

論文の要旨
Summary of the Dissertation

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Dissertation title:

Comparative Study on Changes in Responsibility for Carbon Dioxide Emissions across Major Cities in Japan

要旨

Summary:

Accounting for approximately 70% of global carbon dioxide (CO₂) emissions, cities can play a critical role in mitigating climate change. Although several carbon accounting methods have been proposed to identify the carbon mitigation responsibility of cities, there is still no single common and widely accepted method.

CO₂ emissions within territorial boundaries and mitigation responsibilities are represent two different aspects for consideration. The former are a place-based phenomenon, while the latter are an attribution or allocation issue. City governments account for the mitigation responsibility for out-of-boundary CO₂ emissions associated with electricity consumption in cities, but they do not use the same methods to assess the embodied CO₂ emissions of other goods and services. How much carbon mitigation responsibility should a city shoulder? Is this amount determined by the definition of its chosen system boundary?

Delineating the system boundary for carbon mitigation responsibility is not an easy task, and it is necessary to better understand the relevant complexities. Although city governments consider system boundaries from various perspectives of production and consumption as well as supply and demand, they should act under different policies.

In this study, we adopted a method that is based on four system boundaries to identify and compare the CO₂ emissions of large Japanese cities, including Tokyo, the capital city. We focused on long-term longitudinal data for major Japanese cities.

First, we summarized the literature on carbon accounting methods and defined the system boundaries approach including consumption-based emissions.

Second, we analyzed the per capita CO₂ emissions of six large Japanese cities in 1980 and 2000. Although substantial differences exist among the 6 large cities in terms of industrial structure and transformation, population, and local climatic conditions, we found that for consumption-based emissions, per capita CO₂ emissions are very similar among them and stable over the 20-year study period, although those for all the other system boundaries are not.

Third, we analyzed the CO₂ emissions of Tokyo in 1990, 1995, 2000, 2005 and 2011. Most of Tokyo's electricity is supplied by the Tokyo Electric Power Company (TEPCO). TEPCO suspended its nuclear power plant for a long period in 2003, the Kashiwazaki-Kariwa Nuclear Power Plant was suspended following the Niigata Prefecture Chuetsu-oki Earthquake in 2007, and the Fukushima Nuclear Power Plant (the first and second power plants) was suspended following the Great East Japan Earthquake in 2011. Due to the suspension of these power plants, the CO₂ emissions embodied in the electricity consumed by Tokyo fluctuated significantly, but there was not much change in consumption-based emissions in Tokyo.

According to these findings, regardless of changes in the energy structure, including the energy supply and industrial structure, the carbon mitigation responsibility of cities was stable. This result contrasts with the general claims made by local authorities regarding their success in reducing CO₂ emissions.

We argue that using consumption-based emissions provides a more realistic account of changes in urban CO₂ emissions and trends and should be adopted by local authorities in their efforts to achieve urban climate change mitigation goals.