EEPS special issue on “Carbon Pricing in East Asia”

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Announcements of carbon neutrality, i.e. net zero emissions, have become the norm in the international community. Given the unprecedented severe weather in many parts of the world, nations have started to declare carbon neutrality goals. In 2019, the European Union (EU) announced the goal of carbon neutrality by 2050. In September 2020, the Chinese government also announced a carbon neutrality goal by 2060. In October 2020, both the Japanese and Korean governments declared a goal of carbon neutrality by 2050. After winning the presidential election, the new US president Biden also announced a goal of carbon neutrality by 2050.

Obviously, there is no free lunch in achieving carbon neutrality. Carbon neutrality comes with nonnegligible costs. According to the estimate of the Committee on Climate Change, reaching net zero emissions by 2050 could cost up to 1–2% of GDP per year by 2050 in the UK Ekins (2019). Therefore, we must find a way to reduce the costs of carbon mitigation. Economic theory suggests that the use of market mechanisms, i.e., carbon pricing, is one answer. In fact, many developed countries have adopted carbon pricing systems such as emissions trading schemes (ETS) or carbon taxes.

The EU introduced its carbon market, known as the European Union Emissions Trading Scheme (EU ETS), in 2005. In the United States, 10 states in the northeast implemented the Regional Greenhouse Gas Initiative (RGGI) in 2009. New Zealand has also adopted an ETS. This trend has reached other parts of the world. In 2010,

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the Tokyo Metropolitan Government introduced the first ETS in Asia (Abe and Arimura 2021). In Japan, Saitama Prefecture, which is next to Tokyo, introduced an ETS in collaboration with the Tokyo Metropolitan Government (Hamamoto 2021b). China has implemented seven pilot schemes since 2013 and launched a national cap-and-trade scheme in the power sector in 2021. Korea adopted the first nationwide cap-and-trade scheme for CO₂ in Asia in 2015 (Oh et al. 2017).

Despite these movements towards ETSs in Asia, Japan has not adopted an ETS at the national level for several reasons. First, opposition from energy-intensive sectors is strong, and the voluntary approach is the dominant form of mitigation efforts in some countries, including Japan (Arimura et al. 2019). The opposition comes from the expected burden of carbon pricing. The opposing sectors are often greatly concerned about carbon leakage and competitiveness issues. Moreover, opponents of carbon pricing are often skeptical about the effectiveness of ETSs. They argue that it is not clear whether carbon pricing systems such as ETSs have worked as predicted by economic theory. Others oppose carbon pricing because of inequality in how the burden of mitigation costs is distributed. Some regions may bear heavier burdens, while the burden in other regions is limited.

Economists have tried to address these concerns and questions. Ellerman et al. (2016) reviewed the results of the EU ETS. Martin et al. (2016) offered a nice review of ex post-evaluations of the impacts of the EU ETS. Empirical evidence based on micro-data has been offered. For example, using micro-data from Germany, Löschel et al. (2019) empirically examined the effectiveness of the EU ETS. Murray and Maniloff (2015) investigated what contributed to the CO₂ emission reductions in the RGGI states in the US and confirmed the effectiveness of that ETS. Dechezleprêtre and Sato (2017) reviewed the competitiveness and leakage issues related to the EU ETS. Green (2021) reviewed ex post-analyses of ETSs around the world, including ETSs in Asia. However, the previous literature on ETSs has mainly examined the effectiveness or impacts of carbon pricing by focusing on ETSs in European countries or in North America.

Given this background, this special issue covers the economic analysis of carbon pricing in East Asia. We focus on ETSs in Asia, i.e., those in China, Japan and Korea. ETSs in these countries offer a variety of perspectives because each country has a different type of ETS. China implemented pilot ETSs in seven regions before it started its national ETS with the power sector covered at the very initial stage. The Tokyo ETS was the first cap-and-trade scheme to cover commercial buildings. Moreover, it is unique in that it restricts the role of the financial sector (Roppongi et al. 2017). The Saitama ETS is characterized by its voluntary nature: there is no financial penalty for noncompliance (Hamamoto 2021b). The Korean ETS is the first nationwide cap-and-trade scheme in Asia.

Several papers have investigated the impact of ETSs on emission reductions or investment behaviors. Arimura and Abe (2021) examined the effectiveness of the Tokyo ETS in terms of emission reductions. Despite the emission reductions that occurred under the Tokyo ETS, some opponents have argued that the Great East Japan Earthquake was the main reason for these reductions through increases in electricity prices. Focusing on office buildings, Arimura and Abe (2021) conducted an econometric analysis using facility-level data. They showed that the ETS

contributed to more than half of the emission reduction, while the electricity price increase caused the remainder. They also estimated the permit price to be approximately \$50 per ton of CO₂ in the early phase of the ETS.

Jun et al. (2021) examined the effectiveness of the Korean emission trading scheme (K-ETS) in curbing GHG emissions. The authors focused on the three sectors with the largest emissions during the first commitment period (2015–2017). They revealed that the adoption of the K-ETS contributed to improvements in the carbon intensity of K-ETS-regulated entities in the manufacturing and building sectors. Additionally, they found that the K-ETS had limited effectiveness in the power sector due to the low degree of carbon-cost pass-through in the electricity price under the cost-based wholesale pool and utility price regulation for ensuring price stability. The authors' empirical findings also indicated that to mitigate CO₂ emissions in the power sector, an allocation method to reflect the cost of carbon in power generation costs and electricity prices is necessary.

Hamamoto (2021a, b) investigated the impacts of the Saitama ETS on the adoption of low-carbon technology. Using facility-level data from the manufacturing sector, the author examined the impact of the ETS on investments in high-efficiency equipment. The Saitama ETS was found to have promoted the adoption of high-efficiency machines and devices during the first 3 years of the second compliance period. However, the Saitama ETS did not lead to investments in high-efficiency equipment during the first compliance period. This study indicated that manufacturing facilities may have initially introduced relatively less expensive emissions reduction plans, such as improving already installed equipment, and then moved to the adoption of relatively more expensive high-efficiency equipment. In conclusion, the Saitama ETS was successful in reducing emissions despite its voluntary nature.

Other studies have scrutinized the institutional aspect of ETSs in their infancy and the role of the regulatory agencies in making ETSs work. Park and Lee (2021) analyzed the trading behavior of covered entities in Phase 1 of the K-ETS. The authors identified the factors that impede cost-effective reductions achieved through active market participation. Their empirical analysis revealed which types of firms tend to bank their allowances: firms were more likely to bank their allowances if they perceived the ETS to be a burden. A similar pattern was observed when firms expected government policy continuity and expected the allowance price to increase. In contrast, firms with ample allowance allocations tended to trade their allowances. This study suggests that there are economies of scale in the transaction costs for monitoring, reporting and verification (MRV) and for seeking trading partners. The study also suggests that the government can enhance market liquidity if it supports reducing transaction costs for small emitters and helps those firms to find a clear price signal. Moreover, the government can help by providing signals that the ETS can be a business opportunity.

Li et al. (2021) examined the pilot schemes in China and derived lessons from them. They conducted two surveys, one in 2015 and the other in 2018, and investigated how the regulated entities had responded to the ETSs. The authors found that the regulated entities had learned how to comply with the new regulation, while more improvement was still needed regarding MRV. Within three years, most of the regulated entities had made great progress in developing abatement strategies, while

nearly half of those entities had a limited perception of abatement costs and established no explicit emission reduction targets. The survey also found that some firms had started to engage in allowance management strategies to gain profits from trading activities, although the dominant strategy under the ETS is emission reduction.

Two other studies have examined the impact of carbon pricing, which often raises concerns about burden sharing. Nakano and Washizu (2021) addressed this issue through an input–output analysis in the Japanese context. The authors investigated the socioeconomic impact of energy policies related to carbon pricing by taking the technical constraints of the Japanese power grid into consideration. Incorporating these technical constraints, they created the Inter-Regional Input–Output Table for a Next Generation Energy System (IONGES) to predict emissions in 2030. The technical constraints of the power grid were found to influence the interregional distribution of renewable energy. The authors simulated a carbon-pricing mechanism implemented under the technical constraints of the current power grid. They found that the impact of carbon pricing on consumers in each region is unequal. However, they show that operating the power grid over a wide area can resolve such inequalities.

Finally, a computable general equilibrium (CGE) analysis has been used to examine carbon pricing in Korea. Kim and Lim (2021) investigated the effects of carbon pricing on the economy with a focus on the power sector. As mentioned earlier, retail prices in the power sector are regulated. The authors simulated the Korean economy with a CGE model and analyzed the impact of carbon pricing on gross regional product (GRP) and consumption. They found that the government can achieve better mitigation outcomes in the power sector if it adopts an output-based allowance allocation scheme (or intensity). Moreover, the authors obtained the counterintuitive result that economic efficiency can be improved if the regulator treats both fossil fuel-based and nonfossil fuel-based power plants equally when implementing allowance allocation updates in the power sector on the basis of output.

As shown above, the articles in this special issue provide valuable lessons about the implementation of carbon pricing. The K-ETS experience will be useful for Japan in designing a national ETS. The Korean economy has had export-led growth and has strong exporting industries that often have concerns about carbon leakage and competitiveness issues. These concerns are the major reason why Japan has not implemented a national level ETS by now. Thus, the success of K-ETS depicted in this special issue will be valuable to Japan that has strong energy-intensive and trade-exposed sectors. Japan can also learn from the seven pilot schemes in China because each pilot has its unique design features. Korea can also learn from Tokyo ETS which targets the commercial sector.

Moreover, the experiences in the three countries are expected to exhibit useful lessons to developing economies where ETS is being discussed to control emissions efficiently. Facing the increase of GHG emissions (Arimura and Sugino 2021) and the discussion on Carbon Border Adjustment Mechanism in EU, a few ASEAN countries are considering the introduction of carbon pricing. Singapore has already adopted carbon tax since 2019. Other ASEAN countries are discussing the adoption of ETS.¹ For

¹ <https://www.thepmr.org/>

beginners of ETSs, the experiences in China can be quite valuable. Firms in developing economies sometimes lack the capacity in handling emission abatement efficiently.

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