

# Linkage among Climate Change, International Trade and Environmental Quality : Multiple Global and Local Indicator Analysis

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論 文 名 : Linkage among Climate Change, International Trade and Environmental Quality: Multiple Global and Local Indicator Analysis  
(気候変動、国際貿易、及び環境基準の関連について：世界及び特定地域の複数指標による分析)

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### 論 文 内 容 の 要 旨

The production of internationally traded goods and services released greenhouse gases (GHG) and air pollutants into the atmosphere and I find that trade openness increase the release of embodied emissions in international trade (EET). We also note the impact of sector trade on EET. By applying a fixed-effect model using large balanced panel data from 187 countries between 1990 and 2011, I determine that each unit of increase in trade openness results in a 10% to 23% increase in GHG embodied emissions (EE). The sector trade effect is also significant for the EE of CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, CO, NMVOC, NO<sub>x</sub>, PM<sub>10</sub> and SO<sub>2</sub>. My findings also clearly visualize that the impact of the GDP on EE of exports is positive but that it is negative on the EE in imports. We suggest that the countries monitor emission transfers via sector trade, in addition to trade openness, to ensure progress toward mitigation of global embodied GHG emission and air pollutants.

I investigate the impact of trade openness and sectoral trade on EET. I consider the emission of three GHG: CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O in my model and focus on the EE of these pollutants by considering the trade of 12 industrial sectors. I also consider five air pollutants: CO, NMVOC, NO<sub>x</sub>, PM<sub>10</sub> and SO<sub>2</sub> in my analysis and identify how trade openness and sectors trade impact EET. My empirical results suggest that trade openness contributes to the EE of GHG and air pollutants. From 1990 to 2011, due to global exports, EE of CO<sub>2</sub> increased by 10.5%, CH<sub>4</sub> increased by 14.7% and N<sub>2</sub>O increased by 23.6%. With respect to five air pollutants, I notice significant increase in EET due to trade openness. Specifically, CO increased by 17.8% and NMVOC increased by 16.5%.

Secondly, I aim to study the impact of the most favored nation (MFN) tariff on the environment at the aggregate level. I find support for the environmental Kuznets curve (EKC) hypothesis for global pollutants CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, CO, NMVOC, NO<sub>x</sub>, PM<sub>10</sub> and SO<sub>2</sub>. I estimate the impact of income change and tariff cuts on environmental quality using detailed emission data for about 186 countries over 1990-2014. Tariff cuts have a significantly negative impact on the emission of most pollutants.

Thirdly, I focus on Bangladesh which is vulnerable to climatic changes, and there has been a

serious debate about the occurrence and the relationship with the frequency of flooding. For example, in Dhaka, further flood controls are claimed to be necessary due to a change of climatic patterns and more frequent flood events. Despite the importance of this topic, it has received little research attention. Thus, I examine (i) whether a temporal change in climate variables is occurring, (ii) local people's perceptions to climate and (iii) cooperative attitudes toward flood controls. I conducted face-to-face surveys with 1,011 respondents of different social and demographic strata and seven experts in Bangladesh. Using these data, I derive a temporal trend of climate variables and analyze how closely people's perceptions align with the climate data.

I also examine the willingness to pay (WTP) for flood controls as a proxy of cooperative attitudes, and characterize the determinants in relation to perceptions to climate as well as socio-economic characteristics. I obtain the following principal results. First, some climate variables are identified to exhibit clear upward or downward trends, but most people correctly perceive such temporal changes. More specifically, people's perceptions and our statistical analysis are identical in the qualitative changes of climate. Second, people who correctly perceive climatic changes tend to express a higher WTP than those who do not. Overall, these findings suggest that accurate climate perceptions are keys to increasing cooperation into managing climatic change and related disasters.

Finally, I investigate the water management for agriculture in Bangladesh which is becoming increasingly complex. Agriculture provide employment opportunities to rural population, and ensure food security. A diversified cropping pattern or output mix is widely held as an important strategy to cope with risk. Farmers of Bangladesh are diversifying their cropping to adapt seasonal flooding and irrigation water arsenic contamination. The demand for food has increased dramatically over the last 40 years in Bangladesh due to the increase in population and wealth. But farmers' adaptation is fundamentally adjusting and manage food demand. Bangladesh farmers are producing enough rice grain to satisfy local demand. Moreover, they are exporting aromatic rice in abroad. The government of Bangladesh is planning massive investments in the southern region for the improved provision of surface water irrigation.

However, the fast pace of climate change is hindering adaptation efforts. Bangladesh farmers still face extremely difficult challenges; the continued study of water risks and adaptation methods would not only help the farmers who produce the crops but also would help to reduce the food shortage and provide safer food. Increased runoff and flooding may alter the global risk of water contamination when global food security will rely on adaptation and mitigation. I have emphasized the importance of considering multiple water risks and the interaction between the risks and irrigation in order to understand risk adaptation and the impacts on sustainable agriculture production. Reduction of irrigation water usage through appropriate crop choices would greatly reduce vulnerability of the crops to arsenic contamination and promote food security, especially in flood prone areas. This would lead to reduced health risks for people who consume crops produced in high water risk areas.