Structural Changes in Global Automotive Supply Chains: The Rise of Electric Vehicles

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In global automotive supply chains, the impact of CO2 emissions on climate change has become a focal point of international discourse. Concurrently, the widespread adoption of Electric Vehicles (EVs), including Plug-in Hybrid Electric Vehicles (PHEVs) and Battery Electric Vehicles (BEVs), is anticipated to bring about significant structural transformations to the global economy. This study aims to provide valuable insights for policy formulation by analyzing and simulating changes in production- and consumption-based CO2 emissions across countries, as well as changes in global value-added creation and distribution resulting from advancements in EV-related technologies.

We utilize the latest OECD Inter-Country Input-Output (ICIO) tables to develop an extended EV-Inter-Country Input-Output model. This model disaggregates the automotive industry into three subsectors: conventional vehicles (internal combustion engines), EVs, and vehicle parts and components. Differences in the technological input structures between EVs and conventional vehicles are estimated based on sample surveys, interviews with auto companies and technical experts, and relevant customs trade data.

Initially, the study analyzes the structural changes in the international trade network of key components required for EV manufacturing (such as batteries, motors, and controllers), as well as the essential materials needed for producing these components. Furthermore, through structural change analysis and simulation based on the developed EV-ICIO model, the study examines how the proliferation of EVs affects value-added creation and CO2 emission patterns within global supply chains, both upstream and downstream, and assesses the implications for the competitive advantage of various countries.

Our main findings indicate dramatic structural changes in global vehicle supply chains, primarily due to the rise and expansion of EV production and consumption. Chinaâ€™s role in global EV supply chains, both upstream and downstream (from key materials, key parts and components, as well as finished vehicles), demonstrates a strong dominance in controlling power, resulting in greater value-added gains. CO2 emissions footprints in the entire production process of EVs do not show significant advantages compared to conventional vehicles. This is because EV batteries are relatively high carbon-intensive products compared to combustion engines. Although very limited CO2 emissions occur during the use of EVs, the emissions friendliness of this process highly depends on the source of electricity generation. Even with the popularization of EVs, economies that heavily rely on coal-based power generation to produce electricity still face challenges in emissions reduction.