



Food and Agriculture Organization  
of the United Nations

# **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 (SOCO) 2022



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The State of Agricultural Commodity  
Markets (SOCO) 2022

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## Abstract

Countries' varying natural resource endowments are vital in explaining international trade. Traditional trade theory suggests that differences in technology and factor endowments lead countries to specialize and export certain goods or services in which they have a comparative advantage.

The computable general equilibrium (CGE) model simulations used in this paper aim to explain agricultural trade patterns and show how agricultural trade would change in response to productivity, infrastructure and institutions improvements and trade cost changes from regional and global trade liberalization. A set of nine scenarios is used to explore the effects of productivity, transport costs, non-tariff barriers (NTB), and border measures changes on agricultural and food trade and related welfare implications.

Policies driving agricultural productivity growth such as investments in research and development, economic reforms that strengthen incentives for farmers, rural education and extension, and improved infrastructure are shown to reduce the yield gap and improve productivity. Lower trade costs help comparative advantage play out, resulting in gains from trade. Measures taken to increase trade integration in Africa and Asia will be important for economic growth and development in these regions.

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## Acronyms and abbreviations

AfCFTA	African Continental Free Trade Area
CES	constant elasticity of substitution
CGE	computable general equilibrium
EDI	Export Diversification Index
GDP	gross domestic product
NTB	non-tariff barriers
NTM	non-tariff measures
RCA	Revealed Comparative Advantage
RCEP	Regional Comprehensive Economic Partnership
SPS	Sanitary and phytosanitary
TBT	Technical barriers to trade
TCI	Trade complementarity index
TFP	Total factor productivity



# CHAPTER 1

## Introduction



# 1 Introduction

Countries' varying natural resource endowments are vital in explaining international trade. Traditional trade theory states that differences in factor endowments lead countries to specialize and export certain goods or services where they have a comparative advantage. This global process results in a more efficient allocation of resources, which leads to an increase in global social welfare, in other words, "trade creates value". This theory has been broadened by the introduction of other factors that influence comparative advantage, such as transportation costs, economies of scale, and government policy. Krugman's New Trade Theory supplements traditional trade theory by adding two important observations: consumers prefer brand diversity and production favors economies of scale.

Reducing tariffs mitigates the "loss of efficiency" costs generated by the distortions to the price system that the tariff causes. Reducing the degree of market protection also expands the market, allowing producers in exporting countries to capitalize on economies of scale, benefitting the whole economy. The paper's main objective is to discuss trade policy approaches that leverage gains from trade to promote welfare and growth. These approaches can include efforts towards further trade liberalization, effective trade facilitation, harmonization, or mutual recognition of standards, including environmental provisions, within a multilateral and/or regional trade agreement context.

The computable general equilibrium (CGE) model simulations used in this paper aim to explain agricultural trade patterns and show how agricultural trade would change in response to productivity, infrastructure and institutions improvements and trade cost changes from regional and global trade liberalization. The analysis builds on simulation results of a set of nine scenarios designed to explore the effects of productivity, transport costs, non-tariff barriers (NTB), and border measures changes on agricultural and food trade and related welfare implications.

The main objectives of the simulations are to assess the fundamental forces that drive bilateral trade flows – productivity, transport costs, NTBs, and border measures; the stylized impacts of new and deep regional trade agreements, inspired by the African Continental Free Trade Area (AfCFTA) and the Regional Comprehensive Economic Partnership (RCEP); and a potential multilateral agreement at the global level.

The analysis intends to: (i) assess some of the fundamental drivers of trade; (ii) explore how these drivers determine trade flows and the net trade position of developed and developing countries and discuss whether developing countries trade less than developed ones; (iii) discuss whether some countries/regions tend to trade globally rather than regionally; quantify the contribution of trade to welfare; (iv) simulate the impact of exploratory deep trade integration scenarios; and, (v) quantify the impact of market integration at the global level.

The paper is organized as follows: Section 2 presents the scenarios, section 3 covers the methodology adopted for the study, and section 4 the data used. Section 5 presents the results and section 6 offers concluding remarks.



# CHAPTER 2

## Analytical framework



## 2 Analytical framework

Since the launch of the Doha Round in 2001, agricultural trade has increased substantially (by almost 200 percent between 2001 and 2015). This remarkable growth can be attributed to significant increases in food demand from developing countries, stemming from demographic growth (mainly in Africa), rapid urbanization, and rising middle-income populations (mainly in Asia) that tend to demand more and higher quality food. The pressures of increased food demand have resulted in higher food prices exacerbated by COVID-19 pandemic and the Russian-Ukrainian conflict, which further strain the world's increasingly scarce agricultural resources.

Trade has also seen more players from the South in the last decades. As populations and food demand grow, so will the need for food imports by the developing world, as many developing countries will not be able to meet their domestic demand with their own domestic production. There has been an increase of 80 percent in produced calories per capita (for food and non-food use), and the share of food, measured in calories, crossing an international border rose from 12.3 percent to over 25 percent over the last 40 years. The combined effects led to 4.2 times more calories crossing a border in 2018 than in 1961 (Laborde, Piñeiro and Swinnen, forthcoming) and much of this expansion in food trade has come from developing countries themselves.

Globalization has brought welfare improvements; global inequality has declined as the share of the world's population in extreme poverty (USD 1.9 poverty line) fell from 36 percent in 1990 to 8.6 in 2018. However, there are many differences by region. Poverty in sub-Saharan Africa is still a problem, even though the population living in extreme poverty decreased from 55 percent in 1990 to 39 percent in 2019 (World Development Indicators). In South-eastern Asia, the population living in extreme poverty decreased significantly, from 32 percent in 1990 to around 3.7 percent in 2019.

Several factors have been identified as constraints to food production in Africa. These include land degradation, pests and diseases, mismanagement of water resources, inadequate food production, storage practices, and food processing technologies. More indirect factors such as civil conflicts and wars, poor economic policies to support food production, and the low economic and social status of women, who constitute the majority of food producers all contribute to diminishing overall food production (Wambugu, 2005).

In the Ricardian approach, trade patterns are explained by relative productivity (comparative advantages) and trade costs. With the new trade theory of the 1970s, demand represented by differences in populations' taste and income gained attention. In this report, we focus on the two first drivers - productivity and trade costs. The latter may bias the allocation of production (and consumption) with economic and environmental costs (these are not specifically analysed in this paper).

This paper will consider the ways in which multilateral and regional trade policy efforts can address today's challenges for sustainable development. More specifically, trade policies in food and agriculture should advance nutrition goals, strengthen food security and minimize the trade-offs between economic goals and environmental impacts. It is also important for trade policies to increase the resiliency of the global agrifood system to shocks such as pandemics, extreme weather events such as droughts, and conflicts.

To meet these goals, trade policies are becoming increasingly important as new global challenges arise. As global populations increase, so will urban populations and global demand for food.

Additionally, as incomes rise, the demand for meat and processed food is expected to increase dramatically. However, despite these advances, many people will still lack access to enough and nutritious food to meet their daily needs.

The obvious answer to many of these problems lies in increasing global production of food, but the question becomes how to achieve increased production and by how much? This paper will delve into three key ways to increase food production and improve the distribution of food: Closing the yield gap, investing in infrastructure, and trade integration. The scenarios are divided into three blocks: (1) narrowing the productivity gap, (2) improving infrastructure and institutions, and (3) trade integration. Each block consists of three scenarios, the first one at a global level, followed by a scenario in which the intervention - reduction of the yield gap, reduction of trade costs, or higher trade integration - only applies to a specific region of the world. Even though we move from a global to a regional shock, the results will be seen in all regions. Table 1 provides an overview of the scenarios implemented.

**Table 1. Simulation**

	Scenario	Variable	Regions	Percentage changes
1	Narrowing the productivity gap	Land + Labour + Capital productivity	Global	50% of existing yield gaps
2	Narrowing the productivity gap	Land + Labour + Capital productivity	Sub-Saharan Africa	50% of existing yield gaps
3	Narrowing the productivity gap	Land + Labour + Capital productivity	South-eastern Asia	50% of existing yield gaps
4	Improve infrastructure and institutions	Transport costs + non-tariff barriers	Global	50% reduction
5	Improve infrastructure and institutions	Transport costs + non-tariff barriers	Sub-Saharan Africa	50% reduction
6	Improve infrastructure and institutions	Transport costs + non-tariff barriers	South-eastern Asia	50% reduction
7	Global integration	Transport costs + non-tariff barriers + border measures	Global	100% reduction
8	Regional integration	Intra-regional: Transport costs + non-tariff barriers + border measures	Deep integration Africa	100% reduction
9	Regional integration	Intra-regional: Transport costs + non-tariff barriers + border measures	Deep integration Asia	100% reduction

Source: Laborde, D. and Valeria, P. 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. <https://doi.org/10.4060/cc3135en>.

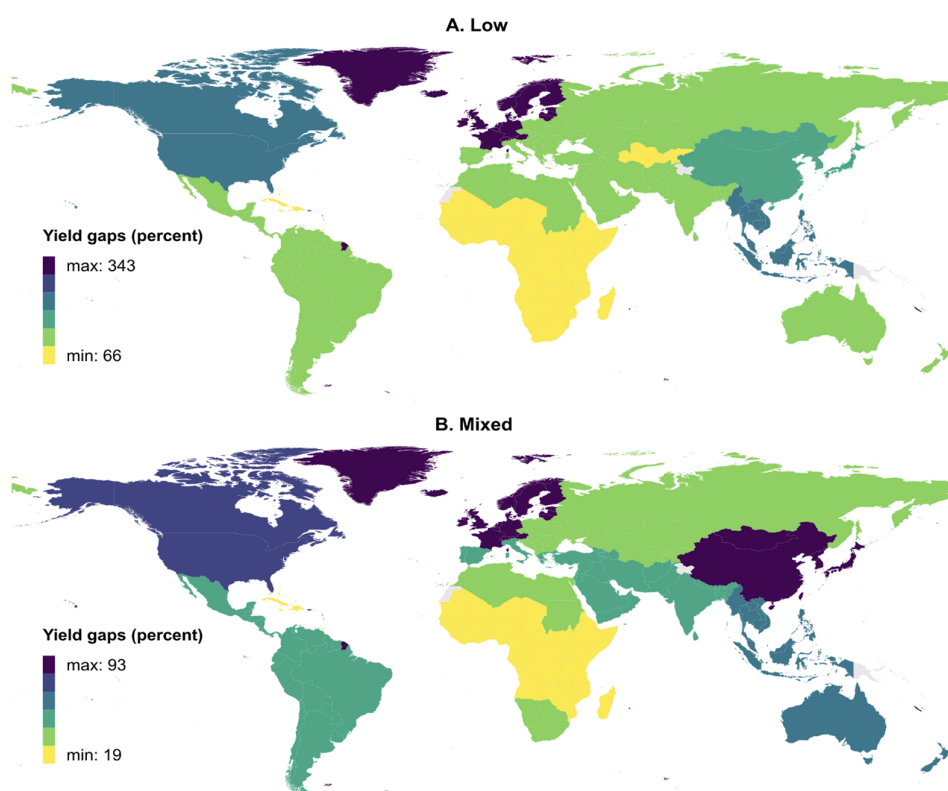
## 2.1 Productivity gap scenarios

Agricultural growth can occur by bringing new resources into production (new land, extension of irrigation, or input intensification per hectare) or by raising the productivity of existing resources. There are two concepts to be considered while discussing productivity increases in the agricultural sector - yields and total factor productivity. Yield is a standard measure of the amount of agricultural production harvested per unit of land area, while total factor productivity (TFP) is the aggregate quantity of outputs produced by the agricultural sector divided by the aggregate quantity of inputs used to produce those outputs.

When referring to yields, we focus on the yield gap - defined as the difference between actual farm yield and the yield potential - to see how far each country is from its potential. Figure 1 shows yield gap ratios compared to potentials attainable with low input use farming<sup>1</sup> and advanced farming (mixed inputs)<sup>2</sup> presented by Fischer *et al.* (2011). The maps (Figure 1) show the estimated yield gaps as the percentage of yield potential for cereals, roots and tubers, pulses, sugar crops, oil crops, and vegetables combined for 2005. At the global level, the achieved crop yields are just over 50 percent of potentially achievable yields, assuming mixed levels of input. Yield gaps increase to about 150 percent in traditional low-level input farming systems.

Disparities across and within regions are remarkably high. At the regional level, we can see significant differences in both ways of producing the above listed crops. Sub-Saharan Africa is the region with the largest yield gap for both types of farming. In this region, the actual yields are lower by a factor of four compared to mixed input potentials. The rest of Africa, Eastern Europe, and the countries in Central Asia also show large yield gaps, while Northern and Western Europe, Northern America, Eastern Asia, and Oceania yield gaps are the smallest. Looking at regional data, Fischer *et al.* (2011) conclude that across individual commodity groups, yield gap ratios are similar.

**Figure 1. Yield gaps at low level of inputs farming and mixed inputs farming, 2005**



Source: Authors' illustration based on Fischer, G., Hitznyik, E., Prieler, S. & Wiberg, D. 2011. Scarcity and abundance of land resources: competing uses and the shrinking land resource base. SOLAW Background Thematic Report TR02. Rome, FAO. Conforms to Map No. 4170 Rev. 19 United Nations (October 2020).

Notes: Final boundary between the Sudan and South Sudan has not yet been determined. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties.

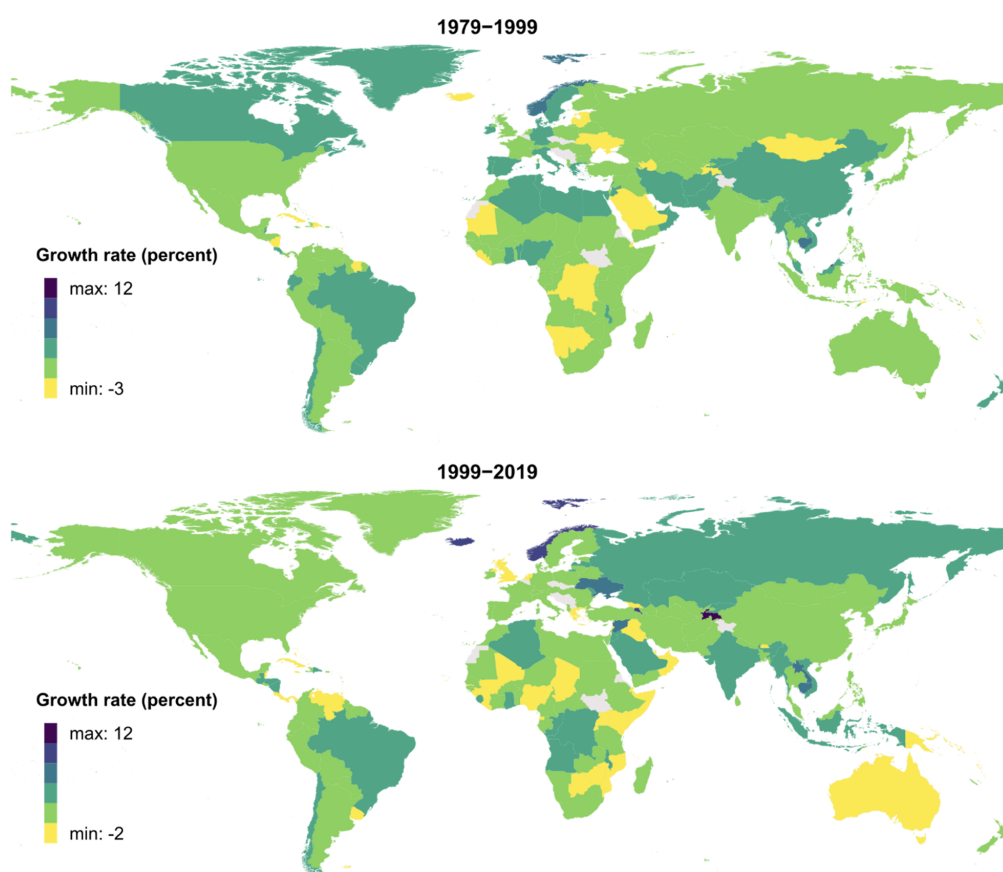
<sup>1</sup> Low-level inputs/traditional farming: under the low input, traditional management assumption, the farming system is mainly subsistence-based and not necessarily market-oriented. Production is based on traditional cultivars, labour-intensive techniques, and no application of nutrients, no use of chemicals for pest and disease control and minimum conservation measures.

<sup>2</sup> Mixed level of inputs: Under the mixed level of inputs, only the best land is assumed to be used for high-level input farming.

Looking at TFP growth, we can observe that agricultural productivity growth may be slowing in some countries and regions, remains very low in sub-Saharan Africa and is keeping momentum in most developing countries (Fuglie, Jelliffe and Morgan, 2021). Figure 2 compares the average annual growth rates in agricultural TFP between 1979-1999 and 1999-2019 using the data provided by Fuglie, Jelliffe and Morgan (2021). TFP growth appears to have remained robust overall but has slowed in some countries, specially developed countries. TFP growth in developing countries doubled from less than 1 percent per year from 1979-1999 to over 2 percent per year from 1999-2019. China and Brazil sustained exceptionally high TFP growth over the past two decades and India has had a remarkable performance in the last 15 years. Several other developing regions, including South-eastern Asia, Northern Africa, Latin America and the Caribbean, also had relatively high TFP growth in the 1990s and the 2000s. However, these regions have seen a smaller growth in the last decade. In sub-Saharan Africa, TFP growth has been below 1 percent per year over the last decade.

To summarize, TFP growth has slowed since the mid-1990s in countries that have already reached high levels of productivity (Alston, Beddow and Pardey, 2009; Fuglie, Wang and Ball, 2012). However, at a global level, there is no evidence that TFP growth is slowing down.

**Figure 2. Average annual growth rates in agricultural total factor productivity, 1979–1999 and 1999–2019**

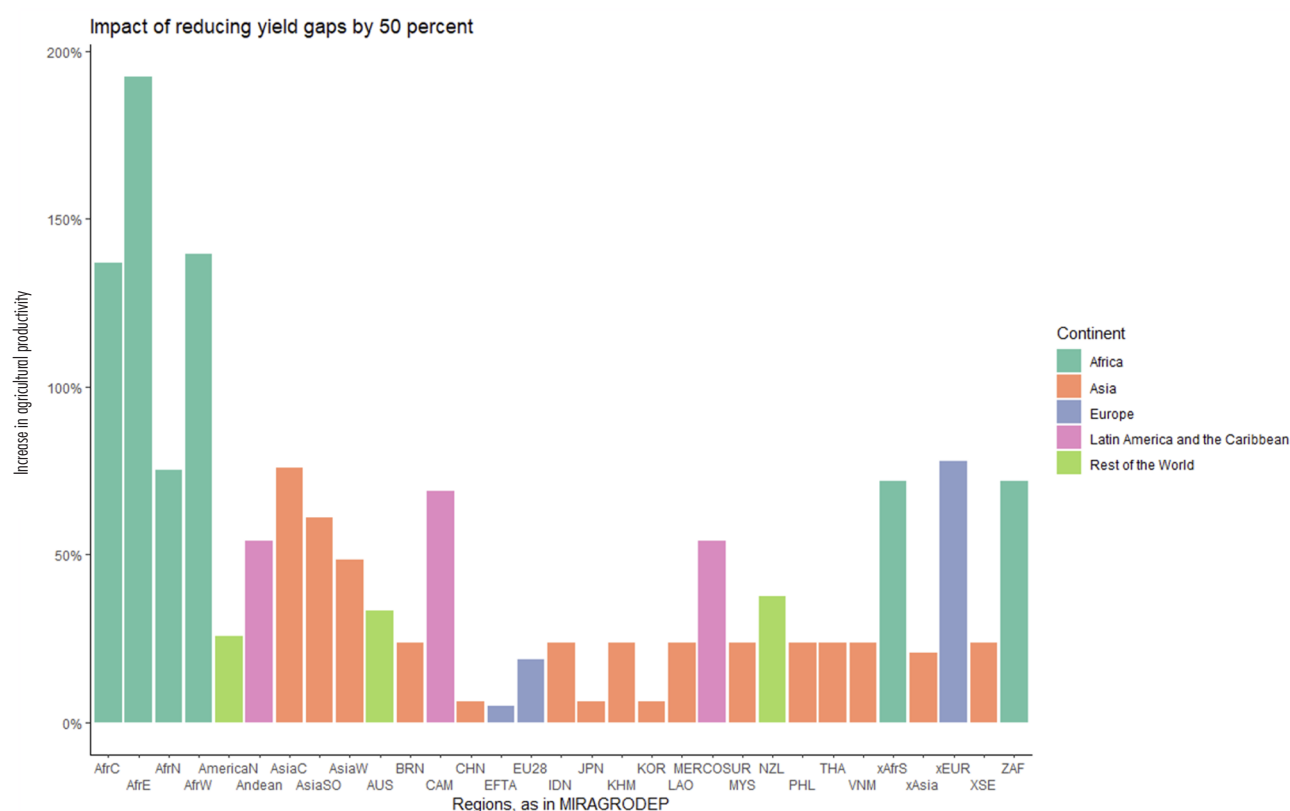


Source: Authors' calculation based on Fuglie, K., Jelliffe, J. & Morgan, S. 2021. International agricultural productivity. TFP indices and components for countries, regions, countries grouped by income level, and the world, 1961-2020. Last updated: 22 October 2021. USDA Economic Research Service. [www.ers.usda.gov/data-products/international-agricultural-productivity/](http://www.ers.usda.gov/data-products/international-agricultural-productivity/). Conforms to Map No. 4170 Rev. 19 United Nations (October 2020).

Notes: Final boundary between the Sudan and South Sudan has not yet been determined. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties.

Figure 3 shows the impact of reducing yield gaps by half <sup>3</sup> in every country on agricultural productivity. The most significant impact would be seen in Africa, followed by Eastern Europe, Central Asia, and Latin America and the Caribbean.

**Figure 3. Reduced yield gaps and agricultural productivity**



Note: AfrC: Middle Africa, AfrE: Eastern Africa, AfrN: Northern Africa, AmericanN: Northern America and Mexico, Andean: Andean countries, AsiaC: Central Asia, AsiaSO: Southern Asia, AsiaW: Western Asia, AUS: Australia, BRN: Brunei Darussalam, CAM: Central America and the Caribbean, CHN: China, EFTA: European Free Trade Association, EU28: European Union and United Kingdom of Great Britain and Northern Ireland, IDN: Indonesia, JPN: Japan, KHM: Cambodia, KOR: Republic of Korea, LAO: Lao People's Democratic Republic, MERCOSUR: Mercosur countries, MYS: Malaysia, NZL: New Zealand, PHL: Philippines, THA: Thailand, VNM: Viet Nam, xAfrS: Rest of Southern Africa, xAsia: Rest of Asia, xEUR: Rest of Europe, XSE: Rest of South-eastern Asia, ZAF: South Africa.

Source: Authors' calculation based on Fischer, G., Hitznyik, E., Prieler, S. & Wiberg, D. 2011. Scarcity and abundance of land resources: competing uses and the shrinking land resource base. SOLAW Background Thematic Report TRO2. Rome, FAO. .

## 2.2 Improving infrastructure and institutions scenarios

Trade costs include transportation costs (policies, freight, insurance), border measures (tariffs, tariff rate quotas, export restrictions) and standard-like nontariff measures (NTMs, NTBs). These costs represent a high share of the total cost of agricultural and food products, given that the goods tend to be bulky or perishable and must meet quality and safety standards.

Technical barriers to trade (TBT) are extensively used in international trade, with more than 30 percent of product lines and almost 70 percent of world trade affected by them. Sanitary and phytosanitary (SPS) measures are typically applied to agricultural products and affect almost 20 percent of world trade. Price control measures affect about 15 percent of world trade, being applied to many sectors, particularly, a large share of world trade regarding agriculture-related

<sup>3</sup> In order to cut the yield gap by 2, productivity increases are given by  $[1-\text{gap}/2]/[1-\text{gap}] - 1$

products. Export measures are also frequently applied to agriculture. Coverage of NTMs by broad category shows that agriculture is the most affected, with most of the world's agricultural trade subject to some form of SPS and, or TBT measures (UNCTAD, 2021).

Border non-tariff measures, such as inspection and certification requirements, quarantines, quotas, and other measures generate entry costs that cover more than 50 percent of world trade. The costs of such measures vary across countries and sectors, with Africa and Latin America and the Caribbean being the regions with the highest costs and the automotive industry and agriculture the most affected sectors. While all regions use this type of measure (border non-tariff measures), the cost and the impact they generate are different across regions and sectors (UNCTAD, 2021).

Increased transaction costs are seen as a barrier for farmers, especially smallholders, from entering the market, hence not allowing them the benefit from trading their products (Pingali, Khawaja and Meijer, 2005). Interventions aimed at reducing transaction costs would encourage increased farmer participation in competitive markets, enabling and encouraging farmers to improve farming productivity. In this paper, we analysed the improvement of infrastructure and institutions by reducing transport costs and NTBs by half. The data for the NTBs come from FAO and IFPRI (2022)<sup>4</sup>.

## 2.3 Global and regional integration scenarios

Trade is a central element for global food security, and in the case of many food-deficit countries, also for national food security. Despite this important role played by the food trade, there are substantial trade barriers. In spite of some improvements in the two decades prior to the global financial crisis, significant tariff barriers remain higher in agricultural products than in any other product group. Since 2000, also NTMs have increasingly been used and may constitute trade barriers.

Integration into the world economy could be a way for countries to promote economic growth, development, and poverty reduction by facilitating the flow of goods, services, capital and people (Atkin and Donaldson, 2021 and Park and Claveria, 2018). Das and Grine (2020) show that globalization is not merely the means of opening new markets but of achieving higher productivity through technology transfers. Some developing countries have made much progress toward more trade integration, such as countries in Asia and, to a minor degree, countries in Latin America and the Caribbean. However, other developing regions such as, Africa and Western Asia, are lagging behind. Trade agreements provide the institutional infrastructure and can be a pillar of regional integration by promoting a reduction in trade costs and defining rules and regulations that the signatory countries must follow. These agreements tend to increase trade and promote foreign direct investment and regional and global value chains (Ruta, 2017).

Deeper trade integration is analysed to see the impact on economic growth within each country and region where three scenarios are considered. The first one includes a global integration, where transport costs, NTBs and all border measures are eliminated; the second scenario arose from the AfCFTA and is carried out as an illustration of the possibilities that a complete agreement may bring to the region and the world; and the third scenario is an illustration of deeper regional integration in Asia.

<sup>4</sup> The collection of data on NTMs on agricultural products in the ASEAN region and the design of a database is based on various existing databases, including the WTO I-TIP, World Bank's Temporary Trade Barriers database, and the UNCTAD TRAINS portal.

# CHAPTER 3

## Model

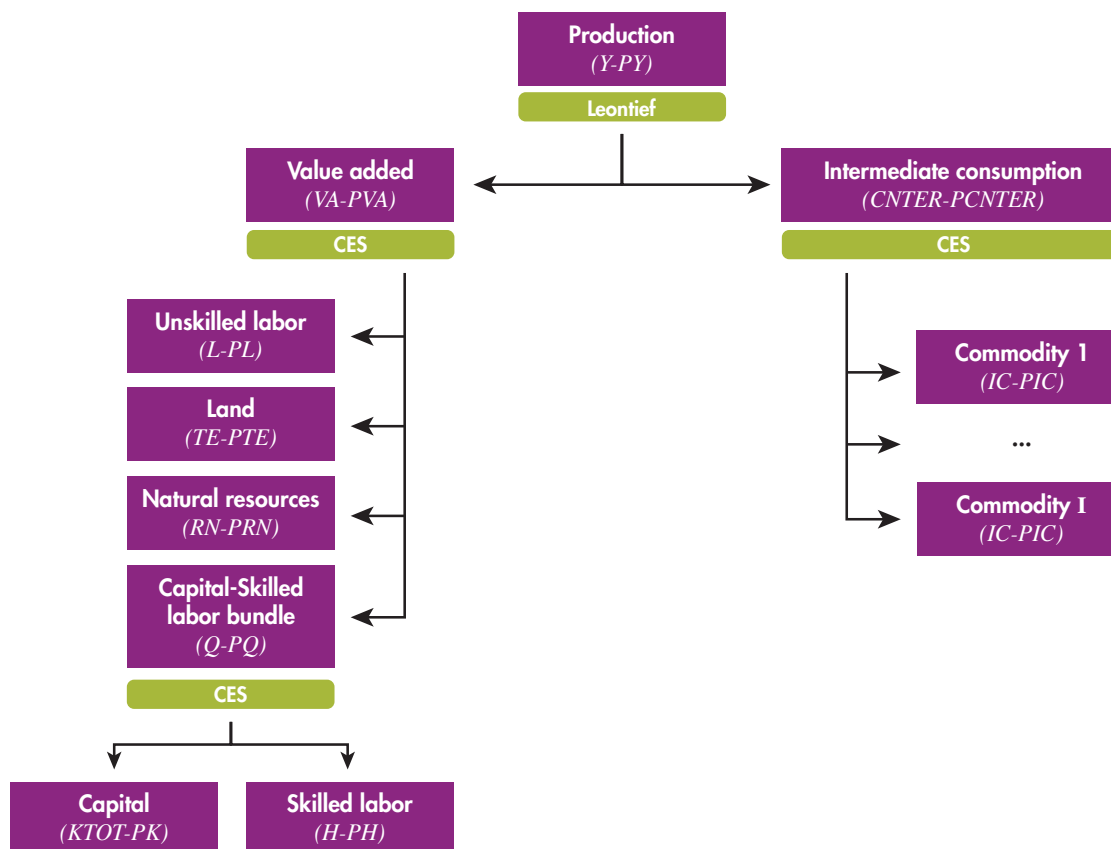


### 3 Model

MIRAGRODEP is a multiregion, multisector CGE model with perfect competition and constant returns to scale (see Bouët, Laborde and Piñeiro, 2021, for complete documentation). It is usual to assume perfect competition in all sectors, enabling a detailed geographic and sector decomposition. The model is based on an input-output framework and its theoretical structure is derived from optimizing the behavior of economic agents, particularly households and firms. In all these models, Walras's law holds: if there is equilibrium in all but one of the markets, equilibrium also holds in the last market. Consequently, one price is held fixed, and all other prices are evaluated relative to this numeraire.

From the supply side in each sector (Figure 4), the production function is a Leontief function of value-added and intermediate inputs; one output unit needs  $x$  percent of an aggregate of productive factors (labour, both unskilled and skilled; capital; land and natural resources) and  $(1 - x)$  percent of intermediate inputs. The intermediate inputs function is an aggregate constant elasticity of substitution (CES) function of all goods, which means that substitutability exists between two intermediate goods, depending on the relative prices of these goods. This substitutability is constant and at the same level for any pair of intermediate goods. Similarly, value-added is a CES function of unskilled labour, land, natural resources, and a bundle of skilled labour and capital. This nesting allows for less substitutability between capital and skilled labour than between these and other factors.

Figure 4. Production side



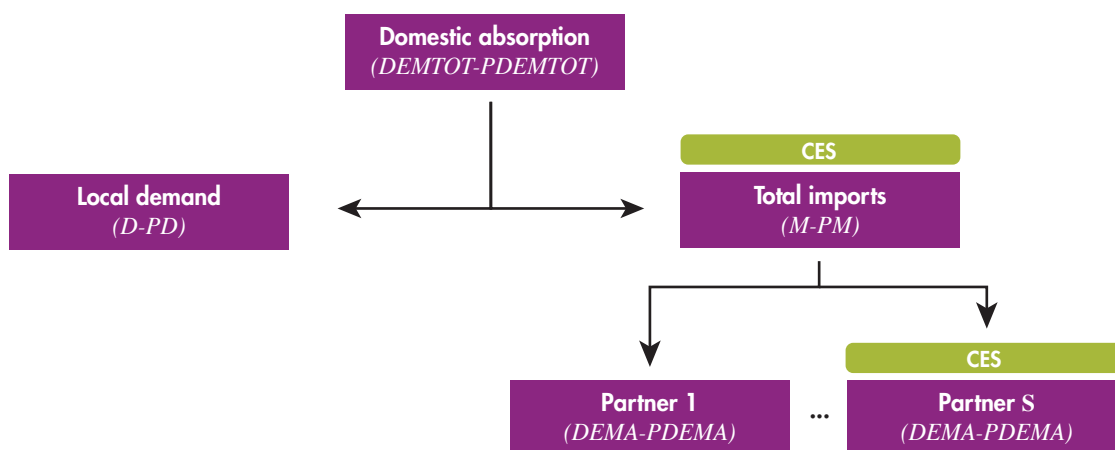
Source: Bouët, A., Laborde D. & Piñeiro, V. 2021. MIRAGRODEP, an analytical model adapted to economic and trade reforms. In The road to the WTO twelfth Ministerial Conference: A Latin American and Caribbean perspective, eds. Valeria Piñeiro, Adriana Campos, and Martín Piñeiro. Pp. 169-179. San Jose, Costa Rica: Instituto Interamericano de Cooperación para la Agricultura (IICA) & International Food Policy Research Institute (IFPRI). <https://doi.org/10.2499/p15738coll2.134842>.

Unskilled labour is imperfectly mobile between agricultural and non-agricultural sectors, according to a constant elasticity of transformation function. Land is also imperfectly mobile between agricultural sectors. Capital in a given region, whatever its origin (domestic or foreign), is assumed to be obtained by assembling intermediate inputs according to a specific combination. The capital good is the same regardless of the sector.

The demand side is modeled in each region through a representative agent that owns all factors of production and whose propensity to save is constant (Figure 5). The remainder of the national income is used to purchase final consumption. Preferences between goods are represented by a linear expenditure system–constant elasticity of substitution function. Additionally, the elasticity of substitution is constant only among the sectoral consumptions over and above a minimum level. The minimal level of consumption can vary across the region (e.g. developing versus developed country).

MIRAGRODEP is a bilateral trade model consistent with the Armington assumption: commodities are assumed to be heterogeneous according to their origin and, thus, imperfect substitutes for one another (Armington, 1969). Nested CES functions are used to reflect preferences among varieties originating from different countries. Therefore, countries can export and import the same product simultaneously due to consumer preferences for different varieties. The price transmission between the domestic and international markets is imperfect and highly dependent on the choice of the CES trade elasticities and the initial share of trade. For the latest studies, Armington elasticities are drawn from the GTAP 11 database and are adjusted for each region based on sectoral composition. The import tree is specific to each market (importer\*sector) to reflect each exporter's export similarities (HS4 level).

**Figure 5. Demand side**



Source: Bouët, A., Laborde D. & Piñeiro, V. 2021. MIRAGRODEP, an analytical model adapted to economic and trade reforms. In *The road to the WTO twelfth Ministerial Conference: A Latin American and Caribbean perspective*, eds. Valeria Piñeiro, Adriano Campos, and Martín Piñeiro. Pp. 169-179. San Jose, Costa Rica: Instituto Interamericano de Cooperación para la Agricultura (IICA) & International Food Policy Research Institute (IFPRI). <https://doi.org/10.2499/p15738coll2.134842>.

In MIRAGRODEP, the government is explicitly modeled as different from private agents. Government income consists of taxes collected on production, factors of production, exports, imports, consumption, and households' income. The government maximizes a Cobb-Douglas utility function: government spending on each commodity is a fixed share, in value, of total public expenditure on goods and services. Government purchases are subject to taxes. The

model includes four important assumptions: the external account closure, the private account closure, the government account closure, and the factor market closure. The private account closure assumption concerns the savings-investment closure. The MIRAGRODEP model is neo-classical: the marginal propensity to save is constant such that variation in income leads to variation in savings, which brings variations in investment.

The external account closure concerns the assumption of the current account. A trade shock could affect this account balance since this policy reform entails a variety of border tariffs and, consequently a variation in imports and exports. For this paper, the real exchange is affected by the reform so that the current account balance is constant. The real exchange rate adjustment could occur through an adjustment of the nominal exchange rate (devaluation, depreciation) or different evolutions of domestic prices in other regions (i.e., competitive disinflation).

The government or public account closure assumption concerns how the public balance is affected when a shock or a reform changes taxes. In many studies, we assume that after a shock that impacts customs duties, a consumption tax (VAT) is adjusted to maintain real public expenses per capita constant while the public deficit is constant in the percentage of gross domestic product (GDP). With this assumption, the level of public services in each country is constant and there is no variation in public deficit and no associated crowding-out effect on private investment. In a sensitivity analysis, it is possible to consider other closures, including changes in public expenditure and the introduction of a lump-sum tax.

For this paper, the comparative static version of the model was used, showcasing the before and after the shock was implemented. The results are expressed as percentage changes from the base year.



# CHAPTER 4

## Data



## 4 Data

The first data source for MIRAGRODEP is the GTAP11 database, prerelease 2 (see Aguiar *et al.*, 2019, for the complete background), which provides world macroeconomic accounts and trade flows for four reference years 2004, 2007, 2011, 2014, and 2017. The database describes values of production, and intermediate and final consumption of commodities and services for 141 countries or regions and 65 sectors, but also global bilateral trade patterns, international transport margins, and protection matrices that link individual countries/regions.

The market access data come from the MacMap-HS6 version 2.1 database (Bouët *et al.*, 2008; Guimbard *et al.*, 2012), which measures protection in 2004, 2007, 2010, 2013, and 2016 and includes all regional agreements and trade preferences existing to these dates. Therefore, protection is measured at the bilateral level for each HS6 line. A critical feature of the model is the Consistent Tariff Aggregator approach which has been implemented for MIRAGRODEP. This is an important element of the model when it comes to trade shocks scenarios since the simulations are often conducted at a relatively low level of sector disaggregation (25 sectors). In contrast, protection is measured at a very detailed level. The Consistent Tariff Aggregator approach captures the exclusion effects and the variance of tariffs at a detailed (tariff line) level. Not considering this approach would yield inconsistent welfare effects since simple trade weights are endogenous and the welfare changes induced by a tariff are a function of its powers, not its level *per se*.

Usually, MIRAGRODEP includes other data: (i) specific Social Accounting Matrix when MIRAGRODEP is used in collaboration with a specific government (Bouët, Laborde and Traoré, 2021, for Morocco); (ii) data collected on export taxes for a specific project (Laborde, Estrades and Bouët, 2013); (iii) evaluation of ad valorem equivalent of NTMs (Bouët, Laborde and Traoré, 2021).

Lastly, MIRAGRODEP can be connected to households surveys: Laborde, Martin, and Vos (2020) conducted two simulations of the economic consequences of COVID-19 pandemic; to estimate the poverty impact of the shock, MIRAGRODEP is connected to the POVANA household dataset and model, which includes data on the full income distribution for over 300 000 representative households globally. The model and the dataset are linked in a top-down fashion.



# CHAPTER 5

## Results



## 5 Results

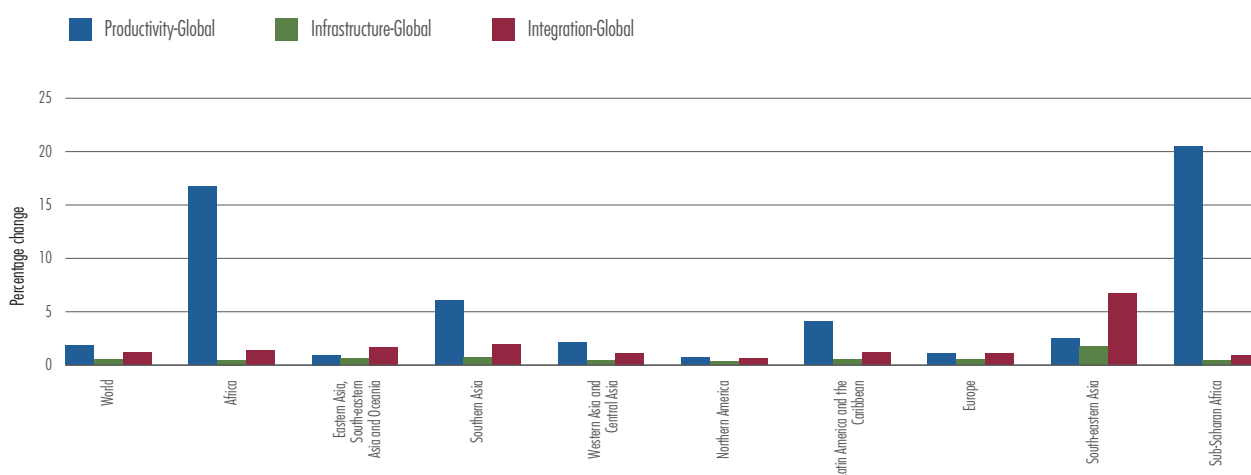
This paper analyses three different strategies for agricultural development, focusing on sub-Saharan Africa and South-eastern Asia. The following sections look at these different strategies separately with the idea of understanding the impact of each of them individually by region and group of commodities. However, as a viable development strategy, a combination of the three strategies should be considered.

Before analyzing each set of scenarios separately - productivity, infrastructure and integration, it is important to compare them together for the case of the global scenarios. Also, it is important to note that the second set of scenarios related to improvements in infrastructure and institutions are the most realistic in terms of magnitude and probability of being reached. At the same time, the third set of scenarios should be seen as an illustration of the upper bound, almost a theoretical exercise of the case of free trade and perfect cooperation between countries.

A global reduction of the yield gap generates the most significant increase in real GDP in all regions, showing the importance of investment in research and development and technologies that foster productivity. It also highlights the differences by region, being Africa the most benefited with a 20 percent increase in their GDP, followed by Southern Asia with 6 percent and Latin America and the Caribbean with a 4 percent increase with respect to the baseline (Figure 6).

The reduction of trade costs and barriers also generates increases in real GDP in all regions but to a smaller degree, given that productivity increases generate more production while a reduction in trade costs can be seen as a shift in trade patterns. South-eastern Asia is the region with the highest increase in real GDP (almost 2 percent with respect to the baseline). Globally free trade increases real GDP in the world by 1.2 percent, with regional differences. South-eastern Asia increased its GDP by more than 6 percent, followed by all other regions in Asia with around 1.5 percent, Africa with 1.3 percent, Latin America and the Caribbean with 1.2 percent, Europe with 1 percent and Sub-Saharan Africa with less than 1 percent.

**Figure 6. Real GDP, percentage change from baseline**



Note: Productivity-Global: scenario in which yield gaps are reduced by half in the world; Infrastructure-Global: scenario in which transport costs and non-tariff barriers are reduced by half in the world, Integration-Global: scenario in which all transport costs, non-tariff barriers and border measures are eliminated in the world. Source: Laborde, D. and Valeria, P. 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. <https://doi.org/10.4060/cc3135en>.

The impacts of these scenarios vary. The ones related to productivity increases are about producing and shifting comparative advantages, while the other two sets of scenarios are about reorganizing trade patterns through the direct effects of trade costs.

The magnitude of the effect of reducing the yield gap and reducing trade costs on prices is similar, even though the first-order effect and mechanism of adjustment differ. In the first case, it is seen through a reduction in costs at the farm level, and in the second one, a reduction in costs throughout the whole value chain. The magnitude of the change in prices will be similar in the case of a region like Northern America with a small yield gap and high level of NTBs than a region like sub-Saharan Africa with large yield gaps and fewer NTBs.

The Revealed Comparative Advantages (RCA) index is related to the level of specialization that each region has per commodity group. For example, Latin America and the Caribbean is more specialized in grains and less in coffee and tea. The RCA shows that Africa would benefit from the productivity scenario, both African production and exports would increase. In this case, the region could move towards a similar development pattern to LAC. The scenarios related to NTBs (the last two sets) suggest that Africa does not have major problems related to market access, but their problem is low levels of productivity and hence production.

The Trade Complementary Index (TCI) shows how the different scenarios change complementary between countries. This index does not change much in either scenario, except for sub-Saharan Africa and South-eastern Asia in the productivity scenarios that only apply to these regions. In this scenario, trade structure changes; Africa increases their production, exporting a lot more and importing less, while Asia will export less rice to Africa.

These scenarios show that Latin America and the Caribbean, Asia and Africa have different constraints in pursuing agricultural growth. Latin America and the Caribbean and Asia can benefit from working towards eliminating trade barriers, while Africa can benefit from increasing agricultural productivity.

The following sections will analyse each set of scenarios in more detail.

## 5.1 Productivity gap

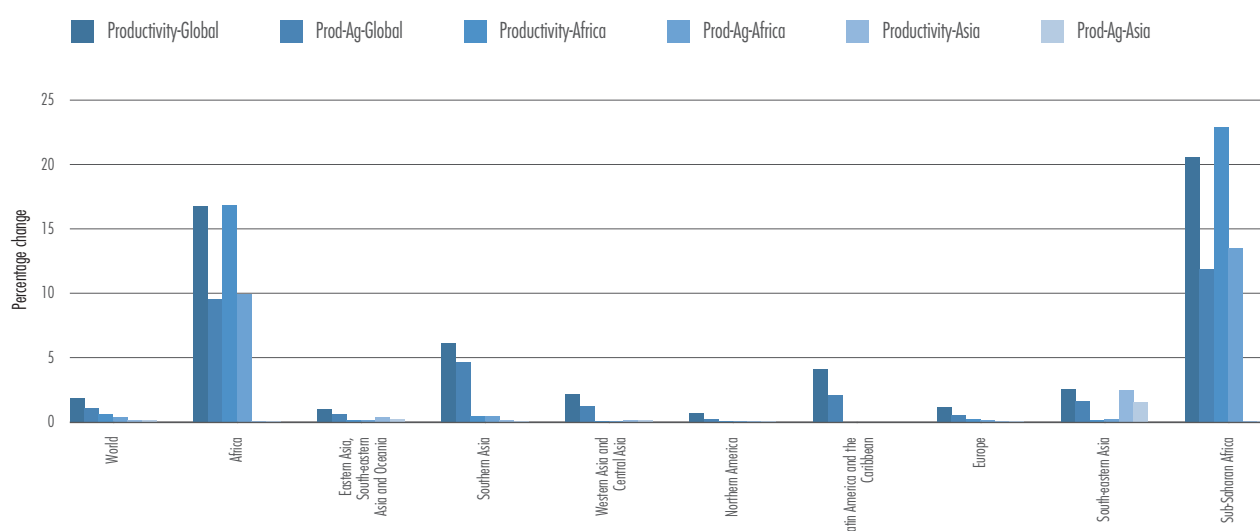
The impact of an increase in TFP will be seen not just in the agricultural sector, but also in changes in real income and income per capita by country. Given the general equilibrium modelling, farmers are assumed to react to price signals, given the open production possibilities. Crop choice is endogenous. Therefore, we model the impact of reducing the yield gap by upgrading technology, improving seed quality, building irrigation systems, or developing an extension service. Over time, changes in TFP growth will affect the profitability of different crops and the supply of different commodities.

We run six scenarios in this first set. The first scenario (Productivity-Global), where the yield gap is reduced by half in the world, and two more scenarios in which only one region of the world will have the yield gap reduction. The second scenario (Productivity-Africa) covers reducing the gap for only sub-Saharan Africa, while the third scenario (Productivity-Asia) looks at the case of South-eastern Asia. The other three scenarios are an extension of the first three, in which only the primary agricultural sector reduces its yield gap, leaving the agroindustry untouched (Prod-Ag-Global, Prod-Ag-Africa and Prod-Ag-Asia).

If the yield gap is reduced by 50 percent globally, the world GDP will be 1.57 percent higher than in the base and welfare will also be higher by around 3 percent (Figure 7). In such a scenario, all regions would benefit from higher productivity levels. However, there are significant differences in the size of the effect by region subject to the initial yield gap, the rate of TFP growth needed to reduce the yield gap, and the mechanisms of adjustment that are required to deal with the initial shock (e.g. the structure of production).

In this case, Africa is the region that gains the most, with a GDP increase of around 16 percent, followed by Southern Asia with almost 6 percent, and Latin America and the Caribbean with almost 4 percent. Eastern Asia, South-eastern Asia and Oceania as a region, Western and Central Asia, Northern America, Europe, and South-eastern Asia (separately) will have positive terms of trade – export prices increase more than the import prices – while the rest of the regions will have the opposite result. This is interlinked with the fact that imports will grow more (compared to the base) than exports for the countries that see an improvement in their terms of trade and vice versa for the regions where imports will have a slower growth rate than exports.

**Figure 7. Real GDP, percentage change from baseline**



Note: Regional groups are not mutually exclusive: South-eastern Asia is a subgroup of Eastern Asia, South-eastern Asia and Oceania and sub-Saharan Africa is a subgroup of Africa. Productivity-Global: scenario in which productivity gaps are reduced by half in the world; Prod-Ag-Global: scenario in which only yield gaps in agriculture are reduced by half in the world; Productivity-Africa: scenario in which productivity gaps are reduced by half only in sub-Saharan Africa; Prod-Ag-Africa: scenario in which only yield gaps in agriculture are reduced by half in sub-Saharan Africa; Productivity-Asia: scenario in which productivity gaps are reduced by half only in South-eastern Asia; Prod-Ag-Asia: scenario in which only yield gaps in agriculture are reduced by half in South-eastern Asia.

Source: Laborde, D. and Valeria, P. 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. <https://doi.org/10.4060/cc3135en>.

Differentiating the productivity scenarios by including processed food or not makes a considerable difference by country. Looking at the global scenario, in developed regions like Northern America or Europe, where the agro-industry sector is more developed, including the reduction in the yield gap for the ag-industry makes the initial gain increase by a much higher number than in the case of less developed regions like Africa and Asia where the level of industrialization of the agro-industry is smaller.

As expected, welfare follows the same pattern as GDP with slightly higher increases but keeping the same ranking between regions. In this scenario, the world will be benefited from a 3.2 percent increase in welfare. Disaggregating the results by region we can see that Africa's welfare will be 20 percent higher than in the case of not reducing the yield gap, followed by Latin America and the Caribbean with 4.3 percent and Asia with 2.5 percent.

If only sub-Saharan Africa closes the gap, that subregion will have the highest returns of such a change with increases in the welfare of around 26 percent. The same applies if only South-eastern Asia sees higher increases in productivity, obtaining an almost 4 percent increase in welfare compared to just 0.2 percent for the world. Interestingly, in the case of the last two scenarios, reducing the yield gap only in a subset of countries, Latin America and the Caribbean resulted in a worse place with losses in welfare.

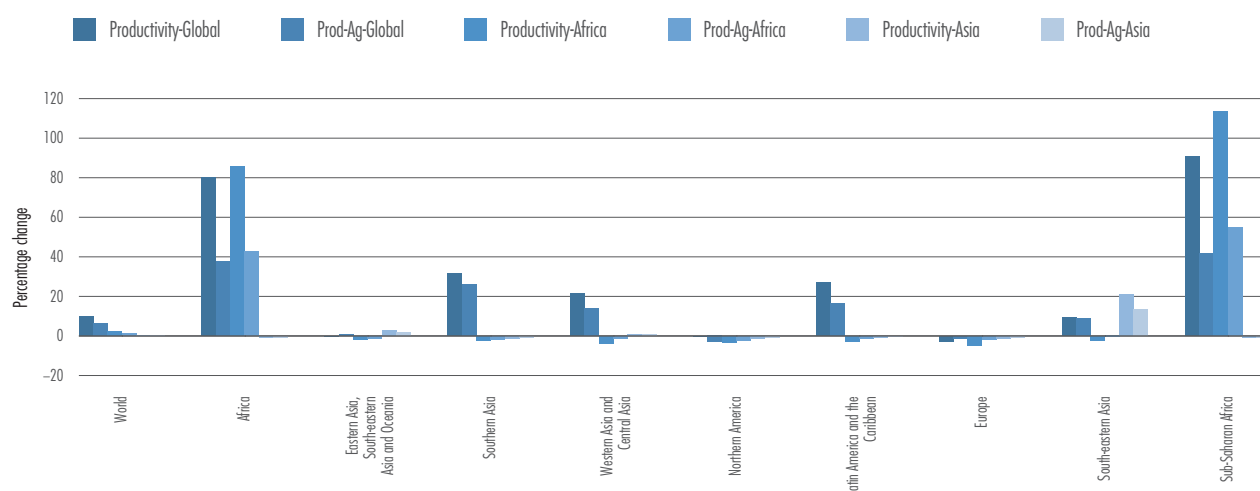
Agricultural production increases in almost all products and regions. Expanding on this, as expected in the first scenario (Productivity-Global), the increases in production are higher than in the case of the following two scenarios related to reducing the yield gap, given the size of the shock, covering all the regions in the world.

Among the eight commodity groups analysed (meat and fish, dairy and eggs, fruits and vegetables, grains, sugar, processed foods, coffee and tea, and vegetable oils), the patterns are similar by region. The most significant increase at the global level can be expected in the production of coffee and tea with 33 percent, followed by grains, fruits and vegetables and sugar with an increase of around 20 percent, and meat and fish, dairy and eggs, processed food and vegetable oil increasing by less than 15 percent under the assumptions of the first scenario (Figure 8).

In the case where only the yield gap is reduced in sub-Saharan Africa, we see a high growth rate in the production of all commodity groups (following the same ranking as in the global productivity scenario) but with a difference that production growth in other regions of the world could decline compared to the base.

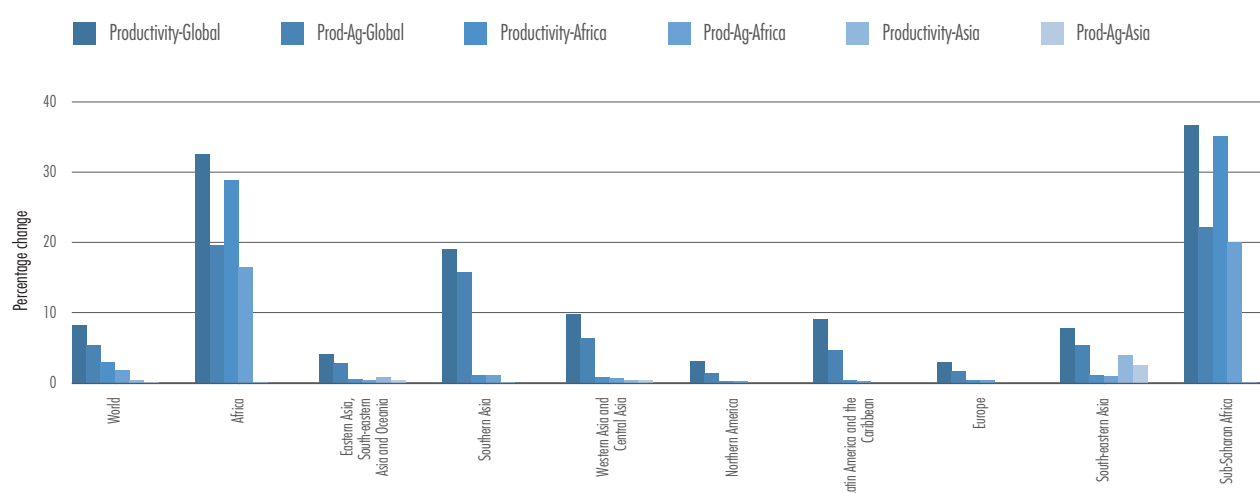
The third scenario follows the same patterns as the previous two scenarios, but, in this case, Asian countries would benefit the most. However, as noted previously, the size (level of impact) in Asia is smaller than in the global or African scenarios, given that Asian countries are already closer to their potential yield.

In the African and Asian scenarios, decreases in production in the regions where there are no extra productivity increases that will reduce the yield gap will be a consequence of the rise in production from the regions benefited by the increase in productivity and the impact on the reduction of prices.

**Figure 8. Agrifood production, percentage change from baseline**

Note: Regional groups are not mutually exclusive: South-eastern Asia is a subgroup of Eastern Asia, South-eastern Asia and Oceania and sub-Saharan Africa is a subgroup of Africa. Productivity-Global: scenario in which productivity gaps are reduced by half in the world; Prod-Ag-Global: scenario in which only yield gaps in agriculture are reduced by half in the world; Productivity-Africa: scenario in which productivity gaps are reduced by half only in sub-Saharan Africa; Prod-Ag-Africa: scenario in which only yield gaps in agriculture are reduced by half in sub-Saharan Africa; Productivity-Asia: scenario in which productivity gaps are reduced by half only in South-eastern Asia; Prod-Ag-Asia: scenario in which only yield gaps in agriculture are reduced by half in South-eastern Asia. Source: Laborde, D. and Valeria, P. 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. <https://doi.org/10.4060/cc3135en>.

Increased productivity increases production and lower food prices, leading to increased demand and food consumption. In the first scenario, world consumption of coffee and tea is projected to increase by around 55 percent. This is followed by grains with a consumption increase of 20 percent, fruits and vegetables with 17 percent, sugar with 16 percent, dairy and eggs with almost 14 percent, meat and fish and processed food with 8 percent, and vegetable oils with around 6 percent with respect to the base year (Figure 9).

**Figure 9. Agrifood consumption, percentage change from baseline**

Note: Regional groups are not mutually exclusive: South-eastern Asia is a subgroup of Eastern Asia, South-eastern Asia and Oceania and sub-Saharan Africa is a subgroup of Africa. Productivity-Global: a scenario in which productivity gaps are reduced by half in the world; Prod-Ag-Global: a scenario in which only yield gaps in agriculture are reduced by half in the world; Productivity-Africa: a scenario in which productivity gaps are reduced by half only in sub-Saharan Africa; Prod-Ag-Africa: a scenario in which only yield gaps in agriculture are reduced by half in sub-Saharan Africa; Productivity-Asia: a scenario in which productivity gaps are reduced by half only in South-eastern Asia; Prod-Ag-Asia: a scenario in which only yield gaps in agriculture are reduced by half in South-eastern Asia. Source: Laborde, D. and Valeria, P. 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. <https://doi.org/10.4060/cc3135en>.

Food prices, as expected given the production increases, will see a decline of a range of 15 to 34 percent depending on the region for the first scenario, with smaller decreases in the case of only reducing the yield gap in sub-Saharan Africa and even less in the case of South-eastern Asia (Table 2). The reduction of food prices and the welfare benefits are reflected in a higher food purchasing power in all regions.

**Table 2. Food prices, actual consumption weights**

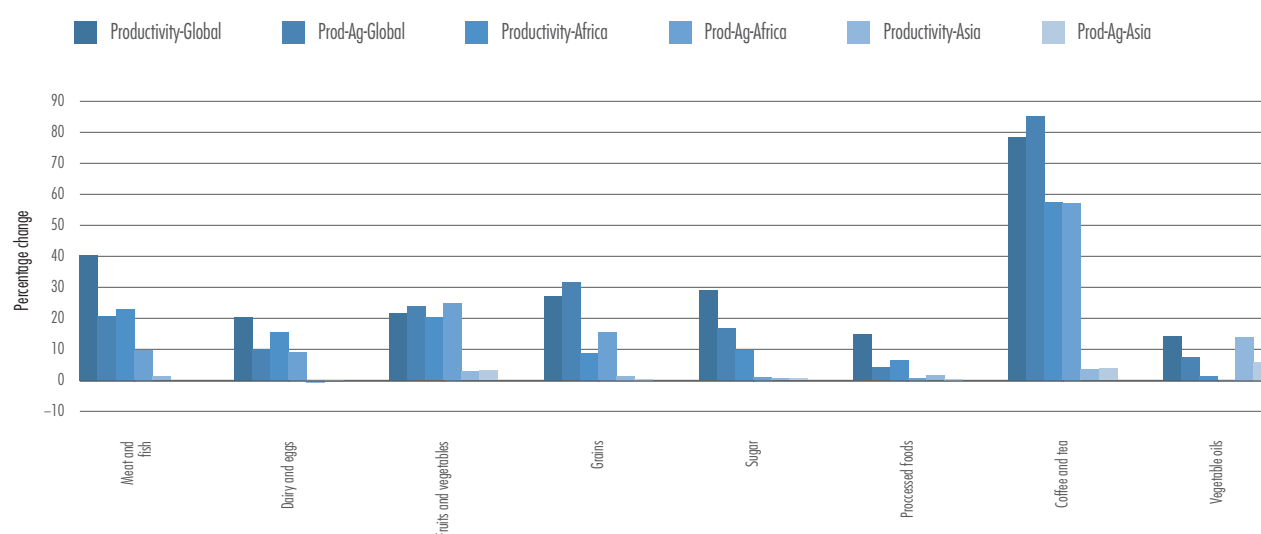
	Productivity-Global	Prod-Ag-Global	Productivity-Africa	Prod-Ag-Africa	Productivity-Asia	Prod-Ag-Asia
World	-14	-9	-3	-2	0	0
Africa	-28	-17	-23	-13	0	0
Eastern Asia, South-eastern Asia and Oceania	-7	-5	-1	-1	-1	0
Southern Asia	-24	-20	-2	-2	0	0
Western Asia and Central Asia	-20	-13	-2	-2	0	0
Northern America	-12	-5	-1	-1	0	0
Latin America and the Caribbean	-19	-10	-1	-1	0	0
Europe	-12	-7	-2	-1	0	0
South-eastern Asia	-11	-7	-1	-1	-5	-3
Sub-Saharan Africa	-29	-17	-27	-15	0	0

Note: Regional groups are not mutually exclusive: South-eastern Asia is a subgroup of Eastern Asia, South-eastern Asia and Oceania and sub-Saharan Africa is a subgroup of Africa. Productivity-Global: a scenario in which productivity gaps are reduced by half in the world; Prod-Ag-Global: a scenario in which only yield gaps in agriculture are reduced by half in the world; Productivity-Africa: a scenario in which productivity gaps are reduced by half only in sub-Saharan Africa; Prod-Ag-Africa: a scenario in which only yield gaps in agriculture are reduced by half in sub-Saharan Africa; Productivity-Asia: a scenario in which productivity gaps are reduced by half only in South-eastern Asia; Prod-Ag-Asia: a scenario in which only yield gaps in agriculture are reduced by half in South-eastern Asia.

Source: Laborde, D. and Valeria, P. 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. <https://doi.org/10.4060/cc3135en>.

In the productivity scenarios, the income effect dominates the price effect. This can be seen when comparing sub-Saharan Africa (food price decreased 29 percent with respect to the baseline, and food purchasing power increased by 82 percent) with Northern America (food price decreased 12 percent with respect to the baseline, and food purchasing power increased by 15 percent) in the global productivity shock scenario. When productivity increases, wages go up and hence, income goes up as well.

The productivity increases also affect trade. When a global improvement in productivity occurs, the world benefits from an increase in the level of trade. However, we can see differences in a group of commodities. Looking at the scenario of a global reduction in the yield gap in the agricultural sector and agro-industry, coffee and tea exports increase the most, followed by meat and fish, sugar and grains. In the case of a reduction of the yield gap only in sub-Saharan Africa, all commodity groups see an increase in exports following the same pattern, that follows the comparative advantage of the region in the different commodity groups, as the case of a global reduction on the yields, however with a minor increase in exports given that only a subset of countries observe the increase in productivity. For the last set of scenarios, in which only countries in South-eastern Asia benefit from the increase in productivity, only vegetable oils and fruits and vegetables would see an increase in exports.

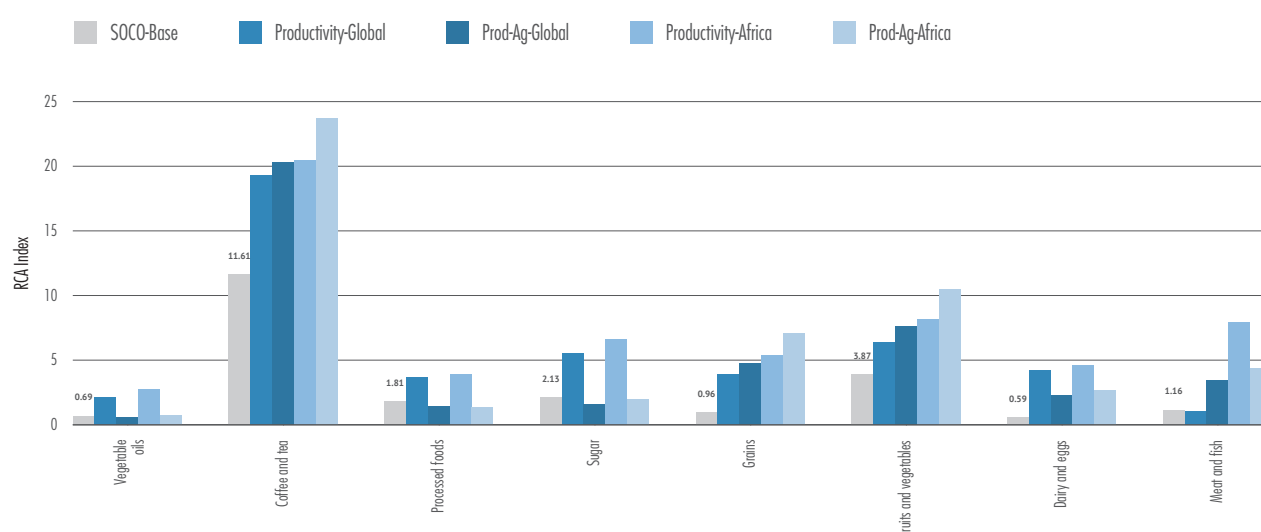
**Figure 10.** Exports by commodity group, world, percentage change from baseline

Note: Productivity-Global: a scenario in which productivity gaps are reduced by half in the world; Prod-Ag-Global: a scenario in which only yield gaps in agriculture are reduced by half in the world; Productivity-Africa: a scenario in which productivity gaps are reduced by half only in sub-Saharan Africa; Prod-Ag-Africa: a scenario in which only yield gaps in agriculture are reduced by half in sub-Saharan Africa; Productivity-Asia: a scenario in which productivity gaps are reduced by half only in South-eastern Asia; Prod-Ag-Asia: a scenario in which only yield gaps in agriculture are reduced by half in South-eastern Asia.  
Source: Laborde, D. and Valeria, P. 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. <https://doi.org/10.4060/cc3135en>.

For a country, many factors can influence trade in food and agricultural products. Still, 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 the endowments of natural resources and production factors that define production costs influence the comparative advantage of each region.

The following figure shows the RCA Index<sup>5</sup> of sub-Saharan Africa for the base, global and African scenarios. The region has a comparative advantage in coffee and tea of around 12, showing the level of specialization in that commodity group, and sees an increase of between 19 and 24 once the world or just the region reduces the current yield gap. Fruits and vegetables will also improve in their RCA in all scenarios. The commodity groups, grains, meat and fish would gain in comparative advantage in the scenario, where only sub-Saharan Africa reduces its yield gaps.

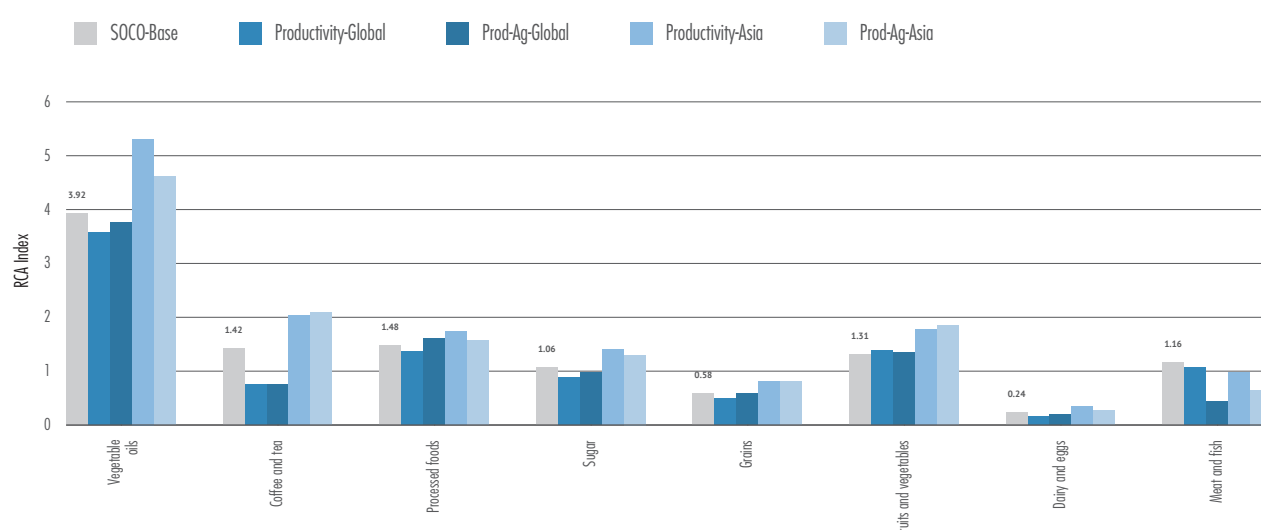
<sup>5</sup> Revealed Comparative Advantage Index (Balassa, 1965).  $RCA_{ij} = (x_{ij}/X_{it}) / (x_{wj}/X_{wt})$ . If the Balassa index for a product is more than 1, product involves specialization. If it is less than 1, no specialization is involved in the product.

**Figure 11. Revealed Comparative Advantages, sub-Saharan Africa**

Note: SOCO-Base: baseline scenario; Productivity-Global: a scenario in which productivity gaps are reduced by half in the world; Prod-Ag-Global: a scenario in which only yield gaps in agriculture are reduced by half in the world; Productivity-Africa: a scenario in which productivity gaps are reduced by half only in sub-Saharan Africa; Prod-Ag-Africa: a scenario in which only yield gaps in agriculture are reduced by half in sub-Saharan Africa.

Source: Laborde, D. and Valeria, P. 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. <https://doi.org/10.4060/cc3135en>.

The RCA for South-eastern Asia that shows the level of specialization the region has per commodity group shows that South-eastern Asia is more specialized in vegetable oils, coffee and tea. In the case of a productivity shock, South-eastern Asia would increase their specialization in those two commodities.

**Figure 12. Revealed Comparative Advantages, South-eastern Asia**

Note: SOCO-Base: baseline scenario; Productivity-Global: a scenario in which productivity gaps are reduced by half in the world; Prod-Ag-Global: a scenario in which only yield gaps in agriculture are reduced by half in the world; Productivity-Asia: a scenario in which productivity gaps are reduced by half only in South-eastern Asia; Prod-Ag-Asia: a scenario in which only yield gaps in agriculture are reduced by half in South-eastern Asia.

Source: Laborde, D. and Valeria, P. 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. <https://doi.org/10.4060/cc3135en>.

## 5.2 Improving infrastructure and institutions

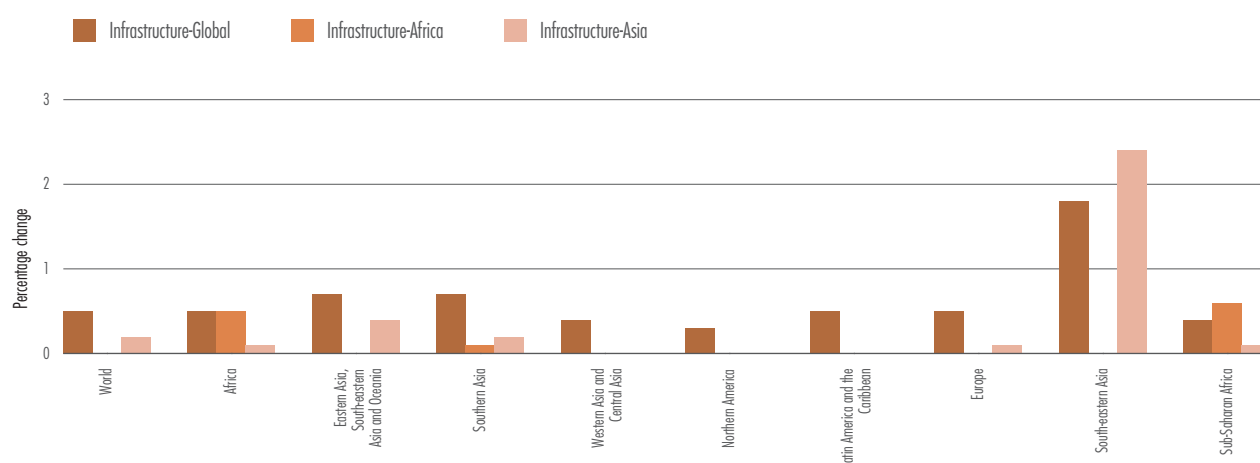
A different investment strategy would be to focus on improving roads, other infrastructure projects and institutions, which we represent by imposing a reduction in transaction costs. By construction, those margins are shown by the commodity group, meaning that they may affect commodities wherever they are produced.

Three scenarios are assessed. The first scenario (Infrastructure-Global), where the transport costs and NTBs are reduced by half in the world but also two more scenarios in which only one region of the world will have the trade costs reduced. The second scenario (Infrastructure-Africa) covers reducing the costs for only sub-Saharan Africa, while the third scenario (Infrastructure-Asia) looks at the case of South-Eastern Asia.

In the case of a global improvement in infrastructure and institutions, real GDP increases in all regions of the world with a range of 0.5 and 1.8 percent with respect to the base. Asia, and in particular, South-eastern Asia, are the regions that will benefit the most from improvements in trade costs. This will allow them to have better market access for their domestic production. Africa and Latin America and the Caribbean also observe an improvement in their GDP but not as big given that they face different constraints in pursuing agricultural growth (Figure 13).

In the second scenario, in which trade costs are only reduced in sub-Saharan Africa, we expect similar levels of improvement of almost a 0.5 percent increase for the baseline for Africa and a 0.6 percent for sub-Saharan Africa (compared to 0.4 in the case of a global reduction in trade costs). South-eastern Asia is the region that benefits the most from improvements in infrastructure and institutions, with a GDP increase of 2.4 percent with respect to the baseline.

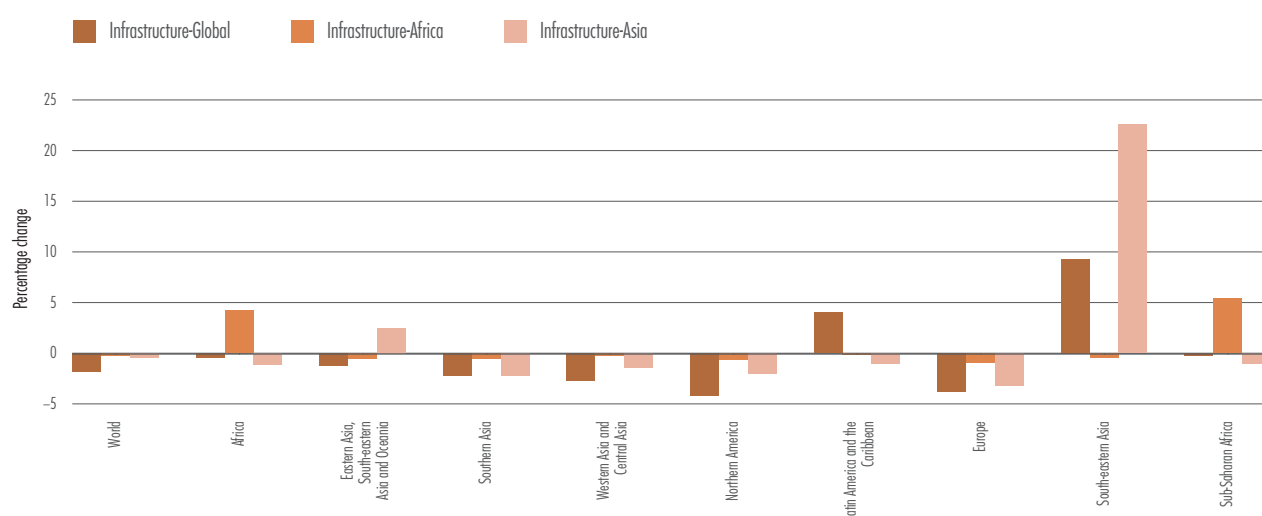
**Figure 13. Real GDP, percentage change from baseline**



Note: Regional groups are not mutually exclusive: South-eastern Asia is a subgroup of Eastern Asia, South-eastern Asia and Oceania and sub-Saharan Africa is a subgroup of Africa. Infrastructure-Global: a scenario in which transport costs and non-tariff barriers are reduced by half in the world; Infrastructure-Africa: a scenario in which transport costs and non-tariff barriers are reduced by half only in sub-Saharan Africa; Infrastructure-Asia: a scenario in which transport costs and non-tariff barriers are reduced by half only in South-eastern Asia.

Source: Laborde, D. and Valeria, P. 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. <https://doi.org/10.4060/cc3135en>.

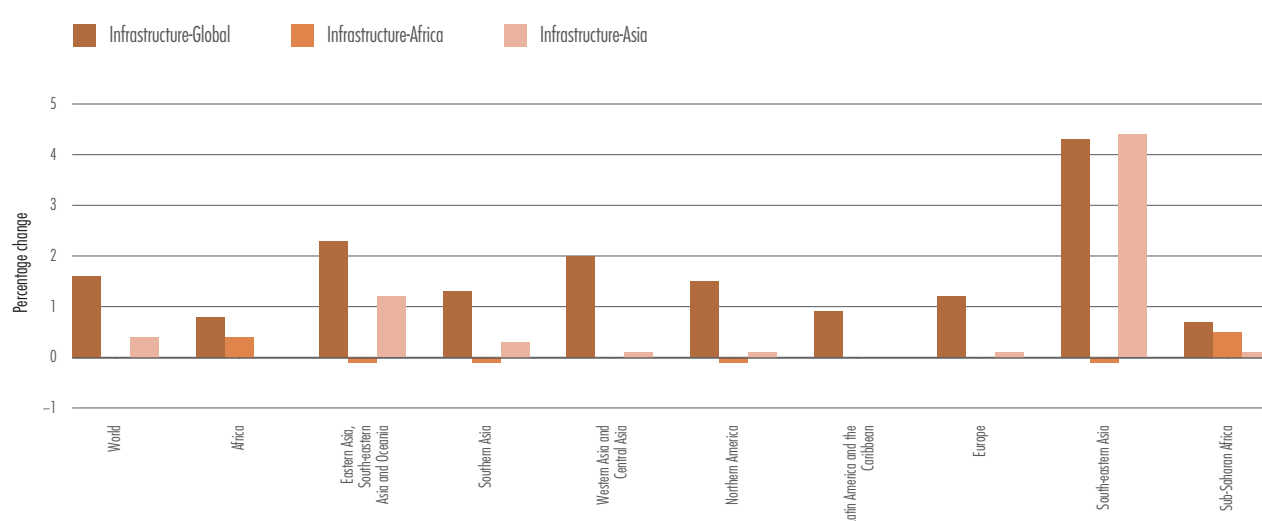
In the global scenario, where trade costs and barriers are reduced, food and agricultural production increases in South-eastern Asia by 9.3 percent with respect to the base, in Latin America and the Caribbean by almost 4 percent. The other regions do not see an increase in agro-food products showing the differences between regions (Figure 14).

**Figure 14. Agrifood production, percentage change from baseline**

Note: Regional groups are not mutually exclusive: South-eastern Asia is a subgroup of Eastern Asia, South-eastern Asia and Oceania and sub-Saharan Africa is a subgroup of Africa. Infrastructure-Global: a scenario in which transport costs and non-tariff barriers are reduced by half in the world; Infrastructure-Africa: a scenario in which transport costs and non-tariff barriers are reduced by half only in sub-Saharan Africa; Infrastructure-Asia: a scenario in which transport costs and non-tariff barriers are reduced by half only in South-eastern Asia.

Source: Laborde, D. and Valeria, P. 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. <https://doi.org/10.4060/cc3135en>.

Looking at food consumption, when trade costs and barriers are reduced, all regions increase their consumption levels. As a result, the world would consume 1.6 percent more food products compared to the baseline and South-eastern Asia with 4.3 percent, followed by the aggregate region of Eastern and South-eastern Asia and Oceania with 2.3 percent, Northern America with 1.5 percent, Europe with 1.2 percent and Latin America and the Caribbean with almost 1 percent. (Figure 15).

**Figure 15. Agrifood consumption, percentage change from baseline**

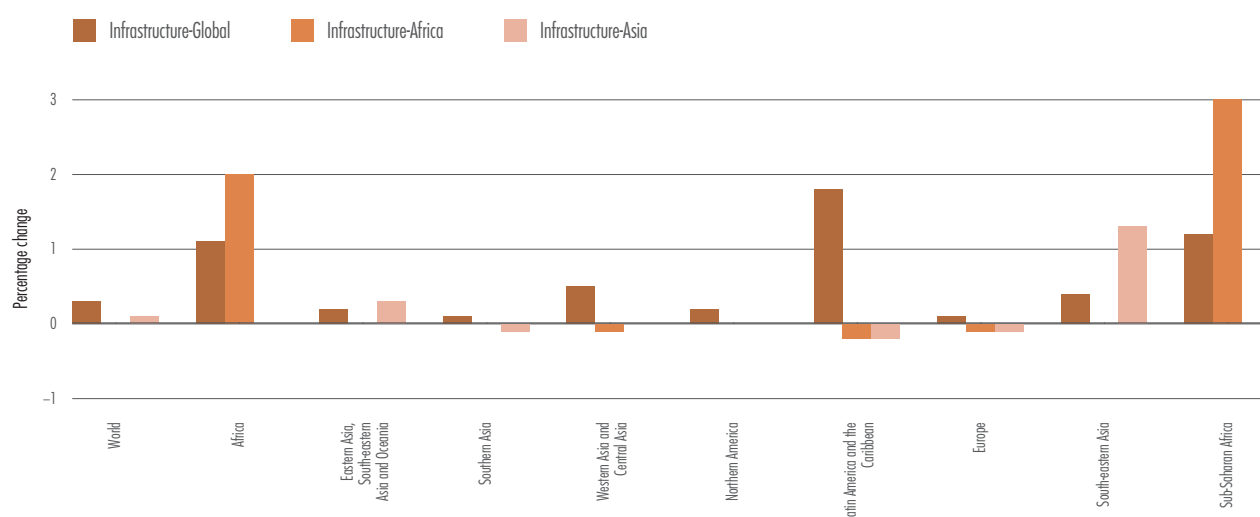
Note: Regional groups are not mutually exclusive: South-eastern Asia is a subgroup of Eastern Asia, South-eastern Asia and Oceania and sub-Saharan Africa is a subgroup of Africa. Infrastructure-Global: a scenario in which transport costs and non-tariff barriers are reduced by half in the world; Infrastructure-Africa: a scenario in which transport costs and non-tariff barriers are reduced by half only in sub-Saharan Africa; Infrastructure-Asia: a scenario in which transport costs and non-tariff barriers are reduced by half only in South-eastern Asia.

Source: Laborde, D. and Valeria, P. 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. <https://doi.org/10.4060/cc3135en>.

Trade costs include transportation, and other costs related to insurance, export and import procedures and time delays at the borders. Such costs can be influenced by the distance of the markets and by domestic procedures required in trading commodities. Trade costs also inhibit the influence of comparative advantages.

Terms of trade are impacted by the reduction in trade costs and barriers. In the case of a global reduction, all regions in the world see an improvement in their terms of trade, by showing a higher increase in export value relative to import value (Figure 16). If only sub-Saharan Africa reduces their costs, the benefits can be observed in the region and Africa and a minor deterioration in terms of trade of Latin America and the Caribbean, showing the increase of imports of that region from sub-Saharan Africa. Replicating the scenario for South-eastern Asia, reducing trade costs, South-Eastern Asia and Asia would see an improvement in terms of trade and Latin America and the Caribbean a slight deterioration. For both scenarios, once the trade costs are reduced in the specific region, trade patterns are modified, favoring the increase in exports from the region to the world.

**Figure 16. Terms of trade, percentage change from baseline**



Note: Regional groups are not mutually exclusive: South-eastern Asia is a subgroup of Eastern Asia, South-eastern Asia and Oceania and sub-Saharan Africa is a subgroup of Africa. Infrastructure-Global: a scenario in which transport costs and non-tariff barriers are reduced by half in the world; Infrastructure-Africa: a scenario in which transport costs and non-tariff barriers are reduced by half only in sub-Saharan Africa; Infrastructure-Asia: a scenario in which transport costs and non-tariff barriers are reduced by half only in South-eastern Asia.

Source: Laborde, D. and Valeria, P. 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. <https://doi.org/10.4060/cc3135en>.

To conclude, South-Eastern Asia and Latin America and the Caribbean will benefit more from working towards the elimination of trade barriers, given that these regions are highly competitive but constrained by high trade costs. However, Africa will benefit more from increasing agricultural productivity.

### 5.3 Global and regional integration

The last set of scenarios cover deep integration scenarios. The first scenario (Integration-Global), where all transport costs, NTBs and border measures are eliminated, constitutes an illustration of a world with free trade. In two additional scenarios, only one region will have deep integration. The second scenario (Integration-Africa) illustrates the case of deep integration in only Africa, while the third scenario (Integration-Asia) looks at integration in only Asia.<sup>6</sup>

Deep integration agreements have the dual benefit of improving market access through preferential tariffs and minimizing trade costs by converging domestic regulation and harmonizing NTMs. In an ideal world of deep integration and frictionless trade – free of tariffs and trade costs – trade flows would instead be shaped by comparative advantages that arise from differences in technology and resource endowments.

In a world free of tariffs and trade costs, the global GDP would be 1.2 percent higher than today. All regions in the world would observe an increase in their GDP, with Asian countries seeing the highest increase starting with South-eastern Asia with 6.7 percent, followed by Eastern and South-eastern Asia together with Oceania as a whole and Southern Asia with 1.9 and 1.7 percent, respectively. Africa and Latin America and the Caribbean showing 1.3 and 1.2 percent. Regions with mostly high-income countries such as Europe and Northern America with 1 and 0.6 percent increase in GDP, respectively.

In the other two scenarios that illustrate regional integration of Africa and Asia, the impact on GDP is seen predominantly in their respective region. For the case of African deeper integration, a 0.14 percent increase in GDP with respect to the base is seen, while for the Asian deeper integration scenario a 1 percent increase in the GDP for the region including Eastern and South-eastern Asia and Oceania could be obtained.

**Figure 17. Real GDP, percentage change from baseline**



Note: Regional groups are not mutually exclusive: South-eastern Asia is a subgroup of Eastern Asia, South-eastern Asia and Oceania and sub-Saharan Africa is a subgroup of Africa. Integration-Global: a scenario in which all transport costs, non-tariff barriers and border measures are eliminated in the world; Integration-Africa: a scenario in which all transport costs, non-tariff barriers and border measures are eliminated in sub-Saharan Africa; Integration-Asia: a scenario in which all transport costs, non-tariff barriers and border measures are eliminated in South-eastern Asia.

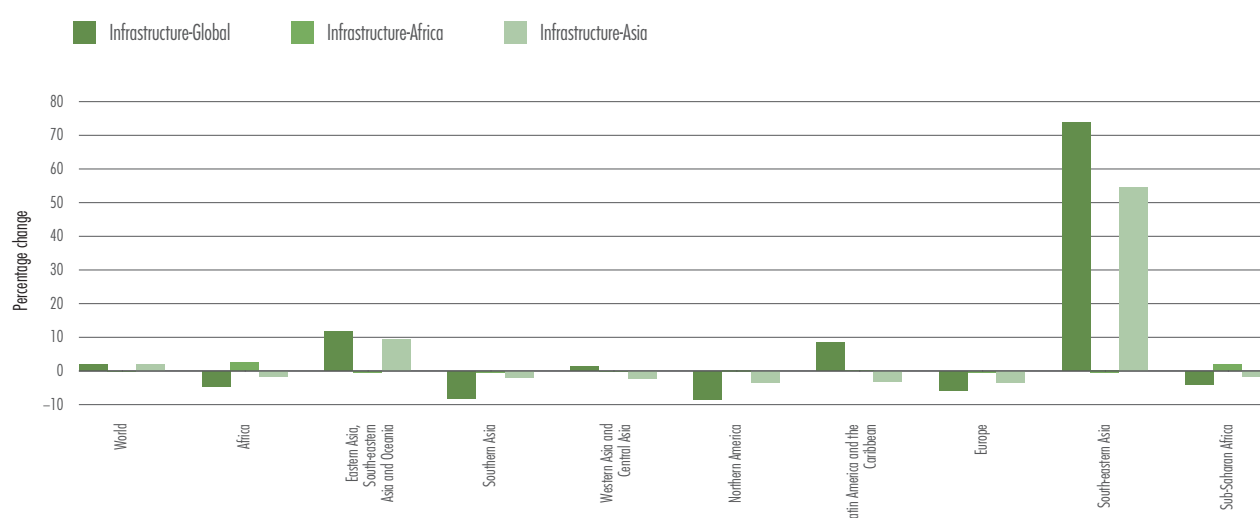
Source: Laborde, D. and Valeria, P. 2022. The impact of changes in the fundamental drivers of trade – Productivity, trade costs, and trade policies. Background paper for The State of Agricultural Commodity Markets 2022. Rome, FAO. <https://doi.org/10.4060/cc3135en>.

<sup>6</sup> The second scenario (Integration-Africa) can be seen as an illustration of the AfCFTA while the third scenario (Integration-Asia) is inspired by the RCEP.

Reducing tariffs mitigates the “loss of efficiency” costs generated by the distortions created by the tariff and could generate a positive incentive to expand the market, allowing producers in exporting countries to take advantage of economies of scale while expanding their production.

World agricultural production is higher in the case of free trade. However, when examining each region, we can see that production in Eastern and South-eastern Asia and Oceania (12 percent), driven by South-eastern Asia (74 percent), and Latin-America and the Caribbean (8.6 percent) increased, while this is not the case in the other regions. Regions that are already competitive can take advantage of better market access to other regions by increasing the production of agricultural goods. As distortions decrease, food prices decrease between 5 percent in Africa and 17 percent in Europe, translating into an increase in the food purchasing power of almost 8 percent in Africa and 30 percent in South-eastern Asia.

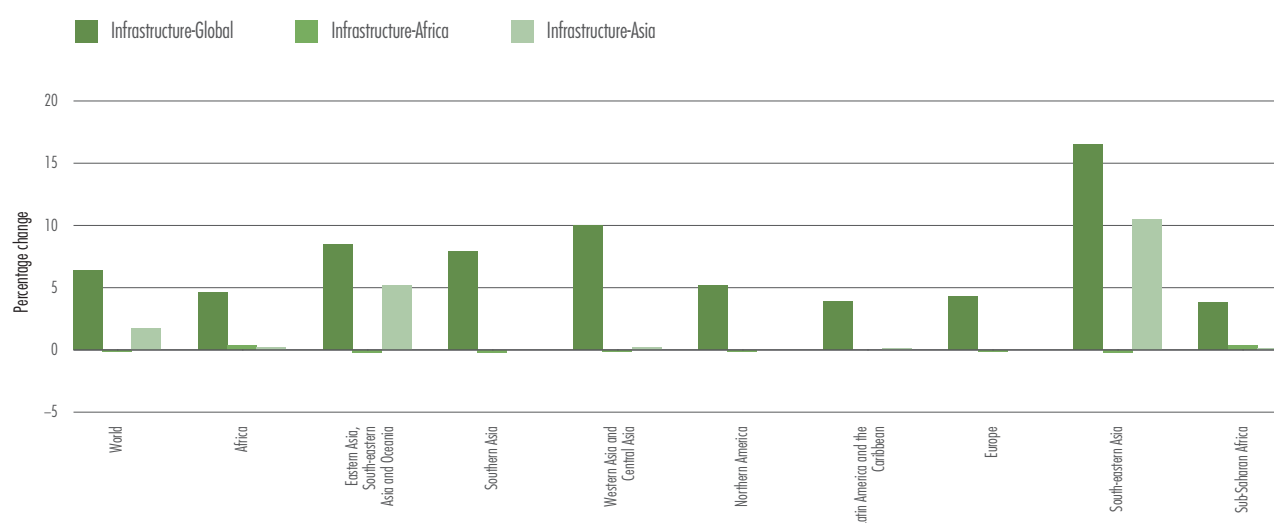
**Figure 18. Agrifood production, percentage change from baseline**



Note: Regional groups are not mutually exclusive: South-eastern Asia is a subgroup of Eastern Asia, South-eastern Asia and Oceania and sub-Saharan Africa is a subgroup of Africa. Integration-Global: a scenario in which all transport costs, non-tariff barriers and border measures are eliminated in the world; Integration-Africa: a scenario in which all transport costs, non-tariff barriers and border measures are eliminated in sub-Saharan Africa; Integration-Asia: a scenario in which all transport costs, non-tariff barriers and border measures are eliminated in South-eastern Asia.  
Source: Laborde, D. and Valeria, P. 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. <https://doi.org/10.4060/cc3135en>.

In the case of a global trade integration scenario, agricultural consumption sees an increase in all regions taking advantage of the lower food prices and higher food purchasing power. Suppose Africa eliminates tariffs, NTBs and trade costs inside the region, the consumption in African countries would increase by 0.4 percent. If the same is applied to Asia, their consumption would increase by 5 percent.

**Figure 19. Agrifood consumption, percentage change from baseline**

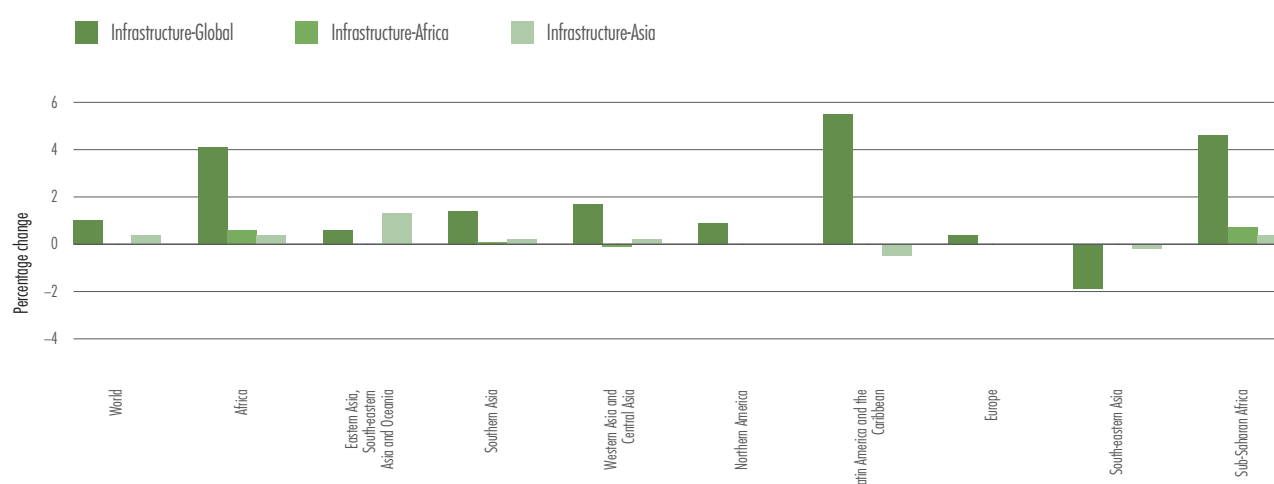


Note: Regional groups are not mutually exclusive: South-eastern Asia is a subgroup of Eastern Asia, South-eastern Asia and Oceania and sub-Saharan Africa is a subgroup of Africa. Integration-Global: a scenario in which all transport costs, non-tariff barriers and border measures are eliminated in the world; Integration-Africa: a scenario in which all transport costs, non-tariff barriers and border measures are eliminated in sub-Saharan Africa; Integration-Asia: a scenario in which all transport costs, non-tariff barriers and border measures are eliminated in South-eastern Asia.

Source: Laborde, D. and Valeria, P. 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. <https://doi.org/10.4060/cc3135en>.

It is worth noting that Africa sees an improvement in trade in the three scenarios, even the one that only refers to deeper integration in Asia. Latin America and the Caribbean sees a gain of almost 5.5 percent in the case of global integration, nearly no change in the case of African deep integration and a deterioration of its terms of trade of 0.5 percent in the case of the Asian deeper integration. This suggests that there is some competition in the international markets of food products with Asia but not Africa and lower levels of food consumption in Africa compared to other regions.

**Figure 20. Terms of trade, percentage change from baseline**



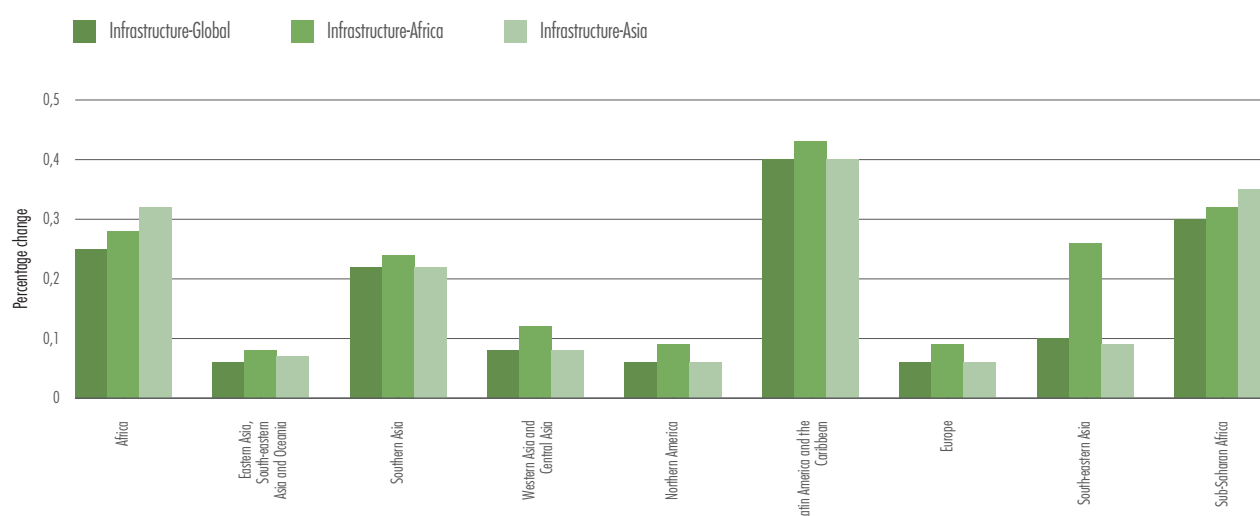
Note: Regional groups are not mutually exclusive: South-eastern Asia is a subgroup of Eastern Asia, South-eastern Asia and Oceania and sub-Saharan Africa is a subgroup of Africa. Integration-Global: a scenario in which all transport costs, non-tariff barriers and border measures are eliminated in the world; Integration-Africa: a scenario in which all transport costs, non-tariff barriers and border measures are eliminated in sub-Saharan Africa; Integration-Asia: a scenario in which all transport costs, non-tariff barriers and border measures are eliminated in South-eastern Asia.

Source: Laborde, D. and Valeria, P. 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. <https://doi.org/10.4060/cc3135en>.

To analyse the possible concentration of exports by region, we calculated the Export Diversification Index (EDI)<sup>7</sup>, which measures, for each product group, the degree of export market concentration by region of origin. Latin America and the Caribbean and Africa display levels of export concentration higher than other regions in the base year. The causes of the lack of export diversification are different for these two regions. In the case of Africa, the lack of export diversification is due to persistent challenges around structural economic transformation, including slow productivity growth and limited advancement in technology and industrialization, while in Latin America and the Caribbean, it is due to the specialization in commodity exports.

Latin America and the Caribbean is the region with the highest EDI, 0.4 in the base (today) and reflects the pattern of the previous variables explained in this section (production, consumption, and terms of trade). EDI increases in the case of a world with free trade, does not change much in the case of deeper African integration and decreases if a deeper Asian integration is fulfilled. Africa would see an increase in export diversification in the case of deep global integration and Africa's deeper integration. The same would result for Asia in the case of a global free trade scenario and the Asian deeper integration. Northern America and Europe see an increase in their EDI in the case of a free trade world, no changes in the African scenario and an increase in the index of export diversification in the case of an Asian deep integration scenario, showing the second-round effect of the improvement in the level of consumption and food purchasing power in Asia.

**Figure 21. Export diversification index**



Note: Regional groups are not mutually exclusive: South-eastern Asia is a subgroup of Eastern Asia, South-eastern Asia and Oceania and sub-Saharan Africa is a subgroup of Africa. SOCO-Base: a baseline scenario; Integration-Global: a scenario in which all transport costs, non-tariff barriers and border measures are eliminated in the world; Integration-Africa: a scenario in which all transport costs, non-tariff barriers and border measures are eliminated in sub-Saharan Africa; Integration-Asia: a scenario in which all transport costs, non-tariff barriers and border measures are eliminated in South-eastern Asia.

Source: Laborde, D. and Valeria, P. 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. <https://doi.org/10.4060/cc3135en>.

<sup>7</sup> The export diversification (EDI) index for a country is defined as:  $EDI_j = (\sum |h_{ij} - x_i|) / 2$ .

Where  $h_{ij}$  is the share of commodity,  $i$  in the total exports of country  $j$  and  $x_i$  is the share of the commodity in world exports. The lower the index, the less concentrated are a country's exports.

Last, we computed the TCI<sup>8</sup> to measure the degree to which one region's export pattern matches another's import pattern. This index can be used as an indicator in evaluating the possibility of successful trade agreements in the case of the existence of a high degree of complementarity.

The following figures zoom in on the two regions of focus, Africa and Asia. The first one shows the TCI for Africa in the three scenarios of this section of the report. In this regard, trade complementarity would show how the composition of Africa's export supply matches or mismatches the other region's import demand. If Africa's export supply matches with a region's import demand, complementarity exists and there would be opportunities for Africa's exports to increase to that region. If there is a mismatch, it implies absence of complementarity, and there would be low opportunities for Africa's exports to that region.

Table 3 shows a match between Africa's exports supply and the world's imports demand regions as the indices set between 60 and 89. The higher the value of the index toward 100, the higher the adequacy of Africa's export supply in meeting a region's import demand. The result from the trade complementarity index shows that when there is a deeper integration in Africa, the complementarity increases with only Latin America and the Caribbean. However, it is important to note that the initial trade complementarity between Africa and Latin America and the Caribbean was the lowest.

**Table 3. Trade complementarity index, Africa**

	SOCO-Base	Integration-Global	Integration-Africa	Integration-Asia
Eastern Asia, South-eastern Asia and Oceania	86	86	81	88
Northern America	89	88	85	87
Latin America and the Caribbean	65	60	69	69
Europe	89	86	84	87

Note: SOCO-Base: baseline scenario; Integration-Global: scenario in which all transport costs, non-tariff barriers and border measures are eliminated in the world; Integration-Africa: a scenario in which all transport costs, non-tariff barriers and border measures are eliminated in sub-Saharan Africa; Integration-Asia: a scenario in which all transport costs, non-tariff barriers and border measures are eliminated in South-eastern Asia.

Source: Laborde, D. and Valeria, P. 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. <https://doi.org/10.4060/cc3135en>.

Looking at Asia, we can see that Asia's complementarity with other regions does not change in the case of deeper integration in Africa. This scenario would not create opportunities for Asian exports to increase to that region. However, in the case of an Asian integration scenario, TCI increases for Africa and Latin America and the Caribbean, and deeper integration in Asia would create opportunities for their exports to other regions, given the increase in efficiency. (Table 4).

<sup>8</sup> TC between countries k and j is defined as:  $TC_{ij} = 100(1 - \sum(|m_{ik} - x_{ij}| / 2))$ .

Where  $x_{ij}$  is the share of good i in global exports of country j and  $m_{ik}$  is the share of good i in all imports of country k. The index is zero when no goods are exported by one country or imported by the other and 100 when the export and import shares exactly match.

**Table 4.** Trade complementarity index, Asia

	SOCO-Base	Integration-Global	Integration-Africa	Integration-Asia
Africa	75	71	68	79
Northern America	93	87	93	77
Latin America and the Caribbean	62	59	62	72
Europe	93	86	93	77

Note: SOCO-Base: baseline scenario; Integration-Global: scenario in which all transport costs, non-tariff barriers and border measures are eliminated in the world; Integration-Africa: a scenario in which all transport costs, non-tariff barriers and border measures are eliminated in sub-Saharan Africa; Integration-Asia: a scenario in which all transport costs, non-tariff barriers and border measures are eliminated in South-eastern Asia.

Source: Laborde, D. and Valeria, P. 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. <https://doi.org/10.4060/cc3135en>.



# CHAPTER 6

## Conclusions



## 6 Conclusions

The 2022 crisis has highlighted the importance of diversification in dealing with the increased level of risk in the current world. Trade tensions, COVID-19, increasing natural disasters and conflict create problems in logistics and trade, impacting the accessibility and affordability of inputs and food products, translating into more volatility in the markets and the implementation of domestic policies that may reinforce higher world prices.

This is the time to think about the possible paths to transform the agrifood system. This paper analysed three different paths, and even though we looked at them separately, they should not be seen as stand-alone ones. Policies driving agricultural productivity growth such as investments in research and development, economic reforms that strengthen incentives for farmers, rural education and extension, and improved infrastructure have been shown to reduce the yield gap. It is also important to think about improving productivity growth while addressing the concerns for food security and sustainability and the resilience of the agrifood system.

To strengthen their resilience and ensure food security and healthy diets, countries should aim to diversify the products they import and increase the number of their trading partners. Policies should aim to improve agricultural productivity and reduce trade costs to reap the benefits of trade. Measures taken to increase trade integration in Africa and Asia will be important for economic growth and development in these regions. Lower trade costs will make a country more open to trade and let comparative advantage play out, resulting in gains from trade.



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