

Thesis Abstract

Title of Thesis	Essays on Market-Based Climate Policy Evaluation
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This thesis consists of three essays that examine the policy effects of carbon taxes, feebate policies, and emissions trading schemes.

In the first chapter, I describe an overview of the three policies and the motivation for empirical analyses in each chapter.

The second chapter is based on Abe, Matsumoto, and Iwata (2017) “Rebound Effects for Passenger Vehicles in Urban and Rural Regions: An Analysis of Household Survey Data” published in *Environmental Science*. This chapter examines an interregional difference in a rebound effect of automobiles in Japan using a household survey. The Japanese government has promoted eco-friendly vehicles such as hybrid vehicles with subsidies and tax reductions, particularly since 2009. The eco-car promotion policy selects target vehicles for promotion according to their fuel economy performance. Previous studies in Japan have observed a rebound effect when improved fuel economy increases vehicle miles traveled; however, these studies do not address the differences in this rebound effect across regions. The existence of a gap in rebound effects across regions would render the uniform nationwide policy cost-inefficient. The empirical results show that while there is no rebound effect in urban regions, the rebound effect reaches approximately 38% in rural regions. These results suggest that the eco-car promotion policy is less cost-effective in rural regions than in urban regions. Thus, the government needs to set different eco-car promotion policies for rural and urban regions and promote the use of public transport systems in rural regions.

The third chapter is based on Abe (2022) “Welfare Effects of Fuel Tax and Feebate Policies in the Japanese New Car Market” available at *ISER Discussion Paper*. This chapter examines the efficiency and distributional effects of fuel tax and feebate policies in the automobile market. I employ a model in which households make two-stage decisions on car ownership and utilization. I estimate model parameters by combining micro-level data from a household survey and macro-level aggregate data on the Japanese new car market from 2006 through 2013. Interestingly, several system

changes in the Japanese feebate created rich variations in vehicle prices across vehicles and over time during the sample period. I use such exogenous variation to overcome the vehicle price endogeneity associated with demand estimation. Counterfactual analyses show that the Japanese feebate results in a significant increase in social welfare while augmenting environmental externalities. In particular, the rebound effect induced by the feebate cancels out approximately 7% of the reduction in CO₂ emissions that would originally have been attained by the improvement in fuel economy. In addition, I find that the fuel tax at the current tax rate in Japan is 1.7 times less costly than the product tax, an alternative feebate scheme considered in the counterfactuals, in reducing negative environmental externalities by the same amount. I also find that the fuel tax is less regressive than the externality-equivalent product tax.

The fourth chapter is based on Abe and Arimura (2022) “Causal Effects of the Tokyo Emissions Trading Scheme on Energy Consumption and Economic Performance” published in *Energy Policy*. The Tokyo emissions trading scheme (ETS) is the first regional ETS in Japan, where a national ETS has not been introduced. In the fourth chapter, I estimate the policy impacts of the Tokyo ETS on energy usage and economic activities during the scheme's first phase (2010-2014) and the first four years of its second phase (2015-2018) using business establishment-level panel data from 2007 to 2018. From the matching-based difference-in-differences (DID) estimation results, I find that while regulated business establishments reduced their energy usage beyond their reduction targets set by ETS regulation, the unregulated business establishments chosen by the matching strategy as a comparison group also decreased their energy usage to the same extent. Additionally, the Tokyo ETS did not have a negative impact on the economic activities of regulated business establishments during phases I and II. These results suggest that the emissions cap levels in each phase may not have been sufficiently demanding to induce regulated business establishments to implement additional energy use reduction practices.

In the last chapter, I discuss the policy implications obtained from the empirical analyses in each chapter and conclude this thesis.

References

- [1] Abe, T., 2022, “Welfare Effects of Fuel Tax and Feebate Policies in the Japanese New Car Market,” *ISER Discussion Paper*, No.1183.
- [2] Abe, T., and Arimura, T.H., 2022, “Causal Effects of the Tokyo Emissions Trading Scheme on Energy Consumption and Economic Performance,” *Energy Policy*, Volume 168, 113151.
- [3] Abe, T., Matsumoto, S., and Iwata, K., 2017, “Rebound Effects for Passenger Vehicles in Urban and Rural Regions: An Analysis of Household Survey Data,” *Environmental Science*, Volume 30, Issue 3, pp. 203-214. In Japanese.