Evaluation of Feebate by Multi-Agent Simulation for Policy Making in the Complex International Maritime Transport

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Abstract. At the 79th Marine Environment Protection Committee in December 2022, it was discussed to combine regulatory measures and market-based measures (MBMs) for decarbonization in the international maritime transport. In this study, the evaluation of Feebate is focused on, which is an MBM proposed by Japan. This institute has the challenge that the carbon dioxide (CO2) emissions to be reduced are not definitive, and it is not easy to make accurate future projections by top-down simulation. In this study, therefore, future CO2 emissions from the international maritime transport with Feebate are simulated by multi-agent simulation to help the policy maker effectively reduce the emissions. Furthermore, it is analyzed what kind of agent behavior affects the CO2 emissions. The simulator developed in this study is a multi-agent simulator that uses multiple agents to imitate the decision-making processes of real shipping companies. Feebate is modeled as the differences of fuel prices among heavy fuel oil (HFO), liquified natural gas (LNG) and ammonia, and as the ratio of fuel consumptions among these fuels. Case studies are conducted by varying the degree of the fee for the fossil fuels, and the starting year of Feebate. The simulation results suggests that Feebate encourages shipping companies to switch from HFO-fueled vessels and LNG-fueled vessels to ammonia-fueled vessels, and the slow start of Feebate makes it difficult to reduce CO2 emissions, even with a stronger fee, which causes unnecessarily cut into shipping companies' profits.

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