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The divergence of South Korea's Emissions Trading Scheme (ETS) from the EU ETS: An institutional complementarity view

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Abstract

Emissions trading schemes (ETS) have spread across the globe to tackle climate change. However, limited attention has been given to how ETS characteristics and designs differ and why. We use the concept of institutional complementarity to explore how the EU ETS and South Korea's ETS (K-ETS) adapt to complement established political economy. The EU ETS is characterized as a market with stakeholder ownership, while the K-ETS is more regulatory in nature with government leadership. The EU ETS complements a decentralized political system with liberalized energy market, and the K-ETS became compatible with the centralized majoritarian politics and a regulated electricity market. The ETSs have evolved incrementally, and they are not likely to link in the foreseeable future due to divergence. We suggest a strong focus on "how to adapt" an ETS to its own institution rather than adopting the established blueprint model in countries with a strong regulatory style of governance.

KEYWORDS

carbon markets, climate change policy, emissions trading schemes, EU ETS, European Union, institutional complementarity, K-ETS, Kyoto protocol, market stabilization, Paris agreement, policy design, political economy, regulation, South Korea, stakeholder ownership

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The Kyoto Protocol (1997) suggested the emissions trading scheme (ETS) as an efficient solution for climate action. There are currently 28 ETSs in use across the globe from supranational to local and jurisdictional levels, and the carbon markets are expected to expand under the Paris regime (ICAP, 2023). The EU, China, Kazakhstan, Mexico, New Zealand, South Korea, Switzerland, and the United Kingdom are examples of countries and regions that have implemented ETSs. Carbon markets are socially constructed and their development and change involve political processes (Stephan & Paterson, 2012). The ETS designs are thus heterogeneous and fragmented due to local politics and divergent institutions (Gulbrandsen et al., 2018).

How did the European Union's emissions trading scheme (EU ETS) and the Korean emissions trading scheme (K-ETS) evolve differently and what are the reasons for their divergence? We examine how the characteristics and designs of these ETSs diverged due to the different institutional arrangements within which the systems are embedded. We compare the K-ETS to the EU ETS as the latter has been considered a model for the design of other ETSs across the world (Narassimhan et al., 2018; Park & Hong, 2014). We demonstrate that the EU ETS evolved to complement its political structure and energy liberalization, while the K-ETS adapted to become regulation-like in order to be compatible with its institutional environment.

LITERATURE REVIEW

Carbon markets emerged in the Kyoto period as a political outcome and diplomatic bargain under the leadership of a powerful epistemic network (Calel, 2013). Developed countries intended to include market mechanisms in the Kyoto Protocol due to their economic efficiency and as a way to bring developing countries on board in the climate change negotiations (Bulkeley & Newell, 2010). They were also seen to improve political acceptability to business actors due to their greater flexibility and opportunity to construct a new market under the neoliberal regime (Bailey & Maresh, 2009). In the Kyoto times, a globally linked carbon market was envisioned.

The EU ETS is the largest and oldest carbon market, adopted in 2005 to meet the Kyoto targets, demonstrating the leadership of the European Union in climate policy. Although the creation of a globally linked carbon market failed, ETSs have expanded globally over time. The K-ETS was adopted in 2015 and it was the second-largest mandatory ETS after the EU ETS at the time of adoption (ICAP, 2022). The EU ETS and the K-ETS are comparable in that they both used ETS as a tool to manage greenhouse gas (GHG) emissions from energy production and energy-intense manufacturing industry sectors. They both adopted net-zero as the 2050 target under the Paris Agreement, which positioned them as leaders in climate policy.

On the contrary, the EU ETS and the K-ETS are different in terms of their size and maturity. Therefore, we compared the two qualitatively, focusing on their divergence due to differences in their institutional environments which include factors such as the nature of political structures and the degree of energy market liberalization. It is important to make the comparison to draw lessons for the future development of the K-ETS, as it learned from the EU ETS at

the design stage and has followed its path of development. The analysis of the K-ETS can also offer lessons to other emerging and developing countries that are planning to adopt an ETS under the Paris regime (ICAP, 2022).

The EU is characterized by "inter-governmentalism," a complex of different modes of governance at different levels and scales (Kaiser, 2002). It is not easy to define the EU as a state as it is neither sovereign nor has a demos (Jolly, 2007). However, it has structures that perform state functions. The EU does not fit the classification into executive, legislative, and judicial organizations of a sovereign state, but the EU Commission serves as a strong executive (Lijphart, 2012). Multiple interests of member states and different sectors are coordinated, and the process of negotiation shapes policy design. This structure results in a policy network of diverse stakeholders, with the EU Commission acting as a moderator of the network. Wang and Paavola (2022) demonstrated how the decentralized powers of the EU legislative triumvirate (the EU Commission, the European Parliament, and the European Council) fostered consensus building in the EU ETS to accommodate heterogeneity in the policy process.

Many scholars have evaluated the K-ETS and the EU ETS. Park and Hong (2014) examined the K-ETS design in comparison to the EU ETS before the former's adoption and anticipated challenges in the allocation of allowances; managing allocation reserve and market stability measures; controlling the capital market; the impact of electricity sector regulation. Narassimhan and others (2018) in turn compared eight ETSs worldwide, including the EU ETS and the K-ETS, to assess their environmental effectiveness, economic efficiency, market management, revenue management, and stakeholder engagement. In their view, the main differences between the EU ETS and the K-ETS lie in the allocation process, market management, and revenue management. However, these comparisons have not examined the reasons for the divergence of ETSs. Oh and others (2017) did analyze how the adoption of the K-ETS was possible in an emerging economy, explaining its governance structure and how the design was compromised due to vested interests. However, they focused on agenda setting.

Others have assessed the EU ETS and the K-ETS designs in light of their compatibility for future linking. For instance, Hawkins and Jegou (2014) examined the similarities and differences between the EU ETS and the K-ETS designs, identifying barriers to linking arising from the K-ETS provisions. Doda and Taschini (2016) shed light on under what conditions and to what extent the linking of the ETSs can be economically efficient, but they paid limited attention to the social, political, and institutional environments within which ETSs are embedded. Here, the term institutions refer to "both formal and informal rules and procedures that structure conduct" (Steinmo et al., 1992, p. 2). Climate policies including the ETSs emerge and evolve in different institutional settings (Stephan & Paterson, 2012), and they work differently in different institutional environments (Bergquist et al., 2013; Ostrom, 1990). We contribute by exploring how institutional arrangements affect the characteristics and evolution of the ETS designs and explain the reasons for their divergence.

Institutions are affected by incumbent structures, and they develop complementary to established political economy (Amable, 2011; Aoki, 1994; Hall & Soskice, 2001). Institutions are complementary when "the presence (or efficiency) of one increases the returns from the other" (Hall & Soskice, 2001, p. 17). Complementarity is the force that sticks institutional forms together and results in incremental institutional adaptation (David, 1994). A new institutional arrangement interacts with and adapts to the pre-existing institutional environment (Streeck & Thelen, 2005). The complementarity of two sets of institutions is context dependent; that is, dependent on whether they are compatible with established social and economic ordering (Boyer, 2005). Boyer (2005) has distinguished the concepts of compatibility and coherence from complementarity: Institutions are *compatible* if their coexistence is at a stable equilibrium, they become *coherent* when the coexistence is justified by their strengthening of each other, and, finally, institutional *complementarity* is reached when conjunction offers greater resilience and performance.

Institutional complementarity scholarship has discovered how market institutions have adapted differently in different nations due to their broader institutional arrangements (Aoki, 1994). However, the conceptual framework has seldom been used to analyze climate policies. Watkiss and others (2015) reviewed the complementarity of climate mitigation and adaptation policies at the global, national, and local levels. Magnin (2018) explored institutional complementarity by analyzing how different forms of capitalism in developed countries adopted sustainable development policies that are compatible with their established institutions. However, the approach has not been used to date to investigate how climate policies and ETSs have evolved differently within different political structures and different degrees of energy market liberalization including Asian countries.

Hall and Soskice (2001) suggested that national political economies can be classified as liberal market economies (LMEs) or coordinated market economies (CMEs) and that different political economies generate different institutions that complement existing institutional frameworks. Institutional complementarities reinforce differences, so a nation with a particular type of coordination in one component tends to generate complementary solutions in the other spheres. In LMEs, coordination is secured through competitive market arrangements, while CMEs use policies such as government interventions that reinforce the capacities of actors for nonmarket coordination. For example, Fioretos (2001) demonstrated how Britain and Germany shaped national preferences over the Maastricht Treaty because of their different institutional make-up as LME and CME.

Political structure and political economy affect the design and performance of climate policy. For example, Finnegan (2022) explains how electoral rules and interest group mediation drove variations in climate policy investments: Countries with proportional electoral rules and interest group concertation have the highest level of policy stringency, and majoritarian democracies with plural interest groups are associated with lower stringency. Consensus democracy with CMEs co-occurs with concertation, and the interest groups are incorporated into the process of policy formation (Lijphart, 2012). Majoritarian democracy with LMEs is associated with interest group pluralism—they are competitive and uncoordinated through market mechanisms (Finnegan, 2022; Lijphart, 2012).

Nevertheless, South Korean climate policy does not really fit the categories suggested by the above studies. It has majoritarian democracy with a semi-presidential political system. The power is split within the government into two separate policy networks with frequent turnover in power through presidential elections. However, energy sector and climate policy interest groups are not plural. The political economy is rather coordinated because the energy market is not liberalized, and the electricity sector is largely owned and regulated by the government. On the contrary, the EU's energy market is liberalized, and the political economy of the energy sector and climate policy is thus plural. Climate policy is significantly affected by the structure of energy markets and their political economy because energy production is the main source of GHG emissions (International Energy Agency, 2021).

The ETS design is dependent on how the energy market is structured (Acworth et al., 2020). Boute (2017) points out the limits to transplanting the EU ETS model to emerging economies and argues that an ETS should be reconceptualized as a mechanism that integrates regulatory energy markets. Kuneman and others (2021) specifically studied how the electricity sector regulations affect carbon price and abatement opportunities of the K-ETS and considered that it plays a limited role in low-carbon investment. The market principles do not fully work in the K-ETS because the electricity supply follows the cost-based merit order, which does not consider the carbon price. The government regulates electricity supply based on economic, political, and technical considerations so that what the ETS should deliver does not materialize (Acworth et al., 2020).

We seek to qualitatively evaluate how institutions mattered in the development of carbon markets in South Korea, highlighting how the political structure and political economy of the electricity sector are shaping the characteristics and design of the policy. We seek to

understand how and why the EU ETS and the K-ETS evolved differently owing to their different institutional environments and to what extent an ETS complements its incumbent institutional structure to shed light on the implications for their futures under the Paris regime.

In what follows, we explain the materials and methods we used. In the Results section, we analyze how the incumbent institutions affect the policy character and ownership of the carbon markets and demonstrate that the ETS design adapted only incrementally despite the emergence of the Paris regime. We then discuss our findings and conclude.

MATERIALS AND METHODS

We used policy documents and expert interviews as materials for analysis to understand how the EU ETS and the K-ETS evolved in their institutional environments. Boyer (2005) suggests that the complementarity of institutions arises from the interaction of agents within a given institutional context. Ideas of agents also have explanatory power in relation to institutional stability and change (Hall, 1993). We seek to understand how the ETS is complementing established institutions by observing how agents interact with ideas in the climate policy sphere. The change in actors' ideas affects how policies and institutions change, despite being bounded by their political and institutional settings (Béland, 2009; Schmidt, 2011). We considered that the oral and written communications of policy actors such as the government, industry and lobby groups, research, civil society, and media explain how the ETSs evolve within their institutional environments.

We analyzed over 200 documents to identify key policy actors and their interactions. They included legal documents, government and national institute reports, seminar reports, and position letters relating to the EU ETS and the K-ETS. Gray literature of think tanks and nongovernmental organizations (NGOs) and academic literature were also analyzed. In addition, we conducted interviews to discuss how the actors are institutionalizing the ETSs in the EU and Korea. Twenty expert interviews were conducted in Europe between September 2019 and March 2020 and another 20 in Korea between August 2020 and June 2021. The participants were identified as part of the analysis of documents on the basis of their visibility and influence, and referral sampling was also used.

In all, 20 face-to-face interviews were conducted in Leeds (2), Brussels (4), London (6), and Seoul (8). Another 20 interviews were conducted over video conference calls. They included interviews with experts from the government (9), academia (8), consultancies (8), NGOs and civil society (7), industry and related nonprofit organizations (NPOs) (6), and media (3). The interviews were semi-structured with open-ended questions, and they lasted between 30 and 60 minutes. Institutional ethical clearance was obtained before data collection commenced. Informed consent for participation was collected before each interview.

We used thematic analysis to identify different characteristics of the EU ETS and the K-ETS and coded and reported the data. The key variables for differences were identified as categories for coding: the political structures and energy sector management institutions. The design elements of ETS in post-2020 (EU ETS Phase 4 and K-ETS Phase 3, see Appendix) were categorized again to compare how they differentiated due to the interactions with established structures and institutions.

RESULTS

Characterizing the EU ETS and the K-ETS

In this section we characterize the EU ETS and the K-ETS (see Table 1) and reflect on their development over time, considering political structure and the degree of energy market

TABLE 1 Comparing characteristics of the EU ETS and the K-ETS.

Characteristics	EU ETS	K-ETS
Government intervention	Rule based	Discretionary
Rule change	Long term, stable	Short term, frequent change
Stakeholders engagement	Engaged	Not engaged
Ownership	Market participants	Government
Character	Market	Regulation
Legitimacy to stakeholders	High	Low

Note: The characteristics diverge due to different institutional settings such as political structure and energy liberalization.

liberalization as key variables explaining their divergence. We then compare the designs of the EU ETS phase 4 (2021–2030) and the K-ETS phase 3 (2021–2025) to shed light on their divergent evolution during the Paris era.

EU ETS

The EU ETS was adopted in 2005, and it has evolved as the result of learning by doing over three phases until 2020. In its adoption, the EU ETS was decentralized, and the allocation process was compromised to gain the cooperation of stakeholders (Bailey & Maresh, 2009). The compromised allocation process led to over-allocation. A major carbon price crash also occurred in Phase 2 due to the financial crisis, over-supply of international carbon credits, and conflict and overlap with renewable energy policies (Koch et al., 2014). The EU Commission (EC) framed these drawbacks as a learning process and attempted structural reform of the ETS.

LaBelle (2012) considers the EU ETS an example of hierarchical governance with a single market and mechanisms based on law, where power is delegated to the EC based on prior negotiations and legislative activities. The EC intervened in the carbon market in order "to make the EU ETS more resilient in relation to supply-demand imbalances" by adopting the Market Stability Reserve (MSR) in 2019.[1] The EU ETS also back-loaded accumulated over-supply in Phase 2 (2008–2012) and limited the use of international offset credits from Phase 3 (2013–2020). However, the interventions are rule based: they take a long time to adopt or change because of multiple consultations and stakeholder engagement.

The carbon market is considered an "odd thing" because it "exists because of the regulation" (NGO 3). Government intervention is inevitable to secure carbon market stability. The principle of subsidiarity allows the EC to intervene since it is about "setting standards which will affect the internal market of the Union" (EU Commission 1). The EU carbon market ensures long-term signals and makes sure of the continuity of the policy, and stakeholders are engaged in the process of the rule change.

> The EU policymaking process ensures a lot of credibility and stability, so people know that, you know, the ETS for example is there to stay they will not go away … so that also provides a strong signal to stakeholders and covered entities.
>
> (Industry NPO)

The engagement of stakeholders evidence policy ownership. The EU strives to give more ownership to market participants as it translates into the legitimacy of the policy. Most of the

[1] Decision (EU) 2015/1814 http://data.europa.eu/eli/dec/2015/1814/oj .

participants considered the EU ETS to be fully legitimate to actors entrenched in the EU system. The culture of engagement makes it "a huge exercise in governance" that gives ownership to the market participants (EU Commission 1).

> It's a market. You bring stakeholders in. … You cannot put everything into the legislation, and the market is important for this, for developing this feeling of ownership and having different players working together, competing together.
>
> (EU Commission 2)

The liberalization of energy markets in Europe contributed to its readiness for ETS implementation. Energy market liberalization started in the United Kingdom in the 1980s and soon after the EU started reforms to liberalize its power market (Pollitt, 2012). When the ETS was adopted, the EU power sector was ready for a carbon market as it was like just adding a carbon commodity to the already functioning energy market (Academia 1):

> You have to remember in that stage [in the early 2000s] the power sector had just gone through the liberalisation process. So, we were used to competition. And we had the trading desks, they were trading electricity and gas, we basically looked in and said, "Here's another commodity—we know how to trade that [carbon]."
>
> (former EU Power sector)

The compliant industry, investment companies, and consulting firms were already building carbon market infrastructure before the implementation of the ETS based on their experience with the Kyoto mechanisms in the early 2000s (Academia 2). "In the end, in fact, the industry has organised itself. You know market players themselves decided to trade carbon" (Former EU Commission).

In short, the EU ETS can be characterized as a market with stakeholder ownership that involves rule-based interventions when needed. The stability of the long-term policy originates from a multilateral and decentralized political structure. The EU's existing institutional architecture of political institutions and energy market liberalization contributed to the legitimacy and ownership of the carbon market.

K-ETS

The K-ETS was modeled after the EU ETS and adopted in 2015, but it evolved to have its own rules. A Korean government official puts it: "We created our own style" (Korean Government 2). The initial K-ETS design was a by-product of a political compromise amid a conflict of interests (Park & Hong, 2014). The K-ETS is evolving by moving from free allocation to auctioning, and the allocation method is changing from one based on historical emissions to a benchmark of efficient installations. The market management rules are also changing to activate the market.

The K-ETS has had a fairly stable carbon price owing to active government intervention. However, the K-ETS phase 1 (2015–2018) experienced illiquidity (Etienne & Yu, 2017). In the earlier phases, there were very few transactions, and the market suffered from volatility. The government made several interventions to change rules to manage the carbon price (Asia Development Bank, 2018). For example, it decided to auction some allowances from the market stabilization reserve and changed the rules to allow increased borrowing from later compliance years of up to 20% in 2016 (Asia Development Bank, 2018). The government also allowed domestic offset credits earlier than planned to deal with liquidity.

In comparison with the EU ETS, the rules of the K-ETS can be changed easily and quickly (Media 3). Korea has a big and active government, and the presidential majoritarian politics contributes to frequent change of rules. There was a change in the presidencies that affected the governance of the ETS. For example, when President Park Geun-hye of the conservative party was elected in February 2013, the competent ministry changed from the Ministry of Environment (MOE) to the Prime Minister Office (PMO) and then to the Ministry of Strategy and Finance (MOSF) in 2016. Under President Moon Jae-in (term May 2017–2022) administration with major Democratic Party, the MOE became again the competent authority with extended responsibilities.

The K-ETS regulations delegate authority to the government to intervene for allocation adjustment and market stability when needed. The discretionary intervention poses questions about the transparency of the process and increases uncertainty to the stakeholders leading to low legitimacy. Several participants highlighted that the K-ETS is like a regulation where the ownership of policy lies with the government rather than a market. It resonates with the findings of Suk and others (2018) that the firms perceive the K-ETS as a compliance mechanism: "The government is changing the scheme continuously, so nobody sees trading as an opportunity. If they become active, they must be responsible for their investment when there is a rule change. So, the firms are mostly passive to the ETS" (Consultancy 4).

One participant said that the MOE has "regulation DNA," which is a challenge for managing a carbon market (Korean Government 2). The MOE was established in 1994 when the government started to develop environmental policy independently from the industrial policy. Before this, environmental policy was present only to regulate industrial pollution when the state priority was the rapid industrial development (Heo, 2013). Thus, the industry still tended to oppose environmental regulations creating a gridlock for ETS adoption (Heo, 2015). The ETS implementation was considered a top-down process without sufficient legitimization (Yun & Won, 2012).

The K-ETS is also perceived as a regulatory mechanism because it has its roots in the command-and-control Target Management System (TMS), which Korea implemented in 2012 to regulate energy generation and industries emissions. The government allocated an emission target to the energy and industry sector installations, and they had to pay a fine if the target was not met. It was intended to act as a pilot phase of the ETS; however, it also led to path dependency with the ETS. Kim (2016) indicates that the Korean industry sector advocated TMS over ETS before the ETS adoption as they would pay a modest fine rather than exposing themselves to an uncertain carbon price, and the target setting is more open to negotiation between the government and companies.

The Korean electricity sector is managed and controlled by the government. The power generation company KEPCO is a public corporation that transmits and distributes electricity, and the government owns more than half of its shares. Most power companies are subsidiaries of KEPCO. Korea does not plan to liberalize the power sector in the foreseeable future. The government established KEPCO and centralized the planning and took control of the governance of power supply for the state-led economic development from the 1970s (Lee & Ahn, 2006). A reform of electricity generation and tariff system was attempted after an economic crisis in 1997 to gradually privatize the monopolized market, but it failed due to political struggle and lack of social acceptance (Lee & Ahn, 2006). The electricity sector reform is politically challenging due to energy security concerns in the context of energy-intense industrial development (Chung & Kim, 2018).

In theory, an ETS is efficient when the energy market is liberalized because then carbon price is reflected in energy production and passed on to consumers (Acworth et al., 2020). Korean main industries like steel, petrochemical, and cement production are energy intensive. The electricity consumption accounts for 78.4% of industry GHG emissions (2018) (Government of Korea, 2021, p. 45). To adapt to the regulated electricity market,

the K-ETS is designed to include direct emissions from the energy production process and indirect emissions from electricity consumption. This seeks to address the incomplete pass-through and reduce the market power of energy-generating companies (Kim & Lim, 2014; Shim & Lee, 2016). However, the design caused inefficiency in the early phases of the K-ETS. Because the carbon price was not reflected in the energy tariff, it did not fully incentivize energy source switch and low-carbon investments. "This is a systematic problem. Our country uses cost-based merit order in the energy sector. … When there is an ETS cost, KEPCO subsidises the cost" (Academia 3).

To address the shortcomings, Korea planned to adopt an environmental merit order dispatch, so that carbon cost is reflected in the energy retail tariff from 2021. However, even the adoption of the environmental merit order is not sufficient for incentivizing fuel switching and low-carbon investments (Kuneman et al., 2021). A participant suggested that it does not make a significant difference within the government-regulated electricity market structure: "In the end, nothing is really changed. The government is supporting the cost. The public is paying the cost.… So the fundamental change is not made still" (Korean Government 3).

To conclude, the K-ETS can be characterized as a regulation that involves frequently changing market rules, and where the ownership of the market lies with the strong government. The political structure of state-centric model, regulatory tradition, and the regulated electricity market turned the K-ETS into a regulatory ETS which adapts to established institutions in an incremental way.

Design features of the EU ETS and the K-ETS

We examined how the ETS design features differ in the EU ETS phase 4 (2021–2030) and the K-ETS phase 3 (2021–2025) due to their institutional contexts as described in the previous section. We explored allocation adjustment, auctioning and trading, market stability measures, and flexibility mechanisms as key design elements that diverged. The Appendix gives more information.

Allocation adjustment

The EU ETS and the K-ETS adjust allowances differently after the initial allocation. Both enable adding allowances for extending capacity or canceling allowances for capacity reduction. In earlier practice, the EU ETS entity provided evidence to the competent authority to prove that capacity or emissions had decreased due to the mitigation efforts to prevent allowance cancelation. The EU directive was amended to be rule based in 2019[2] to adjust allocation when there is more than 15% of activity change.

The K-ETS still provides discretionary power to the government to adjust allocation. Adding or canceling allowances after initial allocation remains a controversy in the K-ETS. One participant indicated that there is a burden for the entity to invest in mitigation because they fear that allowances will be canceled when the emission reduces: "To avoid getting allowances cancelled, the firm has to get approval from the government that it was an 'internal mitigation project.' But this has to be done after the mitigation project has been implemented, so the approval is not clear from the start" (Consultancy 5). The state-centric style of the K-ETS gives authority to the government to approve the allocation adjustments, which increases uncertainty for the firms considering investment decisions.

[2] EU ETS Directive (EU 2019/1841).

Auctioning and trading

The EU-ETS was an open market from its inception, in that allowances (EUAs) are defined as a financial product so financial organizations can trade derivatives in over-the-counter trading. Trading is more liquid due to the participation of market makers in the secondary market and actors are used to auctioning due to the liberalization of energy markets.

The Korean entity operators are not used to auctioning and trading carbon as a commodity (Academia 4). This is partly due to the incomplete liberalization of energy markets. Moreover, the K-ETS had a fairly closed market system until 2021 excluding third-party market makers and it is still in the process of opening up the market to financial products such as futures (Kuneman et al., 2021). A participant explained why. "We still have the idea, the trauma from opening up the financial markets. When we open the market, we fear that foreign investors will come to squander and manipulate the market" (Consultancy 1). Korea is conservative in the operation and management of the financial market.

The fear originates from the experience of the financial crisis in 1997. Kwon (2007) argued that the Korean financial crisis resulted from financial liberalization which began in the 1980s under the pressure from the United States and international organizations such as the International Monetary Fund and the Oranisation for Economic Cooperation and Development. The Korean financial crisis was due to the weak domestic financial system and volatile capital flows of speculation owing to financial globalization (Kwack, 1998; Kwon, 2007). Korea lost control of the financial market when the foreign capital flows made exchange rates unstable.

The K-ETS experienced liquidity and volatility issues until 2020, and the government changed the rules to auction more carbon credits and activate the market through third-party participation from phase 3 (2021–2025). However, the progress is incremental. Market participation in auctions is limited to certain sectors and the power sector tends to dominate trading when trading volume is low (Kuneman et al., 2021). Market participants were limited to covered entities and three policy banks in phase 2, and the carbon market opens to the third party incrementally. "It is still hard to see that the government has a will for market activation" (Consultancy 2).

Compared to the EU ETS, unfamiliarity with the auctioning of commodities affects liquidity in the K-ETS. Moreover, the fear of financial crises makes the K-ETS more conservative to open up the carbon market as a financial scheme. The government seeks to stabilize the market when there is a fluctuation in supply and price.

Market stability measures

The EU ETS implemented a rule-based market stability measure from 2019 to manage the supply–demand imbalance. The K-ETS has a government-led allocation committee that has a key role in implementing the market stability measure. According to the ETS Act, Article 6, the K-ETS establishes and operates an allocation committee to review and mediate allocation, market stability measurement, emission certification, management of offset and international carbon market linking, and cooperation.[3] The committee functions under the MOSF and its chair has the authority to discuss an ad hoc "agenda that needs review and change." The allocation committee comprises up to 20 members, which include high officials from government ministries and experts appointed by the MOSF, and where the vice minister of the MOE acts as the facilitator of the committee meetings.

[3] Korean ETS Law https://www.law.go.kr/LSW/lsInfoP.do?efYd=20200601&lsiSeq=215913#0000 .

The K-ETS market stability measure works to stabilize price and control the volatility of the market when certain pre-conditions are met. The ETS Act indicates that when the carbon price is either too high or too low, the government can intervene to control the allowance reserve, limit the holding of allowances, limit borrowing from other compliance years, or regulate offset credits. It can even establish a temporal price ceiling or floor. The market stability mechanism demonstrates how the government holds regulative power over ETS decision making through the allocation committee, while it gives less flexibility and certainty to the market stakeholders. "Market intervention decision is made by government officials.… It is not systematic, but it is manipulative. Also, you don't know when and how it will happen. It gives much uncertainty since it operates suddenly" (Consultancy 1).

The market stability measure is an example of the government ownership of the K-ETS: The government regulates the system to stabilize carbon prices through discretionary interventions rather than leaving the market to work.

Flexibility mechanism (offsets)

The EU ETS was linked to the Kyoto mechanisms of Clean Development Mechanism (CDM) and Joint Implementation (JI) in the early phases. However, over a billion tons of CDM credits have been purchased for compliance, which contributed to the supply–demand imbalance in the first two phases (Newell et al., 2014). CDM was also questioned for its efficiency and validity of emission reductions (Wara, 2007). The EU ETS used CDM and JI as offset until phase 3 (2013–2020) with restricted criteria but does not accept them from phase 4 (2021–2030).

Korea accepts offsets as a compromise to raise its ambition for 2030 in the post-Paris period (Choi, 2020). The K-ETS accepts offset credits in phase 3, although international credits are limited to 5% of the entities' compliance. The government (MOE) manages and authorizes the use of offset. The offsets are also a means by which the allocation committee can control supply as a market stability measure. "You have to consult with the MOE to convert offset credits to use in ETS.… They try to control this too much.… They think they have power over it, and they make it more difficult. It is very strict" (Consultancy 1).

The K-ETS opened up to accept the offsets due to the political compromise for strengthening ambition and increase liquidity; however, it is allowed under strict government control to prevent large inflow as happened early in the EU ETS. The strong state model enables the government to take control of the offsets to manage the market.

DISCUSSION AND CONCLUSION

The ETSs have evolved to adapt to their institutional environments. They diverged in their designs due to their different institutional contexts and the degree of energy market liberalization. We explained how the EU ETS and the K-ETS governance differed in terms of ownership and legitimacy to stakeholders. By adopting an institutional approach, we demonstrated how the ETSs adapted to pre-existing institutions and gave reasons for why their characteristics and designs diverge.

We consider that political institutions in the EU were complementary to the long-term climate policy implementation, and that energy market liberalization contributed to the readiness and ownership of carbon markets among the stakeholders. In contrast, the state-centric political structure and regulated electricity sector undermined the readiness for and legitimacy of carbon markets in Korea. The country struggles to set a long-term strategy due to the frequent turnover caused by presidential majoritarian politics (Joo et al., 2023). The strong

government enables discretionary intervention in national energy production and the carbon market. Although the K-ETS worked well with sustaining prices because of the government's prompt responses, it lacks certainty and legitimacy for actors. In short, the K-ETS adapted to become regulation-like to be compatible with the established institutional environment.

We found that energy market liberalization is key to how the ETS is institutionalized in practice. The EU ETS was adopted due to political feasibility, and it evolved to be *complementary* to its decentralized political structure and its LME in the energy sector. The K-ETS evolved to become *compatible* with the political institutions of the strong state and existing energy political economy of CME. Institutional complementarity disincentivizes radical change (Hall & Soskice, 2001). Other measures like nonmarket coordination may have been more coherent in Korean climate policy when considering the regulation mode and CME in the energy sector (Magnin, 2018). Still, the K-ETS strived to adapt to the regulatory policy style, and it evolves incrementally under an institutional architecture where the government has control of the electricity market due to unchanging concerns for energy security and industrial development. In particular, the K-ETS included indirect emissions since the electricity price is regulated and later implemented environmental merit order to electricity wholesale to realize the carbon cost at a later stage.

Howie and others (2020) suggest that the K-ETS has contributed to GHG mitigation based on its coverage of key emitting sectors and the rigor of the emissions cap. However, they did not assess the emission reduction attributable to the adoption of the ETS. Kuneman and others (2021) examined how the K-ETS design features impacted the quality of the price signal the allowances created and concluded that the regulations in the electricity sector are hindering the carbon market effectiveness and the opportunities for abatement.

Boute (2017) argued that the EU ETS cannot be transplanted everywhere and that it should be reconceptualized in emerging economies that once had socialist values. Our K-ETS case corroborates and extends that argument: It also resonates with contexts where the government regulates the electricity market due to energy security concerns and the protection of the competitiveness of the export industry. The past experiences with the failing energy sector liberalization may sustain the incumbent electricity market structure. In addition to energy market liberalization, financial liberalization affected how the two polities approached trading and managing the carbon market.

In South Korea, climate policy evolves in a path-dependent way in its established institutional environment and incumbent political economy due to its industry characteristics and policy–industry feedback (Joo et al., 2023; Kelsey, 2018). We found that the issues highlighted by Park and Hong (2014) about the K-ETS have progressed only incrementally since its adoption. Although the market stability is there due to the government's active interventions, the structure of the regulated electricity market persists. The government separated the allocation process for direct and indirect emissions to avoid double counting, but market liquidity is still a challenge to the K-ETS. The six key differences that were pointed out as barriers to linking by Hawkins and Jegou (2014) remain: adjustment of allocation, government intervention for market stabilization; coverage of gases and indirect emissions; penalty scheme; acceptance of international offsets; rules for borrowing. Over phase 3 of the K-ETS, they are still evolving to diverge not to mention the difference in the ambition levels.

International Carbon Action Partnership (ICAP), which was established in 2007 to facilitate technical dialogue, knowledge sharing, and capacity building of carbon markets, stated that the expansion of the ETS in jurisdictions with a regulated power sector between 2013 and 2020 raised questions about the potential for carbon markets linking (2023). "The realisation of the practical challenges of linking, with system designs strongly rooted in domestic economy considerations, also meant that previous hopes of transatlantic linking and the construction of a single, global carbon market became less feasible" (ICAP, 2023, p. 206).

Our analysis of the EU ETS and the K-ETS demonstrated how the two system designs evolved to diverge rather than converge due to institutional settings and conclude that they are not likely to link in the Paris era. We further highlight the importance of considering institutional complementarity when adopting climate policies in the Paris era. The Paris regime is a reflection of the heterogeneity of institutions. In the context of this diversity, climate emergency urges for a common goal. Climate emergency should be perceived as a "long emergency," where climate policy demands both short-term and long-term responses (Rogelj et al., 2021). In this regard, we need wisdom about the policy mix ideas to combine different policy instruments (Rogge & Reichardt, 2016) that are complementary to each other.

Howie and others (2020) emphasized that attention should be paid to the country-specific political and institutional settings when comparing ETSs. We addressed this gap by comparing the ETS characteristics and designs across political and institutional settings. The K-ETS was evaluated to have high predictability and high accountability and transparency compared to Kazakhstan's ETS (Howie et al., 2020). However, in comparison with the EU ETS and considering its political and institutional contexts, we find that it still needs to complement the fast-changing regulatory ETS with long-term measures and implement a rule-based intervention that can give more certainty to the stakeholders.

The EU and Korea have both set carbon neutrality targets by 2050 as the long-term goal and have corresponding strategies such as an ETS and the "new deal" to deal with the climate emergency. ETS can be useful to bridge the short- and long-term goals of climate policy in the Paris era (Media 2). The EU has learned to complement its slow policy change and plans to strengthen government intervention through the European green deal. The EU ETS has become an "insurance policy" to give long-term signals (Academia 5), and the new deal complements with radical and fast interventions for investment into infrastructure and technologies.

Korea can learn from the path of the EU ETS to evolve the system toward complementarity with its established institutions. However, the Korean green deal lacks a long-term vision that would enable the harmonization of policies to drive energy transformation (Academia 4). Kuneman and others (2021) stressed the need for a regulatory alignment with electricity sector reforms and highlighted the importance of defining the role of the K-ETS in the broader policy mix for mitigation and low-carbon investment. In all, we suggest that Korean climate policy should work to build policy coherence as a step forward to complement its established institutions under the Paris regime. "We adopted a very advanced and ideal system ETS, but in the power sector we actually built coal plants. It is a contradiction, or it may be from ignorance of the climate change problem" (NGO 2).

It is important to keep in mind that carbon markets are dynamic and that they change continuously as a response to various endogenous factors as well as to broader political and economic contexts (Wang & Paavola, 2023). Our intention has not been to portray the EU ETS as superior to the K-ETS, rather we sought to learn from the EU ETS as a front-runner, more mature carbon market. We drew lessons from a qualitative comparison to conclude that climate policy evolves toward complementarity with the institutional environment within which it is embedded. We also highlight that the linking of the EU ETS and the K-ETS is not likely in the foreseeable future, as we find more divergence than convergence in their designs due to institutional complementarity.

Further research is needed to discover how the institutional architecture of both developed and developing nations affect ETS evolution and its functioning as many more nations are planning to implement ETSs in the Paris regime. The research agenda on how climate policy can complement the established institutional structure should be a priority. We suggest that other nations with regulatory traditions and/or regulated electricity sectors should consider the K-ETS as a lesson when implementing a carbon market. Focusing on "how to adapt" to their own institutional environment rather than "how to adopt" the established ETS model should be the goal.

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CONFLICT OF INTEREST STATEMENT

The authors have no relevant financial or nonfinancial interests to disclose.

ETHICS STATEMENT

The research obtained ethical review approval from the Social Sciences, Environment and LUBS (AREA) Faculty Research Ethics Committee at University of Leeds (Reference AREA 18-181).

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APPENDIX

Summary of design features of the EU ETS phase 4 (2021–2030) and K-ETS phase 3 (2021–2025). EU ETS design does not incorporate the revisions proposed by the EU Commission on July 21, 2021.

	EU ETS phase 4 (2021–2030)	K-ETS phase 3 (2021–2025)
Overall emissions	4391.9 MtCO2e (2018) • Power 2907.1 (75%) • Industrial Processes 343.5 (9%) • International Aviation 129.2 (3%) • Agriculture 395.4 (10%) • Waste 117.2 (3%)	727.7 MtCO2e (2018) • Fuel Combustion (including transport) 632.4 (87%) • Industrial Processes 57.0 (8%) • Agriculture 21.2 (3%) • Waste 17.1 (2%)
GHG reduction target	2030: 40% below 1990 levels[4] 2050: Climate Neutrality	2030: 24.4% below 2017 emissions (536 MtCO2e in 2030), 38 Mt international, forestry credits 2050: Carbon Neutrality
ETS target	43% reduction compared to 2005 levels	4.7% reduction compared with 2017–2019 levels
ETS covered emissions	1749.5 MtCO2e (2018) 39.8% of EU emissions	601.9 MtCO2e (2018) 82.7%[5] of national emissions
ETS covered GHGs	CO_2, N_2O, PFCs	CO_2, CH_4, N_2O, PFCs, HFCs, SF6
ETS covered sectors	Power stations and other combustion installations with >20 MW thermal input Industry, aviation, others (CCS, NOx etc.)	Heat and power, industry, buildings, transportation, waste, and public sector. Includes indirect emissions from electricity consumption
Compliance	10,569 power plants and manufacturing installations	685 entities
Cap	1610 MtCO2e (2021) 1572 Mt for stationary, 38 Mt for aviation Cap reduces by 2.2% yearly	3048.3 MtCO2e (2021–2025) 14 Mt set aside for market stability, and 20 Mt set aside for market makers
New Entrance Reserve (NER)	200 million supplied from unallocated NER allowances in Phase 3 (2013–2020)	Reserve for New Entrants and additional allocation: Power sector: 6% of allocation (72.7 mln) Other sectors: 4% of allocation (73.5 mln) Cancel unallocated NER at the end of the phase, but it can be transferred to subsequent phase through "**Allocation Committee**" decision
Allocation	Power sector 100% auctioning, Manufacturing /Industry: Free allocation with product benchmarks (Benchmark based on activity levels in 2007–2008, set at an average 10% most efficient installations) Subsectors deemed at risk of carbon leakage receive free allocation at 100% predetermined benchmarks. Benchmarks will be updated yearly. Phase 4 cap includes free allocation buffer of 450 million allowances	At least 10% auctioning, 41 subsectors eligible to auction. Less than 90% free allocation based on benchmarks and historical emission. Benchmark allocation to 12 sectors (gray clinker, oil refinery, domestic aviation, waste, industrial parks, electricity generation, district heating/cooling, steel, petrochemical, buildings, paper, and wood processing) 100% free allocation to 28 Emissions Intense, Trade Exposed (EITE) sectors

[4] 2050 Net zero target was set by the Green New Deal (2019) and European Climate Law in July, 2020. Target is updated to be at least 55% reduction compared with 1990 levels.

[5] Ministry of Environment expected ETS covered emissions to be 73.5% for phase 3 period.

	EU ETS phase 4 (2021–2030)	K-ETS phase 3 (2021–2025)
Auctioning Trading	57% allowances are auctioned Member states can cancel auctioning and transfer allowances to subsequent auctions when the highest bidding price is significantly below secondary market price to avoid market distortion	More than 10% allowances are auctioned to 41 sectors No one bidder can purchase more than 30% of the allowances from one auction. The auctions subject to a minimum price: Financial intermediaries and other third parties can participate in exchange trading since 2021. Futures market will be introduced later
Market Stability Measure	When Total Number of Allowances in Circulation (TNAC) is above 833 million 24% of surplus (12% from 2023) is withdrawn from auction and placed into Market Stability Reserve (MSR) .When TNAC is below 400 million, 100 million allowances are taken from the reserve and injected into the market through auctions. From 2023 onwards, MSR holdings above the auction volume of the previous year will be invalidated	"**Allocation Committee**" implements market stability measures when: • the allowance price of six consecutive months is at least three times higher than the average price of the two previous years • the allowance price of the last month is at least twice the average price of the two previous years, and the average trading volume of the same month of the two previous years • the average market price of a given month is lower than 40% of the average price of the two previous years • it is difficult to trade allowances due to an imbalance of supply or demand The stabilization measures include: • Additional auctioning of allowances from the reserve up to 25% • Limit to the number of allowances in an entity's account: minimum (70%) or maximum (150%) of allowance of the compliance year • Increase or decrease borrowing limit • Increase or decrease the offsets limit • Temporary setup of a price ceiling or price floor
Banking Borrowing	Banking to next compliance year possible. Borrowing is not allowed	Banking possible, borrowing possible within the same phase • Borrowing allowed up to 15% by 2021, Borrowing limit rules (2019)[6] applies after 2021 • During 2021–2023, entities can bank up to two times their net amount of allowances (KAUs) and offsets (KCUs) • During 2023–2025, entities' banking limit is equal to their net amount of allowances and offsets sold • Phase 3 allowances and offsets can only be carried over to the first compliance year of phase 4. (Banking limit in 2025 is the entity's annual average net sold units on secondary market during phase 3)

[6] Less than surrender Allowance × {Borrowing limit of the previous year − (ratio of borrowing against surrender allowance × 0.5)}.

	EU ETS phase 4 (2021–2030)	K-ETS phase 3 (2021–2025)
Offset	Not allowed	Domestic Offsets (Korean Offset Credits KOC) and international credits allowed up to 5% of submission • CDM projects operated by Korean companies are allowed with some qualitative limits

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