Supplementary Information

Examining the sensitivity of global CO_2 emissions to trade restrictions over multiple years

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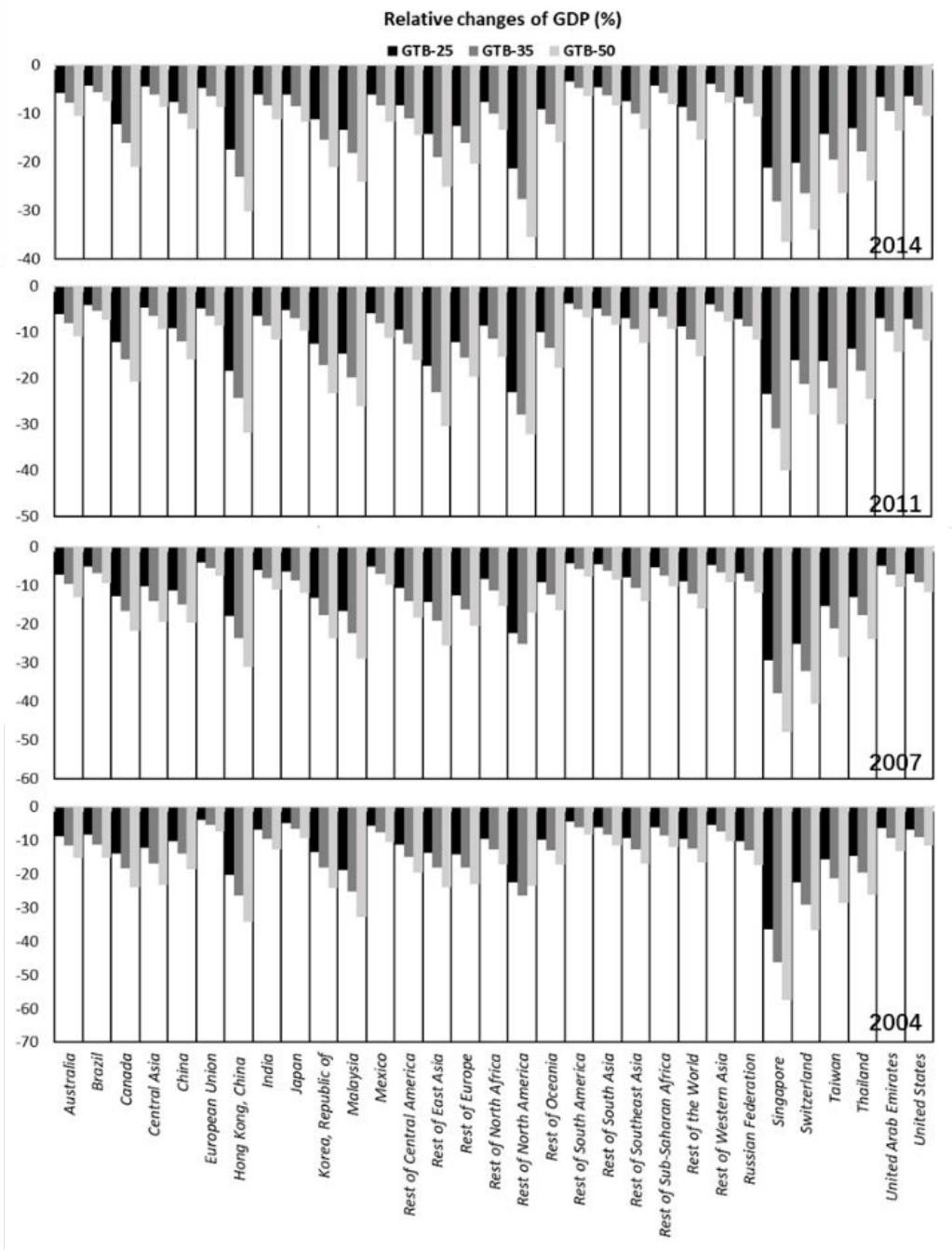
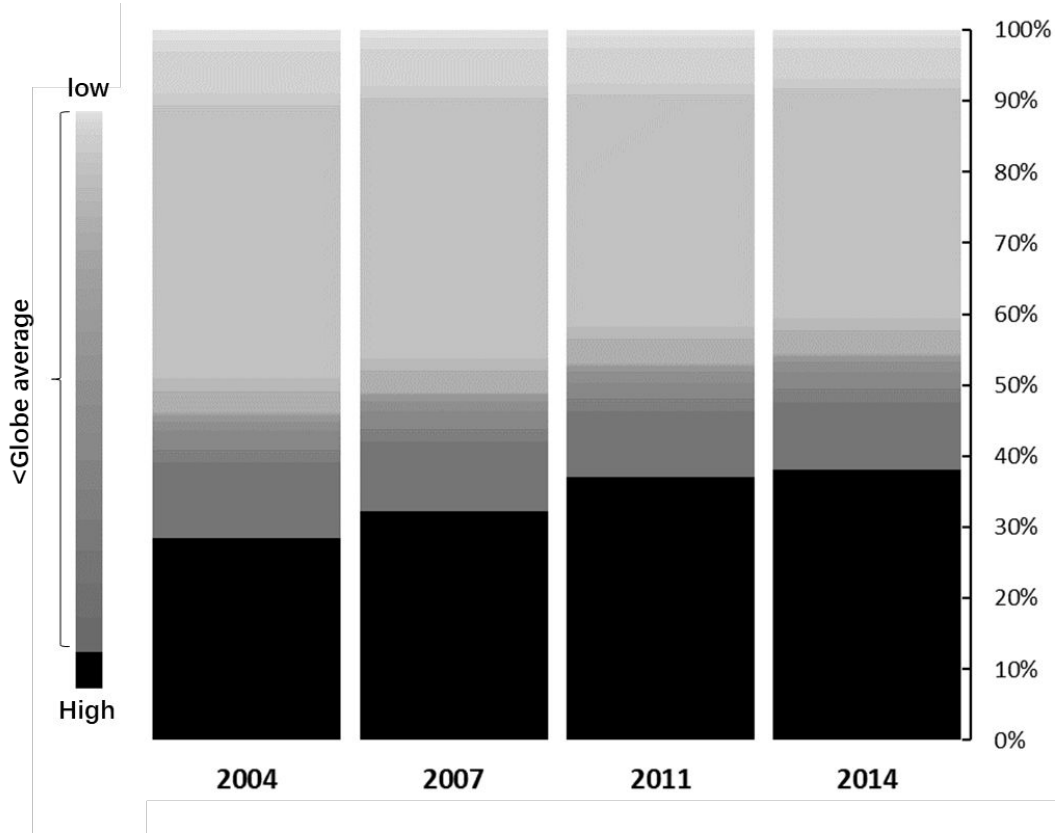
Uncertainty and limitations

Several factors result in uncertainty in our analysis and findings. First, the CO_2 emissions considered here are focused on the source of fuel combustion for economic production. In other words, CO_2 emissions from activities that are not directly related to economic output, like private transport and residential activities, are not included in our study. Thus, the emissions we considered in our simulations, when summed, are lower than the actual regional and global emissions. For example, 9.9 Pg of global CO_2 emission were omitted in this study for the year 2014[1]. However, since the aim of our study was to test the impact of trade on emissions, only including emissions from economic production is sufficient to capture the signature under different trade-related scenarios. Second, our trade restrictions scenarios were designed with an additional 25% tariff, but the impacts on emission might be different with higher-level tariffs imposed. To test the robustness of our results, we added two more hypothetical trade restriction scenario with higher levels of tariff imposed: GTB-35 and GTB-50 (+35% and 50% for each region and traded product, respectively). Under these two tariff levels, even though the simulated magnitudes vary under each scenario, the relative changes for each region are robust and monotonic with the imposed tariff increasing (Supplementary Table 2 and Supplementary Figure 1). The robustness of simulated GDP changes by GTAP have been tested with a similar method in our previous study under several hypothetical scenarios with different levels of additional tariff for China and the US[16]. Therefore, the results of our sensitivity tests support our interpretation that changing the level of tariffs only affects the numerical magnitude of results but not the reliability of this study. Third, the emission calculation under each scenario assumes homogeneity of products sold into different markets. This assumption underlines the differences between domestic products and trade products [2], especially considering the "processing trade" [3]. This limitation will be amplified with a higher level of aggregation. Therefore, we used the most detailed data in the GTAP database (65 production sectors) in this study to reduce this limitation and capture heterogeneity to the greatest extent possible. Besides, note that some regions with negative values of elasticity under specific scenario were not included here.



Supplementary Figure 1: The relative changes in GDP of individual regions from Actual to each scenario under trade restriction series test. Detailed results can be found in the Supplementary Table 2 of this study.



Supplementary Figure 2: Increasing share of regions with emission intensity above the global average as a percentage (%) of total global trade in this study. This figure highlights the effects of changes in export structure over time. Each region's share of global exports is shown as a separate stacked bar for each year. Darker colors represent regions with relatively higher emission intensities compared to the global average. The darkest color is the sum of emission-intensive regions, which are defined as regions with emission intensities higher than the global average for each year. Detailed results can be found in the "Export" tab of Supplementary Table 2.

References

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