An Empirical Study on Technological Development of Renewable Energy

Miyamoto, Mai

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論文内容の要旨

氏　名　宮本　舞
MIYAMOTO Mai
専　攻　　経済学

論文題目

An Empirical Study on Technological Development of Renewable Energy
（再生可能エネルギーの技術発展に関する実証研究）

要旨

The aim of this dissertation is that investigate the technological development of renewable energy using empirical approach. We use the number of patent applications from the Worldwide Patent Statistical Database (PATSTAT) as a proxy variable for technological development throughout this dissertation. The structure of this dissertation is organized as follow.

Chapter 2 investigates patent quality of renewable energy technologies by using a panel data of 27 OECD countries over the period 1978 to 2010. We indirectly describe patent quality using the detailed patent information because the licensing market for trading patent is limited and the actual value cannot be directly observed. We defined 5 types of index as follows: (1) Patent scope; (2) Forward citation; (3) Claims; (4) Family size and (5) Composite index using details of patent data from PATSTAT database. Using patent quality indicator, we compare the effects of policies to promote renewable energy and R&D expenditures between quantity development and

quality development in the field of renewable energy technologies. The results of this chapter are summarized as follows. The first is that patent indexes defined using patent scope, claims and patent family show rising trends, however the forward citation index decreased, even though we normalized in order to control for time effect. Second, the Kyoto Protocol as a policy of international framework was seen to drive an increase in patent quality. However, domestic policies regarding R&D support and promoting renewable energy such as FIT and RPS have no or a negative impact on patent quality, however these factors did have a positive impact on patent count.

Chapter 3 investigates the trade flows in renewable energy products focusing on the role of technological development. We estimate a gravity model explaining the trade floes among 35 OECD countries from 1996 to 2010 considering patent counts as proxy for the technology level in exporter and importer. Moreover, we also estimate the same model with dataset including China in order to examine the effects from rapidly developing in recent years. The results suggest that the technological level is correlated with trade flows. The estimated effect of the technological level on trade flows is smaller in the model for solar products than that for wind products. Furthermore, we also estimate the model with a dataset including China. In this case, the results indicate that the technological level of solar energy is negatively correlated with the export of solar power products.

Chapter 4 examines the impact of Kyoto Protocol on international diffusion of

renewable energy technology. By using patent application data from 133 countries for the period between 1990 to 2013, we found that the Kyoto Protocol increased international patent application from the Annex B countries. This effect is particularly observed for the period between 1997 and 2012. When we focus on the countries with more stringent target among Annex B countries, the effect of Kyoto Protocol is statistically significant during the first commitment period. We also found similar effect of Kyoto Protocol on international application to four developing countries: China, India, Brazil and Mexico. The results suggest that Kyoto Protocol stimulated international patenting activities from countries that committed stringent target for climate mitigation.