



Investigating the R&D-CO₂ nexus in the international trade

Lorenzo Costantini, Francesco Laio, Luca Ridolfi, and Carla Sciarra

DIATI, Politecnico di Torino, Turin, Italy (lorenzo.costantini@polito.it)

Innovation and technological progress are the main drivers of sustainable development and economic growth, and they both play a role in addressing climate change and related actions. These drivers rely on Research and Development (R&D), i.e., the systematic creative work aiming to increase the stock of knowledge and devoted to the creation and development of new products and procedures. Against the existing literature that differently addresses the economic implications of the R&D sector, in this work, we introduce a novel quantification of the R&D content embedded in countries' export baskets. Considering the current need to understand the dynamics of CO₂ emissions and their nexus with the economic aspects, the R&D content in nations' export baskets is related to the country-specific terrestrial carbon emissions. To this aim, we refer the CO₂ emissions embedded in nations' export baskets to the dollars the country at hand exports, defining a country-specific CO₂ export intensity; in this way, we can compare economies of different sizes (for example, Germany and Paraguay). Our results show that as countries export products with an increasing R&D content, their CO₂ export intensity decreases. Germany, Japan, and the United States are examples of countries exporting high R&D products and having low CO₂ export intensity. China stands as an example of elevated CO₂ intensity despite having a high R&D content embedded in its export basket. Fuel exporting economies (such as the Russian Federation) and the majority of developing countries have low R&D-oriented export baskets, with high CO₂ export intensities. Our work provides a novel perspective of the R&D-CO₂ emissions nexus, highlighting the R&D centrality in the green transition and decarbonization process.