related provisions

ae See Principles 4 and 12 of the Rio Declaration on Environment and Development 1992. https://www.iau-hesd.net/sites/default/files/documents/rio_e.pdf

af Products can be considered "like products" if they share one of the four categories of characteristics: i) the physical properties of the products; ii) the extent to which the products are capable of serving the same or similar end-uses; iii) the extent to which consumers perceive and treat the products as alternative means of performing particular functions in order to satisfy a particular want or demand; and iv) the international classification of the products for tariff purposes. The MFN principle is based on the idea that countries should treat all their trade partners equally, and that no one country should give special treatment to goods or services coming from one particular trading partner.

ag See paragraphs (b) and (g) of GATT Article XX. https://www.wto.org/english/res_e/booksp_e/gatt_ai_e/art20_e.pdf

BOX 3.2 EUROPEAN COMMISSION PROPOSALS FOR REGULATING DEFORESTATION-FREE PRODUCTS AND CORPORATE SUSTAINABILITY DUE DILIGENCE

Deforestation-free products

In November 2021, the European Commission released a proposal for legislation to minimize the presence of products associated with deforestation in its supply chains. The proposed legislation asks that supply chain operators working in the European Union ensure that products entering the European market (palm oil, soy, wood, cocoa, coffee, cattle and derived products) are deforestation-free.[244] Operators are required to collect, retain and make available upon request information about the deforestation-free status of their operations, most notably the geo-location of where goods were produced in the countries of origin. Operators would also be responsible for undertaking due diligence in their supply chains.

The proposed regulation set 31 December 2020 as the cut-off date for deforested or degraded land to be put into productive use. National authorities would be responsible for performing checks upon operators and traders and financial penalties are foreseen for non-compliance. The legislation anticipates a review at the end of a provisional three-year period. It also requires an evaluation of the feasibility of expanding the regulation to other ecosystems (beyond forests) and products within two years of entry into the regulation. This proposal differs from previous initiatives in two important ways. First, it goes beyond the concept of illegal deforestation by imposing a zero-deforestation requirement. Second, it places significant weight upon the private sector, which would become *de facto* active enforcers of the regulation. If the proposal is adopted, the regulation will provide a transitional period during which traders and operators would have 12 months to arrange appropriate due diligence systems before placing the products concerned on, or exporting them from, the European market. The European Commission's approach to reducing deforestation is comprehensive and it has pledged to support trading partners in strengthening forest governance, developing legislation, fostering capacities and increasing the transparency of supply chains while considering the rights of forest-dependent communities, indigenous peoples and the needs of smallholders. The exact outcomes of such a policy framework are yet to be determined, as it is a nascent proposal, that has yet to be passed into legislation and the literature on similar measures is scarce.

Corporate sustainability due diligence

In February 2022, the European Commission published a proposal for a Directive on Corporate Sustainability Due Diligence requiring companies of different sizes to identify, prevent and mitigate social and environmental impacts in their supply chains.[245, 246] The legislative proposal aims to encourage responsible sourcing by ensuring that social and environmental considerations are embedded into corporate governance, company management, operations and relationships with upstream suppliers. If adopted, the new rules will ensure that businesses address adverse impacts through trade and sourcing, including in their value chains.

Specifically, companies will be required to enhance cooperation with suppliers to reduce negative impacts in supply chains, monitor their due diligence measures and those of their suppliers, and establish a grievance and remediation procedure. The proposal considers agriculture as a high-risk priority sector and requires certain large companies to have a plan to ensure that their business strategy is compatible with limiting global warming to 1.5 °C in line with the Paris Agreement. The proposal encourages companies to adopt and implement the risk-based due diligence framework from the Organisation for Economic Co-operation and Development (OECD)-Food and Agriculture Organization of the United Nations (FAO) Guidance for Responsible Agricultural Chains, referenced in the legislation's text as the agricultural sector framework for responsible sourcing and development. Some of the European Union Member States, including France and Germany, already have their respective legislation on due diligence in place.

Although the proposal is encouraging, companies in upstream supply chains operate in settings marred by development challenges, and as end-recipients of due diligence (and deforestation) related legislation, these upstream businesses will be expected to address and mitigate risks according to pressure from downstream retailers, traders and companies in the European Union.

BOX 3.3 WTO ENVIRONMENTAL CASES: SHRIMP-TURTLE AND BRAZIL-RETREADED TYRES

The WTO members determine their own environmental objectives. This has been reaffirmed on a number of cases throughout the years, mainly through two special cases: the Shrimp-Turtle, and the Brazil-Retreaded Tyres.

In the 1997 Shrimp-Turtle case, India, Malaysia, Pakistan and Thailand brought a joint complaint against a ban imposed by the United States of America on imports of certain shrimp and shrimp products. The protection of sea turtles was a key driver of the ban. The United States of America's Endangered Species Act of 1973 listed as endangered or threatened the five species of sea turtles that are in American waters and required that American fishing vessels use fishing gear, known as turtle-excluder devices, in their nets when fishing in areas in case sea turtles were encountered. Under the United States of America's Public Law, which deals with imports, shrimp harvested with technology that could have a harmful effect on sea turtles may not be imported, unless the harvesting country was certified to have a regulatory programme or that the fishing environment of the harvesting country did not pose a threat to sea turtles.[247]

The Appellate Body of the WTO Dispute Settlement Mechanism noted that under WTO rules, countries have the right to take trade action to protect the environment, in particular endangered species and exhaustible resources, and that measures to protect sea turtles would be legitimate under GATT Article XX (which deals with various exceptions to the WTO's trade rules, including for certain environmental reasons) provided certain criteria, such as non-discrimination were met. In this case, it was considered that the ban imposed by the United States of America was inconsistent with GATT Article XI (which limits the use of import prohibitions or restrictions) and could not be justified under GATT Article XX. The reason given was that the United States of America discriminated between WTO members, as it provided countries in the western hemisphere with technical and financial assistance and longer transition periods for their fishermen to start using turtle-excluder devices, while it did not offer the same advantages to the four Asian countries (India, Malaysia, Pakistan and Thailand) that filed the complaint.

Similarly, the 2007 case Measures Affecting Imports of Retreaded Tyres dealt with the import prohibition of retreaded tyres from the European Union into Brazil.[248] Retreading tyres is a practice that lengthens the lifespan of the original tyre. Used tyres are refurbished for further use by stripping the worn tread from the outline and replacing it with a new tread. Since it expands the lifespan of a tyre, recycling used tyres is generally an environmentally friendly practice, but Brazil claimed that international trade in already retreaded tyres negatively affected the environment and public health in importing countries. Specifically, it argued that the collection of waste tyres poses risks to human life or health, such as mosquito-borne diseases, for example, dengue and yellow fever, tyre fires and toxic leaching, all of which adversely affect human health and the environment. Brazil argued that its measures were justified under GATT Article XX (b) which allows measures "necessary to protect human, animal or plant life or health."[249]

The Appellate Body concluded that Brazil's import prohibition on retreaded tyres and the fines imposed by Brazil were inconsistent with GATT Article XI:1 (prohibition on quantitative restrictions); Article III:4 (national treatment – domestic laws and regulations); Article XX (general exceptions) and Article XX(d) (exceptions – necessary to secure compliance with laws); and Article XX(b) (general exceptions – necessary to protect human life or health). More specifically, the exemptions of retreaded tyres imported from Mercosur members, Argentina, Paraguay and Uruguay, from the import ban and fines resulted in the import ban being applied in a manner that constitutes arbitrary or unjustifiable discrimination.

These two cases are considered milestones for using environmental concerns as justified measures to impede trade. Both rulings lost under discriminatory – and not environmental – grounds.

NOTE: GATT Article XX on General Exceptions provides grounds for some specific cases in which WTO members may be exempt from GATT rules. WTO members are entitled to adopt policy measures that are inconsistent with GATT disciplines, except when (a) necessary to protect human, animal or plant life or health, or (b) relating to the conservation of exhaustible natural resources. The measures, however, should not be a disguised restriction on international trade, and applied in a way to create arbitrary or unjustifiable discrimination between countries where the same conditions prevail.

(ERPs).[ah] RTAs offer an opportunity for like-minded countries to agree on disciplines that address environmental issues. With respect to WTO rules, RTAs can provide an additional layer of discipline by reaffirming the WTO rules, agreeing to deepen or expand multilateral commitments, or agreeing to refrain from taking counteractive actions between the signatories of the agreements.[203]

Countries have increasingly used trade agreements to cooperate on environmental matters in the past few decades. In fact, the first agreement to include a provision related to the environment dates to 1957, when the Treaty of Rome establishing the European Economic Community included a general exception allowing a party to prohibit or restrict imports, exports or goods in transit on the grounds of protecting the health and life of animals or plants if such prohibitions or restrictions were not arbitrary or discriminatory.[ai] Since then, environmental provisions started to rise slowly, and between 1957 and 2019, out of the 318 trade agreements that were established, 131 included at least one ERP (See Figure 3.4). Of these 131 agreements, 71 incorporate provisions that display an interaction between the environment and agriculture.[aj]

Today, many RTAs contain some reference to the environment, and the inclusion of ERPs followed a pattern that has evolved over the years (see Figure 3.4). Prior to the early 2000s, the number of RTAs with substantive environmental clauses was limited, with some notable exceptions, for example, NAFTA, which became effective in 1994 and its successor, USMCA, which became effective in 2020.

A significant change in this trend can be observed from 2005 when RTAs started to include more specific ERPs.[204] This is especially relevant for the RTAs negotiated by some developed countries, such as Canada, the European Free Trade Association (EFTA) countries, the European Union, and the United States of America. Many RTAs with higher environmental standards were negotiated between developing and developed countries, with the latter being among the active proponents.[205] Likewise, ERPs are included more often when the trade agreement has a vast and diverse geographical scope and encompasses a significant market size.[206] This is the case with the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP). ERPs also tend to be more comprehensive in those agreements negotiated between countries with a significant difference in their environmental performances, suggesting an attempt to ensure that trade results in positive environmental outcomes.[207] Over time, developing countries started to include these types of provisions in their RTAs with other developing partners, as in the case of the East African Community.

The number of agreements and the level of detail of these provisions have expanded since 2012 and address specific environmental issues, including biodiversity, sustainable management of forests and fisheries, and climate change. Moreover, depending on the structure of the inclusion of the environmental-related provisions, some directly refer to agriculture. For instance, the Common Market for Eastern and Southern Africa (COMESA), where the parties commit to take steps to control transboundary, air and water pollution arising from mining, fishing and agricultural activities, and to discourage the excessive use of agricultural chemicals and fertilizers.[ak]

Designing the scope of environment-related provisions

Many of the environment-related provisions are defined as WTO-plus provisions, as they set commitments that go beyond the WTO agreements. Other environmental exception clauses in the main type of WTO-like agreements are modelled on Article XX of the GATT, or on

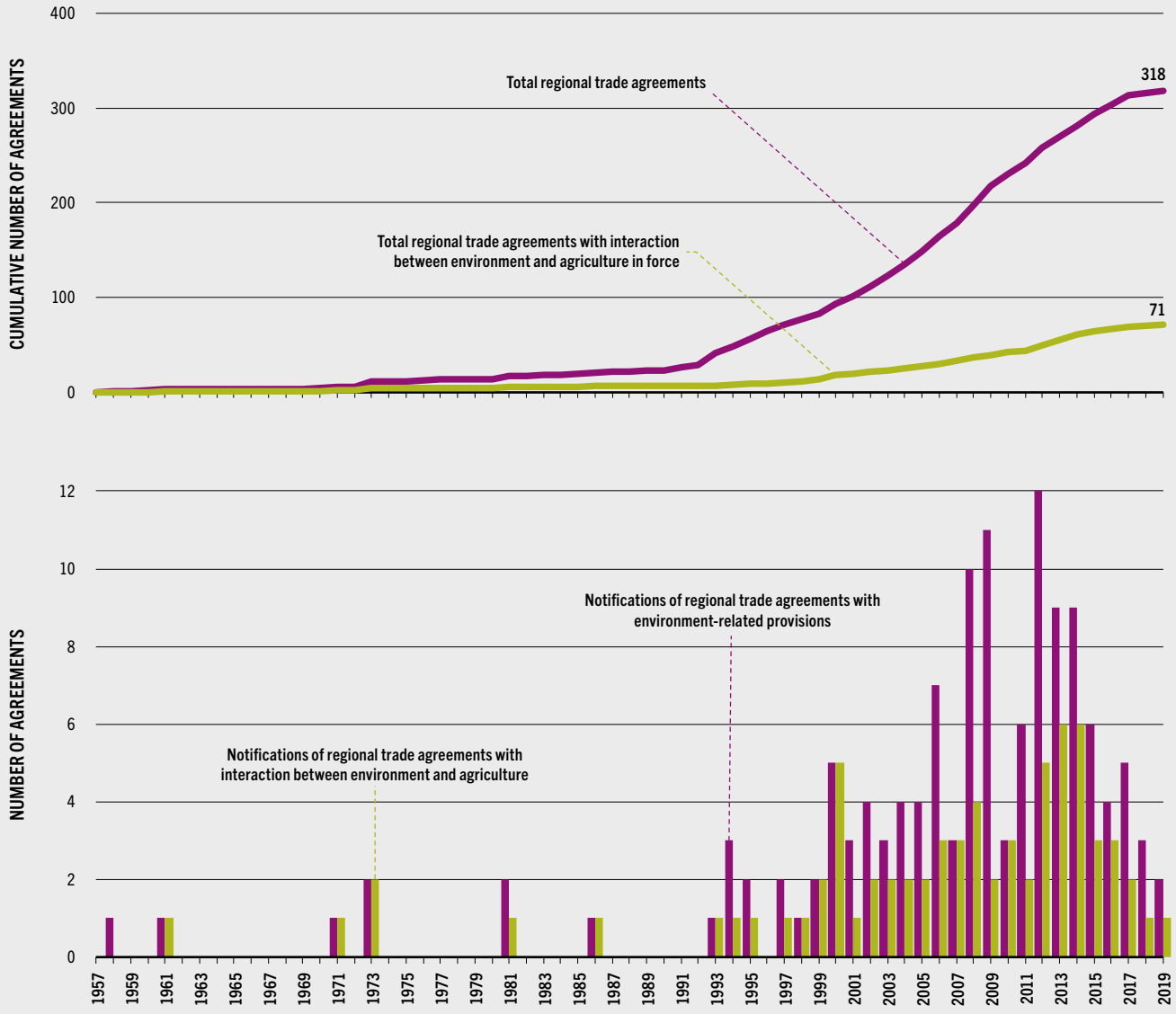
ah ERPs are defined as any provisions referring directly and explicitly to the protection of the environment, sustainable development and other environment-related issues.

ai See Article 30 of the Treaty of Establishing European Community https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:11997E/TXT&rid=1

aj Other ERPs can be applied to agriculture that may not be explicitly covered or captured in the interaction between agriculture and environment.

ak See Chapter 16, Articles 124 and 125 of the agreement. https://www.jus.uio.no/english/services/library/treaties/09/9-01/comesa_treaty.xml#treaty-header1-15

FIGURE 3.4 AGREEMENTS WITH ENVIRONMENT-RELATED PROVISIONS, 1957–2019



NOTE: The provisions that were analysed are obligations that are outside the current mandate of the WTO.
SOURCE: Mattoo, A., Rocha, N. & Ruta, M. 2020. *Handbook of Deep Trade Agreements*. Washington, DC, World Bank.

Article XIV of the General Agreement on Trade in Services (GATS).[208] In practice, most RTAs with environment-related provisions include a combination of both the WTO-like and the WTO-plus environment-related provisions.

The reasons for including environment-related provisions in RTAs are manifold. Countries may have policies requiring the inclusion of ERPs in RTAs to match domestic legislation that limits environmental externalities and fosters harmonization of related non-tariff measures

between trade partners.[209] Others may be pressured to include ERPs in response to concerns by domestic industry or consumers.[210] Countries may also wish to avoid having their trade partners lower their domestic environmental protection levels to increase production and attract investments.[211]

The lack of ERPs could strengthen competition from trade partners with less stringent environmental requirements making them more price competitive. This would displace domestic producers and other exporters that comply with environmental standards resulting in negative environmental outcomes.[al] This is reflected in some ERPs that strive for a balance between fulfilling environment-related policy objectives and trade/investment goals, such as RTAs between Canada-Colombia, Canada-Honduras and NAFTA (as shown in Figure 3.5). This is more nuanced in the EFTA-China, Hong Kong SAR agreement, which discourages weakening environmental protection laws in order to gain competitive trade advantage (see the excerpt from the agreement in Table 3.1).

ERPs in RTAs differ in terms of their scope and take a range of shapes and forms in terms of the extent of the environmental issues covered and the actions to address them.[212] The location of the clauses in the agreement also differs. ERPs can be included in the preamble and the main body of the agreement, in an annex, a protocol, a side agreement – as for USMCA – or be clarified through a letter exchange, such as the Canada-Peru letter on Understanding Regarding Biodiversity and Traditional Knowledge (see Table 3.1).[213] Some ERPs are aspirational and include language adhering to multilateral environmental agreements (MEAs), such as the Paris Agreement.[am] Several RTAs explicitly include provisions related to MEAs, such as those of the United States of America-Republic of Korea, NAFTA, and Canada-Colombia. In fact, the United States of America-Republic of Korea agreement has nine different provisions related to complying with MEAs (as shown in Figure 3.5 under the MEA Compliance category of provisions).[214] Other RTAs make specific commitments based on domestic environmental law, while restating the right of the parties to regulate environmental matters.

Many RTAs overtly mention cooperation in environmental issues, as for example, the agreement between New Zealand and China in which the parties consider their national priorities and available resources, agree to cooperate on environmental matters and jointly decide specific environment cooperative activities (See Table 3.1). RTAs that aim at deeper integration, adopt a more concrete approach, and they include clauses establishing stronger cooperation, including on environmental regulations and standards. This is the case with many recent agreements negotiated by the European Union, Canada and the United States of America. For example, the United States of America-Central America Free Trade Agreement-Dominican Republic (US-CAFTA-DR), where the parties agree to cooperate to protect, improve and conserve the environment, including natural resources, and specify the establishment of a framework for such cooperation among the parties (See Table 3.1).

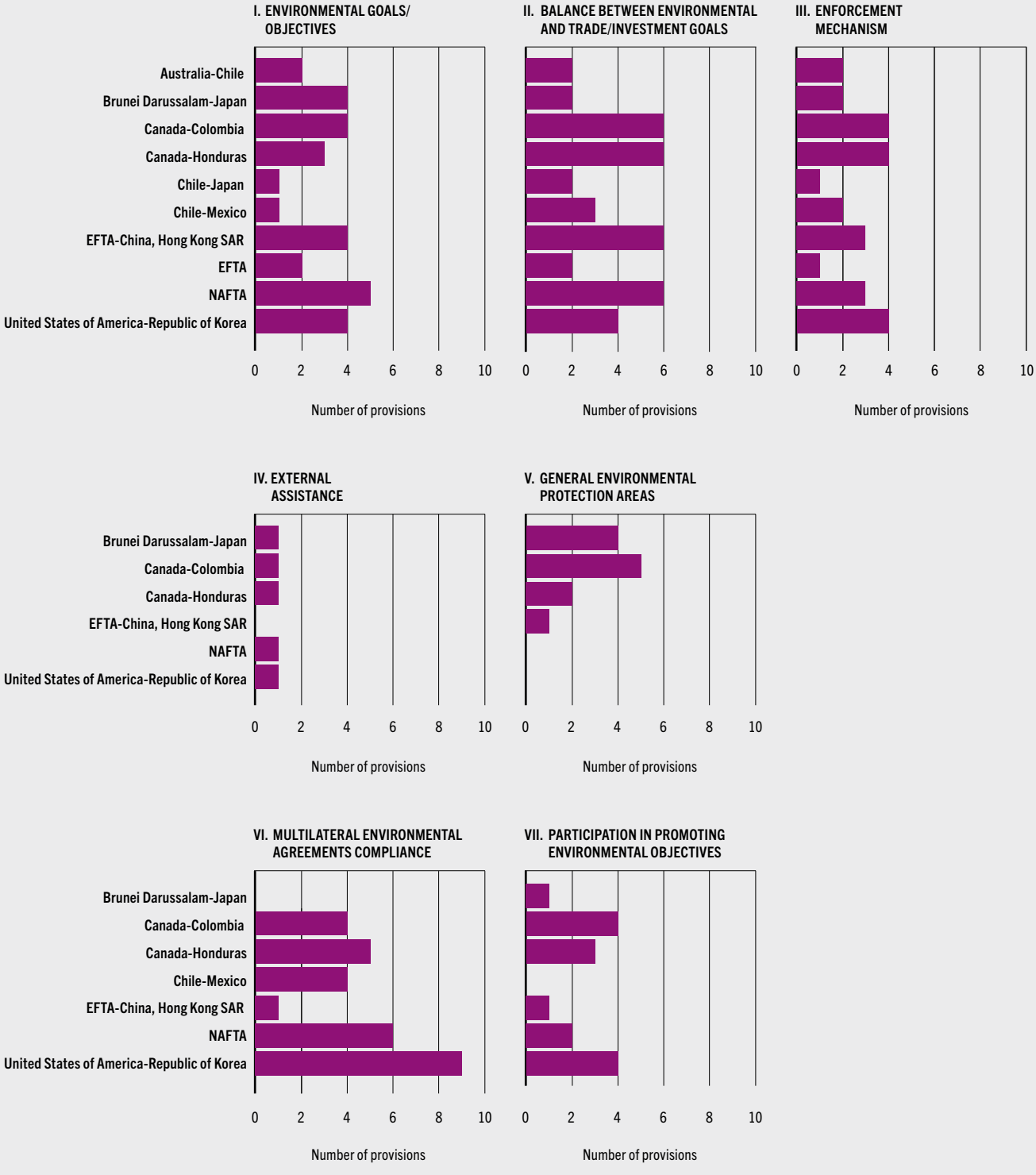
Often, these types of agreements foresee the set-up of ad hoc institutional arrangements to facilitate the enforcement of commitments, such as environmental committees to discuss and oversee the implementation of the ERPs, and mechanisms to solve the disputes related to the environment arising between the parties.[215] In fact, many RTAs with a comprehensive environment chapter or a side agreement, for example, the Canada-Colombia and United States of America-Republic of Korea agreements, establish such ad hoc institutional arrangements and have four different types of provisions related to enforcement mechanisms (see Figure 3.5).

Enforcement mechanisms are included in RTAs mostly through dispute settlement procedures that allow signatories to identify, demonstrate and retaliate against any violations of an agreement within a framework indicated by the agreement. The language on enforceability of ERPs varies

al By increasing market access to countries with lower environmental standards, there is a risk of creating a "pollution haven" to the detriment of the environment at the global level.

am MEAs are among more than two parties and are designed to address environmental problems (most of which have a transboundary nature and are global) through international cooperation, some of which are treaties to which any country may become a party, such as the Convention on International Trade in Endangered Species (CITES) and UNFCCC.

FIGURE 3.5 SELECTED AGREEMENTS WITH A RANGE OF TYPES OF ENVIRONMENT-RELATED PROVISIONS



SOURCE: Monteiro, J. & Trachtman, J. 2020. Environmental Laws. In Mattoo, A., Rocha, M., Ruta, N., eds. *Handbook of Deep Trade Agreements*. Washington, DC. World Bank.

TABLE 3.1 CLASSIFICATION OF FORMATS OF THE INCLUSION OF ENVIRONMENT-RELATED PROVISIONS IN REGIONAL TRADE AGREEMENTS

Types of options	Agreements	Year	Parties	Excerpt
Side Agreement	US-CAFTA-DR Environmental Cooperation Agreement	2005	United States of America – Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras and Nicaragua	"The Parties agree to cooperate to protect, improve and conserve the environment, including natural resources. The Objective of the Agreement is to establish a framework for such cooperation among the Parties." *(Article 2)*
	New Zealand-China Free Trade Agreement	2008	China – New Zealand	"Taking account of their national priorities and available resources, the Parties agree to cooperate on environmental matters of mutual interests and benefit. The Parties shall jointly decide specific environment cooperative activities." *(Article 2)*
	Canada-Honduras Agreement on Environmental Cooperation	2013	Canada – Honduras	"Parties agree to foster sustainable development through the promotion of mutually supportive environmental and economic policies, sound environmental management, and conservation measures;" *(Article 2a)*
An environment chapter or article within the main agreement	Comprehensive and Progressive Agreement for Trans-Pacific Partnership	2016	Canada – Australia, Brunei Darussalam, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore and Viet Nam	"Taking account of their respective national priorities and circumstances, the Parties recognise that enhanced cooperation to protect and conserve the environment and sustainably manage their natural resources brings benefits that can contribute to sustainable development, strengthen their environmental governance and complement the objectives of this Agreement." *(Article 20.2)*
	Canada-European Union Comprehensive Economic and Trade Agreement	2016	Canada – European Union	"The Parties recognise that the environment is a fundamental pillar of sustainable development and recognise the contribution that trade could make to sustainable development. The Parties stress that enhanced cooperation to protect and conserve the environment…" *(Article 24.2)*
	Japan-Mexico Economic Partnership Agreement	2004	Japan – Mexico	"The Parties recognize that it is inappropriate to encourage investment by relaxing domestic health, safety or environmental measures. Accordingly, a Party should not waive or otherwise derogate from, or offer to waive or otherwise derogate from, such measures as an encouragement for the establishment, acquisition, expansion or retention in its Area of an investment of an investor." *(Article 74)*
A sustainable development chapter within the main agreement	EFTA–China, Hong Kong SAR	2011	Iceland, Liechtenstein, Norway and Switzerland – China, Hong Kong SAR	"…(a) weaken or reduce the level of environmental protection provided by its laws, regulations or standards with the sole intention to encourage investment from another Party or to seek or enhance a competitive trade advantage of producers or service providers operating in that Party;" *(Article 8.4)*
	European Union-Southern African Development Community (SADC) Economic Cooperation Agreement	2015	European Union – Botswana, Eswatini, Lesotho, Mozambique, Namibia and South Africa	"The Parties reaffirm their commitments to promote the development of international trade in such a way as to contribute to the objective of sustainable development, in its three pillars (economic development, social development, and environmental protection…" *(Chapter 2, Article 6)*

TABLE 3.1 (Continued)

Types of options	Agreements	Year	Parties	Excerpt
A sustainable development chapter within the main agreement	EFTA-Central America Free Trade Agreement	2013	Iceland, Liechtenstein, Norway and Switzerland – Costa Rica, Guatemala and Panama	"The Parties reaffirm their commitment to promote the development of international trade in such a way as to contribute to the objective of sustainable development and to ensure that this objective is integrated and reflected in the Parties' trade relationship." *(Chapter 9, Article 9.1)*
	EU-CARIFORUM Economic Cooperation Agreement	2008	European Union – Dominican Republic, Antigua and Barbuda, Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, and Trinidad and Tobago	"Parties reaffirm that the objective of sustainable development is to be applied and the application of this Agreement shall fully take into account the human, cultural, economic, social, health and environmental best interests of their respective population and of future generations;" *(Part 1, Article 3)*
Side letters on environmental matters	Canada-Peru Letter of Understanding Regarding Biodiversity and Traditional Knowledge	2016	Canada – Peru	"Canada and the Republic of Peru recognize that the equitable sharing of benefits that may result from the utilisation of traditional knowledge relevant for the conservation and sustainable use of biological diversity can be addressed through appropriate mechanisms."
	United States of America-Peru Free Trade Agreement's letter on Biodiversity and Traditional Knowledge	2006	United States of America – Peru	"The Parties recognize the importance of traditional knowledge and biodiversity, as well as the potential contribution of traditional knowledge and biodiversity to cultural, economic, and social development."
	United States of America-Chile side letter on fisheries subsidies and natural disasters under the Trans-Pacific Partnership (TPP)	2016	United States of America – Chile	"Without prejudice to Article 20.16.5(a) (Marine Capture Fisheries) of Chapter 20 (Environment) of the TPP Agreement, the United States and Chile share the understanding that a Party may grant time-limited subsidies to assist its fishermen to recover from a natural disaster, such as a tsunami or earthquake."

NOTE: Types of options include: side agreements, which are separate agreements from the trade treaties they accompany, and which provide the institutional space for strong proactive environmental agendas covering capacity building, harmonization of regulation, cooperation and monitoring; an environment chapter within an agreement, which can deal with trade-related environmental matters such as failure to enforce domestic environmental laws in ways that affect trade, trade-related environmental commitments related to MEAs (such chapter embedded within the agreement allows for such commitments to be enforceable through the main agreement's dispute settlement mechanism, if the signatories choose to use it); sustainable development chapters may include both environmental and labour commitments, as some European Union agreements do, or may simply set environmental commitments within a broader context of sustainable development; and side letters, which may set out joint commitments that are difficult to achieve within the context of the agreement, either because there are multiple parties that cannot agree, or because their content is too sensitive to form a part of the legally agreed treaty.
SOURCE: Compiled by FAO based on the original trade agreements.

across RTAs, as some are nuanced in non-binding terms, while others are formulated in binding terms.[216]

Dispute settlement mechanisms can be an effective way to enforce compliance with ERPs. Enforcement measures may differ in relation to the ability of countries to impose monetary remedies or trade sanctions. For instance, the procedure established under the environmental chapters of many RTAs signed by the United States of America usually includes the possibility of imposing retaliatory actions. On the contrary, those shown under the sustainability chapters of the most recent RTAs enacted by the European Union explicitly exclude the possibility of imposing trade sanctions.[217]

Environmental impact assessments are instrumental in assessing the impacts of ERPs.[an] Such assessments trace the potential impacts of ERPs on markets, technology and regulations, and are currently mandated for all agreements signed by Canada, the European Union and the United States of America.[218] Many ERPs establish a mechanism to review such impact assessments.[219]

The process by which ERPs are negotiated, implemented and monitored at the national level is vital. For example, public participation enables stakeholders from all potentially affected sectors to contribute.[220] This is especially important for addressing environmental issues, since public participation may be limited during the negotiation process of trade agreements and sectors, such as the environment, may be often underrepresented (see also Box 4.2).[221] ■

an In 1993, the OECD Ministerial Council recommended that "governments should examine or review trade and environmental policies and agreements with potentially significant effects on the other policy area early in their development to assess the implications for the other policy area and to identify alternative policy options for addressing concerns."

THE IMPACT OF REGIONAL TRADE AGREEMENTS ON THE ENVIRONMENT

The effects of environment-related provisions in RTAs on environmental outcomes are difficult to assess, as empirical evidence is limited. Most studies focus on two measurable indicators: the reduction in greenhouse gas (GHG) emissions and the net annual changes in deforestation. For the first indicator, the evidence suggests that, while not limiting the export capacities of countries, ERPs can play an important role in promoting environmental sustainability and lowering GHG emissions.[222] Research shows that CO_2 emissions in countries that are parties to an RTA with ERPs tend to be lower than in countries that are parties to RTAs without such provisions.[223]

For the second indicator, the analysis shows that, following the implementation of RTAs with ERPs that aim to protect forests and biodiversity, no changes in net annual deforestation were recorded.[224] At the same time, signatories to RTAs that lack ERPs saw substantial increases in net forest loss. However, the global impact of such measures remains unclear, as deforestation could shift to countries not covered by such provisions.[225]

Another study notes that environmental provisions can help reduce exports, including agricultural exports that have negative environmental impacts and increase sustainably produced exports from developing countries.[226] This effect is more prominent in developing countries with stringent environmental regulations.

Although trade offers opportunities for greater prosperity and development, trade agreements need to be equipped with a robust political and legal framework addressing environmental externalities. If such a framework is not embedded in trade policies and agreements, trade can spur negative impacts on the environment. Recent studies analysed whether RTAs with ERPs are equipped with effective mechanisms that are in line with global environmental goals to avoid negative effects on climate and biodiversity.[227]

The analysis shows that, while some mandatory standards regarding deforestation and biodiversity loss, for example have been established, overall, agreements lack a comprehensive legal framework to enhance environmental protection. Dispute settlement mechanisms provide a means to enforce commitments and together with mechanisms for regulatory cooperation can enhance the effectiveness of ERPs. Indeed, the analysis suggests that dispute settlement mechanisms covering the entire agreement were effective in mitigating forest loss.[ao, 228]

Another study analysing the effectiveness of ERPs in RTAs, established 14 different climate-relevant provision types found in several agreements and the level of cooperation put forward by the signatories for climate action measures. It focused on four conceptual levels of cooperation: i) *optional*, where parties do not expressly commit to cooperate on climate action but rather leave it optional, often using conditional language; ii) *intentional*, where agreements include statements of intent to cooperate, often with climate-relevant issues identified, but lacking detail on actions, methods and objectives; iii) *action-structured*, where specific cooperative actions are outlined in detail within an action framework or loose governance structure but with no set targets or schedules; and, iv) *programmatic*, where the agreement contains a programmatic plan of specified actions, targets and schedules for cooperation in a well-defined governance structure.

The study showed that non-institutionalized cooperation, such as *optional* or *intentional*, is likely to result in limited impacts and additional contributions to these may be insignificant or not easily determined.[ap] More *action-structured* and *programmatic* cooperation may anticipate additional positive impacts to develop, depending on the effectiveness of governance structure arrangements. For example, the approach by the European Union is especially significant, with the 27 members being involved in approximately one-third of the RTAs and oriented towards greater cooperation. Legally binding commitments within an RTA to undertake specified and time-bound actions are likely to have more defined and quantifiable impacts on trade-related behaviours, and, in turn, climate-relevant cooperation would lead to more substantive results.[229]

Trade agreements and third-party voluntary sustainability certification schemes

Third-party voluntary sustainability certification schemes are alternative mechanisms to foster environmental protection. They are gaining importance in global markets, especially for high-value products with established links to global value chains. For example, one-quarter of the global coffee and cocoa areas are certified through sustainability standards developed by both non-governmental organizations and the private sector.[230]

Such sustainability certification schemes put forward private standards that aim to address environmental, social or economic challenges in agricultural markets and respond to consumer concerns. They do so by using market incentives to encourage the adoption of improved practices. For example, organic standards incentivize producing crops without synthetic fertilizers and pesticides. Other schemes, such as the Rainforest Alliance's Roundtable on Sustainable Palm Oil (RSPO), include a range of requirements for environmentally friendly farm practices to promote agroforestry, the use of organic fertilizers and pesticides, and safer treatment and disposal of waste.

For consumers, sustainability certification schemes provide information on both the quality and safety of food, environmental sustainability, and such social norms as child labour, gender equality and the welfare of the producers.[231] However, compliance with standards often requires significant trade-offs. For example, organic farming or other improved environmental

ao All the RTAs assessed in the analysis featured a broad scope dispute settlement mechanism that covers the entire trade agreement. However, some of those RTAs feature additional dispute settlement mechanisms unique to specific provisions that supplement the broad-scope, agreement-level mechanisms.

ap "Cooperation" in the agreement context refers broadly to mutual commitments by all signatory governments and other relevant parties to engage in new joint collaborative ongoing ventures, projects or other actions in ongoing processes with the aim of realizing specific benefits and transformative outcomes.

practices tend to increase production costs.[232] For farmers, purchase guarantees or price premiums for certified products can secure market access and provide the incentive to adopt practices that protect the environment. Often, higher prices compensate for the increased costs of production and farm management that are necessary to comply with sustainability standards.

Sustainability certification schemes can complement existing policies in multiple ways and blend purposefully into different arrangements and policy mixes. Governments can play a significant role in third-party voluntary sustainability certification schemes as supporters, facilitators and users.[233] The complementary role of these initiatives to inter-governmental regulatory frameworks and the success of some of these labelling initiatives is gaining in importance.[234]

Evidence on the effectiveness of these schemes differs between countries and products, but in general, sustainability certification schemes are found to improve environmental practices.[235] For example, in Brazil, Colombia, Costa Rica, Guatemala and Mexico, standards set by a multinational corporation were seen to improve the environmental conduct of certified smallholder coffee producers compared with their non-certified counterparts. In the Tapi River basin in Thailand, an area that produces up to 60 percent of palm oil in the country, crude oil palm producers certified by RSPO were found to produce the lowest environmental impacts, especially for global warming and photochemical ozone formation.[236] In Ethiopia, shade-grown coffee Rainforest Alliance certification programmes effectively alleviated forest degradation. As a result, sustainability certification schemes have been recognized as a valuable tool and are increasingly implanted in trade agreements.[237]

Certification schemes have become an important transnational tool in the context of sustainable development, as they provide incentives to embed a range of social and environmental issues on economic activities.[238] An increasing number of trade agreements contain references to such sustainability standards. Language in these agreements often refers to the commitment of countries to adopt or encourage the adoption of third-party voluntary sustainability certification schemes, with the strength of the language varying between agreements.[239] These provisions promote the use of sustainability certification schemes but do not condition trade to them.[240] A non-exhaustive overview of the trade agreements with embedded references to voluntary sustainability certification schemes is provided in Table 3.2.

An interesting case of an RTA that deepens this approach by explicitly using third-party voluntary sustainability certification schemes is the EFTA-CEPA Agreement, which entered into force in 2021 (see Table 3.2).[aq] Article 8.10 of the agreement notes that trade in vegetable oils should support the dissemination and use of sustainable standards, practices and guidelines for sustainably produced vegetable oils.[ar] Switzerland, which is the largest consumer market within EFTA, requires that all palm oil imports comply with one of the three globally recognized certifications: RSPO, the International Sustainability and Carbon Certification Plus (ISCC Plus) and the Palm Oil Innovation Group.[as] In order to facilitate traceability, palm oil should be imported in 22-tonne tanks to ensure that the origin of the palm oil can be traced back along the supply chain.[at] These conditions of Article 8.10 of the agreement are specified in national law with the Swiss Federal Council adopting this specific implementation of sustainability certificates. The details are regulated in the federal ordinance on the importation of sustainably produced palm oil from Indonesia, which entered into force at the same time as CEPA in August of 2021.[au]

aq See Chapter 8 of the Comprehensive Economic Partnership Agreement between the Republic of Indonesia and the EFTA States. https://www.efta.int/sites/default/files/documents/legal-texts/free-trade-relations/indonesia/efta-indonesia-main-agreement.pdf

ar See full text of the agreement: https://www.swissinfo.ch/resource/blob/46383572/622a1dad180b881b96e5ddac72661631/fta-indonesia-data.pdf

as See the permitted certification systems details: https://www.fedlex.admin.ch/eli/cc/2021/618/fr

at Trade Agreement Criteria between EFTA (Switzerland) – Indonesia. https://www.seco.admin.ch/seco/en/home/Aussenwirtschaftspolitik_Wirtschaftliche_Zusammenarbeit/Wirtschaftsbeziehungen/Freihandelsabkommen/partner_fha/partner_weltweit/indonesien.html

au See the Swiss federal ordinance: https://www.admin.ch/gov/en/start/documentation/media-releases.msg-id-85237.html

TABLE 3.2 SELECTED EXAMPLES OF REGIONAL TRADE AGREEMENTS WITH EMBEDDED REFERENCES TO VOLUNTARY CERTIFICATION SCHEMES

Agreement	Entry into force	Countries	Conditions
Framework Agreement Establishing a Free Trade Area between the Republic of Türkiye and the Republic of Korea	2013	Republic of Korea – Türkiye	"Parties agree to strive to facilitate and promote trade in goods that contribute to sustainable development, including goods that are the subject of schemes such as fair and ethical trade and those involving corporate social responsibility and accountability." *Chapter 5* Not subject to dispute settlement.
EFTA-Central America Free Trade Agreement	2014 (Pending for Guatemala; on hold for Honduras)	Iceland, Liechtenstein, Norway, Switzerland – Costa Rica and Panama	"Parties agree to promote trade in goods and services that are part of voluntary sustainability schemes." *Chapter 9* Not subject to dispute settlement.
Comprehensive and Economic Trade Agreement (CETA)	2017 (Provisionally)	European Union – Canada	"Parties agree to promote flows and practices that contribute to sustainable development by, among other actions, encouraging the development and use of voluntary schemes relating to the sustainable production of goods and services, such as eco-labelling and fairtrade schemes." *Chapters 22 and 24* Not subject to dispute settlement.
European Union-Mercosur Association Agreement	Agreement in principle announced in 2019, pending ratification	European Union – Argentina, Brazil Paraguay and Uruguay	"Members to the agreement may work together on voluntary sustainability or eco label schemes through experience of information sharing." *Chapter: Trade and Sustainable Development* Not subject to dispute settlement.
European Union-Viet Nam Trade Agreement	2020	European Union – Viet Nam	"Parties shall encourage adherence to practices that foster sustainable development, such as voluntary sustainability schemes." *Chapter 13* Not subject to dispute settlement.
EFTA-Indonesia Comprehensive Economic Partnership Agreement (CEPA)	2021	Iceland, Liechtenstein, Norway and Switzerland – Indonesia	"Parties agree to promote the development and use of certification schemes for forest-related products from sustainably managed forests." With regard to the vegetable oils sector, "Parties commit to applying national legislation, policies and practices protecting forests, peatlands and related ecosystems. Additionally, "Parties agree to support the dissemination and use of sustainability standards." *Chapter 8* Not subject to dispute settlement. Enforced through domestic legislation.

SOURCE: Compiled by FAO based on the original trade agreements.

What makes this case unique is that, taken together, the trade agreement and the national legislation effectively make imports of palm oil and its derivatives into Switzerland conditional upon a specific set of sustainability certification schemes, compared to simply encouraging the adoption of such schemes, and in a way it defers the enforcement of sustainable production to a foreign country. In line with this trend, negotiations started in 2020 between Costa Rica, Fiji, Iceland, New Zealand, Norway and Switzerland on an Agreement on Climate Change, Trade and Sustainability (ACCTS), which would also encourage the adoption of such voluntary sustainability standards. Early information indicates that under this agreement, work is underway to develop "principles-based guidelines for voluntary eco-labelling programmes, alongside institutional mechanisms to support their implementation."[241] This could indicate that voluntary sustainability certification schemes are becoming more deeply embedded. ■

AFRICA
A colourful local fruit market.
©Shutterstock.com/ D.Cz.

PART 4
THE AGRICULTURAL TRADE POLICY ENVIRONMENT

KEY MESSAGES

➔ Today's trade policy environment in food and agriculture, as shaped by the WTO, has discouraged unfair practices, reduced uncertainty and facilitated coordination between countries. The multilateral framework also provides a basis for regional trade agreements. Both multilateral and regional liberalization have contributed to expanding global trade.

➔ Deeper and more extensive regional trade agreements, which address both market access and regulatory convergence, are being developed and include food and agriculture. This has raised concerns about whether multilateral cooperation is weakening.

➔ Regional trade agreements create gains, including through promoting value chains. However, low-income countries, which have limited capacity to negotiate and implement complex trade provisions, may be left out of the trade integration process. Multilateral trade reform results in higher gains globally and is the most efficient way to promote market access and economic growth for all.

➔ Localized environmental externalities generated by trade can be addressed by trade policies complemented by national regulation. When these externalities are global, such as greenhouse gas emissions, unilateral or even regional actions will not be effective. Although difficult to negotiate and implement, only multilateral agreements can effectively address global environmental externalities. Trade rules can help expand the reach of policies that take into account the social costs of such externalities.

THE LANDSCAPE OF TRADE POLICY IN FOOD AND AGRICULTURE

The world started to become more globalized in the second half of the twentieth century, with an increasing number of low- and middle-income countries participating in global markets. Since the 1950s, members of the GATT and the WTO have formed more trade links and have become more closely interconnected than non-members.[av, 250, 251] Similar patterns have been found for food and agricultural trade (see Part 1).

At the same time, the structure of the global food and agricultural trade network has become more decentralized, and trade within regional clusters has increased more than across these clusters. This geography of trade is shaped by comparative advantage, trade policies and trade costs (see Part 2). In general, globalization and regionalization have evolved in parallel with each process complementing the other. While countries come together in the GATT/WTO to negotiate the global rules of trade, these rules are often complemented and deepened within RTAs.

av This could be due to reduced entry costs into new markets through increased transparency as offered by the WTO, but it could also be a reflection of the fact that countries that trade more have more incentive to join the WTO.

Multilateral negotiations under the General Agreement on Tariffs and Trade and the World Trade Organization

Established in 1947, the GATT aimed to promote trade by rolling back trade barriers, removing discriminatory trade policies that had prevailed since World War I and establishing an orderly and transparent international framework to benefit global growth and development.[252] This post-war trading system promoted trade and fast economic growth mainly in industrialized countries. The GATT rules applied to agriculture, but they contained significant loopholes that resulted in the implementation of import quotas and export subsidies, measures that were not normally allowed for manufactures.[253] As richer countries protected and subsidized their agricultural sectors, global agricultural markets became highly distorted, hindering the trade prospects of low-cost producers in the developing world. It was not until the negotiations of the Uruguay Round (1986–1994), the incarnation of GATT to the WTO and the WTO Agreement on Agriculture (AoA) that became effective in January 1995 that agricultural trade was explicitly included in the trade liberalization process.

The GATT/WTO established a forum for countries to regularly convene, resolve disputes and monitor changes in policies that affect trade.[254] One of the most fundamental rules of the WTO, the principle of non-discrimination, resulted in less distorted global markets.[aw] Evidence on the impact of GATT/WTO membership on merchandise trade is mixed and, on food and agricultural trade it is scarce.[ax] A study suggests that the GATT/WTO may have doubled the agricultural trade of its members in the period 1980 to 2004. Although import tariffs in food and agriculture were not reduced as much as those in other sectors (see Part 2, Figure 2.4), limits on agricultural subsidies and the coordination provided by the WTO framework reduced uncertainty and may have contributed to the expansion of trade.[255]

The WTO framework also promotes competition by discouraging unfair practices, such as export subsidies and dumping products at below normal value to gain market share. It encourages predictability through binding and transparency mechanisms, supports less developed countries by granting more flexible provisions and transition periods to adjust to these, and, in the case of the Trade Facilitation Agreement, provides for practical support for implementation and contributes to reducing trade costs.[256]

While the GATT was mainly concerned with improving market access by lowering trade barriers, the WTO extended and deepened its reach to include domestic ("behind-the-border") policies, such as regulation and intellectual property rights, in the reform process.[257] The AoA, in particular, includes provisions on market access, domestic support, export competition and other rules, such as on export prohibitions and restrictions, and explicitly considers the special and differential treatment of developing countries. The WTO agreements permit members to take measures to protect not only public, animal and plant health but also the environment (see Part 3).

Regulatory policies must not only be non-discriminatory, but they must also be transparent and must not restrict trade unnecessarily. Regulations on non-tariff measures under the Agreement on Technical Barriers to Trade and the Agreement on the Application of Sanitary and Phytosanitary Measures, many of which apply to food and agricultural products, have to be supported by scientific evidence (in the case of SPS measures) and should follow good regulatory practices. To ensure that regulations do not create unnecessary barriers to trade, they should ideally be based on international standards.[258, 259]

Although the WTO agreements, including the AoA, have succeeded in promoting trade by

aw The principle of non-discrimination means that a country should not discriminate between its trading partners and between its own and foreign products. See Part 3 for more details.

ax Examples of this research include Rose, A.K. 2004. Do we really know that the WTO increases trade? *American Economic Review*, 94(1): 98–114; Subramanian, A. & Wei, S.-J. 2007. The WTO promotes trade, strongly but unevenly. *Journal of International Economics*, 72(1): 151–175; Chang, P.-L. & Lee, M.-J. 2011. The WTO trade effect. *Journal of International Economics*, 85(1): 53–71; Eicher, T.S. & Henn, C. 2011. In search of WTO trade effects: Preferential trade agreements promote trade strongly, but unevenly. *Journal of International Economics*, 83(2): 137–153; Gil-Pareja, S., Llorca-Vivero, R. & Martínez-Serrano, J.A. 2016. A Re-Examination of the effect of GATT/WTO on trade. *Open Economies Review*, 27(3): 561–584; and Esteve-Pérez, S., Gil-Pareja, S. & Llorca-Vivero, R. 2020. Does the GATT/WTO promote trade? After all, Rose was right. *Review of World Economics*, 156(2): 377–405.

BOX 4.1 THE POLITICAL ECONOMY OF PROTECTION OF FOOD AND AGRICULTURE

Governments protect agriculture for various reasons but ensuring food security and maintaining a level of farm income that keeps pace with the income trends in other economic sectors, makes agricultural trade policy and domestic support extremely sensitive. Agriculture's position in a country's structural transformation – that is, the reallocation of economic activities away from agriculture to industry and services that promotes economic growth – also shapes the demand for and the provision of protection at different stages of the development process.

Along the path of structural transformation, agriculture's relative importance declines as the economy grows. Increases in agricultural productivity per capita mean that fewer people can produce more food. Workers move from agriculture to fast-growing non-farm sectors of the economy, such as manufacturing and services, in search of better economic opportunities and agriculture's share in total employment declines. The society becomes more urbanized and as people become progressively richer, they consume more manufactured goods and services, while the demand for food rises at a lower rate. This makes the share of agriculture in gross domestic product fall. At the end of the transformation process, agriculture's share in the economy is small and its productivity per capita resembles that of other sectors.

For today's high-income countries, structural transformation lasted for more than 100 years. For countries such as the Republic of Korea, the transformation from an agriculture-based to an industry- and service-based economy took much less time.[343] Economists suggest that protecting agriculture is not efficient and that it can hinder structural transformation in fast-growing economies with non-farm sectors characterized by comparative advantage. Indeed, the evidence suggests that in the nineteenth century, free trade contributed to the structural transformation of the United Kingdom of Great Britain and Ireland, as it was then known, as cheaper food imports facilitated rural-urban migration. Between 1965 and 2015, food imports also allowed the Republic of Korea to transform its economy. If the country had not protected its agricultural sector, a higher level of food imports would have accelerated its structural transformation even more.[344]

However, when the non-farm sectors of the economy do not grow quickly, structural transformation can worsen the distribution of income between rural and urban economies, especially when the rural-urban migration is lagging behind. Relatively slow growth in farm incomes during the process of structural transformation creates significant social challenges for policy makers. Although absolute poverty falls as the economy grows, the increasing gap between rural and urban incomes results in political tensions. In some cases, poverty may increase, especially when the economy grows slowly and people find it difficult to exit agriculture.

The solution would be to increase investments, promote education and to introduce measures so that labour markets function well helping people to move from agriculture to other economic sectors. However, this takes time and historically the response to such challenges has been to protect the agricultural sector from international competition and to support farm incomes.[345] For example, in the United States of America, the integration of agriculture into the non-farm economy was not fully completed until the 1980s.[346] Indeed, trade policies, when analysed in the context

making it freer, fairer and more predictable, further progress in improving these rules has been limited. The latest round of multilateral negotiations, the Doha Round, which was launched in 2001, stalled at the end of the first decade of the twenty-first century for many reasons, including divergent views on issues related to agriculture among negotiating members (see Box 4.1).[260, 261]

WTO members agreed on eliminating agricultural export subsidies at the WTO Ministerial Conference held in Nairobi in 2015, and established the Trade Facilitation Agreement, which became effective in February 2017. However, several areas related to agriculture, such as market access, the treatment of public food stockholding and agricultural domestic support, remain under discussion. The size and

BOX 4.1 (Continued)

of structural transformation, can be seen as outcomes of a political process that balance the preferences of different social groups.

Today, as developing countries move along their structural transformation paths, and depending on the rural-urban income gap, the size of their agricultural sector, poverty and food security considerations, the demand to protect agriculture and support farmers increases. In this context, addressing the uneven income distribution between urban and rural areas and ensuring food security using domestic support and trade policies is challenging. For example, the use of administered prices by some developing countries to build public food stockholdings for food security purposes has become contentious.

While some countries maintain that the use of administered prices is trade-distorting and, therefore, should be identified as such in line with WTO rules, others, especially those that implement large food aid programmes, see that WTO disciplines restrict their policy instrument set in providing public goods and carrying out income redistribution.[347, 348]

Social preferences change along the development path and so does the demand for policies. Policy makers are confronted with the need for solutions to balance these preferences, meet multiple objectives and address global challenges. Today, most people are increasingly aware of connectivity between economies, the environment and social well-being, and attach great importance to the outcomes of globalization. Trade, as all economic activities, creates winners and losers and this impact may be large. It can also generate negative environmental or social externalities. In food and agriculture, although trade policies and domestic support address a broad array of mostly economic objectives, they are also viewed as tools to deliver environmental benefits[349] or healthier diets.[350]

Current discussions on repurposing agricultural support and trade policies bring an additional dimension to the debate on how to harness global markets to contribute towards sustainable development. Nevertheless, using only the current set of trade policy instruments may be costly and insufficient to achieve all sustainability targets, especially when trade policy does not directly affect the source of externalities. Challenges such as climate change mitigation or better nutrition should be tackled by targeted policies that act on the relevant margin, that is by policies that directly influence the choices producers and consumers make.[351]

diversity of the WTO – covering most countries of the world – coupled with shifts in economic power among its members, have resulted in difficulties in achieving consensus, especially as issues on the negotiating table have become more complex, such as the concerns related to the impact of trade on environmental and social sustainability, for example.[262, 263]

The proliferation of regional trade agreements

With the deadlock in multilateral trade negotiations, RTAs have emerged even more rapidly.[264] By limiting the number of countries involved and focusing on their strategic interests, RTAs can be more targeted and can be concluded more easily than multilateral negotiations, where a large number of countries and divergent views result in a lack of consensus. While the WTO has taken some significant steps towards behind-the-border convergence in regulations, many RTAs envisage much deeper levels of integration among their signatories.[265, 266]

While the number of RTAs in force has rapidly increased (see Box 1.2),[267] at the same time the average number of policy areas with (legally binding) provisions contained in RTAs has also increased steadily from an average of around 8 policy areas in the 1990s to more than 17 over the period 2010 to 2015.[268] The agricultural sector appears to be increasingly included in RTAs. In analysing 54 RTAs, a recent study found that agriculture is progressively treated similarly to other sectors, although many agreements still exclude some agricultural products from specific provisions.[269] In agriculture, RTAs may facilitate

deeper integration by harmonizing NTMs, including technical and food safety standards and domestic regulations, in areas in which multilateral negotiations have made little progress as preferences across countries worldwide diverge widely.[270] However, RTAs usually do not address (potentially trade-distorting) domestic support to agriculture.[271]

RTAs, by definition, imply concessions between signatories, while excluding others. This has raised concerns about the erosion of non-discrimination, one of the most fundamental principles of the WTO multilateral trade system.[ay, 272, 273] RTAs give preference to members, which can create trade between signatories and divert trade away from non-signatories. This may lead to inefficient outcomes or even to the fragmentation of global trade in competing blocs, thus hindering global integration.[274, 275]

Their proliferation and the fact that many RTAs overlap (see Box 4.3 for an example) has given rise to the claim that RTAs can also be "building blocks" toward multilateral trade reform. However, such overlapping of RTAs can pose significant challenges for compliance and transparency due to multiple rules with respect to tariffs, NTMs and rules of origin,[az, 276] which can differ by agreement, trading partner and product, and can even lead to conflicting regulatory standards across different trading blocs, thus raising trade costs.[277, 278, 279, 280] Negotiating and implementing an RTA requires considerable resources, which could be beyond the reach of many countries.[281]

Studies have found mixed evidence on the impact of RTAs on trade.[282, 283] A study investigating the effects of RTAs on agricultural trade, based on more than 60 agreements, found that the increase in trade among signatories was much larger in agriculture compared to non-agriculture. The analysts attributed this to the larger gains from liberalization due to relatively high levels of protection in agriculture before the RTA entered into force. The effects were also found to differ across specific agreements and were subject to the length of their phase-in periods.[284]

The impact of RTAs on trade depends on the provisions of the agreement and the characteristics of the countries involved.[285] Recent trade agreements no longer emphasize market access but instead focus on behind-the-border regulatory issues, including domestic policy coordination in a much broader sense.[286, 287] Many RTAs pursue deeper integration in the sense of going far beyond the traditional shallow trade liberalization agenda. These agreements are often much more complex as they tend to pursue economic objectives and to add provisions targeting social and environmental sustainability outcomes (see Part 3).[288, 289]

The evidence of the effects of deep RTAs on trade is mixed. A study suggests that deeper trade agreements can create more trade and be less likely to divert trade than traditional regional agreements due to improvements in domestic policies, such as competition policies and institutions, which are especially relevant in the presence of global value chains.[290]

An analysis of the impact of deeper trade agreements in a group of 96 countries during the period 2002–2014 suggests that merchandise trade between signatories can increase up to 44 percent, which is much more than a traditional shallow trade agreement based only on preferential tariffs. The trade-diverting effect of preferential tariffs is found to be offset due to changes in regulations in the signatory countries that strengthen competition and improve custom procedures, thus benefiting non-signatories too.[291, 292] Although RTA trade provisions that are also part of the WTO's mandate and those that enhance institutional quality are generally trade promoting, this does not need to be the case for deeper provisions beyond the scope of the WTO.[293] There are also concerns about the welfare implications of special interests and lobbies that engage in deeper RTA negotiations (Box 4.2).

ay RTAs are allowed under Article XXIV of the GATT, which includes a special exception to the WTO's fundamental principle of non-discrimination. Moreover, Paragraph 2(c) of the 1979 Decision on Differential and More Favourable Treatment, Reciprocity and Fuller Participation of Developing Countries – also known as the "Enabling Clause" – allows for trade arrangements covering trade in goods between developing countries.

az Rules of origin refer to criteria to establish where a product was made. They are important in identifying whether goods qualify for preferential treatment within an RTA because they originate in one of the RTA signatory countries and are not merely re-exported.

BOX 4.2 DEEP TRADE AGREEMENTS

The establishment of the WTO in 1995 reduced tariff levels, promoted trade and provided a set of rules that shaped the international trade system. Together with the process towards liberalization, the number of RTAs increased significantly, raising concerns about the future of multilateralism (see Part 1, Box 1.2 and Figure 1.12). Trade liberalization accelerated with most RTAs focusing on market access and import tariff reductions between the signatories. At that time, few agreements, such as NAFTA signed in 1994, went beyond market access and included environmental and labour issues. Recent trade agreements go beyond market access and aim at deeper trade integration, focusing on harmonizing non-tariff measures and domestic regulations.

The reasons for this shift from relatively shallow to deeper trade agreements are multifaceted. Countries may believe that the gains from traditional trade agreements have been exhausted after decades of progressive globalization. When global value chains are important, deeper trade agreements can reduce trade costs related to compliance with multiple and different standards. Another important consideration is the increasing level of awareness of consumers over the impacts of their purchasing choices on foreign countries. Increasing environmental and social concerns give rise to stringent environmental and labour standards for domestic products, which would be subject to foreign competition from imports from countries with lower standards (see Part 3). Countries may sign deeper trade agreements to facilitate domestic economic reforms.[352]

Deeper trade agreements shift attention to non-tariff measures and, generally, promote the harmonization of practices and processes across signatories, with the aim of reducing trade costs.[353] These agreements go "behind-the-border" and promote cooperation in a broad set of areas, including investment, trade facilitation, standards, competition policy, environmental issues, labour rights and other. In this way, they expand the WTO disciplines or extend their reach beyond the WTO set of rules. Some recent agreements establish institutions that oversee the coordination of regulatory agencies in the signatory countries, such as the Regulatory Cooperation Forum of the Comprehensive Economic and Trade Agreement between the European Union and Canada (see also Part 3). Because of their influence on domestic policies, deeper trade agreements have in some cases triggered strong popular opposition and a recent study explores how globalization shocks evoked anti-trade sentiment and influenced voter preferences against trade openness.[354]

There is little evidence of the welfare impacts of deeper trade agreements in food and agriculture globally. Nevertheless, the welfare implications of deep trade agreements are difficult to measure. Many low-income countries may not have the capacity to engage in complex negotiations and reform domestic policies, develop implementation instruments and meet the regulatory standards of developed economies.

The process of negotiations on non-tariff measures, such as standards, is also important. Negotiations for shallow trade agreements that focus on market access tend to dilute the influence of special interests as lobbies for exporters act as counterweights to import-competing lobbies. This can result in increased welfare. For deeper trade agreements, the extent to which special interests align across signatory countries deserves close attention. When deep trade agreements promote the convergence of product standards, the result will depend on whether special interests in signatory countries are aligned or in conflict. For example, industry interests may be

The degree to which governments negotiate comprehensive and deeper trade agreements appears to be positively related to their level of economic development – the richer a country, the deeper its trade agreements. RTAs are also deeper when more WTO members are involved in the agreement, as provisions contained in RTAs usually build on existing WTO policies. Indeed, WTO members appear to use RTAs not to undermine or circumvent the rules, but rather to build on trade-promoting policies embedded in the multilateral system.[294, 295] ■

BOX 4.2 (Continued)

aligned across countries, as all firms would benefit from less regulation, and this may result in adverse welfare implications.[355, 356] Analysts suggest that in the context of negotiations on the Transatlantic Trade and Investment Partnership (which concluded without an agreement), the engagement of special interest groups was very different from that in traditional trade agreements.[357]

Agriculture remains a contentious sector when it comes to trade negotiations. Its direct linkages with food security, food safety and health, and culture and heritage help explain why this is the case. In addition to the implications for production costs, differences in standards in food and agriculture also raise food quality and food safety concerns in importing countries.

For example, an analysis of submissions to the consultations of the United States Trade Representative in the context of negotiations for the Transatlantic Trade and Investment Partnership suggests that there was almost no opposition by industry interests to the negotiations, and conflict was observed only in agriculture where business interests were not aligned.[358]

The ongoing trade agreement discussions between the United States of America and the United Kingdom of Great Britain and Northern Ireland following the latter's exit from the European Union illustrates the divergent views over standards in food and agriculture. British producers and consumers expressed concern over the possibility of allowing food and agricultural imports from producers required to meet less stringent regulations in the United States of America. These concerns are related to production costs, food quality and food safety. American producers, on the other hand, perceive additional regulations as an unnecessary and unjustifiable burden to their production processes.[359]

Before Brexit, most British pork and poultry import needs were met by European Union members, and the possibility of sourcing poultry from the United States of America to fill import gaps illustrates producer and consumer concerns. In the United States of America, it is mandatory for all producers to treat chicken with antimicrobial rinses, known as pathogen reduction treatments, to eliminate potentially harmful pathogens. There is concern that this practice is a disincentive for having high standards throughout the supply chain, since the rinse at the end is meant to ensure food safety. This, together with economies of scale, can lower production costs.[360] While imports of chicken from the United States of America could have a negative impact on farmers' incomes, British consumers would benefit from the lower priced chicken. Nevertheless, British consumers perceive chicken imported from the United States of America to be of lower quality and they have concerns about consuming chicken treated with an antimicrobial rinse. The antimicrobial rinse practice is safe but ensuring food safety through a single control point in the value chain could raise food safety risks to consumers if that control were to fail.[361]

THE GAINS FROM TRADE: MULTILATERAL TRADE LIBERALIZATION AND REGIONAL TRADE AGREEMENTS

While multilateral negotiations are in a stalemate and RTAs are proliferating, the welfare effects of RTAs, that is the effects on the economic performance of their signatories and the rest of the world, can be very different from the overall gains from trade derived in a multilateral setting.

Deeper agreements not only improve market access through preferential tariffs but can also minimize trade costs through the convergence of domestic regulation and harmonizing NTMs. In a world of deeper integration and frictionless trade – with no tariffs and no trade costs – trade flows would be shaped by comparative advantage derived from differences in technology and resource endowments (see Parts 2 and 3). Food and agricultural products would meet consumers' preferences from around the world and be sourced from the most efficient producer

globally. Compared to deep integration at the global level, an RTA would create incentives to the signatories of the agreement to trade relatively more among themselves than with the rest of the world – the trade creation effect. Because products would be sourced from signatory countries, this could divert trade away from other, potentially more efficient, producers elsewhere in the world – the trade diversion effect.[ba]

For example, liberalization and economic integration in the European Union between 1985 and 2000 was found to have increased the intra-European Union trade of six major food and agricultural products. However, some of this increase came at the expense of countries outside the European Union due to reductions in the level of imports by the European Union from these countries.[296] A study investigating the agricultural trade patterns of 50 countries that are signatories of five major RTAs during the period 2005–2014 found both trade creation and trade diversion effects but concluded that, in agriculture, trade creation prevailed, as the increase in trade between signatories was larger than the trade reduction experienced by non-participating countries.[297]

Simulations using a model of the global economy illustrate these trade creation and diversion effects. The model was used to identify the potential effects of deeper integration, reflected by the hypothesis of no trade policies and no trade costs: (i) globally; (ii) on Africa only, inspired by AfCFTA; and (iii) on Eastern and South-eastern Asia and Oceania inspired by RCEP. In all three scenarios, trade barriers, as determined by border measures such as tariffs, non-tariff measures and transportation and logistics costs are reduced to zero in order to isolate the relative effects of multilateral and regional trade integration (see Box 4.3).[298]

While tariffs are often reduced or removed during the liberalization process at both the multilateral and regional levels, other trade costs can also be reduced through trade facilitation and harmonizing standards (see Box 4.2). At the multilateral level, the WTO Trade Facilitation Agreement aims to expedite border procedures. Trade facilitating measures are also suggested as a policy priority at the regional level, especially in Africa.[299] Elsewhere, a study based on Peruvian customs data shows that trade facilitation provisions in RTAs can reduce trade costs and enhance the export competitiveness of value chains in the RTA signatory countries.[300] Lower trade barriers can promote regional value chains and contribute to growth in agriculture and the food industry. Lower tariffs and harmonized NTMs facilitate global and regional value chain participation and promote value added creation, as they make it easier for products to cross multiple borders.[301]

Trade cost reductions can also be achieved by harmonizing standards.[302, 303, 304] At the multilateral level, both the WTO SPS and TBT Agreements encourage countries to build their national measures on international standards, such as those recommended by the FAO/WHO Codex Alimentarius Commission.[305, 306] At the regional level, many RTAs foresee a harmonization of their standards or provide for the mutual recognition of domestic standards. For example, the Deep and Comprehensive Free Trade Areas (DCFTAs) of the European Union with Georgia, the Republic of Moldova and Ukraine suggest that SPS measures by the three countries converge towards the European Union legislation.[307, 308, 309]

In the hypothetical scenario of globally frictionless trade, food and agricultural trade would significantly increase in all regions (Figure 4.1). Regions that are relatively more competitive, such as Eastern and South-eastern Asia and Oceania, would increase their food and agricultural exports by up to 470 percent. Exports from Africa and Latin America and the Caribbean are projected to increase the least, but they would still more than double. Some countries in Latin America and the Caribbean are already strong exporters and may, therefore, be closer to their export potential. On average, as African countries are characterized by low productivity per worker and are less competitive (see Part 2), they may not

ba In addition, if countries outside the RTA enjoyed preferential treatment by one or more countries that have newly concluded an RTA (which lowers the trade costs among its signatories), the outside countries could lose the relative advantage they previously had – the preference erosion effect of new RTAs.

BOX 4.3 ANALYSING ECONOMIC INTEGRATION AND TRADE COST REDUCTION SCENARIOS

A computable general equilibrium model – a model of the global economy including agriculture and the food sector – is used to simulate the effects of different liberalization and trade cost reduction scenarios. The simulation exercise considers a full liberalization and deep trade integration scenario which entails the removal of all border measures, such as tariffs, non-tariff barriers and transport costs in all sectors, including food and agriculture.

This hypothetical scenario of "frictionless trade" results in the free movement of goods, services and capital between countries. Tariffs are set to zero to reflect trade liberalization, non-tariff measures are removed to reflect that regulatory and legal frameworks have converged and the same rules apply throughout the world or region. Transport costs are also removed to reflect improvements in infrastructure, highlight the influence of comparative advantage and completely isolate the effects of trade integration.

Simulations on these policy packages have been applied at the global level and for selected regions and are specified in Table 4.1. As the model is a stylized representation of the economies involved and specific details on the type of deeper integration cannot be accommodated, the results should be interpreted with care: the mechanisms and direction of impacts matter more than the size of the effects.

Three scenarios are considered: the first one includes a global liberalization and integration, where transport costs, non-tariff barriers and all border measures are eliminated; the second scenario is inspired by AfCFTA and illustrates the direction of the effects that a full agreement may bring to the region and the world; the third scenario is an illustration of a deeper regional integration in Asia and Oceania inspired by RCEP.

TABLE 4.1 SCENARIO ASSUMPTIONS

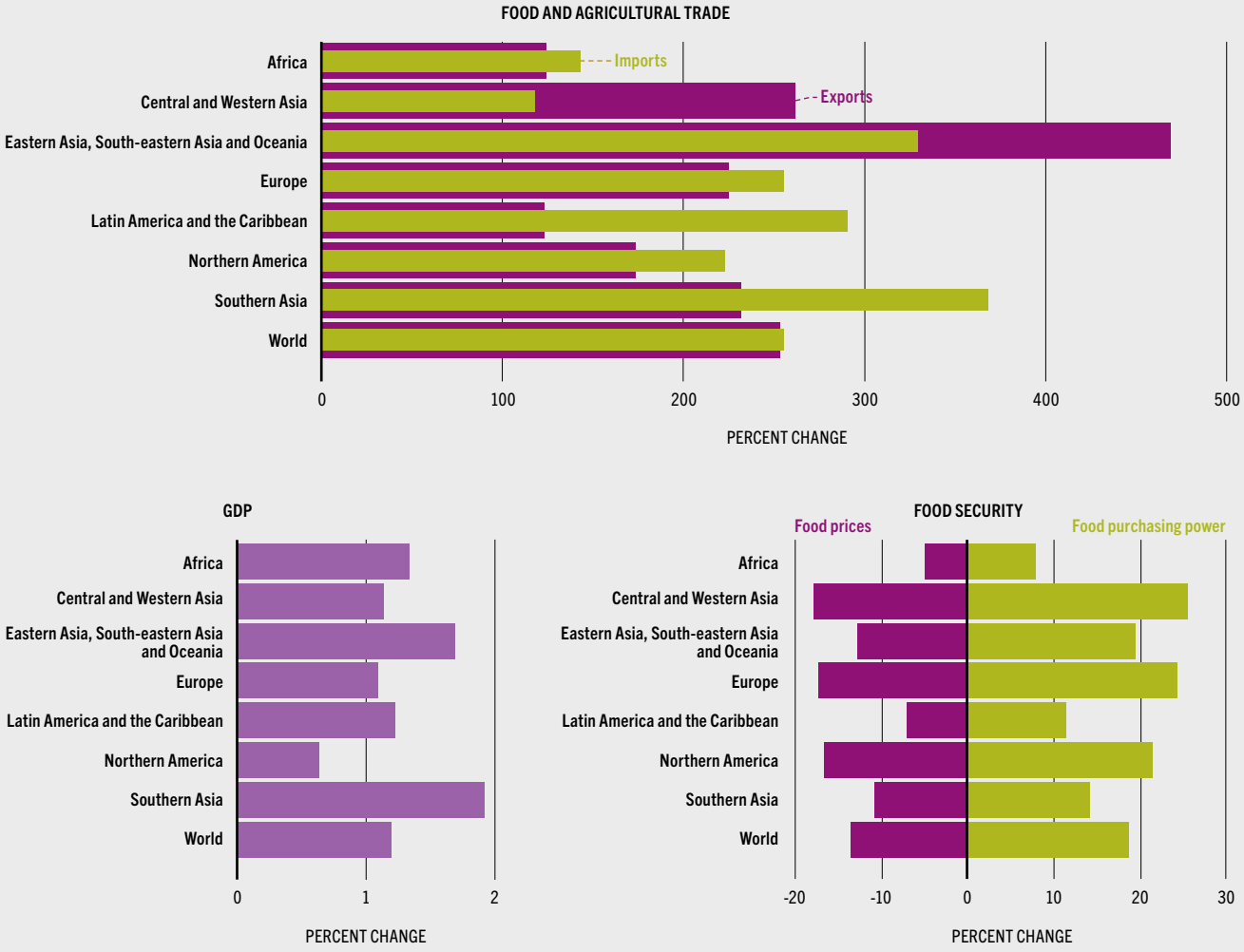
Hypothetical scenario	Description	Trade costs removed
Global integration	Removal of all border measures and trade costs globally	Border measures, non-tariff barriers, transport costs
Regional integration Africa	Removal of all border measures and trade costs in Africa	Border measures, non-tariff barriers, transport costs
Regional integration Asia and Oceania	Removal of all border measures and trade costs in Eastern and South-eastern Asia and Oceania	Border measures, non-tariff barriers, transport costs

NOTE: More details about the computable general equilibrium model used and the simulations can be found at Laborde, D. & Piñeiro, V. 2022. The impact of changes in the fundamental drivers of trade – Productivity, trade costs and trade policies. Background paper for *The State of Agricultural Commodity Markets 2022*. Rome, FAO.

be able to expand their exports as significantly as other regions, even under frictionless trade. With zero tariffs and no trade costs, food and agricultural imports to Africa are expected to increase by 140 percent. This impact is smaller than in other regions due to the lower purchasing power of African consumers. Overall, the hypothetical elimination of trade costs results in an increase in imports by low-income countries in the region to address food consumption requirements (see Part 2).

Under the hypothesis of worldwide frictionless trade, GDP would increase in all regions (Figure 4.1). As trade flows would reshape in a way that countries can import each product from the most efficient producers, food prices would decline in all regions, but relatively less in Africa where productivity per worker is low and relatively lower incomes result in fewer imports. Increasing wages and lower food prices would improve food purchasing power, which would promote food security globally.

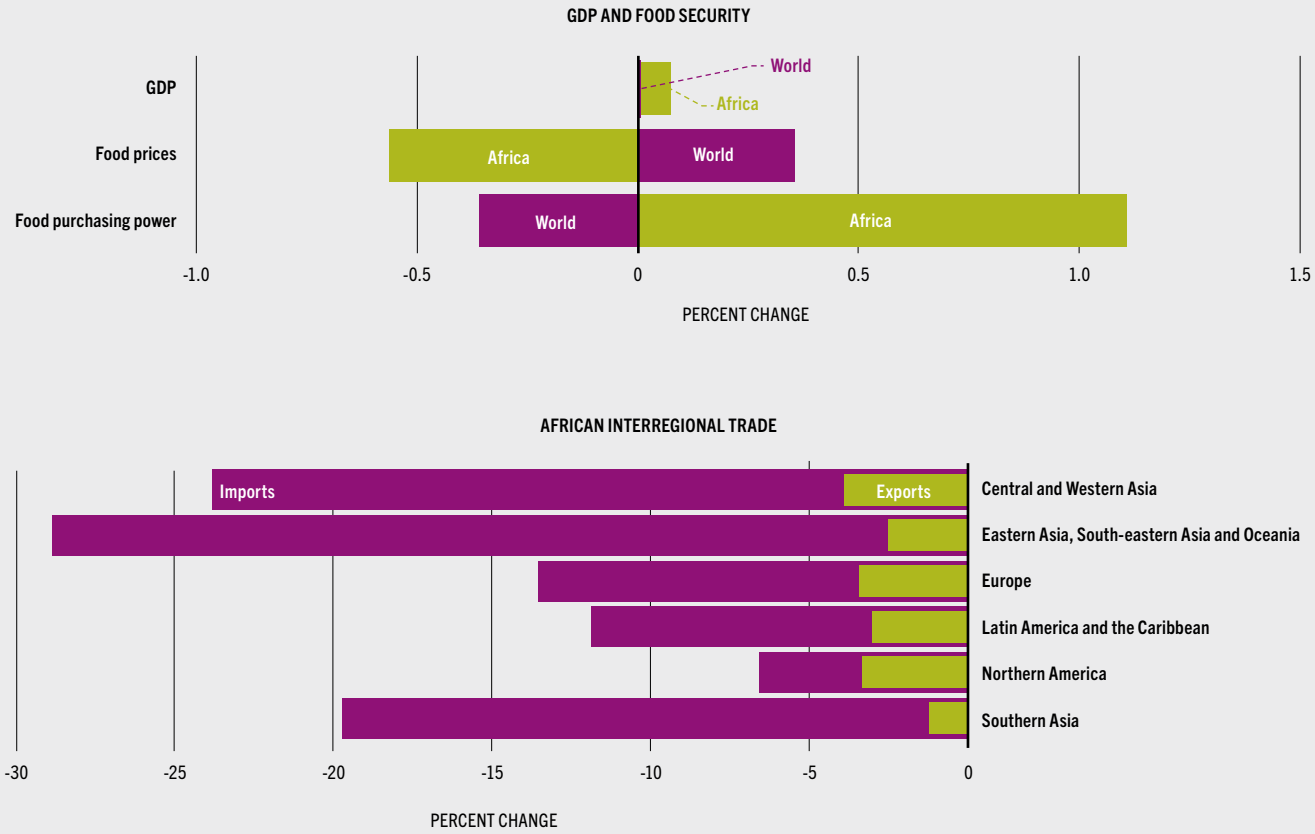
FIGURE 4.1 MULTILATERAL LIBERALIZATION AND INTEGRATION: EFFECTS ON GDP, FOOD SECURITY, AND FOOD AND AGRICULTURAL TRADE



SOURCE: Laborde, D. & Piñeiro, V. 2022. The impact of changes in the fundamental drivers of trade – Productivity, trade costs and trade policies. Background paper for *The State of Agricultural Commodity Markets 2022*. Rome, FAO.

The two regional trade integration scenarios inspired by AfCFTA and RCEP (see Boxes 4.4 and 4.5) should be understood as an illustration of the potential effects if all border measures, transport costs and non-tariff barriers were removed in Africa or Eastern Asia, South-eastern Asia and Oceania. In both the Africa and the Eastern Asia, South-eastern Asia and Oceania integration scenarios, economic impacts would mainly affect the respective regions (Figures 4.2 and 4.3). Because trade would become frictionless only in these regional markets, mimicking the realization of deeper trade agreements, but not in the rest of the world, the effects would remain below those projected in the global trade integration scenario, for both Africa and the Eastern and South-eastern Asia and Oceania regions and for the world as a whole.

FIGURE 4.2 LIBERALIZATION AND INTEGRATION IN AFRICA: EFFECTS ON GDP, FOOD SECURITY, AND FOOD AND AGRICULTURAL TRADE



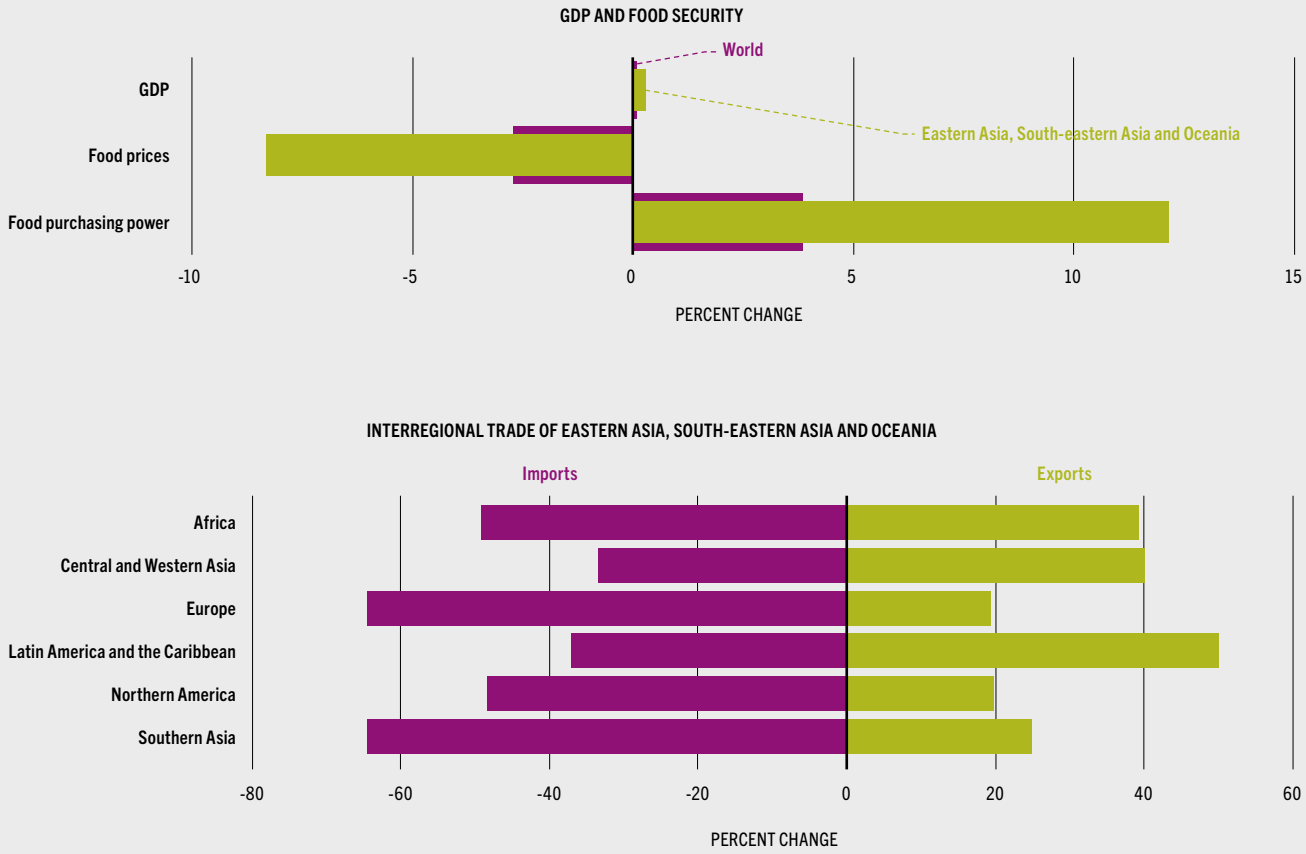
SOURCE: Laborde, D. & Piñeiro, V. 2022. The impact of changes in the fundamental drivers of trade – Productivity, trade costs and trade policies. Background paper for *The State of Agricultural Commodity Markets 2022*. Rome, FAO.

In the Africa trade integration scenario, the food and agricultural exports and imports of African countries would increase.[310] With deeper integration, that implies the removal of significant trade costs, intra-African trade would increase significantly by up to 300 percent,[bb] but trade with other regions, in particular African imports of food and agricultural products from other regions, would decline (Figure 4.2). Exports to other regions would also decline. Thus, on average, removing all trade barriers in Africa only could potentially create intra-African trade but divert trade away from countries outside the region with a higher willingness to pay (in case of importers of African products) or more efficient providers of certain products (in case of exporters to Africa).

Still, the removal of all trade barriers within Africa would lower food prices in Africa, increase GDP and improve food purchasing power.

bb A study by the United Nations Economic Commission for Africa suggests that, with the sole removal of tariffs on goods, the increase in intra-African trade of food and agricultural products could range between 20 and 30 percent. The expansion would be greater, if trade in services was also liberalized and if non-tariff barriers and other trade costs were removed, as shown in this report. See United Nations. Economic Commission for Africa. 2018. An empirical assessment of the African Continental Free Trade Area modalities on goods. Addis Ababa.

FIGURE 4.3 LIBERALIZATION AND INTEGRATION IN ASIA AND OCEANIA: EFFECTS ON GDP, FOOD SECURITY, AND FOOD AND AGRICULTURAL TRADE



SOURCE: Laborde, D. & Piñeiro, V. 2022. The impact of changes in the fundamental drivers of trade – Productivity, trade costs and trade policies. Background paper for *The State of Agricultural Commodity Markets 2022*. Rome, FAO.

However, as comparative advantage would not be able to play out globally, these improvements in Africa would be much lower than in a situation with frictionless trade worldwide. At the global level, food prices might even slightly increase.

In the trade integration scenario for Eastern and South-eastern Asia and Oceania, intra-regional trade would increase by up to 700 percent, leveraging a relatively high comparative advantage and no trade costs. Exports to other regions would also increase, fueling falling food prices in the rest of the world. Imports from other regions might decline (Figure 4.3).

In both regional integration scenarios, income, as measured by GDP, increases to a lesser extent as compared to the scenario of frictionless trade across the world. As comparative advantage cannot influence trade globally, regional trade integration results in trade being diverted away from more efficient producers outside the integrated regions. This adds to the findings of other studies that trade agreements are inherently discriminatory – they create trade between the signatory countries but divert trade away from the rest of the world – and multilateral trade integration is the most efficient way to promote market access and economic growth for all.[311, 312] ■

BOX 4.4 THE AFRICAN CONTINENTAL FREE TRADE AREA

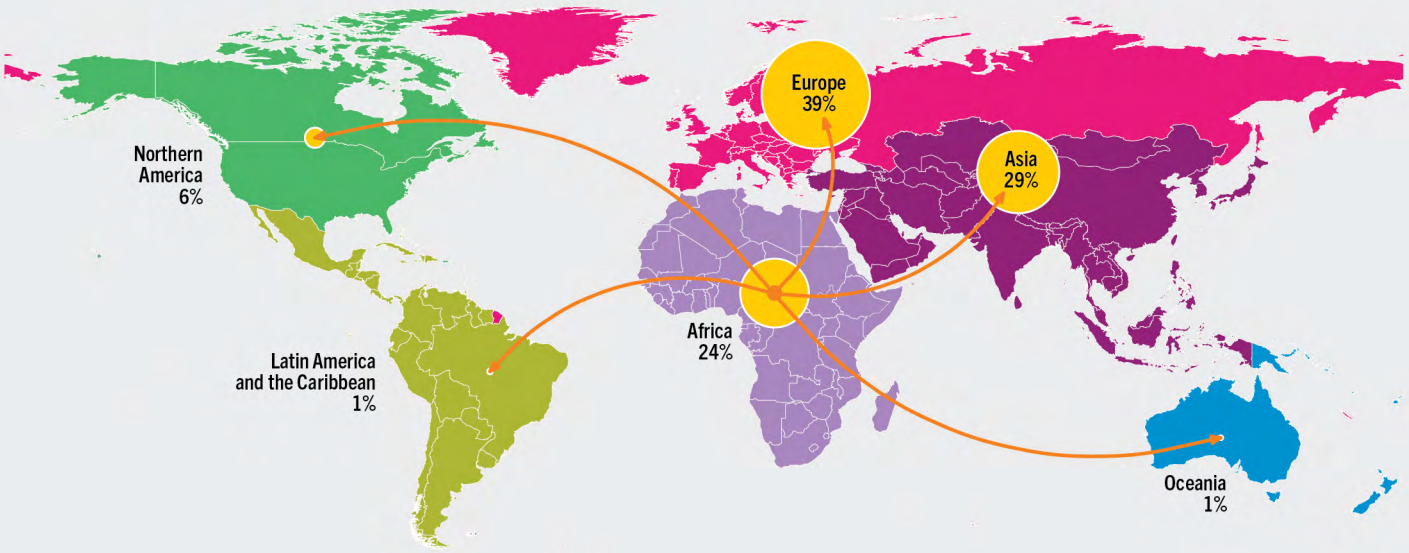
The decision to establish a Continental Free Trade Area was approved by the eighteenth ordinary Session of Assembly of the African Union Heads of State and Government, held in Addis Ababa, Ethiopia in January 2012. This initiative is a flagship project of Agenda 2063 of the African Union – Africa's own development vision. The agreement establishing the AfCFTA entered into force on 30 May 2019, covering 54 of the 55 African Union Member States, 43 of which have ratified the agreement so far.[362, 363]

AfCFTA aims to create, through successive rounds of negotiations, a single market for goods and services to deepen the economic integration of the African continent and to lay the foundation to establish a continental customs union at a later stage. This will be achieved through the gradual removal of tariffs on at least 90 percent of over 5 000 tariff lines. The reduction of tariffs is seen as having significant potential to increase intra-regional trade.[364, 365, 366] The agreement includes the mutual recognition of standards and licenses and the harmonization of plant import requirements and SPS measures to facilitate trade.[367]

AfCFTA will overlap with several regional economic communities already in force in Africa. These include COMESA, East African Community (EAC), the Economic Community of West African States (ECOWAS), the South African Development Community (SADC), the Intergovernmental Authority on Development (IGAD), the Economic Community of Central African States (ECCAS), the Community of Sahel-Saharan States (CEN-SAD) and the Arab Maghreb Union (AMU). There are also several other unions and communities with greater levels of economic integration, such as the South African Customs Union (SACU), the West African Economic and Monetary Union (WAEMU) and the Economic and Monetary Community of Central Africa (CEMAC). One important issue is how the AfCFTA will coordinate and build on these existing regional structures.

To assess the potential trade-creating impact of AfCFTA, it is important to understand the current trade patterns in African countries. Only 8 percent of African merchandise exports are directed toward Africa, suggesting that there are important constraints (for instance, high trade costs) to intra-regional trade.[368]

FIGURE 4.4 INTRA-AFRICAN EXPORTS AND AFRICAN EXPORTS TO OTHER REGIONS, FOOD AND AGRICULTURAL PRODUCTS, 2019



SOURCE: FAO.

BOX 4.4 (Continued)

As for agriculture, almost 40 percent of Africa's agricultural products are exported to Europe (see Figure 4.4), while intra-African agricultural trade is regionally concentrated, mostly centred around South Africa, which is both the major exporter and importer.[369]

However, there are significant differences by product. For instance, the 2021 Africa Agriculture Trade Monitor[370] finds that while the share of intra-African imports in total African imports is low for cereals, it is high for some fruits and vegetables, such as tomatoes and citrus fruit. The evidence shows that the number of trade links between African countries grew substantially between 2003 and 2019 for ten key agricultural products. Still, while rising incomes are fuelling demand for diversified diets in the region, meeting this demand with imports from within the region will require significant efforts in overcoming supply-side constraints, such as low levels of agricultural productivity and infrastructure gaps.

SOURCE: Adapted from FAO. 2022. *Agricultural trade in the Global South – An overview of trends in performance, vulnerabilities, and policy frameworks*. Rome, FAO.

TRADE AND ENVIRONMENTAL EXTERNALITIES: MULTILATERAL AND REGIONAL POLICY SOLUTIONS

Issues related to environmental externalities generated by food and agricultural trade have been receiving attention from both multilateral and regional trade perspectives. Non-tariff measures, such as the prohibition of imports that have a negative impact on the environment, or environment-related provisions and standards play a key role in addressing the impact of trade on natural resources, pollution, biodiversity and climate change (see Part 3).

Most of the environmental impacts of trade depend on local conditions, with trade often generating environmental externalities in poorly regulated contexts. Many externalities can be local or regional, such as unsustainable groundwater withdrawals, land degradation or pollution. However, the most challenging environmental externalities are broadly spread. For example, biodiversity loss may be localized but biodiversity and ecosystems are globally valued. GHG emissions represent a truly global externality. For example, agricultural production or deforestation takes place in a region, but the related effects of climate change also occur in a location that is distant from where GHGs have been released into the atmosphere.[313, 314] The extent to which environmental externalities are localized or spread globally is important in a trade policy context.

Within a trade policy context, such as the multilateral trade system as it is shaped by WTO rules and regulations, environmental externalities are addressed through the dispute settlement mechanism or domestic regulation that gives rise to a multitude of non-tariff measures and standards covered by the TBT Agreement (see for example Box 3.3 and the discussion in Part 3). Between 2008 and 2019, the number of environment-related non-tariff measures notified under the TBT Agreement increased steadily, and, on average, accounted for approximately 15 percent of all technical regulations and standards used by governments to advance a variety of public policy objectives, including health, safety or environmental protection. The most frequently cited environmental objectives include soil and water pollution abatement, energy conservation, or plant and forestry conservation.[315]

The heterogeneity of regulations and standards across countries result in significant compliance costs (see Part 2), and deeper RTAs aim toward

BOX 4.5 THE REGIONAL COMPREHENSIVE ECONOMIC PARTNERSHIP

RCEP is composed of 15 countries across Asia and Oceania, including the ten signatories of the Association of Southeast Asian Nations (ASEAN) and five regional partners: Australia, China, Japan, New Zealand and the Republic of Korea. Signed on 15 November 2020 and entered into force on 1 January 2022, RCEP is the largest regional trade agreement by economic output in the world. The participating countries account for about one-third of global GDP and one-third of world population.[371]

RCEP is comprehensive in terms of both coverage and depth of commitments; it contains 20 chapters and includes many areas that were not previously covered. Key developments expected from implementing RCEP include further liberalization of trade, harmonization of non-tariff measures and increased trade facilitation. The food and agricultural sector will remain the least liberalized, with about 18 percent of tariff lines on which RCEP members remain uncommitted.[372] Indeed, the existing level of protection between RCEP members is higher in agriculture than in any other sector.

Through new market access commitments, modern rules and disciplines that facilitate trade and investment, RCEP aims to strengthen supply chains in the region and promote the participation of micro, small and medium enterprises in regional value chains and production hubs. The most important contribution of RCEP is the harmonization of the rules of origin, which has important positive implications for value chains in the region.[373] However, the agreement does not contain provisions to harmonize regulatory standards on the environment, nor address any issues related to labour.[374]

NOTE: India withdrew from the trade agreement in November 2019 citing concerns related to some provisions proposed in the agreement, including market access, rules of origin, dispute settlement mechanisms, and other important issues. As an original member of the negotiation, the door to rejoin the RCEP for India remains wide open.[375, 376]

regulation convergence across trade partners and at harmonizing standards to reduce such costs while addressing environmental issues (see Part 3).

The choice of environmental standards

Addressing the environmental impacts of food and agricultural trade efficiently is challenging, as it may not be possible to tackle the externalities and achieve a globally efficient outcome when countries retain autonomy over their choices for environmental non-tariff measures and standards. Countries differ in their valuations of externalities and choose different standards and, when engaging in trade, they can decide to either recognize the standards of their trade partners or adhere to their own domestic standards.

For example, an agreement, either multilateral or regional, that aims at promoting trade and includes the "mutual recognition" of standards between countries – with domestic standards being set unilaterally by countries and with each country recognizing that trade partners' standards achieve the same goals – will not provide an efficient outcome in the presence of externalities such as pollution. Governments may prefer to implement standards that are non-stringent to promote exports and maximize the welfare of their farmers. A lower stringency standard implies lower compliance costs but does not reduce the externality sufficiently, as it does not take fully into account the social costs generated by the impact on the environment.[316]

Similarly, "national treatment" – when countries unilaterally set their domestic standards but treat imported goods no less favourably than domestic ones – may also result in a suboptimal outcome. In this case, governments may set standards with high stringency relative to the cost incurred by the externality. This could result in a prohibition of imports that do not comply with the standard, and for large importers with market power it could result in a reduction in the price of imports that comply with the high standard.[317, 318]

Globally, environmental externalities can be addressed more efficiently only when trade policies, and standards in particular, are negotiated between countries.[319] Attempts to address environmental externalities unilaterally would result in either under-regulation or over-regulation, compared with what would be economically efficient. In the first case, consumers will over-consume the good that generates the environmental externality. In the second, the externality will be ameliorated but at the expense of exporters who comply with the standard. This implies that in the presence of environmental externalities in trade, close coordination between countries on trade policies, convergence of regulation and harmonization of standards and their stringency are of paramount importance for achieving optimal outcomes.

A critical question is whether this deep trade integration to tackle environmental impacts could be achieved at the multilateral or the regional level, or both. A study, analysing the choice of standards in the presence of an externality within a comparative advantage framework, suggests that differences in relative productivity are a necessary but not a sufficient reason to trade when countries value the environmental impact differently and, therefore, their standards differ in terms of stringency.[320] In this context, leveraging comparative advantage and taking the different standards under consideration, a country would import only if the gain from trade more than compensates for the differences in the valuation of the externality. In this case, an agreement would balance the economic benefits from trade with the environmental outcomes and a harmonization of environmental standards would be possible through mutual concessions in border measures and the stringency of standards.

However, given a global externality, when the valuations of the environmental impact differ widely across many countries, a multilateral agreement on the harmonization of standards could result in non-stringent standards and minimal environmental gain. It is more likely that such an agreement will be feasible for a smaller number of like-minded countries, where the valuations of the environmental impact are more similar to each other. Although the principle of comparative advantage plays out better multilaterally, the presence of externalities and the choice of standards to address them could explain the emergence of deep trade agreements that aim at regulatory convergence and the harmonization of standards.

Across countries, differences in the valuation of several factors that can affect the environment, but also food safety and health, animal welfare, or labour rights are important in a market where the focus lies on non-tariff measures and deep trade integration. Deep RTAs tend to be signed by countries that have convergent preferences towards issues such as pollution or labour welfare issues. Although RCEP does not cover any environmental issues, CPTPP includes a comprehensive environmental chapter and is not strictly defined in terms of geography. In this way, regionalism, which depends on geographic conditions, opens to other like-minded countries that may be in other regions, thus forming large trading blocs across regions but with similar or converging social characteristics and levels of development.

Climate change: Addressing a global externality through trade policies

Foresight exercises suggest that between 2012 and 2050 food and agricultural production will have to increase by 50 percent to provide food for a growing and progressively wealthier population.[321] Such increases in production could also result in increases in global GHG emissions unless agrifood systems become emissions-efficient and generate lower emissions per unit of output. Food and agricultural trade can play an important role in both adjusting to the effects of climate change (adaptation) and reducing GHG emissions from agriculture (mitigation).

Trade as an adaptation mechanism

The impact of climate change on agriculture is expected to be uneven across regions. Low-latitude regions such as the Near East, Northern Africa, sub-Saharan Africa and Southern Asia would be adversely affected, whereas high-latitude regions such as Northern America, parts of South America, Central Asia and Eastern Europe are expected to experience largely positive impacts on agricultural production.[322, 323, 324] Trade can be seen as an adaptation strategy to lower

the impact of climate change on global food and agricultural markets and can be an important avenue for ensuring food security and nutrition. Food imports by relatively more adversely affected (often developing) countries will have to come from those countries (often developed) that are relatively less adversely affected.

Indeed, most studies integrating biophysical and economic models project a stronger role for trade as a result of climate change at the global level.[325, 326, 327, 328, 329, 330, 331] While a substantial part of adapting to climate change would come from production adjustments, the possibility of changing sourcing patterns that trade offers is as important as changes in the crop mix in determining a country's ability to cope with the negative effects of rising temperatures.[332] Indeed, more trade links between countries allow for the diversification of sourcing patterns, making the global food and agricultural market more resilient to weather shocks and to the adverse effects of rising temperatures on agricultural production (see Part 1).

However, the role of trade in adapting to climate change and ensuring food security, could be constrained by trade policies and trade costs. Many studies suggest that freer trade could offset part of the welfare losses from climate change.[333, 334, 335] Open markets could also contribute towards food security, especially in adversely affected regions that are already characterized by a high prevalence of undernourishment. The reduction of trade costs, which are significant in low-income countries worldwide and particularly in sub-Saharan Africa, can significantly strengthen the climate change adaptation role of trade (see Part 2).

For low-income countries, that are sourcing a small part of their food consumption requirements through trade, climate change and higher average temperatures will negatively affect productivity in agriculture more than in other sectors of the economy. Food imports would not only safeguard food security, they would also facilitate a structural transformation with labour moving towards those nonagricultural sectors that are relatively less affected by climate change. However, when trade integration is limited, subsistence food requirements in many developing countries could drive specialization towards, rather than away from agriculture, thus exacerbating losses from climate change.[336]

Trade in climate change mitigation

Climate change is a truly global environmental externality. Its impacts are indivisibly spread around the entire planet; it affects many economic activities, including agriculture which is responsible for 21 to 37 percent of all GHG emissions; its costs are not accounted for by markets; and the benefits from mitigating its impact cannot be divided and claimed by any one country.[337, 338]

Several policy incentives can help improve emissions efficiency and lower GHG emissions per unit of output. For example, taxing GHG emissions is a way to "internalize" their cost to the society that produces them.[bc] However, it is difficult for national governments to unilaterally impose a carbon tax on food and agricultural products. If a country introduced a carbon tax on food and agricultural products, domestic prices would increase and, without trade, this increase would weaken demand, resulting in a decline in production and a reduction in emissions. In the longer term, the tax would provide incentives to farmers to adopt technologies and climate-smart agriculture practices that reduce carbon footprint and promote climate change mitigation.[bd]

With trade, the unilateral action to impose a carbon tax could put the mitigating country at a competitive disadvantage. The carbon tax would make exports from the mitigating country more expensive in the global market. It would also lead to the displacement of lower carbon footprint domestic products by cheaper and higher carbon footprint imports from countries that do not take similar measures to reduce emissions. With more

bc Cap-and-trade schemes also internalize the social costs of emissions. Cap-and-trade schemes penalize the producers of higher emitting products and services by forcing them to pay for emissions permits, while providing incentives for adopting lower-emission technologies. For more details, see FAO. 2018. *The State of Agricultural Commodity Markets* 2018. Agricultural trade, climate change and food security. Rome, FAO.

bd The carbon footprint of agricultural products generally refers to the cumulative carbon equivalent of the emissions generated by all stages of their production throughout the supply chain (the amount of carbon dioxide equivalent per kilogram of product). In a similar way, a carbon tax refers to a tax to the carbon equivalent of all GHG emissions.

high carbon footprint imports, emissions would leak back to the mitigating country, and international trade would undermine the effectiveness of the carbon tax.[be]

Specific trade policies can help address the emissions leakage. Together with carbon taxes, a country could implement border tax adjustments so that the same rate applying to the carbon footprint of domestic products would be applied to imports. In this case, low-emitting suppliers would face a low tax and would be able to compete with the domestic product. High-emitting suppliers would face a high tax, which could potentially make them uncompetitive. In this way, trade will be shaped not only by comparative advantage but also by the relative emissions efficiency.

The design and implementation of a carbon tax on food and agricultural products would face several challenges. It would require a complete assessment of the costs incurred by the society from the GHGs emitted during agricultural and food production – the carbon footprint. Carbon footprints need to be quantified and to include the emissions generated by agricultural production processes and the emissions associated with transportation, processing, storage and delivery of products to consumers.[339] Agricultural production involves many different sources of emissions that need to be covered and their sources are often diffuse, difficult to monitor and can vary by location.[340] For example, fertilizer use is a major source of nitrous oxide emissions, but measuring the emissions from a given area of land depends on factors other than the amount of fertilizer applied, many of which are site-specific (e.g. management practices, soil types and weather).

Even if these technical challenges were overcome, in practice, it would be difficult to achieve consensus by all countries on a carbon tax mechanism for food and agriculture (see previous section). There would be a need to agree on the carbon accounting mechanisms and the carbon footprint for all food and agricultural products produced worldwide. There would also be a need to agree on the price of carbon in order to set the tax and avoid international trade disputes.

A smaller carbon tax mechanism in the context of a RTA between countries with similar valuations of climate change impacts and similar preferences towards carbon accounting also would not be possible. Although imports from non-signatories into such a climate trade bloc would be subject to the carbon tax, exports from signatories would be more expensive in the global market, resulting in a loss of profits. Few studies have analysed the possibility of forming such regional agreements on carbon tax mechanisms and trade between countries of different sizes, different trade patterns and with a range of complementary trade policy instruments.[341]

Climate clubs are seen as a bottom-up approach to creating a global response to climate change, as compared to a top-down approach, such as the Kyoto Protocol which sets binding emission reduction targets for a number of developed countries and economies in transition but has not succeeded in forming an internationally harmonized and binding system for emissions.[bf] The stability of such climate clubs in terms of membership is also crucial, as well as their size, and some studies suggest that they would tend to be small and fragile.[342] Although more research is needed on the links between policies to address global externalities and trade, an international agreement would be necessary for trade to expand the reach of climate change mitigation policies. ■

SUSTAINABLE DEVELOPMENT AND THE INTERPLAY BETWEEN MULTILATERALISM AND REGIONALISM

Trade is an important instrument for promoting economic growth, but there is much more to trade integration than just promoting the exchange of goods between trade partners. Openness to

be For more details on carbon border tax adjustments see FAO. 2018. *The State of Agricultural Commodity Markets* 2018. *Agricultural trade, climate change and food security.* Rome, FAO.

bf See What is the Kyoto Protocol? United Nations Framework Convention on Climate Change https://unfccc.int/kyoto_protocol

food and agricultural trade can help countries ensure food security and better nutrition, achieve their objectives in the structural transformation of their economies, promote higher incomes and living standards in both rural and urban areas, and better manage their natural resources. Trade is not an end in itself, and there is no single prescription on how to leverage food and agricultural trade for sustainable development as countries differ widely.

However, embedding market-based incentives, competition and provisions to help safeguard the environment and labour rights in trade and agricultural policies is key to making them work for sustainable development. Complementary policies are also necessary to address potential trade-offs. For example, policies that facilitate access to modern inputs for smallholder farmers in developing countries and that upgrade their skillsets can improve their productivity and competitiveness.

Today, the path for trade integration appears to lead to large trade agreements that are regional, such as AfCFTA, or that link regions, such as RCEP. These large RTAs reduce tariffs. Some are deep in terms of encouraging the harmonization of non-tariff measures and facilitating trade, such as CPTPP, others in terms of harmonizing the rules of origin that constitute a high bureaucratic burden for firms, such as the RCEP. In other agreements, such as AfCFTA, details and protocols have still to be negotiated. The extent to which the food and agricultural sector is liberalized within such agreements also varies.

To use trade as a vehicle for sustainable growth, these RTAs have to be negotiated and managed in an inclusive manner. It is easier to achieve consensus between fewer like-minded countries than multilaterally, but an open and inclusive process with all relevant stakeholders within the negotiating countries, including environmental and labour advocates, when discussing specific provisions and standards can make trade agreements and trade work for sustainable development (see also Part 3).

At the same time, multilateral liberalization and harmonization of the rules of trade in food and agriculture increase the gains from trade compared with regional trade integration. Multilateral negotiations also allow for greater transparency and inclusivity at a global level. However, as countries have different needs in terms of promoting economic growth and different preferences towards the environment and social issues, global consensus towards trade policies may be difficult to achieve.

Although multilateral trade negotiations are deadlocked, the WTO offers a system that *inter alia* promotes discussion on border measures, contributes to reducing trade costs through trade facilitation and the harmonization of rules, while recognizing diversity in preferences and standards across countries. The WTO advances transparency, predictability and enforceability of trade rules and includes a mechanism to resolve trade disputes. Many of these mechanisms need to be reformed to address today's challenges and to strengthen multilateralism.[bg] Issues such as the links between agriculture and the environment are already discussed in an informal context. The trade and environmental sustainability structured discussions (TESSD) in the WTO provide a venue to talk about how trade and trade policy can help to achieve environmental and climate goals.[bh]

Together with regional trade integration, strong cooperation at the multilateral level is much needed. Global shocks to the food and agricultural markets, such as the COVID-19 pandemic, extreme weather events that affect harvests and food prices, and more recently, the war in Ukraine, need multilateral cooperation to ensure food security and better nutrition for all. In a world in which regional trade blocs cannot effectively address such challenges, multilateralism has a strong role to play. ■

bg See for example, the lecture delivered by the WTO Director-General at the Institute Rio Branco, Brazil's diplomatic academy, in Brasilia on 18 April 2022. See https://www.wto.org/english/news_e/spno_e/spno24_e.htm?utm_source=dlvr.it&utm_medium=twitter

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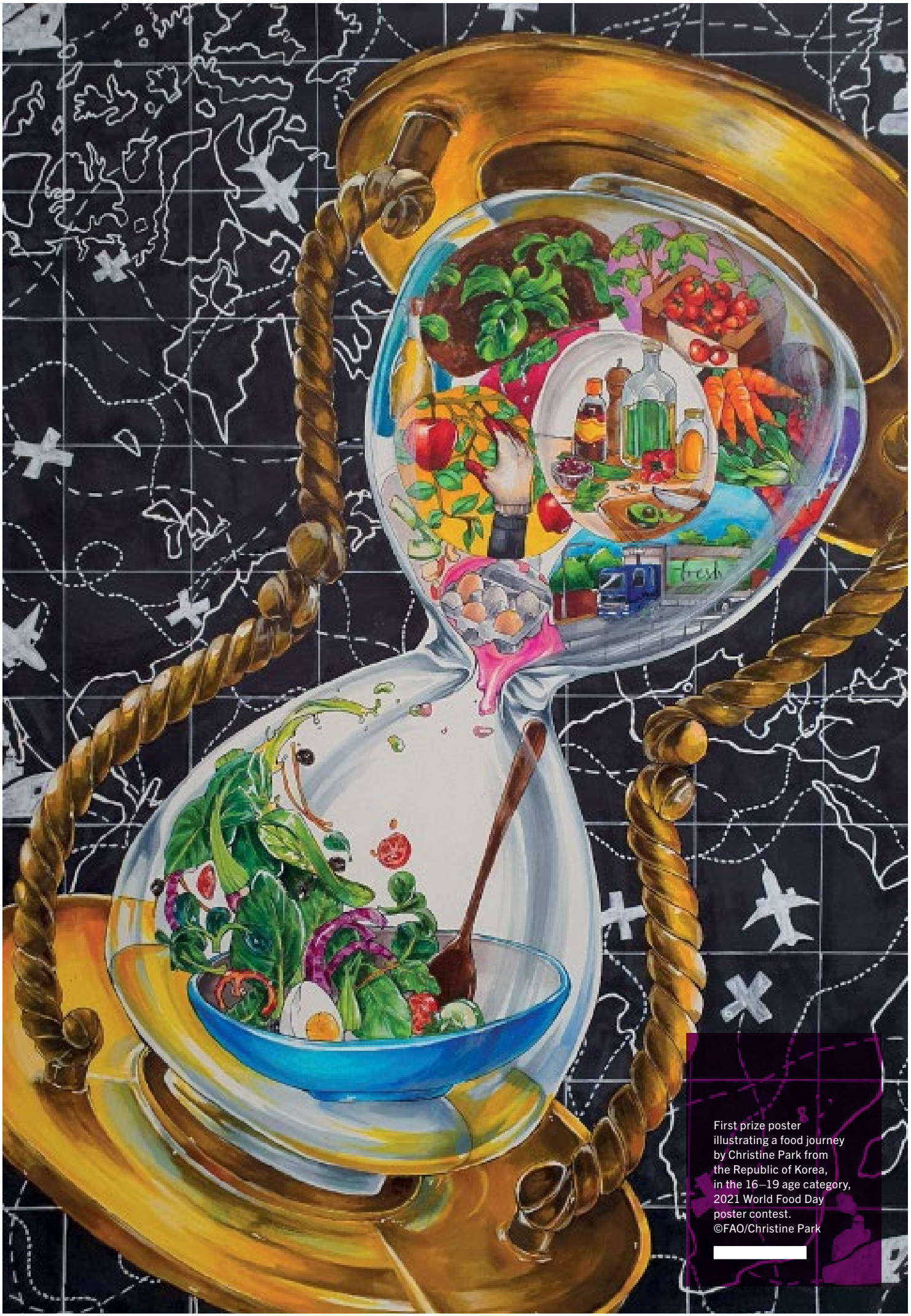

First prize poster illustrating a food journey by Christine Park from the Republic of Korea, in the 16–19 age category, 2021 World Food Day poster contest.
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THE STATE OF THE WORLD

2022

THE STATE OF AGRICULTURAL COMMODITY MARKETS

THE GEOGRAPHY OF FOOD AND AGRICULTURAL TRADE: POLICY APPROACHES FOR SUSTAINABLE DEVELOPMENT

The State of Agricultural Commodity Markets 2022 (SOCO 2022) discusses how trade policies, based on both multilateral and regional approaches, can address today's challenges for sustainable development. Trade policies in food and agriculture should aim to safeguard global food security, address the trade-offs between economic and environmental objectives, and strengthen the resilience of the global agrifood system to shocks, such as conflicts, pandemics and extreme weather. The report discusses the geography of trade, analysing food and agricultural trade and its patterns across countries and regions, its drivers and the trade policy environment. Comparative advantage, trade policies and trade costs shape the patterns of trade in food and agriculture. When comparative advantage plays out in the global market, trade benefits all countries. Lowering tariff barriers and reducing trade costs can promote trade and economic growth. Both multilateral and regional trade agreements can facilitate the process of making trade an avenue for growth but the gains of trade are distributed unevenly. When global environmental impacts, such as climate change, are considered, a multilateral approach to trade can help expand the reach of mitigation measures.

ISBN 978-92-5-136373-7 ISSN 2663-8207

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CC0471EN/1/06.22