
World Trade Organization

Economic Research and Statistics Division

HOW WILL GLOBAL TRADE PATTERNS EVOLVE IN THE LONG RUN?

Eddy Bekkers^{*}, Erwin Corong[†], Jeanne Métivier[‡] and Daniil Orlov[§]

Manuscript date: 31 January 2023

Disclaimer: The opinions expressed in this article should be attributed to its authors. They are not meant to represent the positions or opinions of the WTO and its Members and are without prejudice to Members' rights and obligations under the WTO.

^{*} World Trade Organization

[†] Center for Global Trade Analysis (GTAP), Purdue University

[‡] World Trade Organization, Kedge Business School

[§] World Trade Organization

How will global trade patterns evolve in the long run?

Eddy Bekkers*, Erwin Corong†, Jeanne Métiévier‡ and Daniil Orlov§

January 31, 2023

Abstract

In this paper the evolution of global trade patterns until 2050 is projected with a recursive dynamic computable general equilibrium (CGE) model. Feeding the model with exogenous projections on macroeconomic, demographic, sectoral and trade cost variables, the evolution of trade patterns emerges endogenously from the model. The approach is innovative in both modelling approach and exogenous inputs. GDP growth emerges endogenously in the model because of diffusion of ideas as a result of international trade and trade cost changes are based on estimates of technology and trade policy changes. The projections indicate that (i) because of projected reductions in trade costs, trade will grow more than GDP, generating a global trade-to-GDP growth rate of 1.1; (ii) because of structural change, the global share of manufacturing trade falls from 64% in 2020 to 52% by 2050, whereas the share of services trade rises substantially from 24% to 38%; (iii) because of technological catch-up, the share in global trade of both developing and least-developed countries (LDCs) will rise (with developing countries overtaking developed economies around 2035), the share of intra-developed country trade will fall, whereas the share of intra-developing country trade and those between developing and developed countries will rise.

JEL Codes: F17, D58

Keywords: Global trade patterns, long-run projections, dynamic CGE models

Disclaimer: The opinions expressed in this article should be attributed to its authors. They are not meant to represent the positions or opinions of the WTO and its Members and are without prejudice to Members' rights and obligations under the WTO.

*World Trade Organization

†Center for Global Trade Analysis (GTAP), Purdue University

‡World Trade Organization, Kedge Business School

§World Trade Organization

Contents

1	Introduction	1
2	WTO baseline model	4
2.1	The WTO Global Trade Model	4
2.2	Key features of the baseline	5
2.2.1	Macroeconomic variables	6
2.2.2	Demographic variables	6
2.2.3	Sectoral variables	6
2.2.4	Trade cost variables	7
3	How will global trade patterns evolve in the long-term?	7
3.1	Geographical shifts	8
3.1.1	Heterogeneous variations in GDP, population, and exports growth	8
3.1.2	Developing countries take the lead in trade	10
3.1.3	Trade grows faster than GDP	11
3.1.4	Trade between and within regions and groups of countries	12
3.2	Sectoral shifts	14
3.2.1	A global increase in the importance of services in exports	14
3.2.2	A global shift in production from manufacturing to services sectors	18
3.2.3	Value chains: stronger intermediate linkages in services	19
3.3	Geographical and sectoral shifts combined: Changes in patterns of comparative advantage	20
4	Conclusion	26
A	Appendices	29

List of Tables

1	Average growth rates of key indicators, by region (2020-2050, %)	9
2	Income-weighted averages of income elasticities	21
3	Regional and sectoral aggregation	29
4	Detailed mapping of 141 to 25 regions	30
5	Detailed mapping of 65 to 25 sectors	31
6	Difference between sectoral and average total factor productivity growth	32
7	Savings ratio (2020 and 2050, %)	33

List of Figures

1	Relationship between average historical and simulated growth rates (2014-2019)	5
2	Share of aggregate regions in global GDP, Population and Exports (2020-2050)	10
3	Share of exports by aggregate region at FOB prices (excluding intra-region)	11
4	Share of global exports in China, the EU, and the USA at FOB prices (except intra-region, 2020-2050)	12
5	Global and regional trade elasticities (average 2020-2050)	13
6	Share of global trade within and between groups of countries (2020-2050)	14

7	Share of global exports by continent	15
8	Bilateral share of exports by continent	16
9	Share of exports by aggregate sectors, aggregate regions and globally (2020-2050) . .	17
10	Regional and global shares of manufacturing exports (2020-2050)	18
11	Final value of exports by commodity (global, 2020-2050)	19
12	Share of aggregate sectors in total value added in aggregate regions (2020-2050) . . .	20
13	Imported intermediate share in gross output, all goods	22
14	Global imported intermediate share in gross output, by aggregate sector	23
15	Revealed comparative advantage in aggregate sector by aggregate region (2020-2050)	24
16	Revealed comparative advantage by sector and region (2020-2050)	25
17	Share of exports of developed, developing and least-developed countries going to these different groups of countries (2020-2050)	34

1 Introduction

World trade has been affected by significant changes in recent years, for example, increased tensions between the United States of America (USA) and China in 2017, the African Continental Free Trade Area (ACFTA) in 2021 and Regional Comprehensive Economic Partnership (RCEP) in 2022, disruptions in international trade due to sanitary measures and supply chain bottlenecks related to the COVID-19 pandemic, and regional conflicts such as between Ukraine and the Russian Federation, among others.

Trade has displayed extraordinary growth since the 1950s with trade values expanding by a factor 300 since the 1950s. In 2019, global trade reached US\$25 trillion, with merchandise and services exports respectively reaching US\$19 and US\$6 trillion (WTO , 2020).¹ Within merchandise trade, manufactured goods accounted for US\$13 trillion or around 70%, followed by mining products with US\$2.6 trillion and agricultural products with US\$2 trillion (WTO , 2020). In addition to growth in trade values, the geographical and sectoral patterns of trade have also evolved over time. Indeed, the last 30 years have witnessed the emergence of developing economies as an important player in world trade, as they accounted for 44% of global merchandise exports and 30% of services exports in 2019 (UNCTAD, 2020). The increased prominence of developing countries in world trade is mainly driven by Asian countries, especially China. China is the world’s top merchandise exporter, accounting for 13% of global merchandise trade in 2019 (WTO , 2020). China also accounted for 4.6% of services exports in 2019, ranking fifth behind the USA, the United Kingdom (UK), Germany, and France (WTO , 2020). On the other hand, the role of Least Developed Countries (LDCs) in world trade has also been increasing, with their merchandise and services exports growing by 23% and 30% between 2015 and 2019, respectively (WTO , 2020).

The increasing prominence of LDCs and developing countries in world trade, if sustained in the next three decades therefore raises the following questions: How will global trade patterns evolve? Will there be significant changes in the geographical and sectoral composition of trade, which may in turn lead to changes in specialization patterns and alter the importance of trade in the global economy? This paper aims to answer these questions by projecting long-run trade patterns until 2050 using the WTO Global Trade Model, a multi-sector and multi-region recursive dynamic computable general equilibrium (CGE) model (Aguilar et al., 2019).

To observe changes in trade patterns over time, we follow the literature on long-run trade projections (Fontagné and Fouré (2013); Fontagné et al. (2017); and papers in Dellink et al. (2020)) by exogenously imposing onto the WTO Global Trade Model various external projections on macroeconomic, demographic, sectoral, and trade cost variables until 2050. In contrast to previous approaches on long run trade projections targeting external GDP projections based for example on the Shared Socio-Economic Pathways (SSPs) endogenizing total factor productivity (TFP) growth, in this work productivity growth emerges endogenously in the model as a result of a process of diffusion of ideas between countries driven by international trade. We also project savings rates based on estimates from a life-cycle framework, while projected changes in oil, gas and coal prices are sourced from the International Energy Agency (IEA). We complement population and labour force growth from the United Nations (UN) with projections on changes in the share of skilled workers and estimates of labour force participation from the International Institute for Applied Systems Analysis (IIASA). Sectoral projections are imposed, based on our own estimates of changes in preferences and differences in productivity growth between sectors from OECD. Finally, we impose trade cost projections based on changes in trade policies and technologies. Following the literature on trade projections, feedback effects from trade to the externally imposed macroeconomic, demographic,

¹For this exercise, we use 2019 data as 2020 values were affected by the COVID pandemic, which were exceptional and unexpected.

sectoral and trade cost variables are not included, since such effects are highly uncertain and difficult to model. Furthermore, we do not account for shocks associated with the impact of climate change and decarbonization such as changes in crop productivity and carbon pricing, which are beyond the scope of this paper.

Our projections generate six main results. First, trade is projected to grow more than GDP because of reductions in trade costs, with a global ratio of trade to GDP growth of about 1.10—i.e., global trade is projected to grow by 3.09% while global GDP which is projected to grow by 2.72% annually. Previous work by [Fontagné et al. \(2017\)](#) also projects trade to grow more than GDP and our work confirms that trade growth is more dynamic compared to GDP growth. Second, the share of developing countries and LDCs in global trade is projected to rise. Our projections indicate that total exports of developing countries would overtake developed countries' exports by 2034.

Third, the global share of manufacturing trade is projected to fall from 65% in 2020 to 52% by 2050, whereas the share of services trade is expected to rise substantially from 24% to 38%. The share of agriculture in global trade is expected to fall from 2.5% to 0.8%. Fourth, the intra-developed country trade share in global trade is projected to fall from 40% to 21%, whereas the share of trade within developing countries and between developing and developed countries is projected to rise, respectively from 19% to 37% and from 40% to 42%. Hence, the share of South-South trade will rise considerably, while the share of North-South trade is projected to rise marginally. Both increases are at the expense of a reduced share of North-North trade. In terms of regions, the share of exports from Europe, North and South America are projected to fall, whereas the share of East and South-Asian exporters are projected to rise (from 41% to 48%). Africa's share in global trade is projected to double from 3% to 6%. Fifth, the existing comparative advantage of developed economies in services is projected to rise further, while developing countries expand their comparative advantage in manufacturing. The comparative advantage of LDCs is projected to rise in manufacturing and agriculture but expected to fall in natural resources and services. Finally, intermediate linkages in services sectors are expected to become more important: our simulations project an increase in the imported intermediate input to gross output share for the services sectors.

There is a voluminous literature on long-run projections of the global economy based on recursive dynamic CGE models (See special edition on long-run baselines in the *Journal of Global Economic Analysis* edited by [Dellink et al. \(2020\)](#)). However, the literature focusing on future trade patterns is quite limited. Main contributions are [World Bank \(2007\)](#), [OECD \(2012\)](#), [Fontagné et al. \(2012\)](#), [Anderson and Strutt \(2012\)](#), [WTO \(2013\)](#) (elaborated upon in [Fontagné et al. \(2017\)](#)), and [Chateau et al. \(2015\)](#). All these papers use the GTAP Data Base as initial data, with similar approaches to project the global economy. External projections for GDP growth are generated with macroeconomic models, which are typically targeted by endogenizing TFP growth in the CGE model: the OECD SSP2 Scenario as described in [Dellink et al. \(2017\)](#) is used in most work while [WTO \(2013\)](#), [Fontagné et al. \(2017\)](#), and [Chateau et al. \(2015\)](#) draw from the macroeconomic projections generated with the macroeconometric MaGe Model ([Fouré et al. , 2012](#)). These macroeconomic projections are characterized by catch-up of developing countries and thus higher growth rates for lower income regions. [World Bank \(2007\)](#) introduced various additional features such as differences in productivity growth between aggregate sectors (2% higher productivity growth in manufacturing, and 1% higher productivity growth in agriculture, both compared to services). [World Bank \(2007\)](#) also assumed trade cost reductions of 1% per year complemented by further assumptions leading to higher trade growth compared to GDP growth, such as above average productivity growth of the transport sector. The work based on the MaGe model ([WTO \(2013\)](#), [Fontagné et al. \(2017\)](#)), and [Chateau et al. \(2015\)](#)) introduces changes in savings rates based on a lifecycle model and estimates of changes in labour force participation, in particular catch-up of female labour force participation. [Chateau et al. \(2015\)](#) also include

autonomous shifts in demand towards services.

Many papers work with scenarios for key variables. [WTO \(2013\)](#) and [Fontagné et al. \(2017\)](#) for example distinguish between a "Low" and "High" Scenario for several exogenous variables such as TFP growth, trade costs (tariffs and NTMs), education, demography, and energy prices, based on their impact on GDP. However, the bulk of the difference between the Low and High Scenario is driven by the assumption of divergence, respectively convergence, of TFP growth among developing economies. [Anderson and Strutt \(2012\)](#) explore five potential scenarios: a core baseline that includes variations in GDP, population, labour, capital, land, and natural resources prices; a scenario of slower growth in the volume of trade of developed countries; a scenario of slower total factor productivity growth in primary sectors; a scenario of full liberalization in goods trade barriers; and a scenario of partial liberalization of South-South goods trade barriers. [Chateau et al. \(2015\)](#) explore besides their baseline scenario two trade liberalization scenarios (regional and global liberalization).

The results in these papers are similar to our projections. First, GDP growth rates are higher in developing than in developed economies constituting convergence of growth rates. [World Bank \(2007\)](#) expects differences in GDP per capita to narrow, predicting an average annual growth equal to 2% for developed countries and ranging from 2.4% to 3.1% for developing countries, by 2030. In [WTO \(2013\)](#) and [Fontagné et al. \(2017\)](#), under the "High" scenario, the predicted average annual GDP growth rate reaches 7% for developing countries, compared to 2.1% for developed economies. Second, because of falling trade costs, real trade growth tends to be higher than real GDP growth in the different studies. For example, [WTO \(2013\)](#) projects annual GDP growth rates of 7% and 2.1% respectively for developing and developed economies, whereas annual trade growth is projected at 8.5% for developing countries and 4.5% for developed countries. [Chateau et al. \(2015\)](#) project the global annual GDP growth to be 3% and global annual trade growth at 3.5%. Third, the geographical patterns of output and trade are projected to change with rising export shares of developing economies, thereby generating more South-South trade. The [OECD \(2012\)](#) projects similar rates of growth using a longer time horizon (2060), with a reduction in OECD countries' share in global GDP: from two thirds in 2011 to 50% in 2030 and 44% in 2060. The share of China and India in global GDP is expected to increase: from 17% and 7% in 2011, to 28% and 11% in 2030, and 28% and 18% in 2060, respectively. [Petri and Zhai \(2012\)](#), project that developing countries trade will increase to 36% by 2030. Fourth, the sectoral pattern of trade is projected to change with a rising share of trade in services ([Chateau et al. \(2015\)](#) and [Fontagné et al. \(2017\)](#)).

Our paper makes an important contribution to the existing literature on long-run trade projections in at least three ways. First, we include new features in our model and also additional exogenous shocks in the simulations based on our own econometric work. Our model deviates from previous work by generating productivity growth endogenously in the model based on a diffusion of ideas module, following [Buera and Oberfield \(2020\)](#) and [Bekkers and Goes \(2022\)](#). In this module, productivity growth is a function of the level of productivity of trading partners weighted by the import shares from trading partners. This module is calibrated such that the WTO model is able to accurately replicate historical growth rates (between 2004 and 2019). Furthermore, consumer demand is modelled based on non-homothetic constant elasticity of substitution preferences, recently introduced in the literature by [Comin et al. \(2021\)](#). We include the following additional exogenous shocks: (i) differences in productivity growth based on econometric estimates, going beyond the distinction between only agriculture, manufacturing, and services; (ii) changes in trade costs arising from changes in trade policies, and new technologies and e-commerce; (iii) changes in the structure of production with shifts in intermediate demand based on historical projections. Finally, we are as comprehensive as possible, including changes in labour force participation, savings rates, skills, and natural resource prices. By integrating the above-mentioned new features, we generate a realistic

baseline scenario, which is of significant importance for future policy simulations work.² Although exogenous projections are taken from different sources, they are not inconsistent with each other. Therefore, it is not expected that the omission of a macroeconomic model to generate the exogenous projections is having a significant impact on the projections. Only natural resource prices are based on projections with a different model (from the IEA).

Second, our analysis of future global trade patterns is not limited to variations in standard variables, such as geographical and sectoral changes, but we analyse expected changes in comparative advantage into detail, explore the trade-to-GDP elasticity at the country level, and include an analysis of expected changes in global value chains.

Third, we generate novel findings on variables also projected in earlier work. For example, we project a stronger shift of trade towards services and a stronger increase in the share of Asia's exports in world exports. We do not work with different scenarios in this paper, such as [Fontagné et al. \(2017\)](#) for example. The reason is that trade policy scenarios are most interesting, given the affiliation of the authors, and they are introduced in separate work ([Bacchetta et al.](#), [Forthcoming](#)).

The paper is organized as follows. Section 2 describes the main features of the model employed and the exogenous ingredients used to construct the baseline projections. Section 3 presents the baseline projections, focusing on the changes in patterns of trade from 2020 to 2050. In this section, we present projections on real trade growth, changes in regional and sectoral trade shares, changes in patterns of comparative advantage, and changes in value chain organization. Section 4 concludes.

2 WTO baseline model

2.1 The WTO Global Trade Model

The WTO Global Trade Model (GTM)³ is a recursive dynamic extension of the standard GTAP model ([Corong et al.](#), 2017). The GTM features multiple sectors and factors of production, intermediate linkages, demand by economic agents (private demand, government demand, investment demand, and intermediate demand by firms), non-homothetic preferences for private households, and a global transport sector. Factor income and tax revenues are collected by a representative agent that in turn distributes total income into three spending categories, namely: private consumption, government consumption, and savings. In each region, perfectly competitive firms choose the optimal mix of factor inputs and intermediate inputs by maximizing profits. The GTM features recursive dynamics, with capital stock in the current period specified as a function of net investment and capital stock created in the previous period. National investment is determined by global savings with the latter derived as the sum of all national savings. National savings are a fixed share of household income and are collected by a global trust which then allocates global savings to investment in each of the regions in the model according to changes in rates of return on capital. The model allows for isoelastic factor supply of land and natural resources. Preference changes in domestic and import demand, and changes in labour to capital ratios in total value added are allowed via the twist-parameter approach developed by [Dixon and Rimmer \(2002\)](#). The trade structure is standard with Armington preferences.

We work with a version of the GTM that includes a diffusion of ideas module. Including this module implies that productivity growth is determined endogenously in the model. Productivity growth for each economy is determined by the level of productivity of trading partners and the import shares of intermediates from these trading partners. Regions importing more intermediates

²See for example [Bacchetta et al. \(Forthcoming\)](#).

³Detailed description is provided in [Aguiar et al. \(2019\)](#).

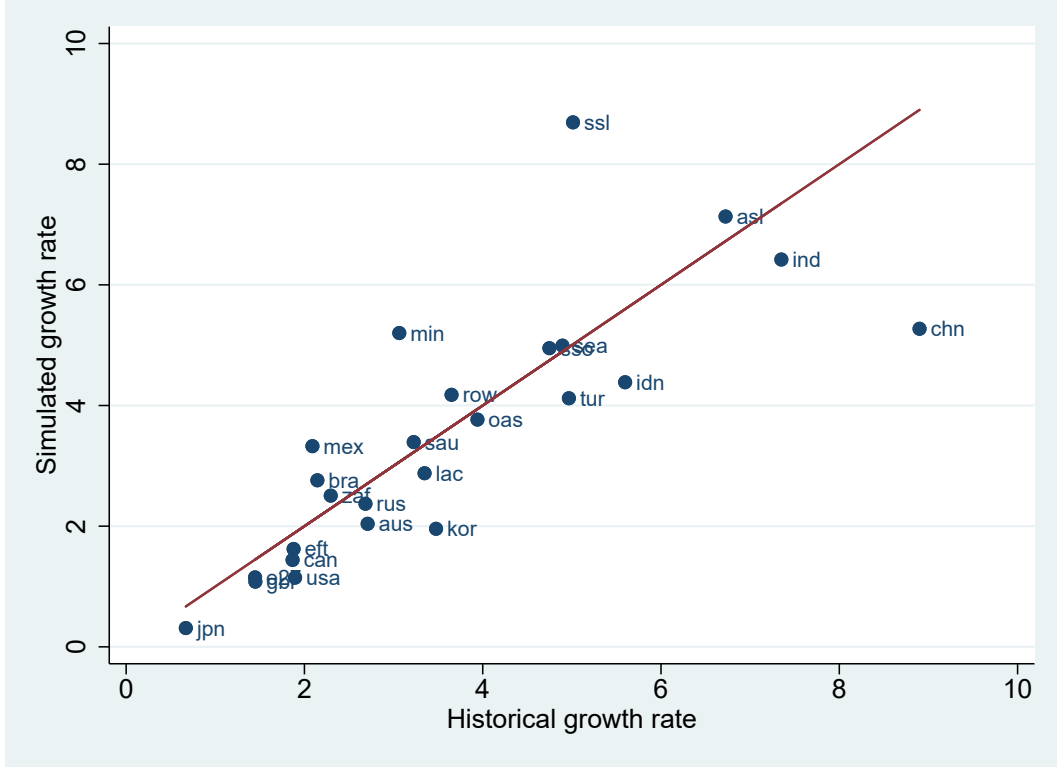


Figure 1: **Relationship between average historical and simulated growth rates (2014-2019)**

from regions with a high level of productivity will display higher growth rates. The diffusion of ideas module facilitates catch-up effects, with low-income regions displaying higher growth rates. The module is parameterized to replicate historical growth rates. Figure 1 displays the relationship between average historical and simulated growth rates between 2004 and 2019, showing that our model is able to closely replicate historical growth rates (See Table 3 for a detailed description of regions).

The GTM is calibrated to the GTAP Data Base version 10A data with 2014 as reference year (Aguiar et al., 2019). To carry out our baseline projections, we aggregate the original GTAP data into 25 regions, 25 sectors, and 5 factors of production. A detailed breakdown of the sectoral and regional aggregation is provided in tables 3, 4, and 5. We conduct yearly projections by updating the initial GTAP data with 2014 reference year up to year 2050 by imposing per-capita GDP growth, population growth, and labour-force growth based on data from the International Monetary Fund (IMF) until 2025, and from the UN onward. Additional features of the baseline model are described in the next section.

2.2 Key features of the baseline

In this section, we describe the exogenous projections imposed on the model to generate our baseline until 2050. We only provide a brief overview of the exogenously-imposed variables on the model, splitting them into four categories, namely: macroeconomic, demographic, sectoral, and trade cost variables. A more detailed description is provided in Bekkers et al. (Forthcoming,F).

2.2.1 Macroeconomic variables

- **Savings rates:** We impose exogenous changes in gross savings rates based on an empirical life-cycle framework. In particular, we follow [Fontagné and Fouré \(2013\)](#) by modelling the gross savings rate as a function of demographic variables.⁴ Without this additional feature savings rates would stay constant.
- **Natural resource prices:** We exogenise each region’s oil export prices, and combine coal and natural gas export prices to match their respective projections from the International Energy Agency ([IEA , 2020](#)), using the Stated Policies Scenario which is based on all existing or announced carbon pricing schemes at the national and subnational level.

2.2.2 Demographic variables

- **Population:** The size of the population is exogenous in the model and growing according to IMF data until 2025, and UN population projections, medium variant 2015 ([UN \(2015\)](#)) from 2025.
- **Labour force:** Labour force growth is determined by employment data from the IMF until 2025. From 2025, the growth in the working age population is based on the UN population projections and changes in the labour force participation rate after 2025.⁵
- **Education/skills.** Growth in the labour force is differentiated between high-skilled and low-skilled workers based on changes in the share of high-skilled workers proxied by the share of tertiary educated according to projections from IIASA ([Samir et al. \(2017\)](#)).

2.2.3 Sectoral variables

- **Differences in productivity growth between sectors:** We implement differential productivity growth across sectors based on historical total factor productivity data from EU-KLEMS and OECD-STAN ([Van Ark et al. \(2017\)](#) and [OECD \(2020\)](#)). Deviating from other CGE projections work, we allow for heterogeneous productivity growth not only between the aggregated sectors of agriculture, manufacturing, and services, but also differentiate between different manufacturing and services sectors.⁶
- **Shifts in sectoral income elasticities:** Private household consumption in the model is characterized by non-homothetic Constant Elasticity of Substitution (CES) preferences.
- **Capital income shares and productivity growth (New technologies):** Robotization will reallocate tasks from labour to capital, which will both raise the capital income share and productivity. The rising capital income share is calibrated based on historical trends, because it is not possible to determine the impact of robotization on the capital income share. Rising

⁴The variables are: GDP per capita growth, GDP per capita relative to the US GDP, and the urbanization rate (extension of [Fontagné and Fouré \(2013\)](#) with [Grigoli et al. \(2018\)](#)).

⁵For the labour force participation rate, we follow [Fontagné and Fouré \(2013\)](#) and differentiate between males and females and two types of workers, high-skilled and low-skilled workers. Female participation rates per age group are projected based on an econometric relation between female participation rates and education, with the data obtained from IIASA. Male participation rates are based on historic projections.

⁶To implement differential productivity growth, the estimated deviation of productivity growth from average productivity growth is imposed, mapping estimates on total factor productivity (TFP) growth into labour-augmenting productivity growth based on labour cost shares by sector.

productivity growth is differentiated by region and sector, based on projections in Bauer et al. (2014), Friedrich et al. (2011), and McKinsey (2015).⁷

2.2.4 Trade cost variables

- **Changes in trade policies:** We include four changes in trade costs associated with changes in trade policies: (1) Tariff escalation due to US-China trade conflict in 2019; (2) Iceberg trade cost reductions due to Trade Facilitation Agreement (TFA). These estimates come from the WTO Secretariat based on disaggregated ad valorem equivalent trade costs of the OECD Trade Facilitation Indicators (TFIs) in Moïsé and Sorescu (2013); (3) Tariff reductions as a result of Free Trade Agreements. These are based on the ITC database of forward-looking bilateral and sector-specific ad valorem tariffs (ITC, 2020); (4) Reduction in Non Tariff Measures (NTMs) from Free Trade Agreements (FTAs) which have recently been signed. NTMs are modelled based on ad valorem equivalent trade cost estimates of changes in depth indices of FTAs signed until 2019.⁸
- **Technological changes leading to changes in trade costs:** Technological changes are projected to result in changes in trade costs along three different channels:⁹ First, digitalization is expected to reduce trade costs by improving efficiency in logistics and custom procedures, thereby reducing the negative impact of not sharing the same language. Increasing broadband internet coverage is also expected to reduce the negative impact of distance on trade. In addition, digitalization fosters blockchain and other digital forms of finance, which could reduce the adverse impact of a bad contract and credit environment on trade. Gravity estimation is employed to quantify these channels and to calculate projected changes in iceberg trade costs. Second, we combine projections on the rising share of online sales with the empirical finding that trade costs are lower for online than offline sales (Lendle et al. (2016)). This leads to a reduction in trade costs for total international sales (online and offline) over time. Third, we operationalize the hypothesis in Baldwin (2019) that new technologies are expected to reduce trade costs in services, because they make it possible to circumvent the need for face-to-face interaction. We determine the potential reduction in trade costs owing from new technologies by estimating the impact of the importance of face-to-face interaction (using task-data).

3 How will global trade patterns evolve in the long-term?

This section presents the main results of our projections for trade patterns until 2050. We divide our analysis into three parts: Section 3.1 focuses on geographical shifts, Section 3.2 reports sectoral shifts, while Section 3.3 looks at the combined geographical and sectoral shifts. Each subsection is divided into several subsections analysing different variables of interest.

⁷Further details are in Bekkers et al. (2022).

⁸We use data from the Design of Trade Agreements database Duer et al. (2014) and Egger et al. (2015)'s gravity-based sector-specific coefficient estimates of the impact of the depth of FTAs on trade costs.

⁹Further details are in Bekkers et al. (2022).

3.1 Geographical shifts

3.1.1 Heterogeneous variations in GDP, population, and exports growth

We begin with the projected macroeconomic patterns until the year 2050 based on GDP and population changes.¹⁰ Table 1 reports the average annual growth rates of GDP, population, and skilled and unskilled labour by region, from 2020 to 2050. The external projections indicate that average annual global GDP and population would increase by 2.72% and 0.62%, respectively. Projected average GDP growth rates vary considerably across countries, ranging from 0.61% in Japan to 5.48% in Sub-Saharan Africa LDC. GDP growth rates are higher in developing countries and in particular LDCs, reflecting income convergence. The GDP levels of developing economies converge to those of developed economies as developing regions capitalise on technology transfers, inward investment, and relatively lower labor costs thereby allowing them to expand market shares in the global economy.

Similarly, average population growth (based on UN demographic projections) display high variations across countries: from -0.45% in Japan to 1.84% in Sub-Saharan Africa LDC, with developing countries and in particular LDCs displaying faster population growth than developed regions. Developing regions and LDCs, in particular Sub-Saharan Africa show average growth rates of skilled and unskilled labour. Globally, skilled labour supply is projected to grow more than unskilled labour as growth in the latter is expected to decline in a number of regions.¹¹

Figure 2 shows that a larger share of developed economies in global GDP and population remains, although this gap becomes smaller over time. The share of developed economies in global population is projected to fall from 18.3% to 16.3%, as do their share in GDP (in nominal terms) which is projected to fall from 63.1% to 46.5%. Developing economies are projected to increase their GDP share from 35.7% to 50.2% while maintaining a relatively stable share in global population (from 69.5% to 68.0%). Nonetheless, the disparity in GDP and population shares of LDCs continue to persist: the share of LDCs in global population is projected to rise from 12.3% to 15.6%, while their real GDP share is only projected to increase from 1.1% to 3.3%.

A comparison of GDP results between 2020 and 2050 shows that developed economies share in global real GDP is projected to fall more than their nominal GDP share (by 19 and 17 percentage points respectively), whereas developing countries' global real GDP share is projected to rise more than their nominal share (by 18 and 15 percentage points respectively). The smaller reduction in nominal GDP share of developed economies indicates rising prices. This is because services represent a larger share of the developed economies and the fact that relative price of services increases because of Baumol effects.¹²

We now look at the trade impacts which are endogenously determined in the model. The last column in Table 1 shows that average annual global exports volumes are projected to grow by 3.09%, which is higher than the average annual projected real growth rate of GDP of 2.72% (Table 1). This confirms that trade is more dynamic than GDP at the global level. At the regional level, discrepancies are strong. India, Sub-Saharan Africa LDC, Sub-Saharan Africa other, and Indonesia show the highest growth rates in exports (higher than 5%), whereas EFTA countries, the Kingdom

¹⁰Recall from the previous section that both GDP and population are exogenous variables in the model.

¹¹Australia represents an exception, with unskilled labour expected to grow by 0.12% annually. This trend may be explained by the migration policy of Australia, which allows temporary migration of unskilled migrants to satisfy the significant demand for seasonal work in tourism and agriculture (ACCI, 2018).

¹²The nominal GDP share in LDCs is projected to rise more than the real GDP share, which is somewhat puzzling at first glance, since this means that relative prices of LDCs are rising compared to developing countries. This result is driven by the comparative advantage of LDCs in agriculture and extraction for which prices are projected to rise (or decrease less) relative to other sectors because of the fixed projection factors for land and natural resources.

Table 1: Average growth rates of key indicators, by region (2020-2050, %)

Region	GDP	Population	Unskilled	Skilled	Exports
Asia LDC	4.70	0.55	0.65	3.41	4.51
Australia	2.04	1.09	0.12	1.98	2.18
Brazil	1.76	0.34	-0.15	1.91	2.27
Canada	1.72	0.81	-0.41	1.13	2.47
China	3.20	-0.23	-0.88	2.29	4.17
European Union	1.54	0.08	-1.03	1.17	1.88
EFTA	1.56	0.66	-0.33	1.65	1.70
United Kingdom	1.62	0.49	-0.39	1.63	1.87
Indonesia	4.13	0.40	0.49	3.52	5.09
India	4.61	0.75	0.62	3.30	5.79
Japan	0.61	-0.45	-2.09	0.41	1.78
Republic of Korea	1.83	-0.19	-2.62	0.77	3.07
Latin America	2.62	0.60	0.41	2.70	2.86
Mexico	2.35	0.60	0.50	3.02	2.21
Middle East and North Africa	3.09	1.10	0.87	3.64	2.74
Other Asian countries	2.98	1.11	1.21	2.84	3.44
Rest of World	2.67	0.12	-0.22	1.46	2.69
Russian Federation	1.80	-0.10	-0.82	0.64	2.16
Kingdom of Saudi Arabia	2.50	1.56	-0.07	2.91	1.72
Southeast Asia	3.64	0.60	-0.02	2.66	3.60
Sub-Saharan Africa LDC	5.48	1.84	2.87	5.60	5.63
Sub-Saharan Africa other	4.98	1.83	2.14	5.11	5.13
Türkiye	2.74	0.65	0.51	3.21	2.68
United States of America	1.51	0.56	-0.10	1.32	2.41
South Africa	2.39	0.63	0.67	2.63	3.08
Global	2.72	0.62	0.08	2.44	3.09

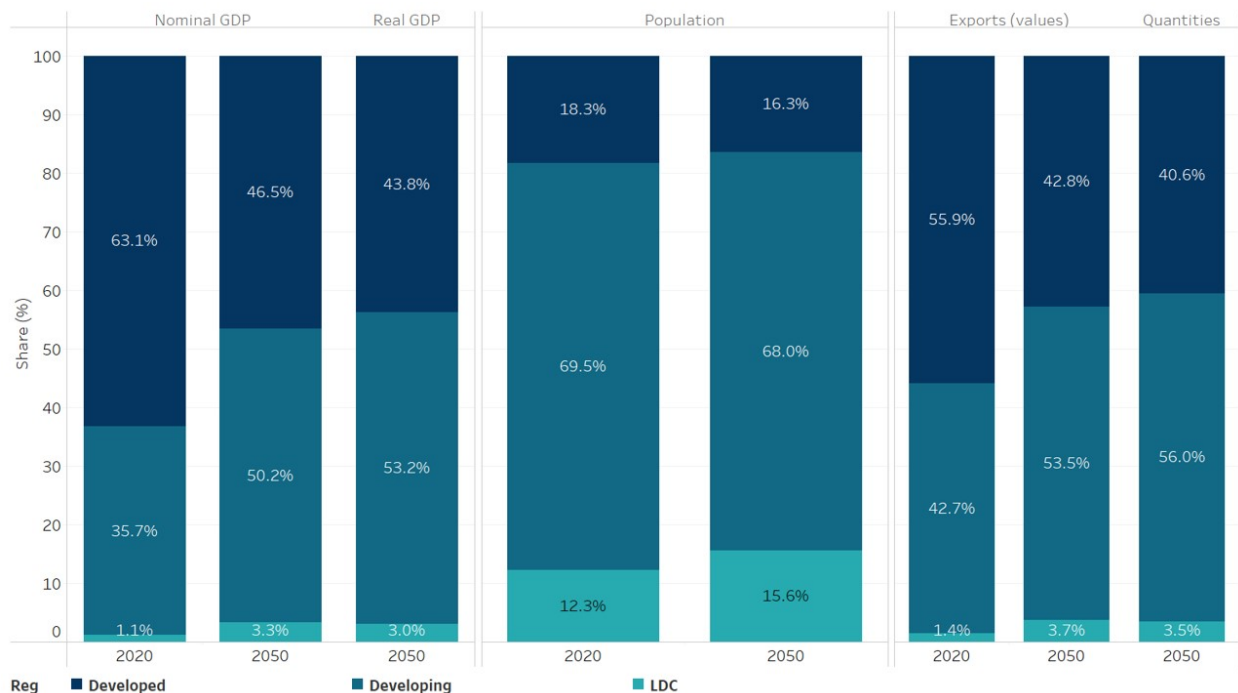


Figure 2: Share of aggregate regions in global GDP, Population and Exports (2020-2050)

of Saudi Arabia, Japan, the UK, and the EU report the lowest growth rates (below 2%). Finally, comparing variations in GDP shares with variations in trade shares (Figure 2), we observe that developing economies' nominal GDP and trade shares increase by 15 and 11 percentage points, respectively.

Since the trade share of developing countries is initially larger than its GDP share (42.7% versus 35.7%), developing countries are therefore expected to represent more than half of global trade by 2050. The share of LDCs in trade is also expected to rise more than their share in GDP—from 1.4% to 3.7% (for GDP from 1.1% to 3.3%). This suggests that LDC exports will rise more than their income levels, raising their importance in global trade. This will be further discussed in the next section.

3.1.2 Developing countries take the lead in trade

Figure 3 shows the evolution of global trade shares, net of intra-regional trade, for developed, developing, and least-developed economies over time. The figure shows that combined exports of developing and least-developed economies are projected to overtake developed economies' exports by 2035. By this time, exports of developing economies will represent around 50% of global exports with LDCs accounting for about 2.3% of global exports.

Figure 4 shows the shares of the three largest economies in the global economy in 2020 and by 2050, namely: China, the European Union (EU) and the USA.¹³ The share of both the EU and the USA would fall substantially, from 17.9% to 14.2% and from 11.0% to 8.0%, respectively. China's share decreases to a lesser extent, from 14.2% to 13.2%. These changes reflect the increasing importance of other economies in global trade and the fact that the Chinese economy is shifting towards domestic orientation as discussed in Bekkers et al. (2021). Nevertheless, China is still

¹³Excluding intra-regional trade, i.e. trade within the EU.

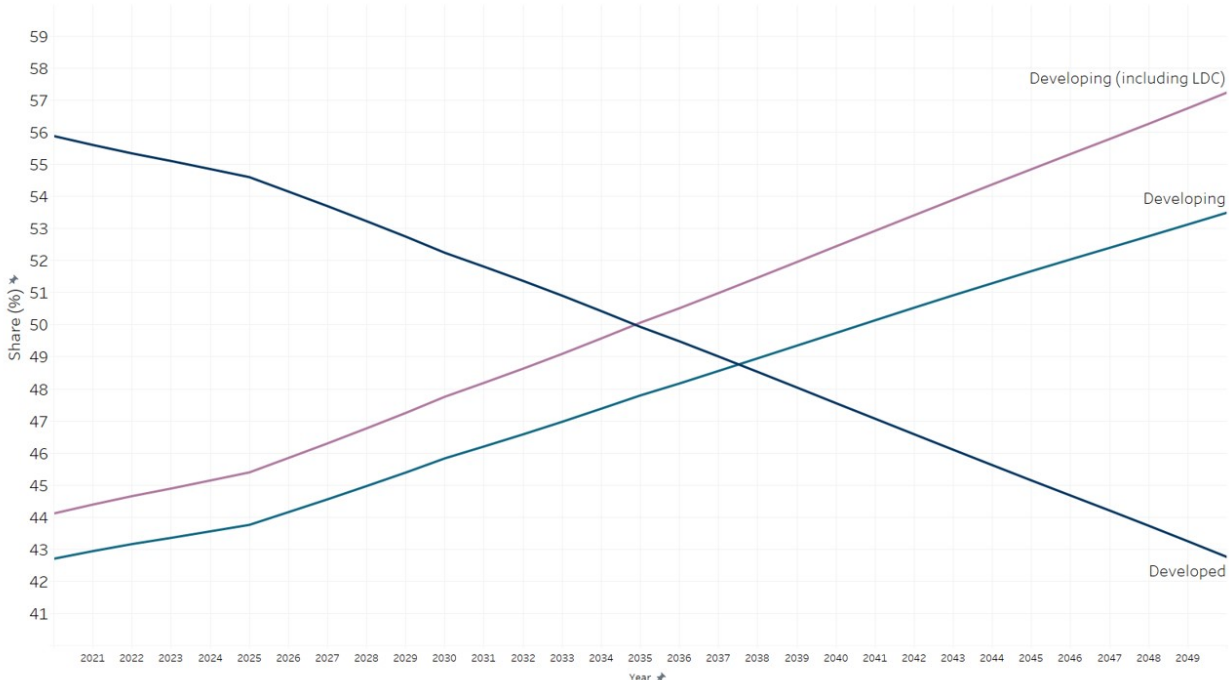


Figure 3: **Share of exports by aggregate region at FOB prices (excluding intra-region)**

projected to have the second biggest export share in the global economy by 2050, slightly behind the EU.

3.1.3 Trade grows faster than GDP

The literature on trade projections (c.f. Fontagné et al. (2017) and Bekkers et al. (2020)) have emphasized that historical growth in real trade has been outpacing growth in real GDP. Our projections also display this pattern because of reductions in trade costs and higher than average productivity growth of the transportation sector. Chateau et al. (2015) even calibrate changes in iceberg trade costs to explicitly target the historical trade-to-income elasticity of 1.4 for goods and of 1.2 for services. As discussed in Section 2.2, trade costs are projected to fall because of digitalization, the rising share of online trade, and the reduced need for face-to-face interaction. Hence, we do not set the reduction in iceberg trade costs endogenously to target a specific trade elasticity as Chateau et al. (2015), but use (own) empirical estimates of expected reductions in trade costs.

Our projected trade elasticity, that is, the growth rate of real trade (average of real exports and real imports) divided by the growth rate of real GDP, is larger than 1. Figure 5 shows that the global trade elasticity between 2020 and 2050 is about 1.07 in our baseline. Figure 5 also shows the regional trade elasticities for each of the 25 regions. These elasticities vary widely, from less than 1 in several regions to 1.4 in the Republic of Korea (kor).

The variation in elasticities makes clear that most regions with a high projected growth rate such as Asia LDC (asl), and Sub-Saharan Africa Least Developed (ssl) display a low trade elasticity, whereas regions which have low projected growth rates like the Republic of Korea (kor), the USA, the Russian Federation and Japan (jpn) display a higher trade elasticity.

This finding is intuitive: the growth in trade (exports and imports) is a function of the growth

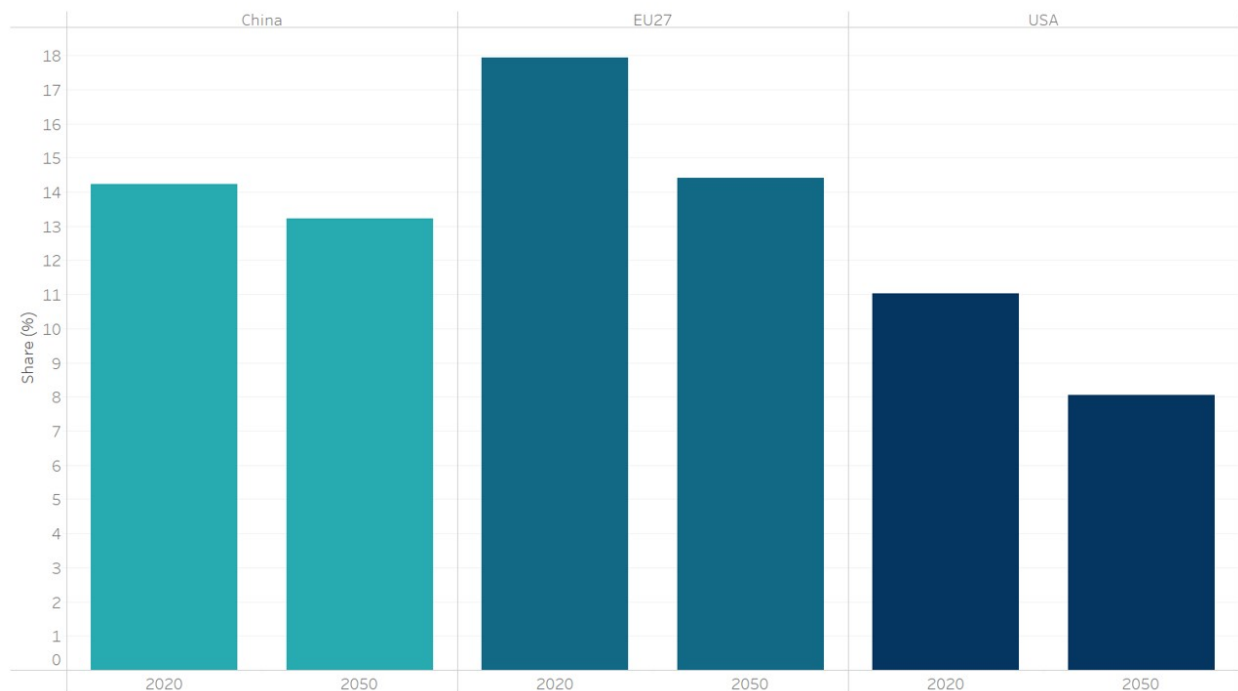


Figure 4: **Share of global exports in China, the EU, and the USA at FOB prices (except intra-region, 2020-2050)**

rate of trading partners, both on the export side (more import demand from regions with higher growth) and the import side (more export supply from regions with higher growth).

Regions like the Republic of Korea, the USA, and the Russian Federation have high trade elasticities, because they are trading more intensively with regions with a higher GDP growth rate than in their own country. In contrast, a less developed region like Sub-Saharan Africa has a higher own growth rate than most of its trading partners.

3.1.4 Trade between and within regions and groups of countries

In this subsection, we focus on trade within and between continents as well as within and between groups of countries by level of development. We start with the latter. Figure 6 shows that bilateral trade between developed countries would decrease from 40% to 21%, whereas bilateral trade between developing countries would increase from 19% to 37%. Trade between developed and developing countries increases slightly from 40% to 42%. Although the importance of trade between developed countries (in global trade) is projected to fall substantially, trade between developed and developing economies stays at a high level. Figure 17 provides a more detailed picture, showing the share of exports of developed countries, developing countries (non-LDC) and LDCs to each of these three aggregate regions. The figure shows that the share of intra-LDC trade is projected to more than double from 4% in 2020 to 10% by 2050. LDCs also raise their share of exports to other developing countries, though the share of LDC trade to developed economies is projected to fall substantially (from 43% in 2020 to 27% by 2050). These changes in trade patterns suggest that for LDCs, trade relations with countries at similar level of development and in particular with other developing countries will become more important.

We now look at trade within and between continents. Since Asia is by far the largest continent

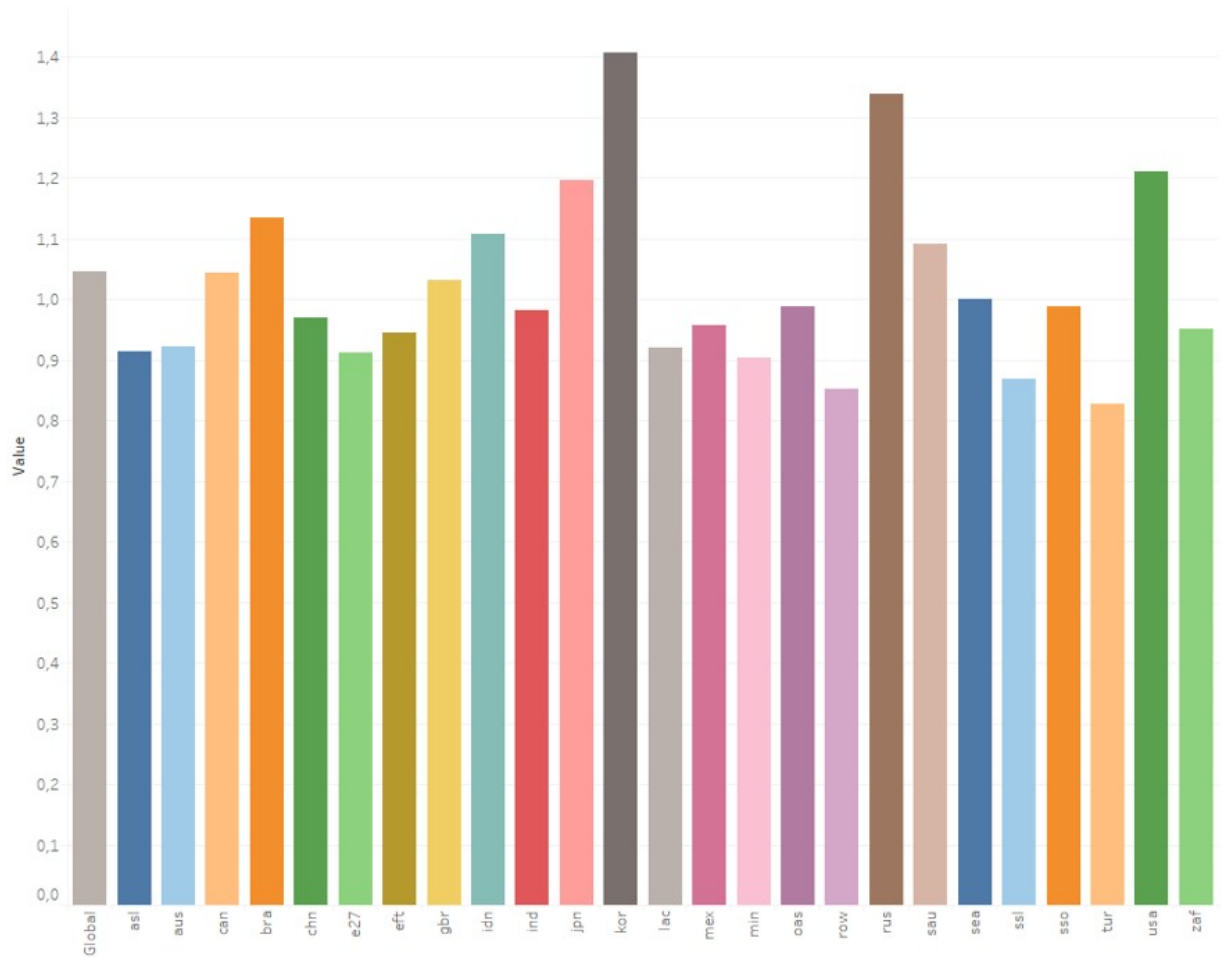


Figure 5: **Global and regional trade elasticities (average 2020-2050)**

in global trade, we classify Asia into two aggregate regions, namely: (i) East and South East Asia; and (ii) South and West Asia. Figure 7 shows that East and South East Asia has the largest initial export share (41% in 2020) and maintains this position over time with export share projected to increase further (48% in 2050). South and West Asia's share also increases, albeit by 1 percentage point (from 11% to 12%). Africa's share in global exports doubles from 3% to 6%. On the contrary, America and Europe see their share in global exports decrease over time, from 21% to 16% and from 25% to 19%, respectively.

In Figure 8 we analyse the trends in bilateral trade shares of different continents showing: (i) an increased share in trade from all other regions (Africa, America, Europe, and South and West Asia) going to East and South East Asia; (ii) increased exports share from all other regions (Africa, America, East and Southeast Asia, and Europe) to South and West Asia; and (iii) substantial increase in intra-continental trade in Africa (from 14% to 23%) coupled with a fall in the share of intra-continental trade for other continents (except East and South East Asia).

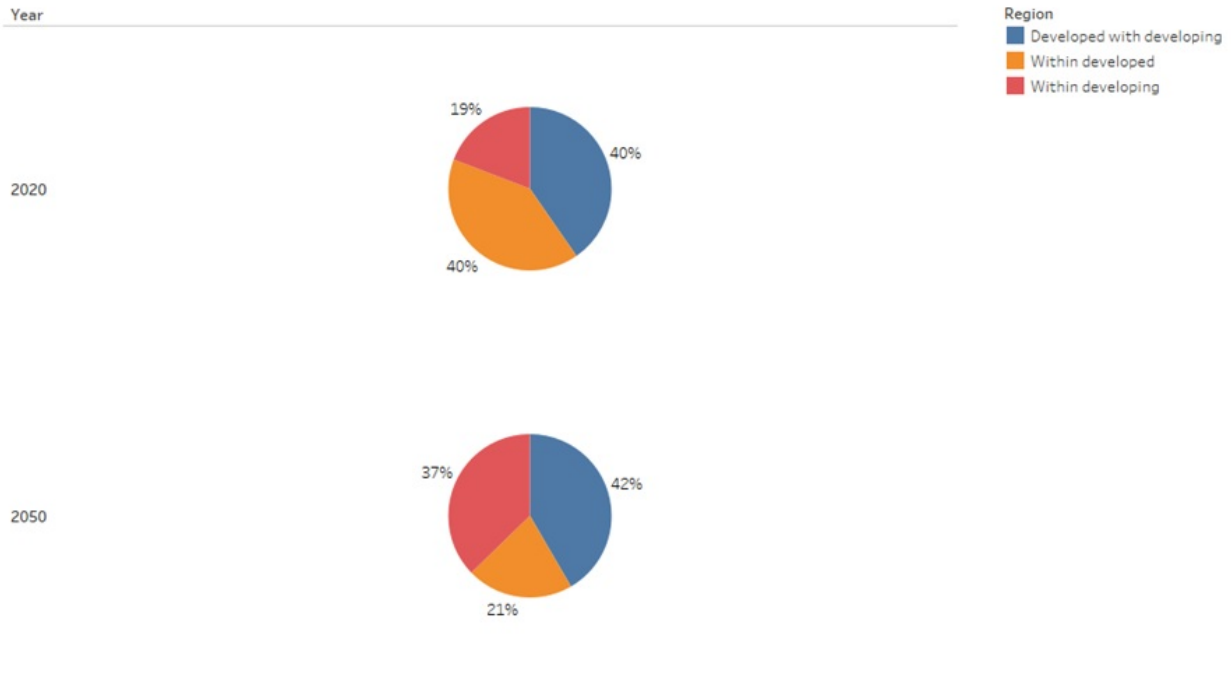


Figure 6: Share of global trade within and between groups of countries (2020-2050)

3.2 Sectoral shifts

3.2.1 A global increase in the importance of services in exports

Figure 9 displays the share of exports by four aggregate sectors: agriculture, natural resources, manufacturing, and services. This figure generates insights on the projected changes in sectoral trade shares at the global and at the regional level. Globally, the share of manufactured exports is projected to fall from 64% to 52%. The share of agricultural goods is also projected to fall (from 2% to 1%), whereas the shares of services and natural resources exports are expected to rise (from 24% to 38% and from 9% to 10%, respectively).¹⁴

We identify three reasons for the falling value share of manufactured exports in global trade. First, structural change reduces the share of manufactured goods, owing to shifting preferences towards services—as economies grow richer—and due to higher manufacturing sector productivity growth. The latter leads to falling prices of manufactured goods and by consequence falling value shares given the limited scope for substitution between different sectors. This effect seems particularly important: the global value share of manufactured goods is falling more than its global volume share. Second, falling savings and investment shares reduce the demand for manufactured goods which are used to create investment-related capital goods. Third, two reasons explain the rising global export shares of primary (or mining) commodities and services, at the expense of falling manufactured goods share. In particular, the share of services is projected to increase owing to reductions in trade costs which are especially large for services sectors,¹⁵ while the rising share

¹⁴The change in the share of natural resources in trade is driven by the projected changes in natural resource prices. We put less emphasis on them, since these are highly uncertain.

¹⁵The large reductions in trade costs for services sectors are driven by technological changes, rather than by trade policies. The average trade cost reductions due to digitalization is 31% for services sectors compared to 11% for goods.

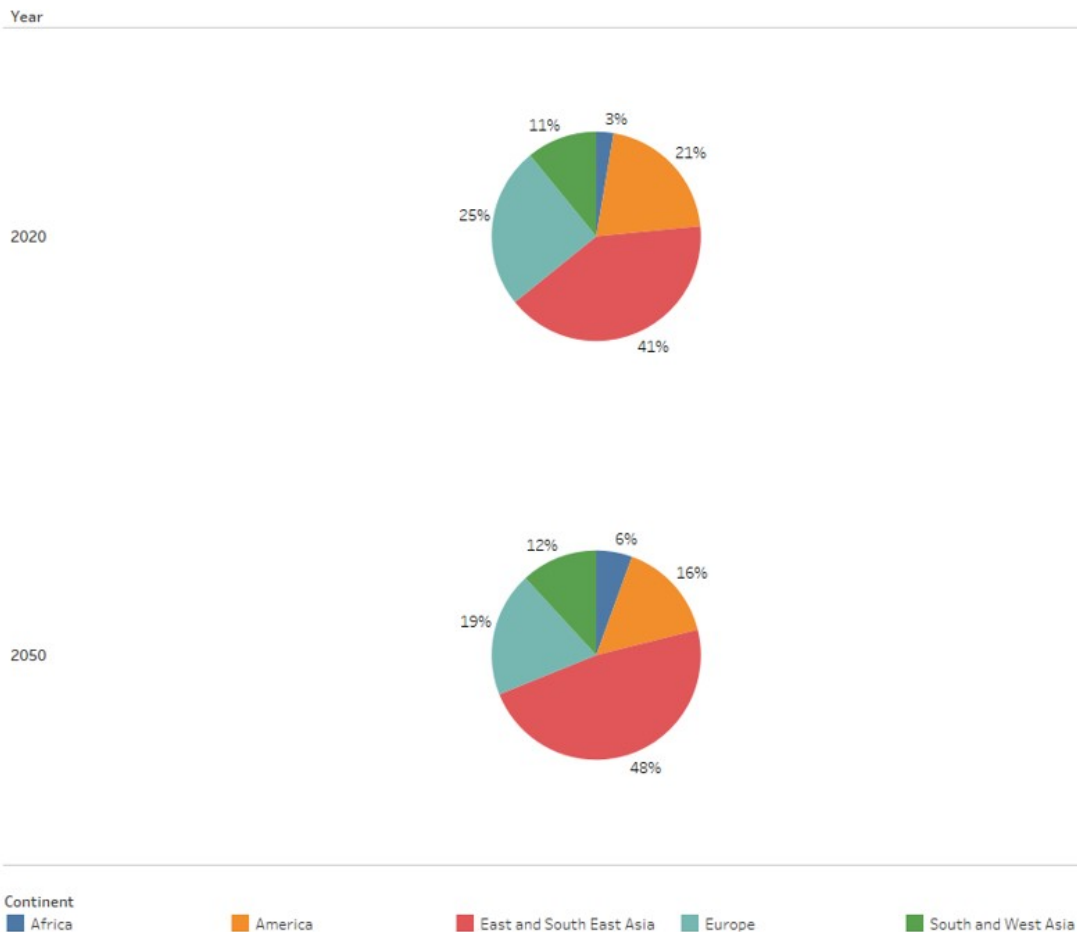


Figure 7: **Share of global exports by continent**

of primary commodities is driven by the projected increase in the price of energy-related natural resource commodities like oil.

Global agricultural trade is projected to fall from 2% to 1% as countries switch towards supplying their own domestic markets. Our simulations show that both developing countries and LDCs focus more on trading agricultural goods within domestic markets, therefore reducing the share of agricultural goods being traded globally. In particular, Sub-Saharan Africa Other (sso) more than double agricultural supply to its domestic market, so does Sub-Saharan Africa LDC (ssl) which increases agricultural supply destined for domestic market by 41%.

There are pronounced differences in the changes in sectoral trade shares between developed, developing, and least-developed economies. The share of manufactured goods trade is projected to fall in both developed (from 62% to 41%) and developing economies (from 67% to 59%), whereas it is projected to increase in LDCs (from 50% to 66%). These results are consistent with the literature. [Fontagné et al. \(2017\)](#) find that the share of developed countries in world exports of manufactured goods and services falls under an optimistic scenario and rises under a pessimistic scenario, and vice versa for the BRICs. Similarly, [Chateau et al. \(2015\)](#) find decreasing share of manufactured exports from OECD countries and an increasing share from emerging Asia and Africa. This means that we expect developing countries to take the lead in world exports of manufactures, even though



Figure 8: **Bilateral share of exports by continent**

their share of exports in manufactures would decrease over time to the benefit of services exports. We find that the share of services exports would increase in all aggregate regions: in developed economies by 22 percentage points (from 28% to 50%), in developing economies by 9 percentage points (from 20% to 29%) and in LDCs by 2 percentage points (from 12% to 14%). Fontagné et al. (2017) find that the share of developed countries in world exports of services should decrease (in both “High” and “Low” scenarios), whereas that of the BRICs should increase. Chateau et al. (2015) confirm these findings, as they find an increasing share of emerging Asia and Africa in world exports of services, at the expense of OECD economies. This means that the share of developed regions in world exports of services will go down, although their share of services exports would increase at the expense of manufacturing exports.

Figure 10 presents geographical detail on the evolving share of manufactured exports in total exports for each of the 25 regions. We observe a rising share of manufactured good exports in lower and middle income regions such as Asia LDC (asl), Indonesia (idn), India (ind), Sub-Saharan Africa LDC (ssl), Sub-Saharan Africa other (sso) and South Africa (zaf), and a falling share in all other regions. The falling share of manufactured good exports is particularly pronounced among rich economies (the EU, the UK, Japan, and the USA) and developing countries with a high initial share of exports in manufacturing (China and Türkiye). The share of manufactured goods is projected to

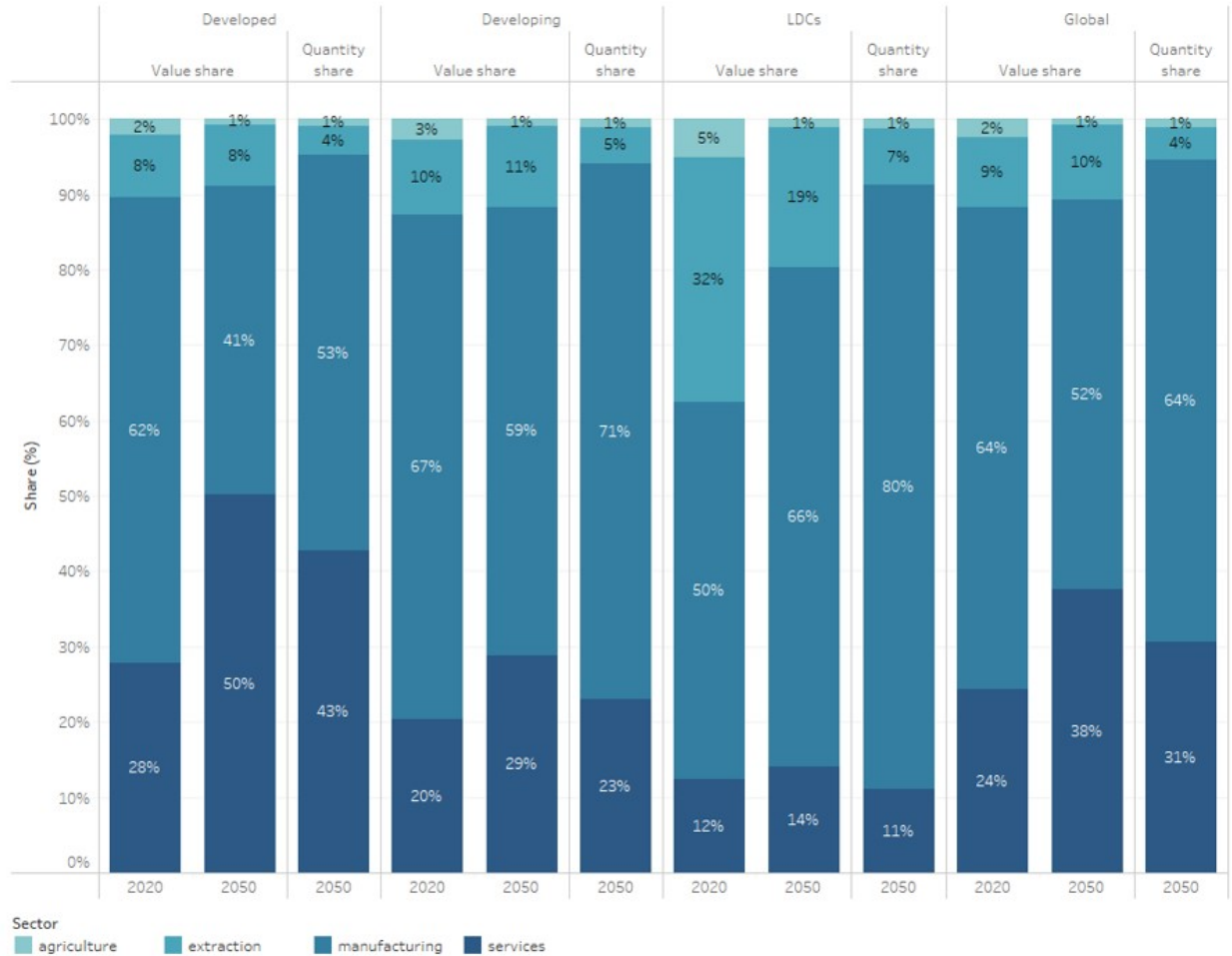


Figure 9: Share of exports by aggregate sectors, aggregate regions and globally (2020-2050)

stay relatively high in Asia LDC (asl). This latter result confirms work by Chateau et al. (2015) who found that Asian economies strengthen their role in manufacturing trade, with the exception of China, which as mentioned above is expected to see its share of manufactured exports to decrease.

Figure 11 provides detailed changes in export shares, for all 25 sectors at the global level in 2020 and by 2050. It corroborates the insights of the previous figure on changes in aggregate sectoral shares. The figure makes clear that the reduction in the share of manufacturing is driven mostly by the fall in chemicals (chm), metals (met) and to a lesser extent motor vehicles (mvh). Furthermore, it shows that the falling share of agricultural exports is mostly driven by crops (cro), and to a lesser extent by livestock (lvs). The higher share of natural resources exports is mainly driven by oil, although the share of other natural resource (onr) exports also increases. In the services sectors, the increase in the share of services is driven by other business services (obs), although the shares of all other services likewise increase.

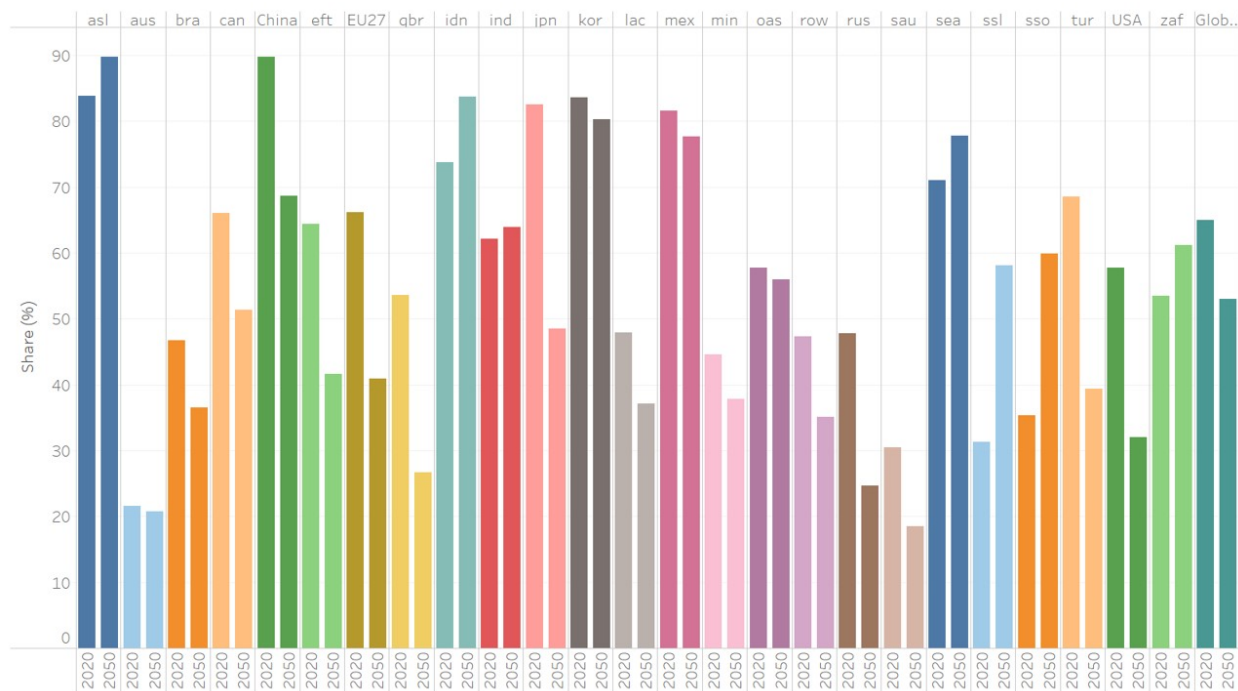


Figure 10: Regional and global shares of manufacturing exports (2020-2050)

3.2.2 A global shift in production from manufacturing to services sectors

Figure 12 displays the value added share (value and quantity share) for four aggregate sectors (agriculture, natural resources, manufacturing and services) classified by level of development. In all economies we uncover the shift from manufacturing to services: the value share of manufacturing is projected to fall from 13.5% to 5.2% in developed economies, from 20.8% to 10.1% in developing economies, and from 14.9% to 9.7% for LDCs. At the same time the share of services will rise: from 82.8% to 92.1%, from 68.4% to 85.1%, and from 63.3% to 82.5% for developed, developing, and least-developed countries, respectively. Given the limited scope for substitution in private household, investment and intermediate demand, the higher productivity growth of the manufacturing sector results in lower relative prices, which in turn leads to falling value shares.

The quantity shares move in the same direction for both developed and developing countries, but the projected changes are smaller: the quantity shares of manufacturing value added fall from 13.5% to 9.4% in developed economies, and from 20.8% to 17.8% in developing economies. This suggests that higher than average productivity growth in manufacturing is an important driver of falling shares and other factors such as savings rates and elasticities. First, falling savings rates observed in most countries reduce demand for investment-related capital goods which intensively uses manufactured goods (Table 7). Second, we observe a shift in preferences because of lower income elasticities in manufactured commodities. From Table 2, we observe that income elasticities of manufactured commodities in developed and developing economies fall over time, compared to the same income in LDCs, which rises with time. For LDCs, the picture is different as the manufacturing sector quantity share in total value added are projected to increase slightly. This can be explained by the fact that LDCs become more competitive in manufacturing due to their strong projected GDP growth.

The value shares of agriculture, when considering geography, show a somewhat more hetero-

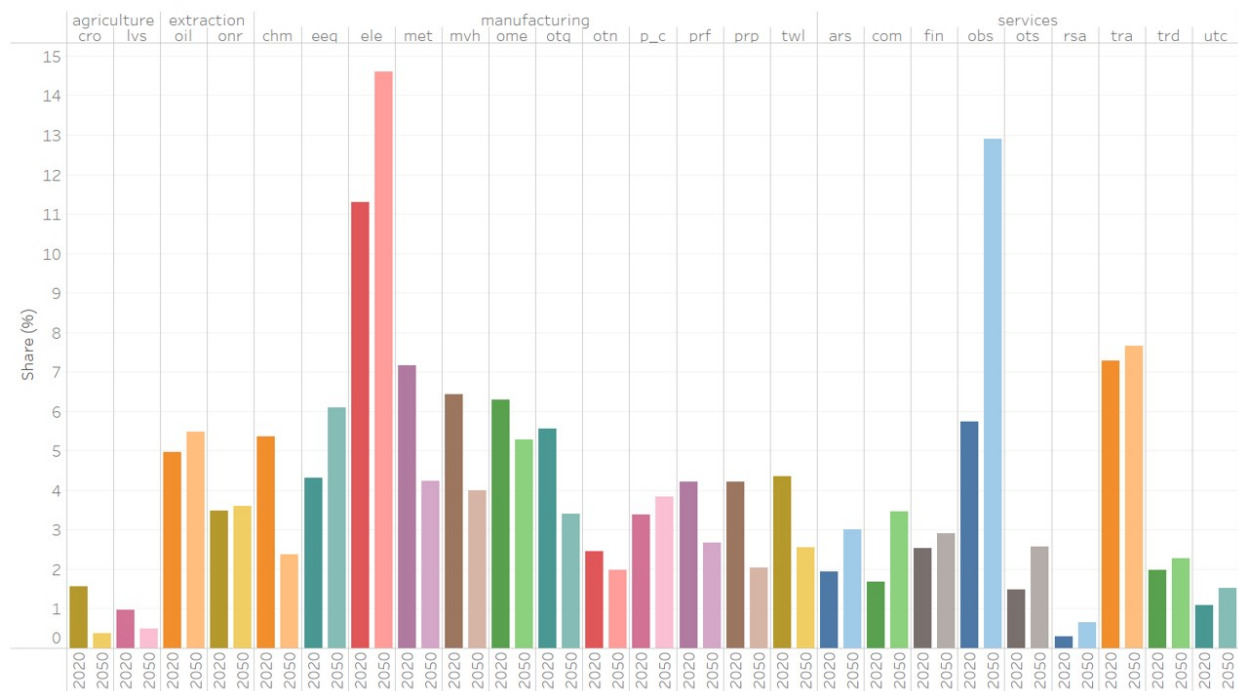


Figure 11: **Final value of exports by commodity (global, 2020-2050)**

geneous picture. The value shares of agricultural valued added are projected to fall in all three aggregate regions. The two main forces driving this trend are a higher than average productivity growth in agriculture and a low income elasticity of food. The changes in quantity shares are also expected to decrease in all three regions, although to a lesser extent than the value shares. Hence, in real terms the agricultural sector declines in all three regions. The falling shares are driven by the fact that income elasticities for food are falling, in particular in LDCs (from 0.84 to 0.62), due to strong income growth. Income more than double in LDCs, rising by 235%, from 2020 to 2050. Rich and developing country income elasticities for food are respectively low at 0.53 and 0.56, and are also falling over time (Table 2).

3.2.3 Value chains: stronger intermediate linkages in services

In general, we observe a reinforcement in global value chains based on the imported intermediate input share in gross output for all goods in almost all regions (Figure 13). The share of global imported intermediate input in gross output for all goods rises from 10.1% to 11.3% (Figure 14). This increase is mainly driven by a rise in the share of imported intermediate inputs in the gross output of services, from 2.09% in 2020 to 3.20% in 2050.

The share of imported intermediates in gross output is projected to fall in manufacturing (from 6.49% to 6.43%), and to a little extent in agriculture. This is explained by the fact that the share of services is rising strongly and because services are non tradable. The increasing importance of international intermediate linkages in services sectors is driven by the rising importance of services in economies, also leading to more demand for intermediate inputs sourced from abroad.

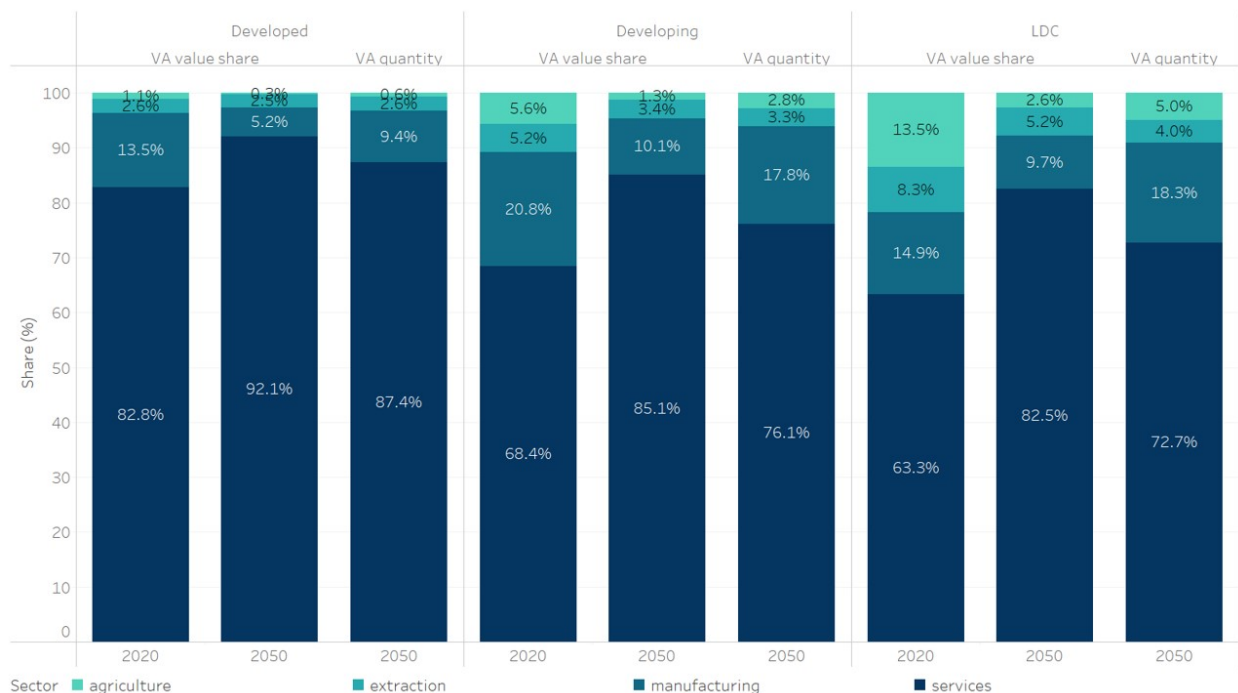


Figure 12: Share of aggregate sectors in total value added in aggregate regions (2020-2050)

3.3 Geographical and sectoral shifts combined: Changes in patterns of comparative advantage

Figure 15 shows the evolution of revealed comparative advantage (RCA) for three aggregate regions (developed, developing, LDC) across four broad sectors (agriculture, extraction, manufacturing and services). Although both regions and sectors are highly aggregated, Figure 15 reveals interesting patterns, which are in line with the analysis in the previous sections. The RCA in developed countries falls for manufacturing, agriculture and extraction, and rises for services. In developing countries, the comparative advantage falls as well for agriculture, extraction and services but rises for manufacturing. In LDCs the changes are more significant with a substantial decrease in the comparative advantage for agriculture and extraction and an increase in RCA for manufacturing.

Figure 16 provides a further breakdown of changes in RCA in agriculture, manufacturing and services for each of the 25 countries and regions. The upper panel of the figure makes clear that most regions with an initial comparative advantage in agriculture such as Australia, Brazil and Latin American countries are projected to extend their initial comparative advantage.¹⁶ The middle panel shows that manufacturing RCA tends to increase in low-income regions such as Least-developed Asia, Indonesia, India, and Sub-Saharan Africa (both sso and ssl), whereas it is projected to fall in rich regions such as the EU, the UK, Japan, and the USA.

For services (in the lower panel of Figure 16), we see the reverse pattern. Rich regions such as the EU, Australia and the USA are projected to extend their comparative advantage (as measured by the RCA) in services, whereas lower-income regions are expected to see their RCA in services decline.

¹⁶Exceptions are Sub-Saharan Africa LDC and Other Sub-Saharan regions (ssl and sso) and the USA whose RCA in agriculture is projected to fall.

Table 2: **Income-weighted averages of income elasticities**

Region	Sector	2020	2050
Developed	Agriculture	0.53	0.52
	Extraction	1.01	0.97
	Manufacturing	0.99	0.98
	Services	1.03	1.02
Developing	Agriculture	0.56	0.49
	Extraction	1.03	0.96
	Manufacturing	0.97	0.93
	Services	1.14	1.07
LDCs	Agriculture	0.84	0.62
	Extraction	1.03	1.00
	Manufacturing	0.87	0.95
	Services	1.25	1.18

Summarizing the findings on projected changes in RCA, we find that the current specialization are reinforced in two large sectors, services and manufacturing. Indeed, rich countries are projected to extend their comparative advantage in services and lose some ground in manufacturing, whereas developing countries and especially LDCs extend their strength in manufacturing, but do not gain ground in services. Hence, our projections indicate that convergence of the global economy and catch-up of low-income regions will be anchored on the manufacturing sector. Developing countries are projected to raise their comparative advantage in manufacturing, while rich countries keep their comparative advantage in services. An important reason for this pattern is that trade elasticities are much higher in manufacturing than in services, implying that the lower income regions with higher growth are expected to gain most market share in these sectors.

The projected developments of comparative advantage have implications for the importance attached to trade in different sectors in future trade policy negotiations. The growing importance of services in global trade and the high and increasing comparative advantage of developed economies in this sector suggests that services trade will be of paramount importance for export interests of developed economies. Developing economies instead are projected to raise their strength in manufacturing and stay relatively weak in services.

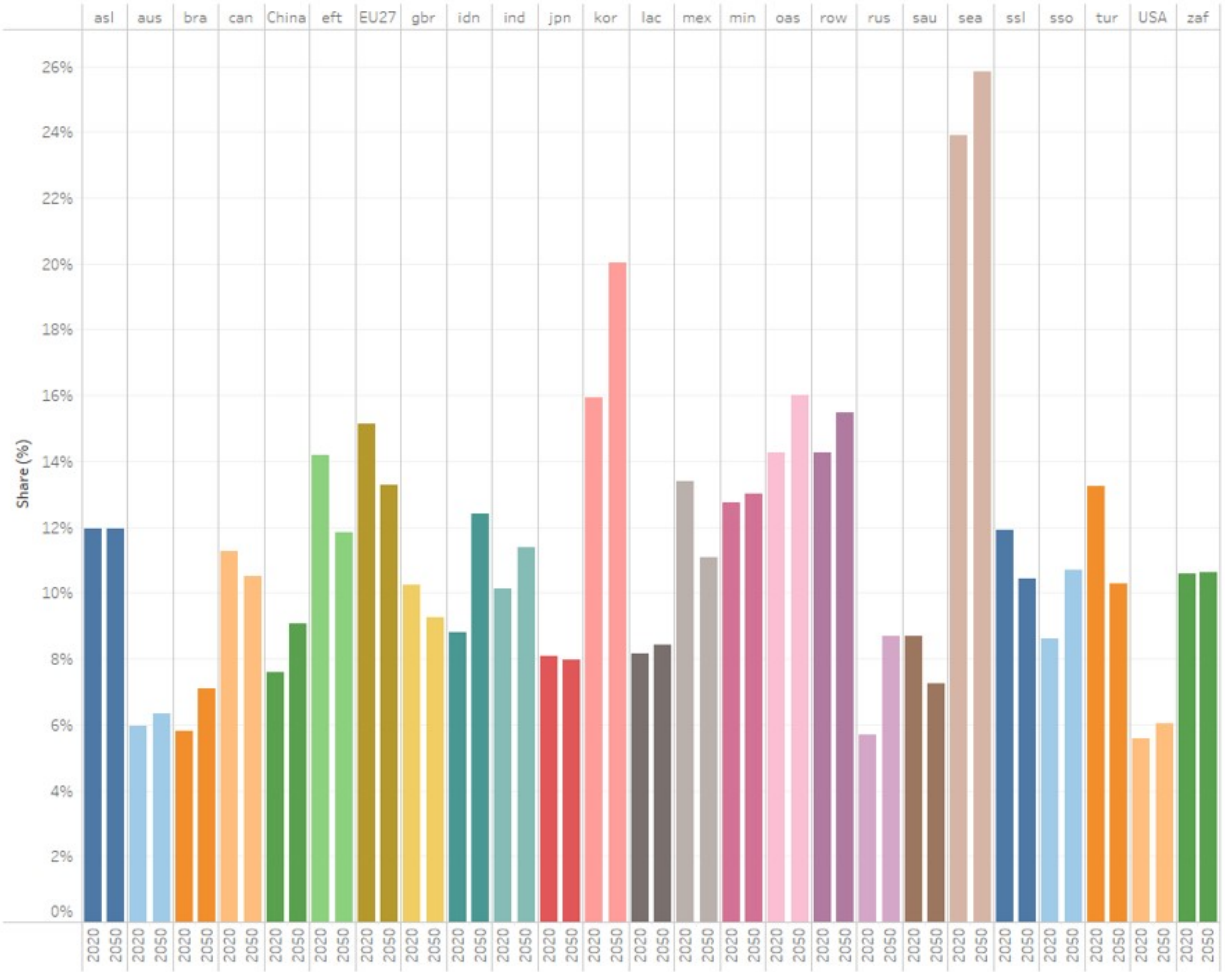


Figure 13: Imported intermediate share in gross output, all goods

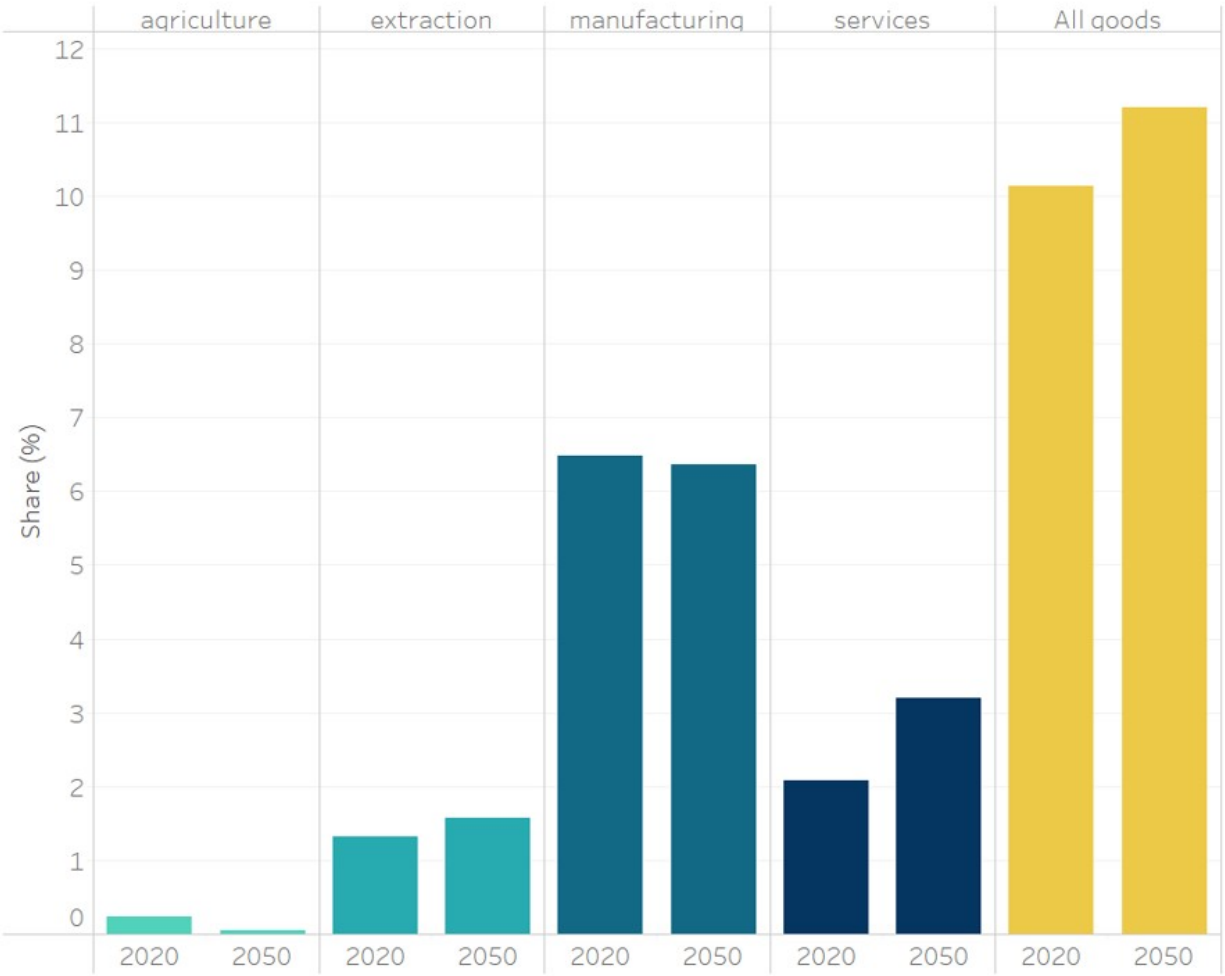
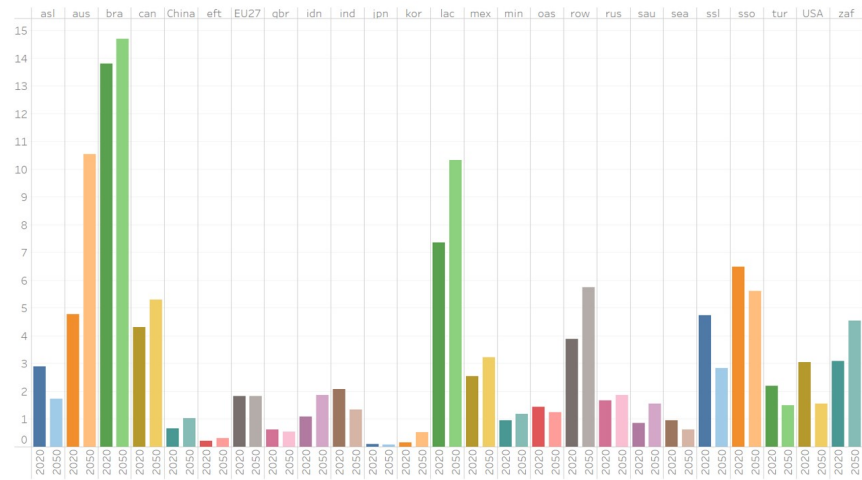


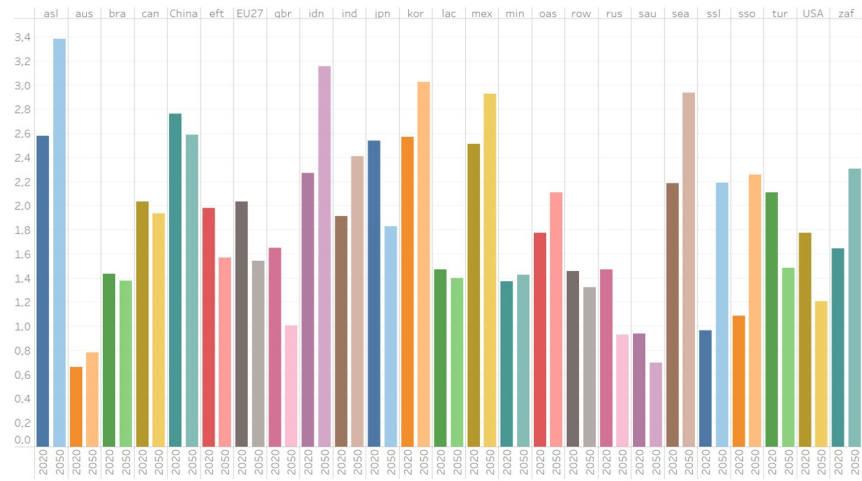
Figure 14: **Global imported intermediate share in gross output, by aggregate sector**



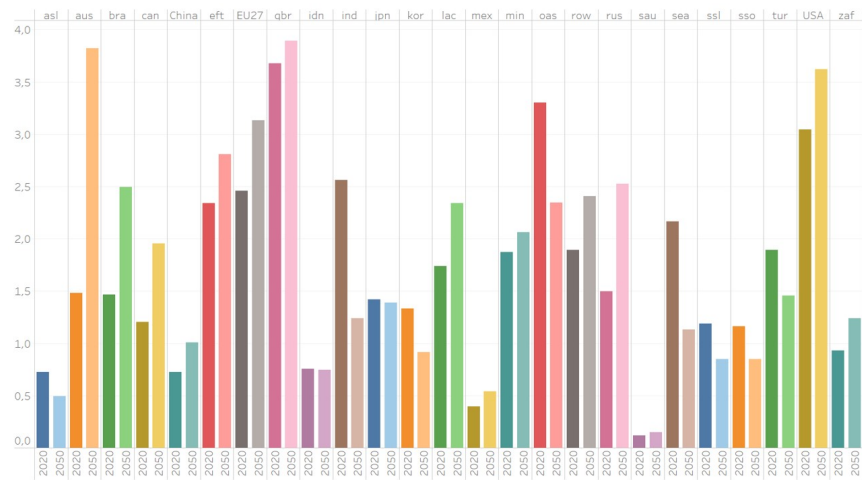
Figure 15: Revealed comparative advantage in aggregate sector by aggregate region (2020-2050)



(a) Revealed comparative advantage in agriculture by region (2020-2050)



(b) Revealed comparative advantage in manufacturing by region (2020-2050)



(c) Revealed comparative advantage in services by region (2020-2050)

Figure 16: Revealed comparative advantage by sector and region (2020-2050)

4 Conclusion

In this paper, we consolidate and expand a baseline scenario using the WTO Global Trade Model to project long-term trade patterns. In particular, we add several new features to the model, such as a diffusion of ideas module and non-homothetic constant elasticity of substitution preferences. We also include new exogenous shocks, such as differences in productivity growth, up-to-date changes in trade costs, and changes in capital income shares.

We emphasize six main results. First, global trade will grow more than global GDP. We project the average growth rate of trade at 3.09% compared to the average GDP growth rate of 2.72%, mainly due to reductions in trade costs. Second, the importance of developing economies and LDCs in global trade will rise. We project their share in global exports to exceed that of developed countries by 2035. Third, the global share of manufacturing trade will fall from 64% to 52% in favor of services trade which will account for 38% of global trade by 2050. Fourth, the share of global trade within developing countries will rise by 18 percentage points, representing 37% of global trade. In contrast, the share of trade within developed countries will fall from 40% to 21%. Fifth, developed countries will reinforce their revealed comparative advantage in services while developing economies will strengthen their revealed comparative advantage in manufacturing. Finally, intermediate linkages in services sectors will become more important, with an increase in the global imported intermediate share in gross output from 2.09% to 3.20%.

These long-term projections shed light on major future trends in international trade and provide a basis for future analysis. Beyond projecting long-term trade patterns, this newly generated baseline scenario may be used for the analysis of trade policy scenarios providing a comprehensive and up-to-date benchmark. Furthermore, it serves as state-of-the-art basis for climate-change focused projections. Finally, the framework can be employed for long-run macroeconomic and trade projections of specific countries, since the set-up of the projections is flexible and allows for changes in the aggregation.

References

- Aguiar, A., Chepeliev, M., Corong, E. L., McDougall, R., and Van Der Mensbrugghe, D. (2019). The GTAP data base: version 10. *Journal of Global Economic Analysis*, 4(1), 1-27.
- Aguiar, A., Corong, E. L., Van der Mensbrugghe, D., Bekkers, E., Koopman, R. B., and Teh, R. (2019). The WTO Global Trade Model: Technical documentation (No. ERSD-2019-10). WTO Staff Working Paper.
- Anderson, K., and Strutt, A. (2012). The changing geography of world trade: Projections to 2030. *Journal of Asian Economics*, 23(4), 303-323.
- Australian Chamber of Commerce and Industry (ACCI). (2018). Migration works for all of us. Policy position paper.
- Bacchetta, M., Bekkers, E., Métivier, J. (Forthcoming). The way forward: trade policies'impacts on global trade patterns.
- Bauer, W., Schlund, S., Marrenbach, D., and Ganschar, O. (2014). Industrie 4.0 Volkswirtschaftliches Potenzial für Deutschland. Berlin/Stuttgart.
- Bekkers, E., Antimiani, A., Carrico, C., Flaig, D., Fontagne, L., Foure, J., and Tsigas, M. (2020). Modelling trade and other economic interactions between countries in baseline projections. *Journal of Global Economic Analysis*, 5(1), 273-345.
- Bekkers, Eddy and Koopman, Robert B and Lemos Rêgo, Carolina (2021). Structural change in the Chinese economy and changing trade relations with the world. *China Economic Review* 65, 1015-1073.
- Bekkers, E., Besart, A., Bacchetta, M., Cariola, G., Fernandez-Amador, O., Goes, C., Koopman, R., Métivier, J., Lemos, C., Oberdabernig, D., Orlov, D., Sabbadini, G., Teh, R. (Forthcoming). Documentation of external projections for the WTO Global Trade Model Baseline.
- Bekkers, E., Corong, E., Métivier, J., Orlov, D. (Forthcoming). What drives global trade patterns?.
- Bekkers, E., Goes, C. (2022). The Impact of Trade Conflicts on Innovation. Mimeo.
- Bekkers, E., Sabbadini, G., Koopman, R., Teh, R. (2022). The impact of COVID-19 on trade patterns in the long run. Assymetric impact accross regions and sectors and acceleration of the introduction of new technologies. Mimeo.
- Bekkers, E., Teh, R. (2019). Potential economic effects of a global trade conflict: Projecting the medium-run effects with the WTO global trade model. WTO Staff Working Paper. ERSD-2019-04. 2-6.
- Buera, F. J., and Oberfield, E. (2020). The global diffusion of ideas. *Econometrica*, 88(1), 83-114.
- Chateau, J., Fontagné, L., Fouré, J., Johansson, A., and Olaberria, E. (2015). Trade patterns in the 2060 world economy. *OECD Journal: Economic Studies*, 2015(1), 67-100.
- Comin, D., Lashkari, D., and Mestieri, M. (2021). Structural change with long run income and price effects. *Econometrica*, 89(1), 311-374.
- Corong, E. L., Hertel, T. W., McDougall, R., Tsigas, M. E., and Van Der Mensbrugghe, D. (2017). The standard GTAP model, version 7. *Journal of Global Economic Analysis*, 2(1), 1-119.
- Dellink, R., Chateau, J., Lanzi, E., and Magné, B. (2017). Long-term economic growth projections in the Shared Socioeconomic Pathways. *Global Environmental Change*, 42, 200-214.
- Dellink, R., Van der Mensbrugghe, D., and Saveyn, B. (2020). Shaping baseline scenarios of economic activity with CGE models: introduction to the special issue. *Journal of Global Economic Analysis*, 5(1), 1-27.
- Dixon, P., and Rimmer, M. T. (2002). Dynamic general and equilibrium modelling for forecasting and policy: A practical guide and documentation of MONASH (Vol. 256). Elsevier.
- Duer, A., Baccini, L., and Elsig, M. (2014). The design of international trade agreements: Introducing a new dataset. *The Review of International Organizations*, 9(3), 353-375.

- Egger, P., Francois, J., Manchin, M., and Nelson, D. (2015). Non-tariff barriers, integration and the transatlantic economy. *Economic Policy*, 30(83), 539-584.
- Fontagné, L., and Fouré, J. (2013). Opening a Pandora's box: modelling world trade patterns at the 2035 Horizon.
- Fontagné, L., Fouré, J., and Keck, A. (2017). Simulating world trade in the decades ahead: driving forces and policy implications. *The World Economy*, 40(1), 36-55.
- Fontagné, L., Fouré, J., and Ramos, M. P. (2012). A general equilibrium long-term path of the world economy.
- Fouré, J., Bénassy-Quéré, A., and Fontagné, L. (2012). The Great Shift: Macroeconomic projections for the world economy at the 2050 horizon.
- Friedrich, R., Le Merle, M., Grone, F., and Koster, A. (2011). *Measuring industry digitization: Leaders and laggards in the digital economy*. Booz and Co., London.
- Grigoli, F., Herman, A., and Schmidt-Hebbel, K. (2018). Saving in the world. *World Development*, 104, 257-270.
- International Energy Agency (2020). *World Energy Outlook*. <https://www.iea.org/reports/world-energy-outlook-2020>
- International Trade Centre (2020). *Market Access Map*. <https://www.macmap.org>
- Koopman, R. B., Bekkers, E., and Rego, C. L. (2021). Structural change in the Chinese economy and changing trade relations with the world. *China Economic Review*, 65, 101573.
- Lendle, A., Olarreaga, M., Schropp, S., and Vézina, P. L. (2016). There goes gravity: eBay and the death of distance. *The Economic Journal*, 126(591), 406-441.
- McKinsey (2015). *Digital America: A tale of the haves and have-mores*.
- Moïsé, E., and Sorescu, S. (2013). Trade facilitation indicators: The potential impact of trade facilitation on developing countries' trade.
- Organisation for Economic Co-operation and Development (OECD). (2012). *Looking to 2060: Long-term global growth prospects*. OECD Economic Policy Paper No. 03
- Organisation for Economic Co-operation and Development (OECD). (2020). *STAN Tructural ANalysis Database*.
- Petri, P. A., and Zhai, F. (2012). *Navigating a Changing World Economy: ASEAN, the PRC and India, 2010-2030*. Available at SSRN 2148796.
- Samir, K. C., and Lutz, W. (2017). The human core of the shared socioeconomic pathways: Population scenarios by age, sex and level of education for all countries to 2100. *Global Environmental Change*, 42, 181-192.
- World Bank (2007). *Global Economic Prospects: Managing the Newt Wave of Globalization*.
- UN DESA (2015). *World population prospects: The 2015 revision*. UN Department of Economic and Social Affairs. Population Division New York, NY.
- UNCTAD(2020). *e-Handbook of Statistics 2020*. United Nations Conference on Trade and Development (UNCTAD). <https://stats.unctad.org/handbook/>
- Van Ark, B., and Jäger, K. (2017). Recent trends in Europe's output and productivity growth performance at the sector level, 2002-2015. *International Productivity Monitor*, (33), 8-23.
- World Trade Organization (WTO). (2013). *World Trade Report 2013: Factors shaping the future of world trade*.
- World Trade Organization (WTO). (2020). *World Trade Statistical Review 2020*.

A Appendices

Table 3: **Regional and sectoral aggregation**

	Region	Region description	Sector	Sector description
1	asl	Asia LDC	cro	Crops
2	aus	Australia	lvs	Livestock
3	bra	Brazil	oil	Oil
4	can	Canada	onr	Other extraction
5	chn	China	prf	Processed Food
6	e27	European Union	p_c	Petroleum, coal products
7	gbr	United Kingdom	chm	Chemicals
8	eft	EFTA	prp	pharma, rubber, and plastics
9	idn	Indonesia	twl	Textiles, apparel, leather
10	ind	India	otg	Other Goods
11	jpn	Japan	met	Metals
12	kor	Republic of Korea	eeq	Computer, electronic and optic
13	lac	Latin America	ele	Electrical Equipment
14	mex	Mexico	ome	Machinery and equipment
15	min	Middle East and North Africa	mvh	Motor vehicles
16	oas	Other Asian countries	otn	Transport equipment nec
17	row	Rest of World	utc	Utilities and Construction
18	rus	Russian Federation	trd	Trade
19	sau	Kingdom of Saudi Arabia	ars	Accommodation and recreation
20	sea	Southeast Asia	tra	Transport
21	ssl	Sub-Saharan Africa LDC	com	Communication
22	sso	Sub-Saharan Africa other	rsa	Real estate activities
23	tur	Türkiye	obs	Business Services
24	usa	United States of America	fin	Finance and Insurance
25	zaf	South Africa	ots	Other Services

Table 4: Detailed mapping of 141 to 25 regions

№	Acronym	Countries
1	asl	Cambodia, Lao People’s Democratic Republic, Rest of Southeast Asia, Bangladesh, Nepal
2	aus	Australia
3	bra	Brazil
4	can	Canada
5	chn	China
6	e27	European Union: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden
7	eft	Switzerland, Norway, Rest of EFTA
8	gbr	United Kingdom
9	idn	Indonesia
10	ind	India
11	jpn	Japan
12	kor	Republic of Korea
13	lac	Rest of North America, Argentina, Plurinational State of Bolivia, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Bolivarian Republic of Venezuela, Rest of South America, Costa Rica, Guatemala, Honduras, Nicaragua, Panama, El Salvador, Rest of Central America, Dominican Republic, Jamaica, Puerto Rico, Trinidad and Tobago, Caribbean
14	mex	Mexico
15	min	Bahrain, Islamic Republic of Iran, Israel, Jordan, the State of Kuwait, Oman, Qatar, United Arab Emirates, Rest of Western Asia, Egypt, Morocco, Tunisia, Rest of North Africa
16	oas	New Zealand, Rest of Oceania, Hong Kong, China, Mongolia, Chinese Taipei, Rest of East Asia, Pakistan, Sri Lanka, Rest of South Asia
17	row	Albania, Belarus, Ukraine, Rest of Eastern Europe, Rest of Europe, Kazakhstan, Kyrgyzstan, Tajikistan, Rest of Former Soviet Union, Armenia, Azerbaijan, Georgia, Rest of the World
18	rus	Russian Federation
19	sau	Kingdom of Saudi Arabia
20	sea	Brunei Darussalam, Malaysia, Philippines, Singapore, Thailand, Viet Nam
21	ssl	Benin, Burkina Faso, Guinea, Togo, Rest of Western Africa, South Central Africa, Ethiopia, Madagascar, Malawi, Mozambique, Rwanda, Tanzania, Uganda, Zambia, Zimbabwe, Rest of Eastern Africa
22	sso	Cameroon, Côte d’Ivoire, Ghana, Nigeria, Senegal, Central Africa, Kenya, Mauritius, Botswana, Namibia, Rest of South African Customs
23	tur	Türkiye
24	usa	United States of America
25	zaf	South Africa

Table 5: Detailed mapping of 65 to 25 sectors

Nº	Acronym	Description	Sectors
1	cro	Crops	Paddy rice, Wheat, Cereal grains nec, Vegetables, fruit, nuts, Oil seeds, Sugar cane, sugar beet, Plant-based fibers, Crops nec, Forestry
2	lvs	Livestock	Bovine cattle, sheep and goats, Animal products nec, Raw milk, Wool, silk-worm cocoons, Bovine meat products, Meat products nec
3	oil	Oil	Oil
4	onr	Other extraction	Coal , Gas, Minerals nec
5	prf	Processed Food	Fishing, Vegetable oils and fats, Dairy products, Processed rice, Sugar, Food products nec, Beverages and tobacco products
6	p_c	Petroleum, coal products	Petroleum, coal products
7	chm	Chemicals	Chemical products
8	prp	pharma, rubber, and plastics	Basic pharmaceutical products, Rubber and plastic products
9	twl	Textiles, apparel, leather	Textiles, Wearing apparel, Leather products
10	otg	Other Goods	Wood products, Paper products, publishing, Mineral products nec, Manufactures nec
11	met	Metals	Ferrous metals, Metals nec, Metal products
12	eeq	Computer, electronic and optic	Electrical equipment
13	ele	Electrical Equipment	Computer, electronic and optical equipment
14	ome	Machinery and equipment	Machinery and equipment nec
15	mvh	Motor vehicles	Motor vehicles and parts
16	otn	Transport equipment nec	Transport equipment nec
17	utc	Utilities and Construction	Electricity, Gas manufacture, distribution, Water, Construction
18	trd	Trade	Trade
19	ars	Accommodation and recreation	Accommodation, Food and servic, Recreational and other service
20	tra	Transport	Transport nec, Water transport, Air transport, Warehousing and support activity
21	com	Communication	Communication
22	rsa	Real estate activities	Real estate activities
23	obs	Business Services	Business services nec
24	fin	Finance and Insurance	Financial services nec, Insurance
25	ots	Other Services	Public Administration and defence, Education, Human health and social work, Dwellings

Table 6: **Difference between sectoral and average total factor productivity growth**

	Generic	Varying
Crops	2.49	2.49
Livestock	2.21	1.78
Oil	0.00	0.00
Other extraction	0.00	0.00
Processed Food	1.63	0.32
Petroleum, coal products	1.51	0.00
Chemicals	1.51	0.91
Pharma, rubber, and plastics	1.51	1.17
Textiles, apparel, leather	1.51	1.51
Other Goods	1.51	0.98
Metals	1.51	0.00
Computer, electronic and optic	1.51	3.69
Electrical Equipment	1.51	3.69
Machinery and equipment	1.51	0.79
Motor vehicles	1.51	1.73
Transport equipment nec	1.51	1.73
Utilities and Construction	-1.31	-1.31
Trade	0.77	0.77
Accommodation and recreation	-1.40	-1.40
Transport	0.00	0.00
Communication	1.30	1.30
Real estate activities	-1.57	-1.57
Business Services	-1.44	-1.44
Finance and Insurance	1.02	1.02
Other Services	-1.25	-1.25

Table 7: Savings ratio (2020 and 2050, %)

Country	2020	2050
Asia LDC	22.34	18.69
Australia	26.25	24.11
Brazil	17.62	14.68
Canada	20.11	18.73
China	43.63	35.06
European Union	22.81	22.15
EFTA	29.73	26.67
United Kingdom	13.28	13.48
Indonesia	33.49	29.07
India	26.09	23.94
Japan	22.25	22.62
Republic of Korea	33.19	29.05
Latin America	20.53	18.93
Mexico	18.33	16.86
Middle East and North Africa	25.24	19.63
Other Asian countries	28.56	29.41
Rest of World	23.47	23.13
Russia Federation	28.02	27.74
Kingdom of Saudi Arabia	34.04	26.08
Southeast Asia	25.90	21.41
Sub-Saharan Africa LDC	18.88	28.49
Sub-Saharan Africa other	21.34	23.49
Türkiye	13.54	12.77
United States of America	15.36	15.01
South Africa	18.18	17.62

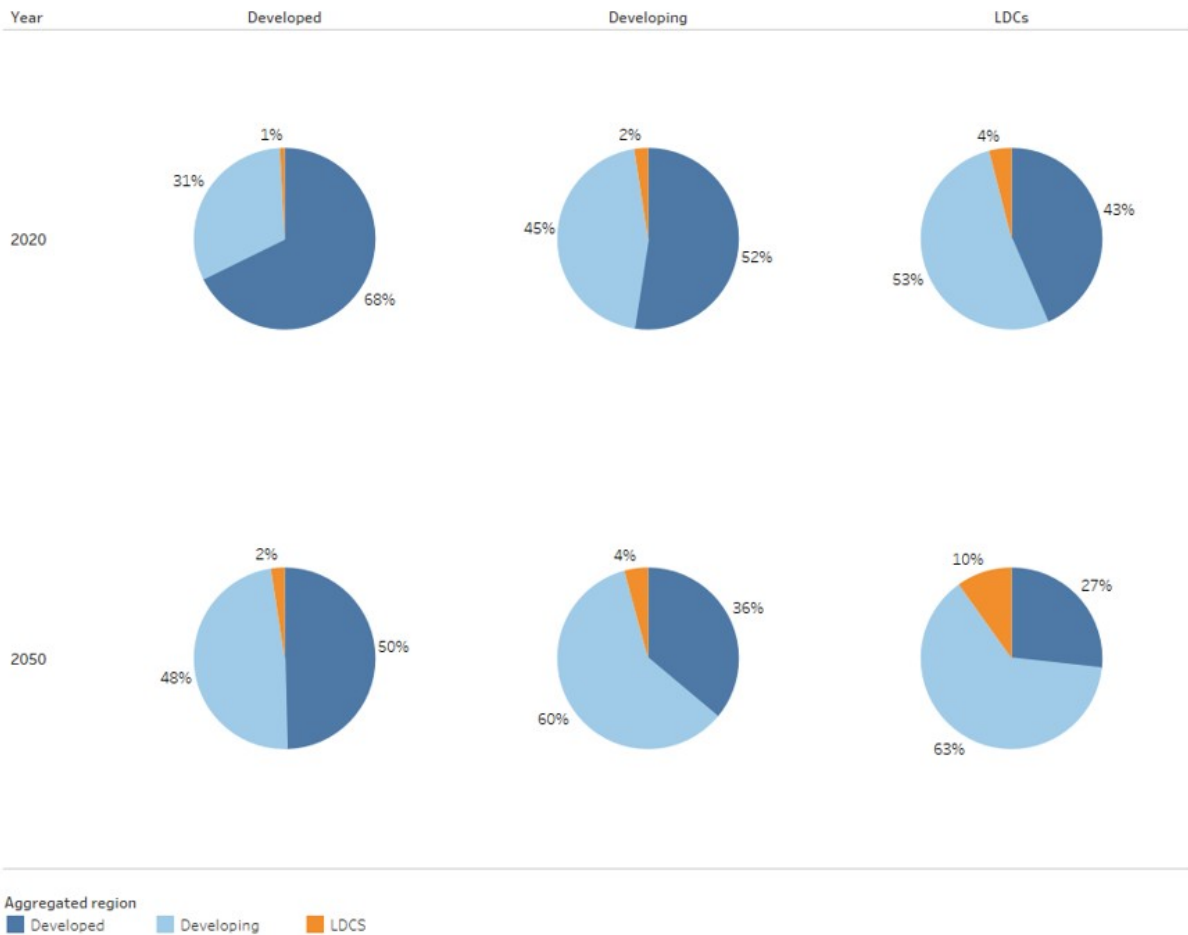


Figure 17: Share of exports of developed, developing and least-developed countries going to these different groups of countries (2020-2050)