[*THE IMPACT OF THE FEED-IN-TARIFF EXEMPTION ON ENERGY CONSUMPTION IN JAPANESE INDUSTRIAL PLANTS*]

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Overview

To promote renewable energy development, Japan introduced a Feed-in-Tariff (FIT) policy in 2012. This policy encourages the deployment of renewable energy plants through a system of subsidies. The costs associated with the guaranteed price are financed through a surcharge, which is added to electricity prices paid by all consumers throughout the country. The impact of this policy is two-folds: it acts as an incentive for renewable energy producers, and, through an increase in electricity prices, encourages consumers to reduce their demand for electricity. Given that the size of the surcharge has been increasing fast, large private electricity consumers expressed concerns over the implementation of the FIT. Thus, the Japanese government offered an 80% discount system for electricity intensive industrial plants. The eligibility conditions were tightened in 2017 to include an electricity efficiency requirement. Exempting plants from paying the full FIT surcharge is not a commonly seen policy, and, to the best of our knowledge, only exists in Japan.

Given that industrial plants, and especially those from energy-intensive sectors are more sensitive to electricity price changes (Hoshino, 2013), granting an 80% discount to certain plants may exacerbate changes in energy consumption. Thus, we hypothesize that there exists a difference in electricity consumption patterns between plants that receive the exemption and those that could not meet the exemption criteria. Based on existing literature (Böhringer and Rutherford, 1997; Bruvoll and Larsen, 2004), it appears that exemption systems that usually accompany carbon pricing instruments often result in inefficient policy outcomes and losses of welfare. Therefore, focusing on energy-intensive industries, we also decide to analyze whether the exemption policy efficiently targeted plants that were more vulnerable to price changes by estimating the elasticity of electricity demand between the two types of plants.

Methods

This study uses monthly data at the plant-level from 2005 to 2018, as provided by the Current Survey of Energy Consumption (CSEC), conducted annually by Ministry of Economy, Trade and Industry (METI) (METI, 2020). Although the survey targets nine energy-intensive sectors, we decide to focus only on iron and steel, chemical products and pulp and paper as these industries are over-represented among the exempted plants. Furthermore, the study of Hoshino (2013) showed that the iron and steel, chemical and pulp and paper industries were particularly vulnerable to price changes, and thus are most likely to be affected by the introduction of the FIT surcharge. The survey provides detailed information at the plant-level on monthly fossil fuel and electricity consumption, per fuel and per consumption target. From there, the data was aggregated to create three dependent variables: electricity purchase and consumption, and fossil fuel consumption. As the FIT system affects electricity price through a surcharge, it is essential to include electricity prices in the analysis. This particular variable was gathered from the Federation of Electric Power Companies of Japan (2021). Since we investigate the impact of the FIT exemption, the list of exempted plants was retrieved from METI's Agency for Natural Resources and Energy (Agency for Natural Resources and Energy, 2020). After combining the dataset with control variables for the three sectors of interest, the sample contains 25,941 observations, across 301 different plants.

Using a Fixed Effect methodology, we estimate the coefficients associated with the exemption binary variable, as well as its interaction term with electricity prices in logarithmic form, for each sector of the analysis. To evaluate the effects of the 2017 reform, we divide the exemption variable to represent each period of the exemption system, and use a similar methodology. Finally, in order to estimate the elasticity of electricity demand, we obtain coefficients associated with electricity price in logarithmic forms, on samples that we split between exempted and non-exempted plants.

Results

First, our study showed that the impact of the exemption depends on the sector of analysis, as the results very much differ between iron and steel, chemical products or pulp and paper. Exempted plants from the iron and steel sector, in particular, showed a rebound in electricity purchase and consumption of 1.06% and 1.04% respectively. This effect is not found for the chemical sector, and pulp and paper plants even experience a decrease in electricity consumption among exempted, estimated around -0.77% on average. Being interested in the impact of the 2017 reform, we divided the exemption system into two, and evaluated each phase individually. The introduction of electricity efficiency requirements did not curb the rebound, as electricity consumption among iron and steel and pulp and paper plants still increased by 1.49% and 0.69% after the reform.Thus, our results imply that the new requirement did not deter such practices, and hence another reform of the FIT exemption system may be warranted.

Second, we estimated the elasticity of electricity and fossil fuel demand, as this particular indicator determines the impact of policies that affect electricity prices, which is the case for FIT. This study showed that there was no clear-cut difference between plants that received exemption or not. This raises the issue of the fairness of the exemption policy. If both types of plants respond to electricity price changes in the same way, then granting an 80% discount to some plants may not be appropriate and could lead to welfare loss, just as Böhringer and Rutherford (1997) predicted with their simulation. In addition to fairness issues and potential welfare losses, the additional energy that was consumed due to the rebound among exempted may have resulted in greenhouse gas emissions.

Conclusions

The costs of policies that promote renewable energy deployment are often shouldered by end-consumers, and the FIT is not an exception. Such policies can be met with hostility from the industry, as certain manufacturing sectors tend to consume large amounts of electricity, and hence, will bear a heavy burden. To reach a consensus with the industry, it may be tempting for policymakers to introduce a discount in the levy for electricity intensive manufacturers. The results from this study showed that the introduction of such exemption system following the implementation of FIT in Japan was accompanied by a rebound in electricity purchase and consumption for plants in the iron and steel sector. The reform of the system in 2017, which included an electricity efficiency requirement, did not curb such trends. In fact, estimated coefficients after the reform are shown to be even larger. This result implies that policymakers must be very careful in designing such exemption system to avoid any rebound, and that a reform of the current scheme may be required. The study also explored the difference in elasticity of electricity and fossil fuel demand between plants that received the exemption, and plants that did not. We could not find strong evidence of difference between the two, which suggests that both types of plants may respond to price changes in the same way. Therefore, our findings imply that, in addition to a rebound in consumption and associated CO_2 emissions, the current exemption system may pose an issue of fairness.

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