A Shared Responsibility Analysis of CO2 Emissions from the Iron and Steel Sector in Japan

Topic: Industrial policies
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Japanâ€™s iron and steel sector accounts for approximately 12.4% of Japanâ€™s CO2 emissions in 2020. This sector has set a goal to reduce CO2 emissions by 30% by 2030 compared to 2013 levels. Introducing hydrogen technology and CO2 capture and storage technology is essential to mitigate CO2 emissions from the iron and steel sector. However, there is a cost associated with researching and developing (R&D) these technologies. In determining which sectors should bear these costs, the proportion of responsibility for CO2 emissions in each sector is crucial.

There are two main approaches to responsibility for CO2 emissions: the producer responsibility principle and the consumer responsibility principle. However, these principles assign all responsibility to either the producer or the consumer. Hence, cost allocation based on each principle may be unfair. This study addresses the following important research questionsï¼šsome previous studies focused on the supply chain structure of the iron and steel sector, but they did not address the allocation of R&D costs. Additionally, since it focuses on a single aggregated â€˜steel sector,â€™ it failed to elucidate the variations in the supply chain structure inherent to different steel products, depending on the manufacturing method (such as blast furnace and electric furnace methods).

The purpose of this study is to appropriately allocate the costs required for decarbonizing the steel sector among sectors directly or indirectly connected to it. This study employed the shared responsibility approach proposed by Gallego and Lenzen (2005) and clarified the allocation of responsibility for CO2 emissions between producers and consumers. The novelties of this study are twofold. First, empirically investigated how industrial sectors contributed to CO2 emissions from the iron and steel sector by steel manufacturing method in Japan (blast furnace method, electric furnace method). Second, this study further proposed a â€˜practicalâ€™ cost allocation strategy for decarbonization in the iron and steel sector.

This study used the 2015 Japanese input-output table, which has high sectoral resolution and is subdivided at the steelmaking method level (blast furnace/electric furnace).

This study revealed that CO2 emissions from the passenger car sector and the non-residential construction (non-wooden) sector, based on the shared responsibility approach, decreased by approximately 70% compared to the consumer responsibility principle. On the other hand, CO2 emissions from the pig iron sector, based on the shared responsibility approach, increased by approximately 36,000 kt-CO2 compared to the consumer responsibility principle. Similar trends were obtained for CO2 emissions from the electric furnace sector. These results show that part of the responsibility for CO2 emissions, which was concentrated in downstream sectors under consumer responsibility, is dispersed to upstream sectors that produce intermediate goods and services under shared responsibility.

This study allocated the costs needed for decarbonizing the iron and steel sector based on the contribution of CO2 emissions from each sector under both the shared responsibility approach and the consumer responsibility principle. In the case of the shared responsibility approach, the passenger car sector would have to bear approximately 500 million JPY, whereas under the consumer responsibility principle, it would need to bear 8 billion JPY. Due to the disparities in CO2

emissions and burden amounts, estimating CO2 emissions and allocating costs based on the consumer responsibility principle were unfair and resulted in overestimation.

Finally, this study employed the shared responsibility approach to clarify the allocation of responsibility for CO2 emissions between producers and consumers. It suggested a practical cost allocation for green technology in the iron and steel sector based on estimated responsibility allocation.