An Input-Output based approach to explore hidden potentials in global production chains

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So far Multi Regional Input Output (MRIOs) models are used to evaluate emissions embodied in trade [1]. At the same time characteristic differences in sectoral production and emission structures around the globe exist. Thus, as a thought experiment we raise the question which amount of resources, energy or CO2 could be saved if global manufacture chains were optimal according to trade and existing production technologies with labor being immobile and global final demand to be covered. Our solution approach intents to optimally rearrange flows of MRIO-table using WIOD data setting up a linear optimization problem that is solved using a Simplex algorithm.
Regional sectors need specific inflow combinations of resources, industrial outputs and differently skilled labor to generate output . These domestic production technologies are assumed to be fix and non-tradable. At the same time labor can be shifted between domestic sectors. Additionally we cap resource and agricultural production because land and resource stocks are immobile and a natural outflow limit exists. Services are partly chosen to be non-tradable.
Optimizing resource use, first results show strong specialization for most economies, which is in line with Ricardian trade theory. Global resource consumption could be reduced significantly (-35%). This is achieved by an increase in trade volume (approximately +250 %).
Transport emissions are expected to have decisive influence in optimization processes [2]. Therefore pairwise distances are derived for all regions. For each sector transportation emissions for 1 $*km due to commodities and transportation modes are estimated. Consequently all trade related emissions are regarded in optimization process. We expect that current global production offers relevant emission reduction potentials to be discovered.

[1] G. P. Peters, J. C. Minx, C. L. Weber and O. Edenhofer (2011): Growth in emission transfers via international trade from 1990 to 2008, PNAS, 108 (21)
[2] A. Cristea, D. Hummels, Laura Puzello and Misak Avetisyan: Trade and the greenhouse gas emissions from international freight transport, Journal of Environmental Economics and Management (2012), http://dx.doi.org/10.1016/j.jeem.2012.06.002