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- Some perspectives on the Saitama Target-Setting Emissions Trading System -

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Abstract

This article reviews studies on the impact of mandatory mechanisms and voluntary mechanisms on carbon emission reduction and introduces the mechanism design of the Saitama Target-Setting Emissions Trading System (Saitama TSETS). Through the analysis, we find that there is no research on the impact of the second phase and whole phase of the ETS on carbon emission reduction in Saitama Prefecture. Moreover, the Saitama TSETS seems more like a voluntary environmental mechanism. Therefore, in future studies, the author will use a difference-in-differences (DID) method with propensity score matching (PSM) method to evaluate the impact of the second phase and whole phase of the ETS on carbon emission reduction in Saitama Prefecture, and add more factors to control the difference between the control group and the treatment group. The author suggests that these studies may be important references for the continuation of the Saitama TSETS in the future and the development of a nationwide ETS in Japan.

Keywords: Saitama TSETS, Mandatory mechanisms, Voluntary mechanisms, Carbon emission reduction, Literature review

1. Introduction

According to the IPCC's Sixth Assessment Report (AR6) Climate Change 2021, global warming of 1.5° C and 2° C will be exceeded during the 21st century unless deep reductions in carbon dioxide (CO_2) and other greenhouse gas (GHG) emissions occur in the coming decades[1]. Global warming will lead to sea level rise and impact biodiversity and ecosystems, which directly or indirectly affect human activities. Therefore, it is imperative to find a means to reduce GHG emissions.

Carbon pricing has emerged as a key policy mechanism to curb and mitigate GHG emissions that cause climate change. Among them, ETS is considered a mainstream market-based policy instrument. To date, ETS has been implemented in many regions and countries. Notably, the European Union emissions trading system (EU ETS), which was implemented in 2005, is the world's first comprehensive emissions trading system to control CO_2 emissions. The United States (U.S.), one of the major emitters of GHG, has not implemented the ETS at the national level, but the Western Climate Initiative (WCI) was jointly implemented by many western states in 2007, followed by the Regional Greenhouse Gas Initiative (RGGI) in 2009 by the northeastern states. China, the country with the highest GHG emissions today, also began piloting ETS in seven regions in 2013 and officially ran a nationwide ETS in 2021.

Carbon pricing can also be divided into mandatory mechanisms and voluntary mechanisms. Japan has not adopted a nationwide ETS, but it has implemented two types of regional emissions trading in Tokyo Metropolitan and Saitama Prefecture in 2010 and 2011, respectively. Unlike other mandatory ETS, the Saitama TSETS requires regulated entities to reduce emissions below a facility-specific baseline, but there will be no fines if they fail to meet them.

In this study, we review the research on the impact of mandatory mechanisms such as the EU ETS, the U.S. state-level ETS, and the China ETS as well as some voluntary mechanisms on carbon emission reduction, and also present the design of the Saitama TSETS. Through the analysis of the existing literature and the scheme design, some possible problems in the implementation of the ETS in Saitama Prefecture are identified. In addition, future research directions and plans are proposed.

The contribution of this research is twofold. First, we find that there is no research on the impact of the second phase or the whole phase of the Saitama TSETS on carbon emission reduction. Second, compared to other mandatory ETS, we identify that although the Saitama TSETS also has emission reduction targets, there are no penalties if the targets are not met. It is more like a voluntary emission reduction mechanism.

The remainder of this paper is structured as follows. Section 2 reviews in detail the role of different attributes of environmental instruments in reducing emissions. Section 3 explains the structural framework of Saitama TSETS. Section 4 presents the research findings and proposes the directions for future work.

2. Literature Review

[1] Climate Change 2021 The Physical Science Basis (Summary for Policymakers), *The Intergovernmental Panel on Climate Change* [website], https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM_final.pdf, (accessed 30 November 2023).

Carbon pricing has become an effective instrument for many countries to incentivize emission reductions in recent years. In this way, the overall environmental goal will be achieved in the most flexible and least-cost way to society (The World Bank). Carbon pricing includes several main methods such as ETS, carbon tax, crediting mechanism, RBCF, and Internal carbon pricing (ICP). For governments, the choice of carbon pricing method is based on national circumstances and political realities. It should be noted that carbon pricing can also be divided into mandatory mechanisms and voluntary mechanisms. Therefore, this paper reviews the research on the impact of mandatory mechanisms and voluntary mechanisms on carbon emission reduction, and attempts to find some inspiration from them to analyze the characteristics of the Saitama TSETS.

2.1 The mandatory mechanism and carbon emission reduction

Generally, carbon tax and ETS are considered the most representative mandatory carbon pricing instruments. ETS is widely adopted worldwide to reduce GHG emissions. The EU, the U.S., Japan, and China have all implemented ETS of various scales. The extent to which ETSs have actually reduced carbon emissions is an important factor in measuring the success of this policy.

As a cross-national mandatory environmental mechanism, the EU ETS was implemented in 2005. It has attracted the attention of many scholars because of its earliest pioneering nature. Several empirical studies have proven that the initial stage (2005-2007) of the EU ETS has a positive effect on emission reductions in all target countries. Ellerman and Buchner (2008) compared the actual emissions data at the installation level of various industrial sectors in the EU with the original allowance allocations. The result revealed that the CO_2 emissions were about 4% lower than the allocated allowances. Ellerman et al (2010) found that from 2005 to 2007, the EU's overall CO_2 emissions decreased by 70Mt. Moreover, Anderson and Di Maria (2011) used historical industrial emissions data for each industrial sector targeted by the EU ETS in the pilot phase (2005-2007) to assess the level of abatement. The results showed that the EU ETS reduces carbon emissions by 2.8% in the pilot phase. However, it should be noted that the aggregate data used in these study also includes facilities that do not participate in the EU ETS. The results of the analysis may be inaccurate.

Therefore, in subsequent studies, other researchers have focused on using facility-level panel data with higher reliability. Abrell et all (2011) used data on the emissions and performance of more than 2,000 European companies from 2005 to 2008 to investigate the effectiveness of this scheme. Specifically, the authors analyzed whether companies changed their emission reduction strategies from the 2005-2006 period to the 2007-2008 period. The results showed that according to the raw data of Community Independent Transaction Log (CITL) and sub-sample data, companies increased their emissions by about 1% and 0.82% between 2005 and 2006, respectively, and then reduced their emissions by about 2% and 5.51% between 2007 and 2008, respectively. It is clear that the shift from the first phase to the second phase of EU ETS has a positive effect on emission reductions. Petrick and Wagner (2014) used the AFiD-Betriebspanel database to study the effect of the EU ETS on emission reductions in the German manufacturing sector. This study used a matching method for quantitative evaluation. The results revealed that in the first half of the second phase (2008-2010), companies that joined the scheme reduced emissions by 25% compared to those that did not join the

scheme. Wagner et al (2014) used plant-level data to review the impact of the EU ETS on emission reductions in the French manufacturing sector. This paper also employed the same matching method. The results showed that the scheme had no effect on the first phase, while for the first half of the second phase (2008-2010) emissions reduction averaged 15-20%. A similar study was also conducted by Jraite and Di Maria (2016), who used a matching method for quantitative assessment. Data from 5,000 Lithuanian companies from 2003 to 2010 are used to examine whether the EU ETS has a positive impact on emission reduction. However, the results were contrary to the conclusions of several previous studies, companies participating in the scheme did not lead to a reduction in CO_2 emissions.

Subsequently, Bayer and Aklin (2020) have also used different approaches to study this topic. A generalized synthetic control approach was employed to investigate whether the ETS reduces carbon emissions when the permit price is low. The results find that the system saves about 1.2 billion tons of CO_2 emissions during the second phase and the first half of the third phase (2008-2016) relative to a market without institutional constraints.

China, the largest emitter of GHG, launched a regional pilot ETS in 2013 and a mandatory nationwide ETS in 2021, respectively. The China national ETS regulates more than 2,000 companies from the power sector with annual emissions of more than 2,600t CO_2, including combined heat and power, as well as captive power plants in other sectors.

Due to the available data, current studies have focused on the pilot phase of the scheme. Dong et al (2019) used data from 30 provinces from 2006 to 2015 and employed the DID model to analyze whether the ETS can deliver environmental dividends. The results showed that the system can significantly reduce carbon emissions in the pilot provinces in both the short and long term. Based on the panel data of the two-digit code industry[2] at the province level from 2005 to 2015, Hu et al (2020) also adopted the DID model to examine the impact of the CO_2 ETS on energy conservation and emission reduction. The results show that the CO_2 emissions of the regulated industries in the pilot areas decreased by 15.5% compared to the non-pilot areas. Xuan et al (2020) used the DID model to explore the effect of carbon emission trading policies on carbon emission reduction. The article used data from 30 provinces from 2000 to 2016 to conduct the study and concluded that the system can significantly reduce the intensity of CO_2 emissions and promote carbon emission reduction. Also using the DID model is Zhang et al (2020), who analyzed industrial carbon emissions data from 2008 to 2016 for 30 Chinese provinces to empirically evaluate the impact of ETS on corporate carbon emissions and economic growth. The conclusions revealed that industrial CO_2 emissions were reduced by 24.2% in all seven pilot regions.

Some scholars have added other models to the DID model for further studies. Chen et al (2020) applied the DID model as well as parallel multiple mediator models based on panel data from 30 provinces from 2007 to 2016 to investigate the carbon emission reduction effect of the pilot ETS in China and the impact path of the scheme at both national and regional levels. The results showed that total carbon emissions were reduced by 13.39% when the policy was in place. The heterogeneous impacts of the policy were also found after classifying China into three representative regions based on economic and geographical differences. The strongest emission abatement is found in western China, which is higher than in central and eastern China. Yan et al (2020) included a mediating effects

[2] The two-digit SIC code defines broad industry categories such as manufacturing, transportation, and business services.

model based on the DID model. Panel data from 267 prefecture-level cities in Chinese 30 provinces from 2003 to 2016 were used to test whether the pilot ETS in China achieves collaborative governance effects on air pollution. The results showed that the scheme did have a significant reduction effect on haze pollution concentration levels, which was probably achieved by "promoting the application and transformation of green technologies among enterprises" and "transferring heavy polluting industries".

Some scholars also added the propensity score matching (PSM) technique to the DID model in order to make the results more accurate. Zhang et al (2019) explored the causal impact of a pilot ETS on carbon emission reduction in China during the initial phase (2013-2015). This study first calculated carbon emissions from 2005 to 2015 for 37 individual industrial subsectors in each of China's 26 provinces and cautiously identified the industrial sub-sectors covered by the Chinese pilot ETS. The results of the study provided strong evidence that the pilot mechanism significantly contributes to carbon emission reduction of the covered industrial sub-sectors, and this impact has presented an overall enhanced trend according to year-by-year analysis. Also employing the DID model with a PSM technique is Shen et al (2020), which differed from all previous studies. Instead of providing macro-level empirical evidence as other researchers have done, they tried to reveal the effect of the pilot ETS in China at the micro-level through the policy implementers (pilot firms). This article analyzed data from listed companies from 2009 to 2017 and concluded that the system reduces carbon emissions by 129,588 million tons, but the effect has diminished over time.

Although there was no nationwide ETS in the U.S., there have been early regional attempts by individual states. This was represented by the RGGI, the first mandatory GHG ETS in the U.S., which was launched in 2009. RGGI covers power sector emissions in participating states. Up to 2020, it covered around 14% of the aggregate participant states' emissions. Murray and Maniloff (2015) explored the emissions reduction effects of the RGGI scheme. Variables of recession, natural gas prices, and Renewable Portfolio Standards (RPS)[3] were also considered in the analysis. The final results showed that without the implementation of RGGI, the target region would have emitted 24% more CO_2 emissions after 2009.

The ETS of the Tokyo Metropolitan Government (TMG) was launched in 2010 and is Japan's first mandatory ETS. It covers around 20% of the metropolitan area's emissions. Unlike other regional and national ETS, the Tokyo ETS included not only direct emissions from fuel combustion in the industrial sector but also indirect emissions from the commercial sector (office buildings). Wakabayashi and Kimura (2018) first examined the Tokyo ETS on the impact of carbon emission reduction. The results found that emissions from covered targets have been significantly reduced compared to the beginning of the scheme. And at the end of the first phase, carbon emissions were reduced by an average of 14%. However, the scheme did not lead to these reductions, but rather factors such as the energy savings triggered by the 2011 Great East Japan Earthquake played a key driving role. Subsequently, Arimura and Abe (2021) also conducted an empirical analysis of the effect of the Tokyo ETS on carbon emission reduction using a facility-level dataset of Japanese office buildings. The results showed that half of the emission reductions were due to the scheme, while the rest of the reductions were due to the increase in electricity prices. Abe and Arimura (2020) used a university-level dataset to examine whether the Tokyo ETS contributes to the reduction of carbon emissions from university buildings. The results found that the Tokyo ETS reduced carbon emissions

[3] The Renewable Portfolio Standards (RPS) is a regulation that requires the increased production of energy from renewable energy sources, such as wind, solar, biomass, and geothermal.

and energy consumption at regulated universities relative to unregulated universities by approximately 3-5% in the first phase. Moreover, rolling blackouts and power-saving orders also had an impact on university behavior. In addition, Sadayuki and Arimura (2021) concluded that the Tokyo ETS has achieved a 5% emission reduction in the service sector and 10% in the manufacturing sector through the analysis of the "Accounting/Reporting/Publication system" dataset.

2.2 The voluntary mechanism and carbon emission reduction

Several materials have investigated the effectiveness of voluntary environmental schemes. Brophy et al（1995） argued that the voluntary approach would not lead to improvements in environmental performance, which could only be achieved through the adoption of a legislative approach. Paton (2000) believed that compared with other policy instruments, there was uncertainty about the effectiveness and efficiency of voluntary approaches. Furthermore, Cunningham and Clinch (2004) also questioned the feasibility and rationality of the voluntary approach as an environmental policy.

In fact, the Japanese government has proposed many voluntary environmental policies in an attempt to reduce CO_2 emissions. The Japanese Business Federation (JBF) has implemented the voluntary action plan (VAP) from 1997 to 2012. The unique feature of this scheme is that regulators cannot penalize industrial organizations that fail to meet emission reduction targets. However, few studies have focused on whether the different industry sectors or individual firms were able to meet the voluntary targets. Jones and Yoo (2009) believed that pressure from society, government, and non-governmental organizations (NGOs) would encourage companies to comply with the voluntary targets. Sharing a similar positive view was Wakabayashi and Arimura (2016), who found that the VAP encouraged small and medium-sized enterprises (SMEs) to set reduction targets. Furthermore, Arimura (2019) mentioned that voluntary targets could be easier to achieve when emissions are concentrated among a few companies. However, Lu et al (2022) found that the VAP was ineffective in reducing emissions in sectors with low market concentration. Before 2010, Japan also implemented a few voluntary carbon pricing policies to achieve emission reductions, such as the Japan Voluntary Emission Trading Scheme (J-VETS) and Japan-Verified Emissions Reduction (J-VER). Since 2011, Saitama Prefecture has implemented TSETS. It was worth noting that unlike other mandatory ETS, regulated facilities of the Saitama TSETS would not be fined even if they did not meet the targets. In order to investigate the effectiveness, Hamamoto (2021) used a multiple regression model and DID model to empirically analyze the effect of emission reduction during the first compliance period of the ETS in Saitama Prefecture. The results showed that the scheme had a positive effect on emission reductions, with facilities covered by the scheme reducing emissions by approximately 14% compared to non-covered facilities.

3. The Design of Saitama TSETS

The Saitama TSETS is a market-based environmental instrument that sets and implements emission reduction targets for large-scale facilities in Saitama Prefecture that emit large amounts of emissions.

Facilities with a total energy consumption of 1,500 Kiloliters (KL) or more per year in crude oil equivalent for three consecutive fiscal years are subject to this system.

Initially, the Saitama prefectural government implemented the "*Environmental Load Reduction Plan*" in 2002 in order to make energy-consuming facilities voluntarily reduce their CO_2 emissions. This plan requires facilities that consume more than 1,500 KL of fuel, heat, and electricity[4] per year, or facilities with a store area of 10,000 square meters (m^2) or more, to submit a reduction plan for CO_2 emissions and waste material and to disclose the implementation of the reduction plan items. However, the system did not have the expected effect because there was no specific deadline or method for achieving the voluntary targets. The Saitama prefectural government created a more detailed and sustainable measure to reduce facility carbon emissions and announced the "*Global Warming Strategy Action Plan*" in 2010. The new scheme is based on the requirements of the "*Environmental Load Reduction Plan*" and makes it obligatory to prepare and report the emission reduction plans of facilities. At the same time, the scheme makes the "*TSETS*" as a priority measure for future implementation.

The TSETS has been implemented in Saitama Prefecture since 2011, and two phases have been fully implemented so far. The GHG emitters subject to regulation are all from the manufacturing sector, The first compliance period ran from 2011 to 2014, and the second compliance period ranged from 2015 to 2019. Also, the third compliance period is ongoing, from 2020 to 2024. In the first compliance period, the CO_2 emission reduction target for the first classification of facilities in the first category is 8%, and the reduction target for the second classification of facilities in the first category and all the second category facilities is 6% compared to the base year level. In the second compliance period, the CO_2 emission reduction target for the first classification of facilities in the first category was tightened to 15%, and the target for the second classification of facilities in the first category and all the second-category facilities was tightened to 13%. For the third compliance period, the Saitama prefectural government has also set the expected targets for the two types of facilities at 22% and 20%, respectively.

Table 1 Category of Facility Types and Target Reduction Rates

	Facility types	**Target reduction rate**		
		Phase 1	Phase 2	Phase3
First category ①	Office buildings, commercial facilities, educational facilities, hospitals, etc.	8%	15%	22%
First category ②	In the above cases, the heat supplied from the outside facilities accounts for 20% or more of the energy used.	6%	13%	20%

[4] The consumption of fuel, heat, and electricity convert into units of crude oil.

Second category	Factories, waste facilities, water supply and sewage facilities, etc.	6%	13%	20%

(Source: Saitama Prefecture Website, translated and compiled by the author)

The setting of base year emissions differs between existing facilities[5] and newly established facilities[6]. The base year emissions of the existing facilities are defined as the average emissions of three consecutive fiscal years between 2002 and 2007. Also, the newly established facilities need to flexibly choose their base year emissions from the average emissions of the three consecutive fiscal years from four years before the start of the system to the previous year, or from the value calculated using the unit of the emission standard[7].

In order to facilitate facilities to achieve their reduction targets as much as possible, the Saitama TSETS provides five types of domestic offset credits in addition to allowing the purchase of excess reduction amounts from other facilities as a substitute for reduction amounts. The first type is the small and medium-sized facilities credits within the Saitama Prefecture area. Large-scale facilities can invest in small and medium-sized facilities that are not regulated by the system and use their reduction amounts to replace their own outstanding credits. The second type is credits outside of Saitama Prefecture. Large-scale facilities in Saitama Prefecture will also receive credits if they organize emission reductions by facilities of comparable size in areas outside of the prefecture. The third type of credit can be obtained by investing in projects that have the value of generating renewable energy. The fourth type is forest sink credits. Finally, the fifth type is the credits through mutual certification with the Tokyo ETS.

Table 2 Types of Offset Credits

Offset credits	
In-prefecture small and medium-sized credits	The amount of CO_2 emissions from energy use has been reduced by small and medium-sized facilities (excluding large-scale facilities) in Saitama Prefecture.
Out-of-prefecture credits	The amount of reduction exceeds the amount of CO_2 emissions reduction for facilities outside of Saitama Prefecture that are comparable in size to large-scale facilities (Saitama ETS target facilities).
Renewable energy credits	● Environmental value equivalent The environmental value equivalent of renewable energy generated by solar, wind, hydro, geothermal, and biomass power generation facilities certified under this system. ● Other reductions

5 Existing facilities stand for large-scale facilities that have used 1,500 KL or more of energy consumption (converted into units of crude oil) for five consecutive fiscal years from 2006 to 2010.

6 Newly established facilities stand for large-scale facilities other than existing facilities.

7 The unit of the emission standard is determined by factors such as floor area and is set by Saitama Prefecture.

	Renewable energy environmental values (green energy certificate, etc.) certified under other systems are converted into credits that can be used under this system.
Forest sink credits	The amount of absorption certified under the Saitama Prefecture Forest Carbon Dioxide Absorption Certification System and the J-Credit System, etc. (for forest management) is converted into credits that can be used under this system.
Tokyo collaboration credits	The credits created by the Tokyo ETS are made into credits that can be used under this system.

(Source: Saitama Prefecture Website, translated and compiled by the author)

As shown in Table 3 and Table 4, the overall actual emission reduction rate during the first compliance period reached 22%, exceeding the target reduction rate. The 608 target facilities in the first compliance period include 428 factories and 180 office buildings. Among them, 599 facilities have achieved emission reduction targets, 533 have achieved emission reductions through their own efforts, and the remaining 66 have achieved through the use of the Saitama TSETS. However, 9 facilities ultimately failed to achieve their goals, accounting for approximately 1.5% of the total.

Table 3 CO_2 Emissions Condition (Phase1)

Classification	Number	Reference Emissions	Actual Emissions	Reduction	Reduction Rate
Factories, etc.	428	3,041 million tones	2,373 million tones	668 million tones	22%
Office buildings, etc.	180	514 million tones	402 million tones	112 million tones	22%
Total	608	3,555 million tones	2,775 million tones	780 million tones	22%

(Source: Saitama Prefecture Website, translated and compiled by the author)

Table 4 Achievement Status (Phase1)

Classification	Number	Number of Facilities that Achieved Reduction Targets		
		Own Reduction	ETS	Total
Factories, etc.	428	371	50	421
Office buildings, etc.	180	162	16	178
Total	608	533	66	599

(Source: Saitama Prefecture Website, translated and compiled by the author)

Regarding the second compliance period information shown in Table 5 and Table 6, the overall actual emission reduction rate was also higher than the target reduction rate and increased to 29%. During this period, 630 target facilities, consisting of 445 factories and 185 office buildings, participated in the scheme. A total of 618 facilities have accomplished their emission reduction targets,

507 of them were achieved during the second compliance period, 66 were achieved through both compliance periods, and 91 were completed through transactions under the Saitama TSETS. There were 12 facilities that failed to achieve the target, accounting for only 1.9% of the total.

Table 5 CO_2 Emissions Condition (Phase2)

Classification	Number	Reference Emissions	Target Reduction	Reduction	Reduction Rate
Factories, etc.	445	4,419 million tones	559 million tones	1,281 million tones	29%
Office buildings, etc.	185	823 million tones	119 million tones	230 million tones	28%
Total	630	5,241 million tones	677 million tones	1,511 million tones	29%

(Source: Saitama Prefecture Website, translated and compiled by the author)

Table 6 Achievement Status (Phase2)

Classification	Number	Achieved				Not Achieved
		Total	Own Reduction(Phase2)	Own Reduction(Phase1+Phase2)	ETS	
Factories, etc.	445	437	354	18	65	8
Office buildings, etc.	185	181	153	2	26	4
Total	630	618	507	20	91	12

(Source: Saitama Prefecture Website, translated and compiled by the author)

However, it should be noted that unlike most other ETSs in the world, the Saitama TSETS is not mandatory, but is a voluntary scheme based on the understanding and cooperation of the target facility. Therefore, there is no penalty when a target facility does not achieve the target reduction amount.

4. Results and Future Work

In this article, we learn about the design of the ETS in Saitama Prefecture and review relevant research on the impact of mandatory mechanisms and voluntary mechanisms on carbon emission reduction around the world. Based on the existing studies, the author found that (1) under certain circumstances, voluntary mechanisms can also achieve carbon emission reductions. (2) unlike the other mandatory ETS, the emission reduction requirements of the Saitama TSETS are not mandatory and there are no punitive measures for failure to meet the targets. We believe that if this voluntary mechanism is effective, it will provide a new idea for the future development of ETS in Japan. On the contrary, if this voluntary mechanism is ineffective in the mitigation of CO_2 emissions, the Japanese government cannot rely on the voluntary approach to achieve carbon emissions reduction targets. (3) there is no research on the impact of the second phase or the whole phase of the Saitama TSETS on carbon emission reduction. The Saitama prefectural government has set a more stringent reduction rate in

the second plan phase compared to the first plan phase. We believe that even without any punitive measures, the second phase of the system should have a better reduction effect and the whole phase will continue to be successful.

Therefore, the author will conduct empirical analysis to address the above issues in their future research. First, a PSM-DID model is used to examine whether the second phase and the whole phase of the ETS in Saitama Prefecture have a positive impact on carbon emission reduction. Second, various variables are added to the model to control the differences between the control group and the treatment group.

The author believes that future research will help to better identify some of the problems in the implementation of the ETS in Saitama Prefecture. This may be an important reference for the continuation of the ETS in Saitama Prefecture and the development of a nationwide ETS in Japan in the future.

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