Measuring and comparing the international carbon trade efficiency of major countries

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With the globalization of the world economy, the multiple parts in the production process of a commodity are gradually divided into different countries, and a large number of intermediate products are flowing among different countries. Accordingly, what the distribution of the value added of specific commodities from the global value chain perspective has gained widely attention. Meanwhile, many studies has focused on computing the embodied greenhouse gas (GHG) emissions of international trade. While little literature pays attention to the measurement of carbon trade efficiency which makes a linkage between embodied CO2 emission and supply value chain. By using extended multi-countries input-output models based on world input-output database (WIOD), this paper constructs a macro carbon trade intensity index to measure the carbon efficiency of international trade which plays a significant role in helping each country to understand their emission responsibilities more profoundly. Based on the global value chain and embodied carbon emissions, this index can be understood as the negative externalities of the country, which is a measure that can include the economic benefits. Meanwhile, the higher the carbon trade intensity, including the export carbon intensity (ECI) and import carbon intensity (ICI), the stronger the negative externality. Note that the domestic carbon intensity (DCI) index means the negative externality of the domestic consumption to their own country, which can be compared with the ECI and ICI. Combining the value added extended GMRIO model and the environmentally extended GMRIO model and by using world input-output database (WIOD), this paper calculated and compared the carbon trade intensity of 14 major countries based on which some policy implications are discussed. The main findings are as following: 1) The intensity indices for China, India, Chinese Taiwan and Russia reveal the characteristic of ECI > DCI > ICI, while for other countries, the characteristic is ICI > ECI > DCI; Meanwhile, there is not much difference in the ICI between countries, while obvious differences exist between their ECI; Moreover, the ECI of the developing countries (including the transition countries) are significantly higher than those of the developed countries. 2) Compared with 1995, almost all countriesâ€™ three types of carbon intensities decreased, although with different decline degrees; The carbon trade intensities of developed economies are concentrated and do not decline much, while the ECI and DCI of China, India and Russia are all very high and decrease significantly, with Chinaâ€™s ECI decreasing most by 42.5%; In particular, the increase in the ECI would bring more challenges to Taiwan's energy-saving and emission reduction.3) Seen from the bilateral carbon trade intensity (in 2009), there is no big difference in the ECIs of China to other countries; for India, bigger differences exist in its ECIs to other countries; the ECIs of Russia to other countries are commonly high; and the most surprising result is that the ECI of Taiwan to Japan is the highest and much higher than those to other countries; In addition, the ICIs of Australia, India, Japan and the US with oversea countries all show that those oversea trading countries with a higher intensity are mainly concentrated in several developing countries and transition countries.

Keywords: Carbon trade efficiency; Developed and developing countries; Import carbon intensity; Export carbon intensity; Climate change