

# Use of GTAP data base and model at the World Bank 2021/2022

## A. Global studies

### 1. Assessing exposure to international climate change transition risks

Countries' exposure to international climate change transition risks is increasing as the world takes action to decarbonize economies. In simple terms, these risks refer to the risks to assets and incomes resulting from a transitioning global economy caused by changes to the policy and regulatory landscape, technology, and consumer preferences. While it may take time for these transition risks to materialize, exposure to these risks increases as global efforts to decarbonize accelerate. Further, actions to manage these risks can take time to implement and industries need time to adapt. Two key factors that influence the level of potential exposure to international transition risks are the level of exposure to international markets; and the emissions intensity of its trade-exposed sectors. The World Bank uses the GTAP database (version 10) to estimate historical emissions intensities of each sector with a country (in metric tons CO<sub>2</sub> per million USD), enabling a comparison of:

- emissions intensities across sectors within a country
- emissions intensity for products/sectors across countries.

Combining the emissions intensity comparison with assessments of trade exposure provides useful insights into a country's exposure to international transition risks.

### 2. The Changing Wealth of Nations 2021 : Managing Assets for the Future. Washington, DC: World Bank.

GTAP-ENVISAGE with fossil fuel extraction module used to estimate the values and global distribution of stranded fossil fuel assets under alternative global low-carbon transition policy pathways.

Publication:

Grzegorz Peszko, Dominique van der Mensbrugge, Alexander Golub, and Maksym Chepeliev. 2021. Low-Carbon Transition, Stranded Fossil Fuel Assets, Border Carbon Adjustments, and International Cooperation: In "World Bank. 2021. The Changing Wealth of Nations 2021 : Managing Assets for the Future. Washington, DC: World Bank. © World Bank.

<https://openknowledge.worldbank.org/handle/10986/36400> License: CC BY 3.0 IGO:

### 3. Global Adaptive Pathways to Low Carbon Transition.

GTAP-ENVISAGE with fossil fuel extraction module used to simulate the landscape of alternative global climate action pathways to for country models for World Bank Climate Change Development Reports (CCDRs) in large fossil fuel exporters and stress-testing the value of fossil fuel assets in different global climate action landscapes

### 4. Reshaping Global Value Chains in Light of COVID-19: Implications for Trade and Poverty

Global value chains (GVCs) have driven dramatic expansions in trade, productivity, and economic growth in developing countries over the past three decades. Reshaping Global Value Chains in Light of COVID-19: Implications for Trade and Poverty Reduction in

Developing Countries examines the economic impact of the COVID-19 (coronavirus) pandemic on GVCs and explores whether they can continue to be a driver of trade and development. The book undertakes the following: • Assesses what the impact of previous crises, such as the global financial crisis of 2008–09, can say about the resilience of GVC firms to shocks • Examines what high-frequency data on trade flows can show about the impact of COVID-19 during the sharp global recession of 2020 • Uses discussions with GVC firms to gain a deeper understanding of the impacts of—and their responses to—the COVID-19 shock • Explores simulations from a global economic model to assess the potential longer-term impacts of COVID-19 on low- and middle-income countries and key factors shaping the global economy, including the evolving role of China, the rise of trade restrictions, and policy responses to global warming • Asks what steps countries and international institutions can take to enhance the resilience of GVCs in low-income countries to future shocks. The analysis shows that well-operating GVCs are a source of resilience more than a source of vulnerability. Moreover, steps to maintain and enhance trade contribute to managing a crisis and recovery, while measures to reshore production make all countries worse off. This economic crisis offers countries an opportunity to reshape the global economy into a greener, more resilient, and inclusive system that is better equipped for a changing world. Trade is a powerful tool for achieving this aim.

Launch and publication: <https://live.worldbank.org/events/reshaping-global-value-chains-light-covid-19-trade-development-climate-change>

[Presentations: Present to WTO Director-General - Dr. Ngozi Okonjo-Iweala; Macroeconomics Trade and Investment Global Practice \(MTI\) training](#)

Uses GTAP v. 10 MRIO data base and Envisage model.

## 5. The Trade and Climate Change Nexus: The Urgency and Opportunities for Developing Countries

While trade exacerbates climate change, it is also a central part of the solution because it has the potential to enhance mitigation and adaptation. This timely report explores the different ways in which trade and climate change intersect. Trade contributes to the emissions that cause global warming and is itself also affected by climate change through changing comparative advantages. The report also confronts several myths concerning trade and climate change. The report focuses on the impacts of, and adjustments to, climate change in developing countries and on how future trade opportunities will be affected by both the changing climate and the policy responses to address it. The report discusses how trade can provide the goods and services that drive mitigation and adaptation. It also addresses how climate change creates immense challenges for developing countries, but also new opportunities to promote trade diversification in the transition to a low-carbon world. Suitable trade and environmental policies can offer effective economic incentives to attain both sustainable growth and poverty reduction.

Launch and publication: <https://www.worldbank.org/en/events/2021/09/29/trade-part-of-solution-to-climate-change>

Presentation: MTI training

Uses GTAP v. 10 MRIO data base and Envisage model.

## 6. Pandemic, Climate Mitigation, and Reshoring: Impacts of a Changing Global Economy on Trade, Incomes, and Poverty

The resilience of global value chains has been put to the test by the COVID-19 pandemic, extreme weather events, and trade tensions spurred by growing economic nationalism and protectionism. Shocks in production and trade can be transmitted from one country to another by global value chains, although they can also help to lessen the blow of a domestic shock, such as a lockdown, and drive economic recovery. What shocks to global value chains should be anticipated in the coming years? Is it possible to design policies that can enhance resilience to trade shocks in developing countries without endangering growth? This paper explores simulations from the ENVISAGE global computable general equilibrium model to enhance understanding of the potential longer-term impacts of COVID-19 and the policy responses it engenders in developing countries. The paper assesses the likely impacts of measures designed to reshore production and reduce reliance on imports. It also evaluates other key factors shaping the global economy, including stylized scenarios to capture the essential elements of policies to achieve carbon emission reductions that will have an impact on trade.

Publication: <https://openknowledge.worldbank.org/handle/10986/37105>

Uses GTAP v. 10 MRIO data base and Envisage model.

## 7. Country Climate and Development Report (CCDRs)

The Country Climate and Development Report (CCDR) is a new public World Bank Group tool that aims to ensure a holistic approach to climate and development. CCDRs aim to capture the interplay between development (including poverty reduction, growth, inequality), climate change and climate policies. The world is decarbonizing, and well-prepared economies will be ready to manage the risks and take advantage of the opportunities. As of April 2022, seventy-four countries, representing 84% of global GDP, have committed to achieving net-zero in the mid-century<sup>1</sup>. This rises to 131 countries and 90% of GDP if we include the countries proposing and actively discussing adopting a net-zero target. A 90% GDP coverage has immense implications for global markets. Achieving net-zero involves a fundamental transformation of the economy and impacts many sectors. Alongside national commitments, banks and investors are aligning their portfolios with net-zero commitments. Further, 696 of the world's 2,000 largest publicly traded companies have set net-zero targets. Our section in the CCDRs assesses the risk of a decarbonizing world on each of the country of study by examining and comparing the results in three scenarios, one modelling the impact of the NDCs, other on the EU Green Deal, and the third on the proposed EU CBAM. These scenarios were made based on work from previous reports: "Reshaping GVC" and "Trade and Climate Change Nexus". In several of the CCDRs the scenarios have been further updated to incorporate new data/information and the GTAP 10 Power database. The results suggest that by 2030 global CO<sub>2</sub> emissions would fall by around 3.8 percent relative to the pre-COVID-19 baseline if the Paris Accord were fully implemented. Each region and sector will be affected differently as countries strive to reach their NDC targets, with coal hardest hit. Coal production drops significantly: anywhere from 6-7 percent in MENA and China, to more than 20-30 percent in Latin America, Europe, the USA, and the Rest of High-Income Countries. The impact of climate policies on other countries, such as the EU Green deal or CBAM, will depend on the degree of their carbon intensity and reliance on related exports. Separating macro impacts of the CBAM on EU trading partners from domestic EU mitigation policies (within the EU Green Deal), we can observe that the impacts correlate with the carbon intensity (in kg per US\$1 of exports) and magnitude (share of exports to the EU in a country's GDP) of exports to the EU. The top three regions most impacted by the CBAM – Europe and Central Asia, Middle East and North Africa, and Sub-Saharan Africa – have high carbon intensity of exports per US\$1 and at least 1 percent of the EU-designated export share in country GDP. At the same time, high-

income countries, including the USA, having the lowest carbon intensity of exports to the EU, experience negligible impacts from the CBAM.

The simulations are included in the CCDRs of: Philippines; Indonesia; China; Morocco; Egypt; Brazil; South Africa; Switzerland; Peru; Turkey; Jordan; Vietnam

Publication: Forthcoming

Uses GTAP v. 10 MRIO database/GTAP 10 Power database and Envisage model.

## B. Regional studies

### Sub-Saharan Africa and Middle East North Africa

#### 8. Estimating the Job Creation Potential of the Clean Energy Transition

We use the ENVISAGE computable general equilibrium (CGE) model to assess the potential job creation impact of the clean energy transition for nine sub-Sahara African countries. The model uses data inputs from the GTAP-Power database, and more importantly, detailed electricity generation data and projections from ESMAP's Electricity Planning Model (EPM). We construct and simulate four main scenarios (investment in renewable energies, regional energy trade, increased reliability of power supply, energy efficiency investments) to assess how different aspects of the clean energy transition will affect each country's labor markets and macroeconomic results. The project is completed and in the process of preparation for publication.

#### 9. Making the most of Africa Continental Free Trade Area: Leveraging Trade and Foreign Direct Investment to Boost Growth and Reduce Poverty

The creation of the African Continental Free Trade Area (AfCFTA) creates a unique opportunity to boost growth and poverty reduction by expanding regional and global value chains. It should contribute to increase investment from within and outside Africa by creating a continent-wide market, which will enable greater trade, reduce investment hurdles, and foster greater competition. It will increase the attractiveness of Africa for investors by increasing the size of the market that investors can access by locating in an African country. The potential gains from fostering foreign investment and deeper integration are estimated using a baseline and three scenarios. The first scenario, "AfCFTA Trade", considers the impact of reductions in intra-AfCFTA tariffs, non-tariff barriers in goods and services, and implementation of trade facilitation measures. The second scenario, "AfCFTA FDI Broad", incorporates the impacts of FDI from preferential trade agreement among all countries on the continent. The third scenario, "AfCFTA FDI Deep", simulates the expected gains if the provisions of the AfCFTA agreement are expanded to include additional policy areas, notably covering investment policy, competition policy and international property rights, further boosting FDI flows. The study uses the global computable general equilibrium (CGE) model Envisage to simulate the economic impacts of the "AfCFTA Trade" scenario, compared to the baseline scenario in 2017. It was then used a gravity analysis to yield estimates of potential impacts of the AfCFTA FDI Broad and AfCFTA FDI Deep on FDI flows in and out of the continent, including among the AfCFTA members themselves, as well as the additional expected trade cost reductions driven by deeper preferential commitments. It was then introduce the gravity-based estimates of FDI flows into the global CGE model Envisage, and it was simulated the economic implications of the AfCFTA Trade, augmented with FDI flows (AfCFTA FDI Broad) and also accounting for the integration in policy areas in Phase II (AfCFTA FDI Deep). Finally, the economic impacts under the three scenarios are translated into their effects on poverty and income distribution using the Global Income Distribution Dynamics

(GIDD) microsimulation framework. The results from the AfCFTA FDI Broad and AfCFTA FDI Deep scenarios show that the whole of Africa stands to gain from greater FDI as a result of the AfCFTA. The results suggest that Africa could more than double the FDI it attracts (in part because it starts from a relatively low level), reaching an increase of 111 percent in FDI under AfCFTA FDI Broad, and an increase in FDI of 159 percent under AfCFTA FDI Deep.

Forthcoming June 2022 - [www.worldbank.org/afcfta](http://www.worldbank.org/afcfta)

Uses GTAP v. 10 MRIO data base and Envisage model.

## East Asia and Pacific

### 10. Regional Carbon Markets for ASEAN Member State Countries

The project aims to produce a report on the cost-benefit of ASEAN regional cooperation in carbon pricing. The value proposition of regional cooperation and harmonization will be based on a cost-benefit analysis based on the CGE analysis using the CGEBox model based on GTAP Power and other satellite databases. All ASEAN countries are included in the regional aggregation of the model together with their main trade partners as well as large countries that represent a large share of the world economy. Sector and commodity aggregation will focus on share in national economies and employment, carbon intensity, the importance of the sectors in the green transition. Factors of production will include land, capital, and labor where the latter will be disaggregated based on skill groups.

The simulations will explore potential economic gains that could be realized from transboundary carbon trade between sectors with high and low marginal abatement costs to reduce GHG emissions (e.g., between the industry sector of Singapore and the power sector of Vietnam). The analysis will also identify and assess potential risks of regional mitigation cooperation on issues, such as competitiveness, carbon leakage, and distributional considerations in the context of growing global value chain, movement of the introduction of a carbon border adjustment mechanism (CBAM) and other international trends.

## Europe and Central Asia

### 11. Impact of EU CBAM on ECA Countries

The EU has announced that they are considering introducing a carbon border adjustment mechanism (CBAM) no later than 2023. A CBAM would act as an increase in tariffs imposed by the EU, but this time by considering the carbon intensity of the covered commodities in exporting countries. Recognizing the likely impact of CBAM on the decarbonization of the countries in the region, the team has developed a regional model that could be an entry point for a broader dialogue on the potential benefits of decarbonization. We ran several scenarios using the Global CGE model ENVISAGE, on GTAP Power database. Simulations cover the period 2014-2035, where 2014 is the base year. The Baseline projection for the years 2014-2035 covers all variables of the model, including industry outputs, trade in commodities, relative prices of commodities, aggregate economic categories, energy use, and GHG emissions. The results are featured in the following reports:

- Russia and Global Green Transition : Risks and Opportunities
- Azerbaijan Country Environmental Analysis Report
- Kazakhstan Country Climate and Development Report
- Ukraine Country Climate and Development Report

- Turkey Country Climate and Development Report
- Armenia Deep Dive into the CBAM: Modelling the Impacts on Armenia's Economy up to 2035 Report

## 12. Russia and Global Green Transition : Risks and Opportunities

GTAP-ENVISAGE with fossil fuel extraction module used to estimate the low-carbon transition risk to Russia related to alternative scenarios of international climate clubs applying climate policies with and without border carbon adjustment policies.

Publication:

December 2021: Makarov, Igor; Besley, Daniel; Hasan, Dudu; Boratynski, Jakub; Chepeliev, Maksym; Golub, Elena; Nemova, Vladislava; Stepanov, Ilya. 2021. Russia and Global Green Transition : Risks and Opportunities. World Bank, Washington, DC. © World Bank. <https://openknowledge.worldbank.org/handle/10986/36757> License: CC BY 3.0 IGO.”:

## 13. The impact of the War in Ukraine on Global Trade and Investment

Many countries are suffering serious economic consequences as a result of the Russian invasion of Ukraine. Ukraine and Russia are major exporters of agricultural commodities and fossil fuels, and disruptions to supplies of these commodities and associated price spikes are already being felt across the globe. As the Black Sea region is a large exporter of fertilizers, the resulting shortages and price increases could translate into lower crop yields in many regions. This in turn could lead to food prices reaching new highs. The Russian invasion has prompted an unprecedented reaction by the United States, the European Union, and other high-income economies, in the form of sanctions. These range from sanctions targeting Russian individuals and enterprises, to bans on Russian energy imports and restrictions on exports of select electronics to Russia, such as semiconductors. The stylized scenario considers: A shock to energy and crop supplies from Russia, Ukraine, and Belarus resulting in a global crude oil price increase of 7 percent and a 20 percent price rise for wheat and other cereal grains; An increase in the price of imported fertilizer used in agricultural production by 50 percent; Restrictions on exports of electronics to Russia imposed by high income countries and large exporters of electronics from Asia, as well as export bans on electronics from Russia; A ban on imports of fossil fuels from Russia by the United States. The report shows that the estimated decline in global income due to the invasion of Ukraine is 0.7 percent, with low-income countries losing 1 percent and high-income countries losing 0.6 percent. Importers of energy and agricultural commodities suffer real income losses, while countries in MENA and ECA regions could benefit from terms-of-trade gains and see their incomes expand. The war is adding inflationary pressures to food prices that were already high due to COVID-19 disruptions, region-specific weather events, currency devaluations, and worsening fiscal constraints.

Publication: <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099750104252216595/idu0008eed66007300452c0beb208e8903183c39>

Uses GTAP v. 11 data base and ENVISAGE model.