

# Analysis of net CO<sub>2</sub> emissions embodied in trade – International comparison of Japan, China, US and UK –

## Background

As developed nations gain momentum in domestic climate policy, CO<sub>2</sub> emissions from the domestic production decrease whereas CO<sub>2</sub> emissions embodied in imported goods (CO<sub>2</sub> import) increase. In preparation for COP15 in 2009, Denmark, which is the host country, will take up the international transaction of CO<sub>2</sub> as one of the six agendas related to international trade and climate policy. And there is another discussion of whether certain protective trade policy is well-justified when domestic industry is at a great disadvantage because competitors in developing nations are free of CO<sub>2</sub> constraints. In these respects, CO<sub>2</sub> emissions embodied in trade (embodied CO<sub>2</sub>) become a growing concern from both the sides of climate policy and international competitiveness of industry.

## Objectives

This report summarizes the recent trend of international transfer of embodied CO<sub>2</sub> for Japan, China, US and UK using macro economic and trade statistics data. In particular we focused on the period after 2000, when BRICS countries emerged in the global economy and drastic change in trade structure took place.

## Main Results

### 1. Estimation from macro statistics (Figure 1):

Based on aggregate data of each country, we estimated net CO<sub>2</sub> imports after 1991, which have increased significantly after the year 2000. UK imported as much as 44%, Japan, 38%, US, 20%, respectively, of the domestic emissions in 2005: meanwhile, 27% of domestic emissions in China in 2004 were induced by its exports. In UK and US, even if the domestic emissions decrease because of the declining manufacturing industry, those countries cause the emissions increases in China, Japan and the other manufacturing exporting countries through their increasing consumption of imported goods. Although the occurrence of carbon leakage (CO<sub>2</sub> emissions increase outside of a country caused by replacement of domestic production with overseas production) is already well known, it is believed to be about 10% at most, of domestic CO<sub>2</sub> emissions. We found that carbon leakage is about 20 to 40 % of domestic CO<sub>2</sub> emissions, and it is still increasing due to the globalization of the world economy.

### 2. Estimation from industry level statistics (Figure 2,3):

- (1) We estimated embodied CO<sub>2</sub> of iron and steel industry which is a typical energy-intensive industry. In Japan and China, CO<sub>2</sub> emissions are driven by domestic production for exports. In 2005, the ratios of net CO<sub>2</sub> emissions embodied in exported goods (CO<sub>2</sub> export) to domestic emissions were 11.0% in Japan and 5.5% in China. In contrast, the ratios of net CO<sub>2</sub> imports to domestic CO<sub>2</sub> emissions were 38.4% in UK and 33.4% in US, respectively.
- (2) We estimated embodied CO<sub>2</sub> of textile industry which is a typical non-energy-intensive industry. CO<sub>2</sub> imports of textiles are the same volume as those of iron and steel in Japan. As for UK, the volume of imported CO<sub>2</sub> in textiles is half as much as that of iron and steel, and for US, it is about 30% that of iron and steel. The developed countries such as Japan, US and UK imported CO<sub>2</sub> emissions from abroad more than they emit at home, while China exported 33% of domestic CO<sub>2</sub> emissions in textile industry in 2004.

### 3. Policy Implication:

Having the concepts of embodied CO<sub>2</sub>, both developing and developed countries become aware of the reality that they are sharing the common problem under the progress of globalization.

## Future Development

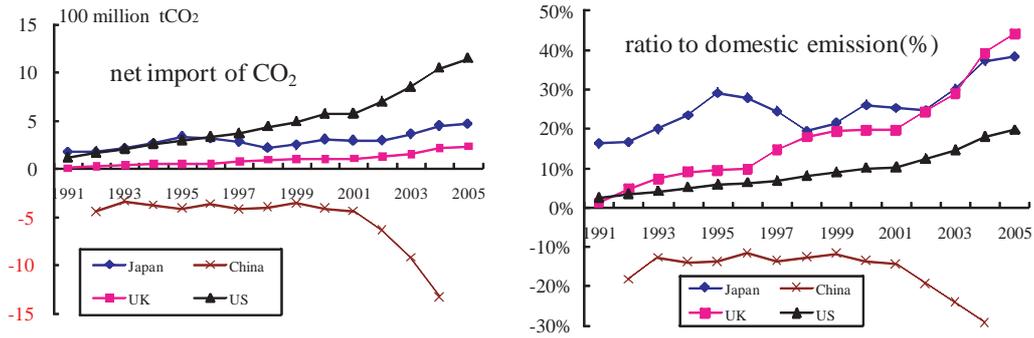
Keeping close watch on the international trend of climate policy, we will continue to study international comparison of emission trends from various aspects.

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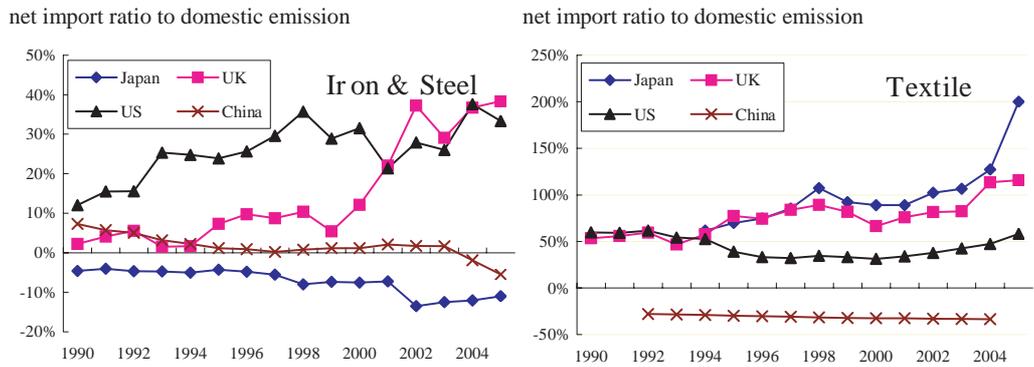
## Reference

Y. Hoshino, Taishi Sugiyama and Takahiro Ueno, 2009, "CO<sub>2</sub> emissions embodied in trade – International Comparison of Japan, China, US and UK –", CRIEPI Report Y08028 (in Japanese)



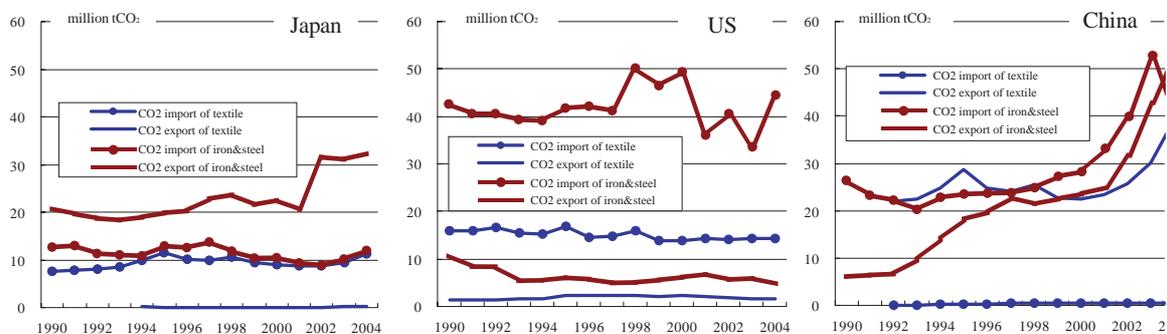
Concerning the CO<sub>2</sub> imports, developed nations induce hundreds million tons of emission increase out of the states (Left). In 2005, compared to the domestic emissions, it corresponds to 20% in US, 38% in Japan and 44% in UK (Right). On the contrary, in China, 27% of its domestic CO<sub>2</sub> emissions were induced by production of export goods in 2004.

**Fig.1** Net CO<sub>2</sub> imports estimated from macro statistics  
 – Net import (Light) and their ratio to domestic emissions (Right) –



In iron and steel industry, CO<sub>2</sub> emissions are induced by the production of export goods in Japan and China. On the contrary, UK and US induce CO<sub>2</sub> emissions out of the states by their imports (Left). In the textile industry, developed nations (Japan, US and UK) induce CO<sub>2</sub> emission out of the states much more than the domestic emissions. On the other hand, China exports large amounts of CO<sub>2</sub> (Right).

**Fig.2** Net CO<sub>2</sub> imports estimated from industry level statistics (Iron & Steel, Textile)  
 – Ratio of net CO<sub>2</sub> imports to domestic emissions –



Shadow line shows iron & steel, solid line shows textiles. In Japan, CO<sub>2</sub> imports of textiles are comparable in size to those of iron & steel. In US, CO<sub>2</sub> imports of textile are about 40% as much as of iron and steel. In China, CO<sub>2</sub> exports of textile are comparable in size to its CO<sub>2</sub> imports of iron & steel.

**Fig.3** Amount of CO<sub>2</sub> exports and imports of Japan, US and China