

Climate mitigation policy and restructuring of the global value chains

Maksym Chepeliev

Maryla Maliszewska

Israel Osorio Rodarte

Maria Filipa Seara e Pereira

Dominique van der Mensbrugghe

DRAFT: NOT FOR PUBLICATION

Keywords: global value chains; economic growth of open economies; measurement and analysis of poverty; computable general equilibrium modeling; distributional impacts of trade; climate change

Abstract

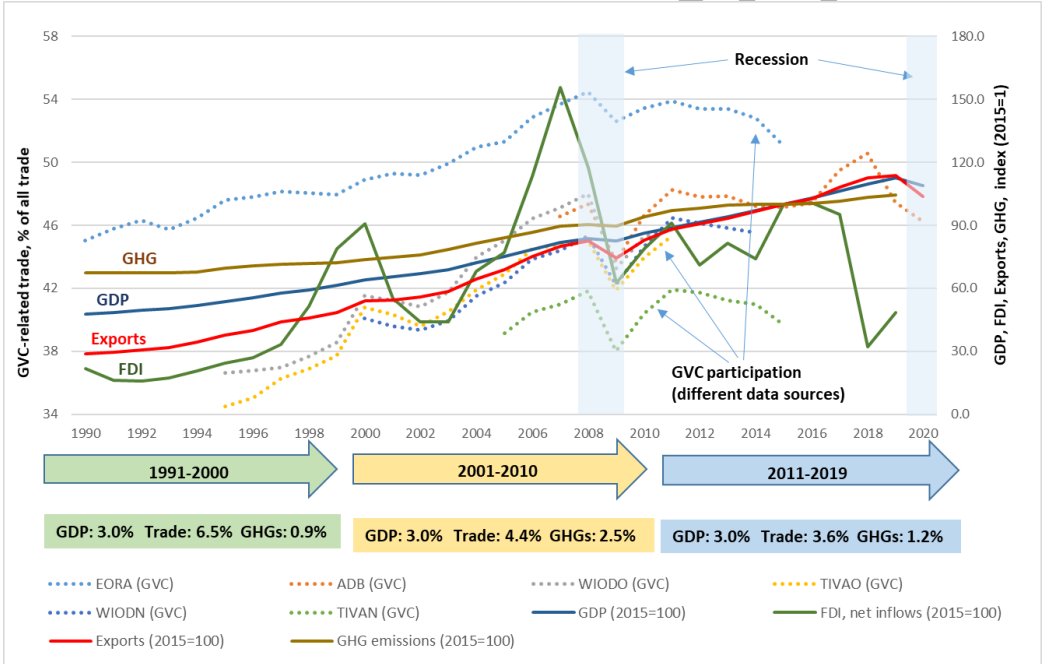
Climate change and the respective policies for carbon emission reductions will test the resilience of global value chains and shape them. Shocks in production and trade can be transmitted from one country to another by global value chains, although they can also help to lessen the blow of a domestic shock. This paper explores simulations from the ENVISAGE global computable general equilibrium model to enhance understanding of the potential longer-term impacts of environmental policies. It evaluates the key factors shaping the global economy with stylized scenarios that capture the essential elements of policies to achieve carbon emission reductions that will have an impact on trade.

DRAFT: NOT FOR PUBLICATION

During the last three decades global economy has experienced dramatic transformations. Since 1990, gross domestic product (GDP) has been growing at an average of 3 percent per year, with a share of services increasing by over 12 percentage points. Growth in global trade has been outpacing GDP and the foreign direct investments (FDIs) have reached unprecedented levels in the mid-2000s, before decreasing in a post-2008 period after the global financial crises (Figure 1).

Such rapid economic growth has been accompanied by an uptake in global value chains (GVCs), a phenomena when production stages of individual commodities are separated and distributed across different countries and often continents. Examples of such cases can be found everywhere around us – from cars and cell phones to pens and shoes. Studies show that this phenomena has been driven by a number of factors among which authors distinguish declining transport and communication costs, increasing technological progress, as well as lower barriers to trade and capital flows (Baldwin, 2013; Amador and Cabral, 2016). Especially rapid growth in the GVC-related trade has been observed between early 1990s and mid-2000s, when a more complex global trade and production structures started to evolve exploiting the differences in factor costs across countries (Figure 1).

Figure 1. Global GVC and macro indicators over 1990-2020



Notes: Doted lines represent estimates of GVC-related trade (as a share of total trade – left axis) based on different datasets. Each dataset is identified by name and covers different time period. Numbers below each arrow under the chart represent annual average growth rates of the indicator within the period.

Source: Estimated by authors using data from Borin et al. (2021) and WB (2022).

Over this period the GVCs have emerged and reshaped in unprecedented ways. Many countries, especially in Europe and East Asia, have transitioned into more sophisticated forms of GVC participation, with increasing role of advanced manufacturing and services in trade (WB, 2020). The overall share of GVC trade in total world trade has stagnated over the last decade, but still remains high – around 40-52 percent depending on the data source (Figure 1). COVID-19 pandemic has added an additional uncertainty in framing the future of the GVCs, although some authors think that the pandemic itself should not be considered as a major driver of the long-term GVC restructuring (Curran

and Eckhardt, 2021). Nevertheless, considering the recent trends in trade patterns, a decade ahead might as well prove to be transformational for the GVCs, with significant implications for the organization of global production and investment landscape (Zhan, 2021).

Future restructuring of the GVCs would be defined by a number of factors, with a sustainability endeavor, as one of the key societal challenges, most likely being at the top of this list (Zhan, 2021). A number of previous studies have explored the underlying factors of GVC reshaping in the historical perspective (Baldwin, 2013; Amador and Cabral, 2016; WB, 2020), however the analysis of the forward-looking drivers remains very limited, while available studies mostly provide a qualitative perspective of the potential GVC evolution (Antras, 2020; Zhan, 2021).

In this paper we aim to address this gap in the literature and focus on a set of exploratory scenarios that represent future climate mitigation policies and measures. The analysis builds on a global dynamic computable general equilibrium (CGE) model ENVISAGE (van der Mensbrugghe, 2019). A particular feature of our approach is that we include an extension of the standard modeling framework by incorporating multi-region input-output (MRIO) tables that distinguish between imports of intermediate, final, and investment goods to better capture the nature of trade typical for GVCs. The CGE model relies on the GTAP 10 MRIO Data Base with a 2014 reference year (Carrico et al., 2020) and runs until 2030. The analysis covers 27 sectors and 21 countries/regions.

Our scenario framework includes a baseline which accounts for the impacts of COVID-19 pandemic via a set of COVID-specific shocks (changes in trade costs, trade and domestic supply pattern changes, changes in global energy prices, etc.) and three climate mitigation scenarios. The latter include **(a)** emissions reduction targets consistent with Nationally Determined Contributions (“NDC” scenario); **(b)** a more ambitious climate mitigation efforts by the EU, represented within the “EU Green Deal” scenario; **(c)** an implementation of the stylized Carbon Border Adjustment Mechanism (CBAM) by the EU countries (“CBAM scenario”).

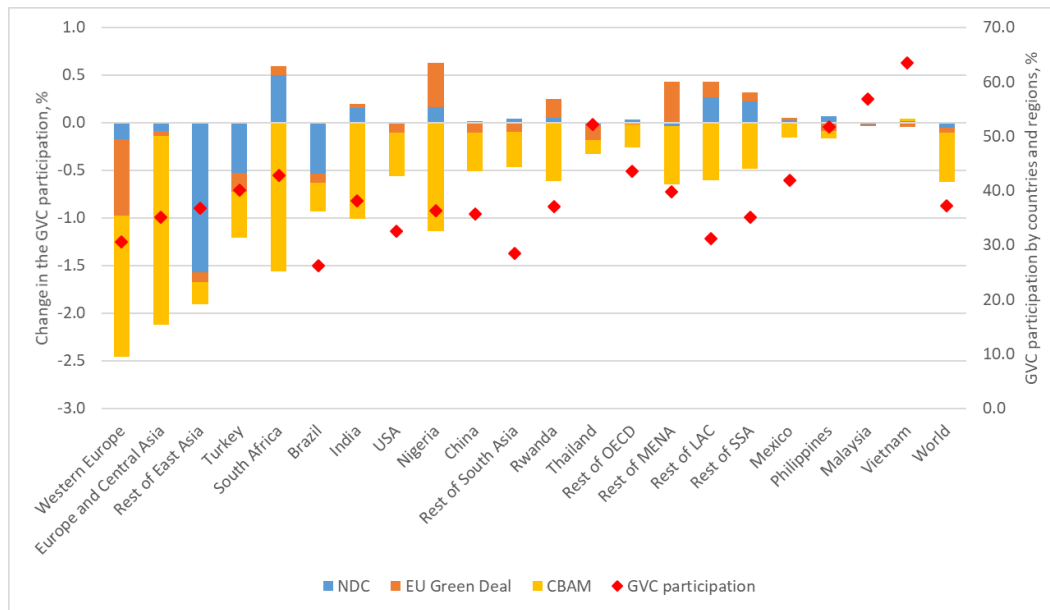
Our preliminary findings indicate that Implementation of the climate mitigation policies leads to the reshaping of the GVCs both at the regional and sectoral levels. Decomposing the impact of the considered climate mitigation measures on the GVC participation rate,¹ an overall trend of the declining GVC participation is observed by countries and regions (Figure 1). Corresponding impacts are rather moderate and range from around -2.5% in Western Europe – a region with the most stringent mitigation policies in our scenarios – to virtually 0% in some countries with a high GVC participation rate like Philippines, Malaysia and Vietnam, which are involved into the trade in low carbon-intensive commodities.

On average, implementation of the NDC targets has a minor negative impact on the GVC participation. Moderate negative impacts are experienced by countries with higher ambition NDCs, e.g. EU, Turkey, Brazil and Rest of East Asia. At the same time, some countries and regions with a relatively unambitious mitigation goals even benefit from changes in the trade patterns and increase their GVC participation – this group includes India, South Africa, Philippines and a number of other countries from South Africa and Latin America (Figure 2).

Implementation of the EU Green Deal has a major impact on the GVC participation for Western Europe, where the former declines by around 0.8%. At the same time, with the redirection of trade flows and an increasing trade intensity outside of the EU, GVC participation rate for most other countries and regions increases. Only the closest EU trading partners experience minor reduction in the GVC participation due the EU Green Deal implementation. Among considered climate policy measures, CBAM has the most adverse impacts on the GVC participation. With increasing trade barriers, not only does the Western European countries observe a sharp decline in GVC participation (-1.5%), even more substantial reduction is experienced by some EU trading partners, with Europe and Central Asia being impacted even more substantially than the EU itself (-2%) (Figure 2).

¹ GVC participation rate equals the sum of the backward and forward GVC participations (see e.g. Borin et al., 2021).

Figure 2. Impacts on the GVC participation by countries and regions in 2030, % change w.r.t. baseline

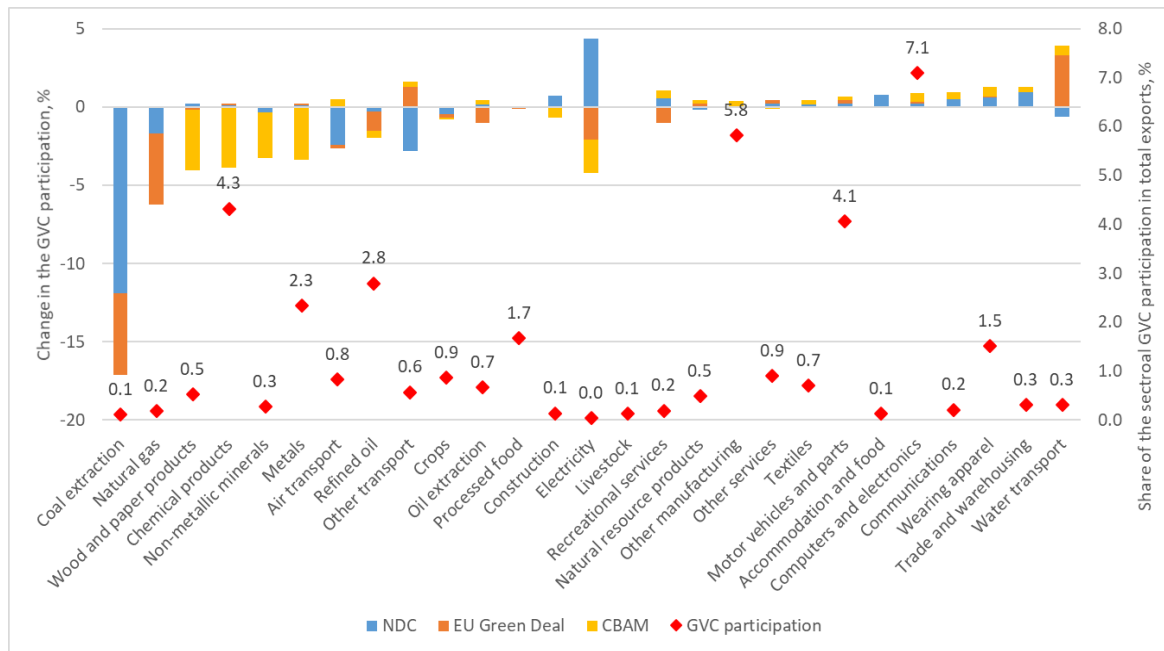


Source: ENVISAGE simulations

At the commodity level, trade in fossil fuels is being impacted the most adversely due to the NDC policies, with coal at the top of the list (Figure 3). Implementation of the EU Green Deal mitigation efforts further reduces GVC participation for fossil fuels, though it should be noted that these commodities are not heavily involved into the forward and backward GVC linkages. CBAM, on the other hand, targets selected energy intensive sectors with relatively higher participation in the GVCs, with chemical products at the top of this list of the most GVC-integrated commodities. With increasing barriers for trade in these commodities, their participation in GVCs shrinks rather substantially, as wood and paper products, chemicals, non-metallic minerals and metals are all experiencing a reduction of 3% to 4%.

While fossil fuels and energy intensive sectors experience a reduction in the GVC participation rates, service sectors and light manufacturing activities experience a moderate increase in their involvement to the global values chains (Figure 3). These include such highly GVC-integrated commodities like computers and electronics, motor vehicles and parts and other light manufacturing. Climate mitigation policies stimulate both trade and GVC participation for these commodities, making them even more integrated in the global value chains.

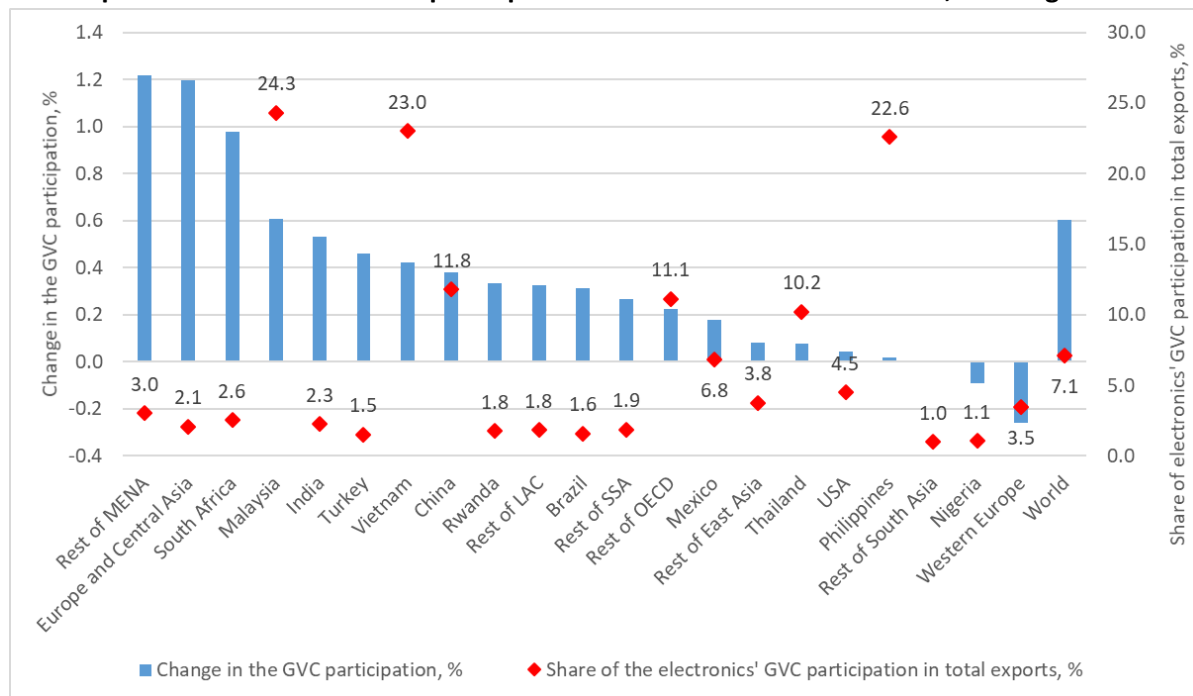
Figure 3. Impacts on the GVC participation by sectors in 2030 (global average), % change w.r.t. baseline



Source: ENVISAGE simulations

Focusing on the CBAM impacts on the computer and electronics – a sector with the highest rate of the GVC participation – all EU trading partners experience an increasing GVC participation rate (Figure 4). As the trade barriers for heavy manufacturing increase, producers of electronics observe an increasing demand for their goods worldwide with a global average increase in GVC participation for electronics of around 0.6%. Key exporters of the electronics, such as Malaysia, Vietnam and China, also substantially strengthen their integration into the global values chains due to the border carbon adjustment measures. Thus, our results suggest that the climate mitigation policies not only lead to the decarbonization of the economy, but also stimulate a higher integration to the GVCs of the low carbon intensive commodities.

Figure 4. Impacts of the CBAM on GVC participation for electronics sector in 2030, % change w.r.t. baseline



Source: ENVISAGE simulations

References:

- Amador, J. and Cabral, S. 2016. Global value chains: a survey of drivers and measures. *Journal of Economic Surveys*, 30: 278-301. <https://doi.org/10.1111/joes.12097>
- Antras, P. 2020. Conceptual Aspects of Global Value Chains. *The World Bank Economic Review*, Volume 34, Issue 3, October 2020, Pages 551–574, <https://doi.org/10.1093/wber/lhaa006>
- Baldwin, R. 2013. Global supply chains: why they emerged, why they matter, and where they are going, *In* D.K. Elms and P. Low (eds), *Global Value Chains in a Changing World (chapter 1, pp. 13–59)*. Geneva, Switzerland.
- Borin, A., Mancini, M., and Taglioni, D. 2021. Countries and Sectors in GVCs. *World Bank Policy Research Working Paper No. 9785*. <https://openknowledge.worldbank.org/handle/10986/36314>
- Curran, L. and Eckhardt, J. 2021. Why COVID-19 Will Not Lead to Major Restructuring of Global Value Chains. *Management and Organization Review* 17:2, May 2021, 407–411.
- World Bank (WB). 2020. *World Development Report 2020: Trading for Development in the Age of Global Value Chains*. Washington, DC: World Bank. doi:10.1596/978-1-4648-1457-0.
- World Bank (WB). 2022. DataBank. <https://databank.worldbank.org/home.aspx>
- Zhan, J.X. 2021. GVC transformation and a new investment landscape in the 2020s: Driving forces, directions, and a forward-looking research and policy agenda. *Journal of International Business Policy*, volume 4, pages 206–220 (2021). <https://doi.org/10.1057/s42214-020-00088-0>