PhD project description
8/11/2018

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Working title: Global Analysis of Trade-related Emissions **(**GATE**)** using Multi-regional input-output modelling

Background and motivation

Most existing environmental assessments neglect any emissions embodied in trade. The IPCC's guidelines for the computation and compilation of national emission inventories is based on a territorial/production-based accounting method, which ignores consumer responsibility for emissions and the effect of trade. Environmental impacts abroad generated of local demand for foreign goods and services should be assigned to countries where such goods are finally consumed. Recent studies have identified international trade as a key driver of the rising global GHG emissions. Disregarding the emissions embodied in trade leads to carbon leakage and the creation of pollution havens abroad, as countries make efforts to reduce GHG emissions locally through outsourcing production as well as importing emission intensive products and services.

Global trade in food contributes to a significant share of global merchandise trade and GHG emissions. The food sector accounts for around 22% of total global GHG emissions, largely from the conversion of forests into farmland. However, 30-50% of the world's food gets lost post-harvest with part wasted in global supply chains and in households. The global demand for food, especially livestock products is predicted to double by 2050 due to rising incomes and population worldwide.

Reducing emissions embodied in agricultural/food trade will require both production and consumption-based policies and policy instruments. I reckon the concept of circular economy provides an intriguing and revolutionary means for advancing innovative ideas and technologies that will add value to and generate useful products from agricultural/food waste such as feedstocks, fertilizers and bioenergy. Nonetheless, models will be useful for measuring the environmental impacts in terms of GHGs embodied in the global trade of food/agricultural commodities and the waste it generates.

Research objectives

The overall aim of the GATE research project is expected to evaluate the environmental impact associated with trade at different levels of analysis; sectoral (agriculture), national (Denmark), and global levels. The main objective is to create a solid platform addressing the knowledge-generation for assessment of trade-related emissions and externalities as a basis for measures to incentivize consumers and systems for climate mitigation and sustainable resource flows. Using an environmentally extended Multi-regional input-output (EEIO) and hybrid LCA models with a consumption-based accounting perspective of greenhouse gases,

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1. I will evaluate the environmental impact associated demand-driven emission embodied in the global trade of specific food/agricultural products like livestock products. At the national level, Denmark will be an important reference point due to its food/agricultural trade-oriented predisposition. At the sectoral level, the livestock sector will be investigated comprehensively. I will assess the regional variations in consumption emissions associated with livestock/food products in Denmark.

2. The next step involves the development of scenarios based on findings on the most emission-intensive food/livestock products imported by Denmark. Scenarios will include evaluating the environmental impact/consequences of substituting emission intensive food (for humans) and feed (for animals) sources with less emission-intensive alternatives. I will like to find ways to incentivise producers to reuse agricultural and food waste. For instance, generating biofuels from agricultural waste to replace fossil fuels used on and off farms, and the use of alternative feed ingredients like seaweeds and algae that are more environmentally friendly and do not require intensive use of land and water resources.

3. I will study how different environmental impact assessments integrate the concepts of circular economy in modelling. I will trace the transition from the traditional linear economy approach to the circular economy thinking in modelling techniques such as life cycle assessments, input-output modelling among others. I will also like to inculcate elements of circular economy in my papers especially in the area of modelling and policy formulation.