A Unified Framework of Trade in Value Added; Physical, Monetary, Exchange Rates, and GHG Emissions

Topic: Tracing Carbon Emissions in Global Value Chains I
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Koopman et al. (2014) developed a method to consistently decompose gross exports in value added terms, which takes up infinite repercussions of international and inter-sector transactions. This helps better understanding on the nature and significance of Trade in Value Added (TiVA) in global value chains as compared to the conventional gross exports in which double counting problems occur. However, the framework based on the monetary input-output tables cannot separate prices and quantities, and thus unable to consider financial adjustments through the exchange market. This paper proposes a framework based on a physical World Input-Output (WIO) system, in its linear programming equivalent Ã la Dorfman et al. (1958), which can clarify the various complexities associated with the existing TiVA indicators, and is proved to be consistent with the results obtained by Koopman et al. when the physical decompositions are evaluated in monetary terms using the equilibrium prices. While the international monetary tables are generally described in terms of current U.S. dollars, the physical framework can consider the price adjustments through the exchange market. An iterative procedure to calculate the exchange rates is proposed, and some numerical exercises with hypothetical WIO data are conducted to demonstrate the significance of local wages and capital flows that are to be determined respectively in the labor and capital market, which are exogenous to the input-output system. The physical framework is also convenient to consider the indicators associated with GreenHouse Gas (GHG) emissions.