Emissions Trading in the European Union and China

A Comparison of System Resilience

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The candidate confirms that the work submitted is his/her own and that appropriate credit has been given where reference has been made to the work of others.

Assertion of moral rights

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Abstract

Emissions Trading Systems (ETS) have proliferated internationally over the past two decades. The European Union's (EU) and China's ETSs have attracted much attention given their importance to global climate politics. The EU ETS as the world's largest and foremost ETS has become a model for many countries to follow. China has also launched regional pilots and a national ETS based in part on the EU experience. Yet, they are divergent because of differences in their system design and institutional embedment. The divergence is often attributed to the distinctive political-economic contexts within which ETSs are implemented.

However, limited attention has been given to date to the evolution of the ETSs. Empirical evidence suggests that the ETSs are not static but evolve as a response to changing environment and priorities. In the EU, the expansion of the Union, other changes in the political landscape and the economic recession after 2008 led to ETS reforms to adapt it to the changed circumstances. In China, the recent ministerial reform and the ongoing macro-economic slowdown have created comparable pressure for change. An ability to cope with contextual disturbances like these is crucial for the functioning and performance of the ETS. This thesis investigates how the ETSs in the EU and China have reacted to disturbances in their respective political-economic contexts.

This thesis develops a neoinstitutionalist conceptual framework of ETS resilience to examine the ability of the ETS to cope with contextual disturbances, and applies it to an empirical investigation of the evolution of the EU's and China's ETSs in changing circumstances. A polycentric-monocentric continuum is suggested to describe decision-making over the ETS in the EU and China. Drawing from substantial documentary materials and stakeholder interviews in the EU and China, the thesis finds that shaped by their distinctive institutional embedment, the EU's and China's ETSs exhibit different patterns of resilience to political and economic challenges. It indicates that facilitated by a polycentric decision-making structure, the EU ETS has high resilience to the political disturbance from the EU enlargement but has been slower to respond to the impacts of economic recession. In China, where the ETS is governed under a monocentric structure, the recent ministerial reshuffle will affect the ETS given the power disparities between

the economic and environmental regulators in the political system. The ongoing economic slowdown is also a challenge to the future ETS functioning, given the government's prioritisation of economic development.

The research contributes to the ETS studies by highlighting the significance of contextual factors for explaining the divergence of ETSs. It also highlights the need for future research on the impacts of ongoing disturbances to China's ETS that provide further opportunities to harness the conceptual contributions of the thesis.

Key Words:

The European Union (EU), China, Emissions Trading System (ETS), Climate Governance, Neoinstitutionalist, ETS Resilience, Contextual Disturbance, Polycentricity, Monocentricity.

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List of Abbreviations

ACI	Actor-Centred Institutionalism
CCAP	Centre for Clean Air Policy
CDM	Clean Development Mechanism
CEEC	Central and Eastern European Countries
CGE	Computable General Equilibrium
CO	Carbon Monoxide
CO2	Carbon Dioxide
DFID	Department for International Development of the UK
DG CLIMA	Directorate-General Climate
ENVI	Environment. Public Health and Food Safety Committee
EPB	Environmental Protection Bureau of China
ETS	Emissions Trading System
EU	European Union
FIELD	Foundation for International Law and Development
FYP	Five Year Plan for National Economic and Social Development
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GW	Gigawatt
INDC	Intended Nationally Determined Contributions
ITRE	Industry, Research and Energy Committee
JI	Joint Implementation
LI	Liberal Intergovernmentalism
LRF	Linear Reduction Factor
MEE	Ministry of Ecology and Environment
MEP	Ministry of Environmental Protection
MG	Multilevel Governance
MPs	Members of the Parliament
MRV	Monitoring, Reporting and Verification

MSR	Market Stability Reserve
NAP	National Allocation Plan
NDRC	National Development and Reform Commission of China
NEA	National Energy Administration of China
NEPB	National Environmental Protection Bureau of China
NGO	Non-Governmental Organisation
NRDC	Nature Resources Defence Council
QMV	Qualified Majority Voting
SCLGCC	State Council Leading Group on Climate Change
SEA	Single Europe Act
SEPA	State Environmental Protection Administration of China
SERC	State Electricity Regulatory Commission of China
SO2	Sulphur Dioxide
SRC	Securities Regulatory Commission of China
The Commission	The European Commission
The Council	The Council of the European Union
The Parliament	The European Parliament
UK	United Kingdom
UNFCCC	United Nations Framework Convention on Climate Change
US	United States

Chapter 1
Introduction

1.1 Research Background

In the last two decades, many countries and regions have established Emissions Trading Systems (ETSs) to reduce Greenhouse Gases (GHG) emissions. Among them, the European Union (EU) and China have attracted much attention given their importance to global climate politics. The EU has introduced an EU-wide cap-and-trade system since 2005 as its flagship mitigation policy. China has also experimented with several regional systems and launched a national market in 2017.

However, albeit the same economic fundamentals of emissions trading, their practices are very different from each other. The EU ETS represents a typical cap-and-trade system that operates within a liberal market environment correlating to its long-term absolute climate target. Despite some fluctuations, the system has been in place for 15 years, and has become a mature market after several rounds of policy enhancement. By contrast, China's ETS is still at an explorative stage, as the government seeks to adapt the system to its unique political-economic environment. Several regional pilots were established to experiment with the ETS within varying conditions (Zhang 2015). The national market is also in a three-year trial that only covers the power sector at the beginning. The government has shown a cautious attitude in designing the system with intensity-based caps, double counting of emissions, restrictions on carbon finance and market intervention measures (Munnings et al. 2016; Zeng et al. 2018; Lo et al. 2019; Stoerk, Dudek and Yang 2019).

The ETS dissemination in the EU and China, and their varying practices, therefore, inform the empirical foundation for a comparative study. Such a comparison is of importance as the EU and China represent two typical positions in global climate politics. The EU has its representativeness as a developed economy. It commits to an absolute climate obligation and has a mature institutional infrastructure to operate a cap-and-trade system. On the other hand, China demonstrates a typical situation of how a developing

country struggles to manage emissions trading within a rapidly growing economy and an immature market environment. Thereby, a comparative study of the EU's and China's ETSs would not only reveal how their indigenous factors have led to ETS variations, but also reflect their varying norms, perceptions and interests concerning climate mitigation and emissions trading. The insights from the comparison can be thus generalised and disseminated to a broader scale.

Another comparative foundation refers to the trajectories of their ETS development. With three phases of operation, the EU ETS has encountered many challenges in relation to the system's political-economic context. For instance, the EU's political landscape has changed significantly compared with the time when the ETS was commenced. The EU enlargement in 2004 brought ten new member states to the Union, and also brought the problem of socio-economic disparities to the ETS (Homeyer 2004; Burns, Carter and Worsfold 2012). Economically, the economic recession from 2008 also had an impact in the ETS, resulting in considerable surplus allowances and price volatility (Declercq, Delarue and William 2010; Berghmans and Stephan 2012; Laing et al. 2013; Koch et al. 2014).

Similar challenges can also be observed in China's ETS. Politically, the Chinese government in 2018 had a ministerial reform, in which the competence of climate governance was transferred from the National Development and Reform Commission (NDRC) to the newly founded Ministry of Ecology and Environment (MEE). As the country's economic management authority, the NDRC has a powerful role in China's administrative system, whereas the environmental agency in China has long been a marginal actor (Pittman and Zhang 2008; Chang and Wang 2010). It is anticipated that the ETS would be affected given the power disparities between the NDRC and the MEE. Economically, China's ETS is also facing the pressure from the ongoing economic slowdown, which may force the government to prioritise economic development over climate mitigation. The ETS agenda could also be marginalised following the government's economic prioritisation.

Based on the above empirical observations, this PhD research advances a comparison of the EU's and China's ETSs by looking into how they have reacted differently to similar political and economic challenges. Although many

studies have devoted to the divergence of ETS design and implementation (e.g. Welfens et al. 2017; Zhang, Liu and Su 2017; Ervine 2018; Narassimhan et al. 2018; Wettestad and Gulbrandsen 2018; Zeng, Weishaar and Vedder 2018), little has been known how the indigenous factors have contextualised the ETS policy to varying external disturbances. This research contributes to the ETS policy debate by facilitating an understanding of how indigenous factors have played out behind the variations of ETS practices and their varying responses to similar contextual disturbances. Through the representativeness of the EU and China in global climate politics, insights from this research are also expected to be adapted to other ETSs.

The theoretical roots of this research are based on a neoinstitutionalist approach outlined in Chapter 2.4. It regards the ETS as an institution contextualised by the broad political, economic and institutional environments where it operates. The divergence of the ETS practices can be perceived as an evitable consequence of the varying indigenous factors in different jurisdictions. Following the approach, a framework of ETS resilience has been developed in this thesis to depict and analyse the ability of the ETS to address varying political-economic disturbances. The framework contains three theoretical components: the resilience framework from socio-ecological research, the collective choice theory and the polycentric-monocentric governance continuum. Together they offer an analytical framework to assess the resilience of the EU's and China's ETSs to varying political-economic challenges. This will be explained in detail in Chapter 3.1.

Empirical evidence of this research was gathered through documentary materials and fieldwork interviews. The former included primary and secondary sources such as legal documents, official reports and files, academic studies, publications from concerning actors, newspaper articles and websites. A total of 54 interviews were conducted in both the EU and China during 2018-2019. Interview data were analysed through a combination of narrative analysis and critical discourse analysis to construct the storylines (Fairclough 1995; 2003; Bryman 2012; Allen 2017). The evidence was then processed through the framework of ETS resilience and presented in the empirical chapters.

1.2. Research Aim and Structure

The overarching aim of this research is to compare how the EU's and China's ETSs have reacted to similar political and economic challenges. To this end, the remaining of the thesis is organised as follows.

Chapter 2 is a systematic review of the literature that identifies the existing knowledge gap and builds a theoretical basis underpinning the analysis. Section 2.1 introduces the research context by showing the different philosophies and approaches between the EU's and China's ETSs. Section 2.1 documents the current ETS research landscape based on three key strands: system design, impact assessment and policy linkage. Through the review, Section 2.3 identifies the existing knowledge gap and outlines the research objective of the thesis. Section 2.4 provides the theoretical foundation for the research. It firstly discusses the political fundamental of the ETS, pointing out the importance of political analysis in ETS research. Then it explores several neoinstitutionalist ideas that help construct the analytical framework for this research.

Chapter 3 presents the analytical framework and research design. Based on the neoinstitutionalist approach, Section 3.1 conceptualises an analytical framework of ETS resilience that consists of three theoretical components: the resilience framework from socio-ecological research, the collective choice theory and the polycentric-monocentric governance continuum. Section 3.2 outlines the research design, which includes a multi-case comparative approach and a qualitative method of data collection and analysis.

Chapter 4 and 5 are the empirical chapters of the EU ETS, assessing the system's resilience to varying political and economic challenges. Chapter 4 defines the EU ETS as a polycentric model and investigates the impact of the EU enlargement on the EU ETS and how the system has reacted to the impact. Chapter 5 examines the impact of the economic recession after 2008 on the ETS and how the system has reacted to the impact.

Chapter 6 and 7 are the empirical chapters of China's ETS. Chapter 6 defines the ETS as a monocentric model by looking into the background, development and institutional settings of the ETS. It then examines how the ministerial

reform in 2018 would affect the ETS and assesses the resilience of the ETS to the impact. Chapter 7 analyses the impact of the ongoing economic slowdown on the ETS and evaluates the system's resilience to the impact.

Chapter 8 provides a comparison and synthesis of the empirical cases, discussing how the varying indigenous factors and institutional settings have resulted in different ETS practices and shaped their resilient abilities to similar political-economic challenges.

Chapter 9 concludes the thesis by summarising the research findings, and presenting the research contributions, policy implications and limitations of the research.

Chapter 2
Literature Review

This thesis has both empirical and theoretical relevance to the existing body of knowledge. Empirically, it relates to the ETS research in the EU and China, and to the broad comparative ETS study field. Theoretically, it refers to a series of neoinstitutionalist perspectives. The literature review thus divides into four sections. The first sets forth the research context with a review of the ETS literature in the EU and China. The second turns to the comparative ETS studies by focusing on three prevalent strands: system design, impact assessment and policy linkage. With the review of past individual and comparative ETS perspectives, the third section points out the knowledge gap in current ETS research that lacks a comparative lens on the system evolvement in response to the changing environment. The last section builds the theoretical roots by reviewing the field of Neoinstitutionalism and searching for constructive ideas.

2.1. Research Context: The development of ETS in the EU and China

2.1.1. The EU as an ETS Pioneer

The EU ETS is the world's first and by far the largest domestic ETS. This means that when the EU decided to introduce the policy, it had no model to learn but had to explore the approach by trial-and-error. The development of the EU ETS therefore has demonstrated a process that the policymakers constantly adapt the system to the EU's political, economic and institutional contexts. Meanwhile, this adaptation process also reflects the characteristics of the EU ETS decision-making.

Many studies have devoted to the reasons why the EU opted for an ETS as its flagship mitigation policy (e.g. Lefevere 2005; Skjarseth and Wettestad 2008; 2010a; Convey 2009). The reasons can be roughly categorised into four aspects. First, the EU needed a flagship mitigation policy to replace the then failed carbon tax initiative, and the ETS proved institutionally feasible within the EU's legislative procedure (Skjarseth and Wettestad 2008; Convey 2009). Second, there were also some bottom-up ETS experiments at the company

and member state levels that inspired the EU policymakers on an EU-wide ETS (Skjærseth and Skodvin, 2003; Victor and House 2006; Oberthur and Tanzler 2007). Third, the personnel change within the European Commission (the Commission hereafter) further strengthened the belief in the effectiveness of market-based instruments (Lefevere 2005). Last, key environmental non-governmental organisations (NGOs) and industrial groups also supported an EU ETS (Skjarseth and Wettestad 2008).

Against this background, the Commission started to prepare an EU-wide ETS. In 1998, it issued a communication paper, Climate Change - Towards an EU post-Kyoto Strategy, as the first step towards an EU-wide ETS, specifying that "the Community could set up its own internal trading regime by 2005……" (European Commission 1998: 20). As the Commission lacked experience in emissions trading, it commissioned the Foundation for International Law and Development (FIELD) and the Centre for Clean Air Policy (CCAP) in Washington to undertake studies of design options (CCAP 1999; FIELD 2000). Based on the preparation, in 2000 the Commission published the Green Paper to launch a discussion on the detailed policy options regarding an EU-wide emissions trading project (European Commission 2000). An ETS Directive was thus formally proposed in October 2001 and approved by the Council of the EU and the European Parliament (the Council and the Parliament hereafter) in 2003, which started to operate in 2005 (European Commission 2003).

As there were multiple stakeholders and institutions involved in the EU ETS decision-making, Skjarseth and Wettestad have conducted a series of studies to explain the establishment of the EU ETS based on two major theories: the Liberal Intergovernmentalism (LI) and the Multilevel Governance (MG) (Skjarseth and Wettestad 2008; 2010a; 2010b; Wettestad 2009; Skjarseth 2010).

The LI understands the EU as an intergovernmental regime where sovereign states are key actors. Therefore, the determinants of the ETS agenda-setting and decision-making are the interests and positions of the member states, and the key institutional body in Brussels is the Council (e.g. Moravcsik 1998; Schimmelfennig and Rittberger 2004). It explains the initiation of the EU ETS as a result of the interstate bargaining and preference compromise among key

member states. Indeed, the interests of member states were primarily reflected in the initial design of the ETS, particularly concerning the cap-setting and allocation. After the Commission submitted its ETS proposal, the Council and the Parliament had a huge disagreement. While the Parliament called for a more centralised allocation approach with more auctioning, the Council strongly preferred a decentralised approach with the authority delegated to member states and allowances handed out mainly for free. In 2002 the Parliament held its first reading regarding the ETS proposal, tabling around 80 amendments including wider industrial coverage and a fixed EU-wide cap, but met strong opposition from the Council. After two rounds of reading, the Parliament had to concede in order to have the ETS in place to comply with the Kyoto commitment (Skjarseth 2010).

However, although the LI explains the features of the ETS design, its state-centred perspective underestimates the functions of other actors and institutions. The MG hence offers an alternative explanation to the EU ETS. The governance of supranational institutions and the influence of non-governmental actors constitute the central research category in the MG (e.g. Weale *et al*. 2000). Its analysis regards the Commission as an entrepreneurial leader who took the initiative, built up necessary preparative knowledge and mobilised broad support for the ETS. The Commission originally preferred a carbon tax but met strong opposition from member states and industries. It thus turned to the ETS as a promising alternative. It should be noted that, as no evidence can suggest that the countries that took the presidency of the Council during that time tried to launch an ETS (Skjarseth and Wettestad 2010a), the policy shift from taxation to the ETS can be regarded as the sole effort by the Commission. The entrepreneurial leadership refers to the Commission's efforts in convincing stakeholders, bridging up the epistemic gap and brokering policymaking (Skjarseth 2010; Skjarseth and Wettestad 2010a). With the efforts, it successfully facilitated a common understanding among all stakeholders, and eventually established the ETS. Via this perspective, the decentralised ETS design at the beginning can be understood as a pragmatic approach of the Commission to gain more support from member states.

In addition to the EU ETS initiation, the LI and MG theories can also account for the later reform of the ETS in 2008. Due to the lack of experience, the EU ETS was initially designed as a decentralised system. But this structure soon

proved problematic, as member states were overgenerous in allocation. As a result, the market was riddled with surplus allowances and the carbon price plummeted. The circumstance became more critical when the national governments submitted their National Allocation Plans (NAPs) for Phase 2, as the aggregate of all proposed NAPs indicated 5% more emissions than the 2005 level. The Commission as a watchdog had to step in and rejected most of the NAPs, which caused a furious political battle with some member states (Ellerman and Joskow 2008).

As a response to the problem, the EU had to centralise the system by retrieving the authority from national governments. Here, the centralisation can also be explained by the LI and MG. Through the LI theory, the centralisation can be understood as a change of the standpoint of member states. To national governments, a decentralised system was problematic. Given the huge windfall profits from the ETS, there was intensive lobbyist pressure of industries at national governments, resulting in great administrative costs in making the NAPs (Grubb 2014). Also, a decentralised ETS faced a race to the bottom in cap-setting and allocation, as member states tended to set generous caps due to the fear of competitiveness and free-riders (Ellerman, Buchner and Carraro 2007; Wettestad 2009). To avoid the hitch and ensure the effectiveness of the system, member states were apparently willing to hand in their authorities to the Commission.

Through the MG theory, the Parliament and the Commission also had motivation. As to the Parliament, it had been suggesting a centralised approach from the very beginning, arguing that a stringent and effective ETS can only be assured with its governance authority centralised at the EU level. Due to the growing influence from pro-green parties, the Parliament often played a proactive role on climate issues (Schreurs and Papadakis 2007). In the 1999 parliamentary election, the European Green Party and the European Free Alliance secured 36 seats, and raised to 42 after the 2002 election, becoming the fourth largest political group in the Parliament. Against this background, the Parliament had increasingly taken climate change as a central topic, through which it could "gain more legitimacy and power relative to the Commission and the Council" (Schreurs and Tiberghien 2007: 36). Although in the initial ETS legislation its demand for a more stringent system was largely compromised by the Council, it did not give up on a centralised ETS approach (European Commission 2008).

As to the Commission, a decentralised ETS brought significant challenges. In Phase 1 and 2, it served as a watchdog responsible for scrutinising the NAPs of member states, which resulted in substantial administrative workloads. According to the ETS Directive, the Commission needed to review the NAPs within three months and table its suggestions (European Commission 2003). However, it was almost impossible to assess all NAPs within only three months, let along some NAPs lacked elements that were essential for assessment. Some countries even could not submit their NAPs in time. In phase 1, Germany, Poland and the United Kingdom (UK) took several rounds of discussion to submit their NAPs (Skjarseth and Wettestad 2008). Due to the lack of accurate historical data, most of the NAPs were produced by intensive lobbying rather than data calculation and analysis. Also, the ETS Directive initially only proposed a small proportion of auctioning in allocation – up to 5%, but in practice only Denmark reached this amount with some other members proposing smaller percentages (Grubb 2014). The price collapse and overallocation at the end of Phase 1 finally caused intervention from the Commission that banned banking between Phase 1 and Phase 2, ensuring that the mistake made in the first phase will not affect the policy in the future.

With the experience and data of Phase 1, it was expected that the NAPs in Phase 2 were able to be projected more correctly to the Kyoto target. However, the NAPs submitted suggested even 5% more emissions than the 2005 level (European Commission 2005), which revoked strong defence from the Commission, as it feared that this would cause another price collapse. It thus rejected most of the NAPs and triggered a political battle with some countries (Reuters UK 2007; Ellerman and Joskow 2008). Meanwhile, the EU enlargement provided another momentum to the dispute. New members from Central and Eastern Europe argued that the ETS was determined by the dominant Western European members and did not take into account their interests. They challenged the Commission's proposal that would significantly cut down their NAPs on different legal grounds (Grubb 2014). At last, the Commission won the battle, which cut back the total cap by around 10% and thereby brought about an overall 6% lower emissions in Phase 2 compared with the 2005 level.

With all the reasons, the EU decided to centralise the ETS authority to the Commission. In 2007, the European Climate Change Programme held a consultation over the ETS performance, indicating a change of attitude of many stakeholders on the system design, which further boosted the EU's determination for an ETS reform (European Commission 2007). In January 2008, the Commission brought up a revised ETS proposal, suggesting a centralised cap-setting method, more auctioning in the allocation and a limitation on the use of international offsets. The proposal was soon agreed by the Council and the Parliament in December and took effect in Phase 3 (European Commission 2009).

Again, the LI and the MG offer different explanations to the EU ETS reform. From the viewpoint of the LI, the reform was in line with the interests of member states. Despite the grievance from some new members, the reform could effectively eliminate the competitiveness concerns within the Union. And as the Parliament had been supporting a centralised approach throughout, the change of the Council’s standpoint apparently constituted a key factor for the ETS revision. From the viewpoint of the MG, the Commission, the Parliament and other stakeholders were also the key supporters for the reform. Especially for the Commission, it took various measures in Phase 1 and 2 to address the problems in a decentralised system. The disappointing performance of the ETS in the first few years obviously convinced many stakeholders that a centralised system would be more efficient and effective, which built a common ground for the reform.

The EU ETS development at the beginning clearly showed that the ETS is not a static policy, but has to evolve as the policymakers gain experience and adapt to the changing operational context. Although the LI and MG explanations here provide different accounts to the development, they together indicate a key characteristic that the ETS decision-making in the EU cannot be determined by a sole actor, but by multiple stakeholders facilitated by a common understanding.

2.1.2. The Deviation of China's ETS Approach

As a frontrunner, the EU ETS provides a successful manual of how emissions trading should be implemented, leading to the conventional wisdom that the ETS as a market-oriented instrument should be operated within a mature

market institution and a transparent political system (Han et al. 2012; Lo 2013). Some literature thus questions the feasibility of emissions trading in those emerging economies where lack a liberal market basis (e.g. Lo 2013; 2015; Jiang 2014). China's decision to build a domestic ETS therefore has attracted much scholarly attention due to its unique political-economic context.

The compatibility of the ETS with the country's political-economic context is the primary focus of many early research. A study by Han et al. (2012) discusses the reasons why China opted for an ETS and the potential barriers it may face. The driving factors are both internal and external. Internally, the experience from the 11th Five-Year-Plan period indicated that traditional command-and-control approaches faced increasing administrative costs but with little effectiveness. The government thus expected that market-based instruments could lower the costs and enhance administrative efficiency in reducing carbon and energy intensities. Externally, the decline of the Clean Development Mechanism (CDM) and the prevalence of ETS discourses in international climate negotiations motivated China to establish its own ETS. With respect to the barriers, it concerned about the inadequate market basis. The economic characteristics of China such as the heavy government intervention, the dominance of state-owned enterprises, a controlled energy market and a distorted financial market all may become potential barriers, let alone the conventional problem of weak enforcement in China's environmental governance.

Through a series of studies, Lo (2013; 2015; 2016a) systematically analyses the compatibility of the ETS within China's political-economic environment, the reasons behind the policy choice and the challenges ahead. He firstly questions whether China as a developing economy with a socialist political tradition is suitable to host an ETS (Lo 2013). Two unique features are identified as a sharp contrast to other ETS operators. First, China's engagement in emissions trading is primarily economic- and energy-oriented. The authority of the ETS was assigned to the NDRC rather than the MEP, and local governments were keen on the ETS to secure the advantages of low-carbon investment. The second refers to the feature of 'authoritarian environmentalism' in China's environmental governance (Gilley 2012). The government relies on regulatory and coercive measures to implement environmental policies, casting a shadow on the market effectiveness of the ETS.

As to the reasons, Lo (2013; 2015) contends that China decided to embrace the ETS to secure its influence in an emerging global climate market. From a geopolitical perspective, China's ETS is built on a desire to engage in global carbon finance and to gain more discursive power from international carbon actors (also in Lo 2016b). As the ETS has been prevalent in many economies, China, who benefited from its CDM engagement, saw a greater potential of investment from a new round of climate capital accumulation (Paterson 2010). The ETS is thus embedded in the discourse of economic development and global carbon markets, adding political motivation to the government's ETS initiative. As to the barriers, he (Lo 2016a) identifies four structural challenges: the weak domestic demand, constrained financial involvement, incomplete regulatory infrastructure and extensive governmental intervention, which all derive from China's unique political-economic context.

From a legal perspective, Jiang (2014) finds that the obscure legal status and regulatory authority of the ETS may cloud the ETS prospect in China. As China has no absolute reduction obligation, its ETS thus faces uncertainty as it lacks legal effect and binding force. The legal status of the GHG emissions and the property right of the allowances are also unclarified. Moreover, the ETS regulation in China also has little binding force within the legal and administrative systems. The regional pilots were built based on the rules of the local governments, lacking the power to enforce the penalties for regulated companies. Those legal loopholes therefore constitute a challenge to the ETS.

Chang and Wang (2010) examine the ETS compatibility in China by looking into a plurality of parallel policies and the broad institutional embedment of the government's environmental governance. They argue that the ETS should be introduced alongside the existing environmental and energy policies, and ought to deliver the objectives of those policies. However, the existing institutional and policy contexts in China are not compatible with the ETS functioning, which thus may lead to ineffective performance.

In addition to system compatibility, the experience from previous emissions trading activities is another research focus. China had engaged in two types of emissions trading before the ETS: Sulphur Dioxide (SO2) trading and the CDM. As China has neither a mature market system nor a fully developed

legal basis for emissions trading, lessons from its previous trials of SO2 trading and the CDM can help assess China's institutional capacity for an ETS (e.g. Burtraw 2000; Tietenberg 2003; Lo and Chang 2014).

Lu (2011) assesses the SO2 trading project in Taiyuan, China, revealing several weaknesses of the government's environmental administration on emissions trading. The research finds that the Environmental Protection Bureau (EPB), as the administrative authority of the Taiyuan SO2 market, did not attach importance to the project. The frequent change of personnel within the EPB often led to data disruption and inaccuracy. There was also excessive intervention from the EPB in market transactions. Despite few transactions were made, almost all of them were matched by the EPB and the trading prices were suggested by the Bureau directly. In addition to the inappropriate regulations, the incomplete market infrastructure and legal basis also limited market liquidity. The poor understanding of emissions trading of both enterprises and regulators is attributed as the major factor for the poor performance. Throughout the project, although SO2 emissions were reduced, the reduction was not achieved through the market system. The project was still operated in a traditional mandatory manner.

The motivation behind the excessive government intervention in SO2 trading has been examined by Tao and Mah's (2009). The intervention can be understood as an inevitable dilemma due to the country's status as a transitional state. They contend that China, through SO2 trading, attempts to harness two inter-incompatible logics within its environmental governance, which are the logic of the market with its essential basis of liberalisation and competition on one hand, and the logic of its authoritarian political system with its emphasis on the control and uniformity on the other. This dilemma is especially prominent in the power sector, where despite several rounds of reform, the energy prices are still regulated by the central government. Therefore, in order to utilise the market potential to achieve environmental goals, the government needs to update its governance capacity fitting the liberalised approach.

Unlike the disappointing performance of the SO2 trading experiment, the CDM had a positive outcome which may explain why China decided to adopt the ETS rather than other mitigation policies. As a non-Annex I country, China had

no emission reduction obligation in the Kyoto Protocol but was eligible to sell offsets to industrialised countries. In 2005, China entered the CDM market and soon became the largest supplier. By 2014 it accounted for around 60% of all registered CDM offsets worldwide (Schreurs 2017). Shen (2015) contends that the CDM left two significant legacies to the later ETS. First, the CDM fostered a better understanding of emissions trading among those domestic participants. Second, it accumulated carbon-related expertise in the government. As the CDM regulator, the NDRC gained experience and knowledge of emissions trading, which later facilitated its governance in the ETS. More importantly, the successful performance of the CDM made the government realise the great economic benefits of emissions trading, which further strengthened its determination for a domestic ETS (Sautter 2009; Thomas, Dargusch and Griffiths 2011).

The problems of incompatibility and experience of emissions trading highlight a key deviation of China's ETS practice from the EU. Unlike the climate-oriented EU ETS, China's ETS is primarily economic-oriented. China's existing political-economic settings are not suitable for an ETS. Politically, the government relies on regulatory and coercive measures to implement environmental policies. The experience of SO2 trading has also proved that frequent government intervention would make the market difficult to tease out the correct price of emissions abatement. As China has not committed to an absolute climate target, the convention of government intervention would threaten the certainty of the ETS cap-setting and allocation. Economically, the regulated energy market would also distort the pass-through of carbon costs. The government concerns more about energy security and economic growth and is not willing to liberalise the energy market.

As a result, the economic benefits are considered as the chief motivation behind the policy decision (Sautter 2009; Thomas, Dargusch and Griffiths 2011; Lo 2016a; 2016b; Schreurs 2017). The economic benefits from the CDM convinced the government that the ETS has more advantages than the command-and-control approach in terms of cost-effectiveness and investment-attracting potentials. The initial governance setting of the ETS also has indicated that the government treated emissions trading principally as a policy closely related to the economic and energy domains. As climate change and the CDM were considered as an economic-related issue that involves international negotiation and foreign investment, the NDRC was appointed as

the competent authority on climate governance (Gilley 2012; Lo 2015). The economic consideration has dominated China's ETS policy, indicating a difference of orientations between the EU's and China's ETSs.

Similar to the EU, emissions trading in China has gone through a process of modification as the policymakers drew lessons from the past and adapted to the operational context. Regional disparities are also reflected in the design of the pilots. However, compared with the EU ETS where the decision-making is characterised by multiple actors, the ETS governance in China is mainly dominated by the state, or more specifically the NDRC, whereas other stakeholders are less influential (e.g. Tsang and Kolk 2010; Wang, Liu and Wu 2018). Apparently, despite a common logic of emissions trading, the ETS has evolved to different directions in the EU and China characterised by their distinctive contexts. The next section will show how their differences have been manifested in the current ETS research landscape.

2.2. Strands of ETS Studies

By far, many studies have been devoted to the EU's and China's ETSs. This section reviews those studies based on three main strands: system design, impact assessment and policy linkage. The system design has been a central research category in many ETS research, as it reflects the jurisdiction's political-economic background and informs the contextual differences in comparative studies. The impact assessment has been primarily dominated by quantitive research, referring to those ex-ante and ex-post assessment on the ETS performance. The impact includes many research variables, such as the price trend, emission reduction results, abatement costs and the effect on the broad climate-related domains. Policy linkage has attracted less attention if compared with the above two strands, but nevertheless constitutes a key concern of many comparative studies due to its potential benefits. The prospect of system linkage is especially evident concerning China's ETS, in which scholars discuss the possibility of linking different regional pilots, expanding the national ETS to the pilots, or bridging the ETS with the EU.

There are also overlaps among them. For instance, some studies assess and compare the potential outcomes of different design options to provide policy recommendations. Where appropriate, this section may reference some

literature more than once, or categorise them into only one strand. Moreover, it should be noted that neither the EU's nor China's ETS is a holistic system, and many studies only focus on a single EU member state or a regional pilot in China, but they nevertheless reveal the general characteristics of the broad system. Also, some studies may have contradicting arguments or results. The review does not make a verdict but invites a discussion among them, and therefore shows the existing body of knowledge in the field.

2.2.1. System Design

2.2.1.1. EU ETS Design

System design is important, as it determines how the ETS will function and generate a carbon price. As a frontrunner, the design of the EU ETS has gone through several rounds of changes due to the lack of experience and a matter of trial-and-error. Based on the design changes, the EU ETS can be roughly divided into four stages, each of which has been characterised by unique design features.

The first stage includes the first and second phases of the ETS, featured with a decentralised structure (European Commission 2003). Due to the then political-economic realities, the ETS was designed as a decentralised structure with the authority of cap-setting and allocation held by the member states. The national governments drafted their NAPs, and the Commission reviewed the NAPs in line with the Union's Kyoto target. Knight (2011) finds that, highly counter-intuitively, companies in those member states with less open energy markets were more difficult to profit from the carbon price, as they faced more restrictions to manipulate the energy prices. The disparities of economic geography within the EU clearly became a key variable influencing the ETS functioning.

The second stage started in 2013 along with the ETS Phase 3, signalled by the revision of the EU ETS legislation in 2008 (European Commission 2008). The highly problematic performance of the system in Phase 1 and 2 soon drew attention from Brussels, and this time all of the EU triumvirate agreed to centralise the system (European Commission 2007; Skjarseth 2010). Troubled by the cumbersome administrative process within a decentralised

ETS, the Commission and member states all preferred a harmonised system with the authority of cap-setting and allocation determined at the EU level. The Parliament also welcomed the decision (Wettestad 2009; Skjarseth 2010). A revised ETS Directive was soon approved in December 2008 despite the looming shadow of the global financial crisis. It introduced a single EU-wide cap with allocation on the basis of fully harmonised rules and expanded to new sectors and gases.

The third stage can be featured by the introduction of price-containing measures from 2014. While the EU managed to fix the problem of a decentralised system, the global financial crisis brought a larger challenge. The plunged industrial demand in the ETS combined with the effects of other climate policies and the inflow of international offsets caused significant price volatility. The crisis highlighted a dilemma regarding ETS governance: should the government intervene in the market? The neoliberal account of the ETS would suggest the least of intervention from the government, as the strength of the market-based instrument rests on the promise that the market will determine the most cost-effective price of carbon abatement. However, the system at the time faced the urgency of market failure. The crisis sparked fierce discussions among stakeholders, and finally, the EU decided to intervene in by introducing a one-off backloading measure that temporarily suspended the allocation of allowances in 2014-2016 (European Commission 2013; Wettestad 2014). In 2015 it further agreed to establish a Market Stability Reserve (MSR)[1] as a long-term price adjustment instrument (European Union 2015).

The price crisis and the market intervention reverberated discussions on the issue of market independence and the political economy of the ETS. For instance, Knox-Hayes (2010), by analysing the organisations and relations of the ETS, classifies three institutional pillars of the ETS: regulative, normative and cultural-cognitive. Both the regulative and normative pillars provide rationales for state intervention in the ETS. The regulative pillar confirms the importance and necessity of the governing authority and property rights in the

[1] A detailed explanation of the mechanism of the MSR will be in Chapter 5.2.2. Simply put, the MSR will absorb a certain number of allowances circulated in the ETS to adjust the supply-demand of the market and affect the carbon price. In the scenario of supply shortage, it will also release allowances back to the market.

functioning of an ETS. The normative pillar reaffirms the social value of the ETS that emissions trading should provide a social good by reducing emissions and addressing climate change. Lederer (2012) supports the idea that state intervention is necessary and unavoidable in the ETS, as carbon allowances are highly fictitious commodities that entirely depend on government regulation. De Perthuis and Trotignon (2014) contend that the EU ETS as a public policy in nature can only revive and function again until there is strong political intervention. As to the concern of market distortion, they suggest that the intervention can be implemented by creating an independent ETS authority ensuring the consistency and creditability of the system. From a political economy perspective, Ervine (2017) argues that the price formation is fundamentally determined by the system design, which is not independent but is rooted in the power structure that give birth to the market.

The fourth stage is to begin along with the ETS Phase 4 from 2021, characterised by a more stringent design. After the MSR legislation, the Commission in 2015 revealed its proposal for the EU ETS Phase 4 (European Commission 2015a). The proposal revised several features of the system to achieve the EU's 2030 reduction target and its contribution to the Paris Agreement. After a lengthy process, the Parliament and the Council in 2017 agreed on the proposal with several amendments that further tighten up the system stringency (European Union 2018). The Linear Reduction Factor (LRF) of the system cap has been enhanced from 1.74% to 2.2%, and the MSR intake rate has been doubled to 24% with the ability of permanently cancelling some surplus allowances. A report by the I4CE and Enerdata (2018) anticipates that with the competence of cancelling surplus allowances, the MSR could invalidate around 2.4 billion allowances by 2023 and 2.6 billion by 2030.

2.2.1.2. China ETS Design

Unlike the EU that lacked experience when experimenting with the ETS, China had learned lessons and received some support from the EU and other international actors regarding the system design at the beginning. However, it turned out that the design of its regional pilots is very different from the EU ETS. Literature thus, by consciously or unconsciously taking the EU ETS as a frame of reference, focuses on the different design features and attributes them to China's distinctive political-economic context.

Zhang (2015) conducts a comprehensive survey on the design of the seven regional pilots, identifying common and different features among them. He finds that the key deviation of China's ETS from the EU is that all pilots are based on intensity targets[2] rather than an absolute cap to fit the growing economy. The immature market infrastructure has constrained the role of carbon finance, and administrative measures are commonly used to underpin the system. A comparison by Duan (2015) reveals that regional disparities have resulted in significant differences of system design among the pilots. Local governments have discretional power, but the underlying principles for the power are not clear, which could confuse stakeholders. Apparently, the legal basis of China's ETS is still underdeveloped. Similar research from a legal perspective conducted by Parenteau and Cao (2016) investigates the potential loopholes in the pilot design, arguing that the weaknesses in the legal basis of the ETS will become a major challenge in the future. The weaknesses include the problem of transparency in policymaking, the lack of confidence of participants in the enforcement of the Monitoring, Reporting and Verification (MRV) system, and the concerns on the robustness of the rule of law.

Zhang, Liu and Su (2017) compare the ETS design between the EU and China, revealing that the EU ETS is more mature and effective than China's pilots. But they also add that the differences can be attributed to the varying political-economic conditions and developmental phases, and that there is no generic template for the ETS design as governments need to tailor the system fitting the local conditions. Goron and Cassisa (2017) also find differences between the EU and China in terms of their ETS ideology and regulatory characteristics. While the EU perceives price limits and governmental intervention as a necessary evil, interference from the government is frequent in China and the carbon prices have been largely driven by the actions of the government rather than the market.

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[2] In China, the intensity cap of the ETS is determined in a bottom-up approach as the aggregate of all covered companies' permitted caps in that year. Every covered company faces a permitted cap every year calculated based on an intensity reduction target and its real emissions in that year. In practice, regional pilots have different allocation methods to adapt to this approach. A detailed explanation of different allocation methods can be seen in Chapter 6.1.2.2.

There are also studies on individual or selected pilots. Munnings et al. (2016) compare the design of Guangdong, Shanghai and Shenzhen pilots, and assess their preliminary performance. The comparison finds that China's regulatory, economic and legal circumstances have deviated its ETS practice from other markets in the world, such as the features of double-counting and annual cap-setting. The low market liquidity also suggests a disappointing performance in those pilots, exposing many structural weaknesses. A study by Lo et al. (2018) finds that behind the system design, the decision-making of the ETS may also have deficiencies in stakeholder-engagement and capacity-building. Through an examination of the Guangdong pilot which is considered more mature than others, it reveals that the involvement of stakeholders, especially the private actors, is still underdeveloped, and the ETS is mainly steered by the government via coercive means. A case study of the Hubei pilot by Engels and Wang (2018) also reveals that the government has played a dominant role in the system, and at the company level the ETS participation is largely driven by the obligation of state-owned enterprises to comply with the government's policy.

Given the abundant literature on China's ETS design, a fully detailed review cannot be unfolded. Instead, here is a rough outline based on their research focuses that reflect China's distinctive political-economic circumstance and the developmental stage characteristics. (1) Zhang (2015) and Zeng et al. (2018) find that, due to the regulation in the electricity market, all regional pilots have included both upstream and downstream sectors despite the problem of double-counting. (2) China has opted for an intensity-based cap combined with a bottom-up approach (Duan 2015; Pang and Duan 2016; Xiong et al. 2017; Qi and Cheng 2018; Wang, Jotzo and Qi 2018). In most pilots, the cap is the adding up of allowances in the market, which is calculated based on the carbon intensity target and historical data and is also subject to the ex-post adjustment on the real production level. (3) Regional pilots only have an annual cap and compliance span compatible to its frequent ex-ante and ex-post adjustments, but this creates uncertainty and constraints to the decision-making of transactions and investment (Jotzo and Loschel 2014; Shenzhen Urban Development Research Centre2015; Zhang 2015; Munnings et al. 2016; Hu, Li and Tang 2017). (4) Free allocation is primarily used, despite a symbolic experiment of auctioning in Guangdong (Zhang 2015; Li and Jia 2016; Tang et al. 2016). (5) The source of offsets is generally constrained to indigenous, indicating a strong capacity base of the CDM in China's ETS

development (Swartz 2016; Lo and Cong 2017; Ba, Thiers and Liu 2018). (6) Price management has been underlined due to the experience from the EU ETS (Munnings et al. 2016), and state intervention is excessive in market activities (Cong and Lo 2017). Some scholars also suggest introducing a price corridor in China (Li and Lu 2015; Zhao et al. 2017; Zeng et al. 2018). (7) Stakeholder engagement and awareness are underdeveloped （Duan, Pang and Zhang 2014; Shen 2015; Yang, Li and Zhang 2016; Zhao et al. 2016; Zhang et al. 2017; Liu and Fan 2018; Lo et al. 2018). (8) Sometimes local authorities postponed the compliance deadline or made exemptions to ensure compliance rate (Munnings et al. 2016). As the financial penalties are generally weak, local authorities have also relied on administrative punishments (Zhang 2015). Some scholars thus call for a strong legal framework (Dong, Ma and Sun 2016; Duan and Zhou 2017; Zhang et al. 2017). (9) Linkage to other carbon markets has been a promising topic (Qi and Weng 2016; Zeng et al. 2018; Li, Weng and Duan 2019).

2.2.2. Impact Assessment

Ex-ante and ex-post assessment of the impact of emissions trading has constituted a key strand in ETS studies. Despite some qualitative efforts, this strand has been primarily dominated by the quantitative approach. Due to the qualitative approach of this thesis, this part only maps out the current landscape of knowledge in this regard. The impact of the ETS has many aspects. For instance, through a multi-criteria framework, Mundaca and Neji (2009) propose seven criteria to evaluate the policy of a tradable certificate system. Specific to the ETS, Konidari and Mavrakis (2008) develop three criteria for an evaluation of 8 selected countries in the EU ETS. They are environmental performance, political acceptability and feasibility of implementation, each of which consists of sub-criteria. Venmans (2012) further concludes four criteria for the evaluation of the EU ETS, which are environmental effectiveness, cost-effectiveness, distributional considerations and institutional feasibility.

The above methods outline three key aspects concerning the ETS evaluation: environmental performance, economic performance and political feasibility. While the aspect of political feasibility usually falls into the competence of the qualitative approach (e.g. Braun 2009; Convery 2009; Skjarseth 2010; Lo et al. 2018), the former two aspects are commonly evaluated by quantitative

research. Accordingly, this thesis categorises quantitative literature based on these two aspects.

2.2.2.1. Environmental Performance

The environmental performance refers to the effect of the ETS on carbon abatement and climate mitigation. A simple way is to compare the emissions of the ETS to a business-as-usual scenario. For instance, Ellerman and Buchner (2008) measure the abatement effect of the EU ETS in 2005 and 2006, finding that the system led to 3.1% lower emissions. Following Ellerman and Buchener's approach, Egenhofer et al. (2011) further measure the ETS in 2008-2009, suggesting that the system had a stronger abating effect than in 2005-2006. However, a report commissioned by the UK's Climate Change Committee indicates that by the time of reporting the overall abatement in the EU ETS was largely due to the impact of the economic recession (Cambridge Econometrics 2009). A similar conclusion can also be found in Bel and Joseph (2015). Meanwhile, New Carbon Finance (2009) reports that 40% of the abated emissions in 2008 were attributed to the EU ETS while more than 30% were caused by the decline of industrial output.

With a dynamic panel data model, Anderson and Di Maria (2011) find that during Phase 1, emissions abatement and overallocation of allowances coexisted in the EU ETS. The system abated around 245 million tons of Carbon Dioxide (CO2) but also had 280 million surplus allowances. Case studies on selected key member states also suggest a positive effect of the ETS. Research by Ellerman and Feilhauer (2008) estimates that the ETS in Phase 1 resulted in 121.9 million tons of upper boundary carbon abatement and 13.2 million tons of lower boundary abatement in Germany. The UK power sector also benefited from the system. With the motivation for fuel-switching, the ETS resulted in between 13-21 million tons abatement in 2005 and 14-21 million tons in 2006 (McGuinness and Ellerman 2008).

An ex-ante study by Hu et al. (2015) evaluates the abatement potential of the EU ETS during 2013-2030 with a revised LRF and price adjustment measures, suggesting that the system could lead to around 5,560 million tons reduction including the aviation sector, and 524 million additional reduction if with an enhanced LRF or MSR. But it also argues that the abatement effect can only emerge from 2023 given the sizeable surplus in the market. Since the EU

introduced the MSR and further tightened up the system stringency, more studies have been devoted to the evaluation of those reforms. Richstein et al. (2015) and Perino and Willner (2016) find that without the competence of invalidating allowances, the MSR can only influence the carbon price temporarily. Bocklet et al. (2019) develop a discrete-time model taking into consideration the recent reforming measures in the EU ETS, finding that an increased LRF would have a greater influence on the price than other reform measures. With an analytically tractable simulation model, Perino and Willner (2017) argue that the enhanced LRF and the MSR would have a similar effect on the price during Phase 4 only with different time horizons.

The abatement of the EU ETS at the beginning was largely achieved through fuel-switching between coal and gas. Delarue, Voorspools and D'haeseleer (2008) find that the EU ETS motivated the power sector to switch from coal to gas, resulting in around 88 million tons abatement in Phase 1 and was estimated to achieve up to 300 million tons annual abatement in Phase 2 if with a sufficiently high carbon price. A key factor influencing fuel-switching is the price differential of different fuels. The fluctuations of fuel prices thus would have an impact on the ETS. Aatola, Ollikainen and Toppinen (2013) and Lutz, Pigorsch and Rotfuß (2013)'s studies suggest that fuel prices consist of a key variable determining the EU carbon price. However, as the coal market is less integrated than oil and gas markets, the power sector could face different coal prices in their decision-making, which further complicates the assessment of fuel-switching (Hintermann, Peterson and Rickels 2016). Declercq, Delarue and William (2010) find that the decrease in gas prices during the economic recession resulted in around 17 million tons abatement in the ETS. In addition to fossil fuels, renewable energies also have an impact on the EU carbon price (e.g. Koch et al. 2014; Rickels et al. 2015).

With respect to China, evaluations are devoted to either regional pilots or the upcoming national market. As China launched its regional experiment in a short time, there are only a few ex-ante evaluations on selected pilots (Liang et al. 2014; Wang et al. 2014; Cheng et al. 2015). Despite some drawbacks on the economic facet, the regional pilots have achieved a satisfying performance on climate mitigation with a high compliance rate and reduced carbon intensity (Zhang 2015). Yi et al. (2018) develop a comprehensive evaluating model to assess the maturity of the regional pilots, in which they further sub-categorise the environmental performance of the ETS into three

indexes: market coverage area, market performance and punishment intensity. They find that Shenzhen ranks the highest with Beijing in the second. Compared with the EU, although Parenteau and Cao (2016) assume that the slowing economic growth in China may provide a viable room for the ETS, few studies have investigated whether the carbon abatement in the regional pilots is a side effect of the economic slowdown, and the main focus is still on the economic fundamentals of the ETS.

The upcoming national market has attracted a growing number of ex-ante studies. With a simulation of an interprovincial emission reduction quota trading scheme, Zhou et al. (2013) estimate that a national ETS would help reduce the costs of carbon abatement by 40%. Zhang et al. (2013) and Cui et al. (2014) find that the national ETS will have varying impacts in different provinces, given the disparities of economic welfare and energy structures. In addition, Shi et al. (2013) and Cao et al. (2019) evaluate the potential benefits of a hybrid of emissions trading and carbon taxation, suggesting that such a policy combination would better abate emissions at lower costs.

2.2.2.2. Economic Performance

The economic performance refers to the market fundamentals of the ETS reflected in many aspects such as price formation, cost-effectiveness, market liquidity, financial attribute and the change of corporative behaviours. Emissions trading refers to the market-based instrument that limits GHG emissions by providing economic incentives for polluters to reduce emissions. Compared with the traditional command-and-control approach or a carbon tax, it could reduce GHG emissions at the lowest costs. The traditional command-and-control can mandate a limit on the emissions of polluters, but provide little flexibility as to how they reduce emissions. A carbon tax has the same drawback and also cannot guarantee that GHG emissions can be reduced to a certain level (European Commission 2015).

As opposed to them, emissions trading offers a way of reducing emissions by setting a cap on the emissions of polluters but allowing them to trade their emitting entitlement. A carbon price is thus set by the market through trading, and companies can determine what is the least-cost abatement option based on the price and their own circumstances (Austin 1999). The socio-economic costs and benefits of carbon abatement can be thus achieved at the most

cost-effective level as long as there exists a price of carbon emissions determined by the interplay of supply and demand in relation to industries' abating capacity (Hahn and Stavins 2011; Ervine 2018). In an ideal scenario the price signals the least costs of carbon abatement in real-time. A company that faces a higher cost to reduce emissions can buy allowances from the market to lower its compliance costs, or sell allowances if it faces a lower cost.

As a result, the carbon price constitutes the central element of the ETS, and price formation has been a primary focus in many assessment studies. Price formation is the most comprehensive criterion involving a variety of deterministic factors, including fuel prices, stock index, commodity index, electricity price and weather variations (e.g. Aatola, Ollikainen and Toppinen 2013; Lutz, Pigorsch and Rotfuß 2013; Koch et al. 2014). A cost-effective way to reduce emissions is to switch from polluting fuels to cleaner energies such as from coal to gas or to renewables. Energy prices thereby constitute a deterministic factor to the carbon price. Using cointegration techniques, Creti, Jouvet and Mignon (2012) reveal that the trends of fuel prices and carbon prices were correlated in the EU ETS but only during Phase 2. Lutz, Pigorsch and Rotfuß (2013) also find that the prices of coal and gas had a positive impact on the carbon price in certain price volatility regimes. On the contrary, Koch et al. (2014)'s research finds no clear-cut evidence suggesting that the carbon price reflects the dynamic of fuel-switching costs. A similar conclusion is also held by Aatola, Ollikainen and Toppinen (2013) and Fell, Hintermann and Vollebergh (2015).

As to renewables, Koch et al. (2014) provide strong evidence that the development of solar and wind power correlates with the decline of the EU carbon price. Rickles et al. (2015) find that different renewable energies may have varying impacts on the carbon price. Whereas no strong evidence suggests that wind power is associated with the carbon price trend, hydropower in Norway denotes a negative correlation with the carbon price. But they also add that the provision of hydropower heavily depends on the weather variations and regional interactions, which may have little implication to the price assessment.

With respect to the stock index and commodity index, research shows that economic activities have the closest correlation with the carbon price. Creti,

Jouvet and Mignon (2012) confirm that the stock index correlates to the carbon price trend since the economic recession from 2009. Through an examination of the economic sentiment index and the stock index, Koch et al. (2014) argue that the EU carbon price is very sensitive to the change of the expected economic conditions. Rickles et al. (2015) also capture the influence of economic activities on the EU carbon price by looking at the variables of the equity index and the oil price.

In addition to price formation, cost-effectiveness is another field concerned by evaluation studies. It denotes the advantage of the ETS to other mitigation policies that emissions trading can achieve the desired abatement goals at the least cost (European Commission 2003). Since installations face different abatement costs, the ETS could equalise their marginal costs through a viable price, and therefore achieve the overall abatement goal at the least cost. However, this economic fundamental can be distorted by free allocation. Arto et al. (2009) find that the grandfathering method did not take into consideration the early abatement efforts before the ETS, allocating more to those installations with greater abatement potentials. Anderson and Di Maria (2011) also observe a misallocation due to questionable baseline data combined with an overly optimistic economic projection, distorting the market and preserving the incentives of carbon abatement. Clo (2009) concludes that national governments assigned more allowances, and the overallocation among member states differed. As a result, the system lacked a level playing field for companies that distorted market competition and created undesirable economic consequences.

A key variable influencing the cost-effectiveness of the ETS is implementation costs. Wittneben (2009) criticises the ETS by pointing out the problem of rent-seeking and general administrative costs. By comparing with the carbon tax, he argues that the ETS bears excess costs from daily operations and rents for participants and intermediaries. A similar concern is also held by Schleich, J. and Betz (2009). Jaraitė, Convery and DI Maria (2010) find that in Ireland transaction costs are excessive for small participants, and the routine MRV costs are substantial for medium and small operators. A case study in Sweden across 114 firms by Sandoff and Schaad (2009) reveals that even in an infrequent trading scenario, it takes a firm averagely more than 26 man-hours for ETS compliance, while the system in practice has little motivation on the companies' abatement efforts.

With respect to China, ex-post evaluation studies find that the economic performance of regional pilots is not ideal. Through a framework of structure-conduct-performance, Tan and Wang (2017) find that the ETS pilots have common weaknesses in market liquidity, information diffusion and resilience to price volatility. Hu, Li and Tang (2017) also observe the problems of market illiquidity and price volatility in the Beijing pilot. Cong and Lo (2017) argue that the Shenzhen pilot is still immature, as the rate of return in the market is negatively associated with the expected risk which stands odds with the usual expectation in the financial market. Munnings et al. (2016) assess the performance of three regional pilots, identifying six common weaknesses: the lack of legal basis, the weak enforcement, a regulated electricity market, the dominance of state-owned enterprise, the paucity of information disclosure and the overlapping energy policies.

Fitting the economic fundamentals of the ETS into China's economic context is a key research focus of many studies, as China faces the imperatives of both climate mitigation and economic growth. Cheng and Zhang (2011) therefore suggest that China's ETS should be designed with a flexible cap at the present stage rather than an absolute one. Through a multi-region, multi-sector Computable General Equilibrium (CGE) model, Hübler et al. (2014) calculate the potential loss of the economic growth by the ETS, arguing that an intensity-based system would be more suitable to China.

Correlating to the intensity-based cap, Cong and Wei (2010) recommend an output-based allocation method to the power sector. Zhou et al. (2011) also suggest an output-based allocation method combined with ex-post adjustment for industries in the ETS. Through a simulation in the Hubei pilot, Wang, Jotzo and Qi (2018) argue that the ex-post cap adjustment could lower the abatement costs and minimise the influence of uncertainty, which is suitable for the upcoming national ETS.

As to cost-effectiveness, with a dynamic CGE model, Li and Lu (2015) recommend that a price range between 30-50 yuan would be ideal for China's ETS during 2016-2020. Lin et al. (2015) also suggest a similar price level between 35-45 yuan to protect the competitiveness of industries. Wang et al. (2014) develop a hybrid nonlinear grey-prediction and quota allocation model,

estimating that the costs of China's 40-45% intensity reduction target would be 180.6–194.2 billion yuan.

In order to achieve market efficiency and reduce the overall abatement costs, expanding the ETS coverage is suggested as an ideal way. Through an interval-fuzzy two-stage stochastic programming model, Li et al. (2011) argue that expanding the ETS to more sectors and participants would reduce the economic costs and bring more benefits. A similar argument is also held by Zhu et al. (2013) with an application of a full-infinite interval-stochastic mixed-integer programming method in the power sector in the Beijing pilot, and by Zhu et al. (2015) via a full-infinite fuzzy stochastic programming method.

2.2.3. Policy linkage

Research discussing potential policy linkage constitutes a marginal but unique strand in ETS studies. It incorporates a comparative lens and is built on the economic fundamental that linking carbon markets could further reduce abatement cost and limit the uncertainty of carbon leakage. Studies of ETS linkage are categorised into two groups here, with the first on the linkage among China's regional pilots, and the second on the linkage between the EU and China's ETSs.

Through a nonlinear programming model, Zhou et al. (2013) argue that an interprovincial ETS could reduce by over 40% abatement cost in China. By simulating the scenario in Hubei and Guangdong, Liu et al. (2015) also confirm that an interprovincial ETS is more cost-effective than separated systems, but adding that the linkage may result in social welfare inequality. Wang and Wang (2015) find that the interprovincial offsetting mechanism can reduce the equilibrium carbon price, which relieves the production losses caused by the emission constraint. Munnings et al. (2016) point out that the successful linkage requires careful alignment of system design features among regional pilots.

As to the EU-China linkage, bridging the ETS with others has potential benefits for China. With a simulation through a marginal abatement cost curve, Böhringer et al. (2014) estimate that China could even profit from its abatement effort if there exists an ETS regime under the Copenhagen

Accords. Zhang et al. (2015) use a CGE model to simulate a multi-region ETS scenario, finding that a multilateral ETS could promote the development of clean energy in China. By contrast, Hübler et al. (2014) indicate that an EU-China ETS linkage only creates a small benefit to China. Carbon Market Watch (2015) examines the compatibility of the EU's and China's ETSs, contending that there is little prospect for a system linkage in the near future, due to their different design features such as cap stringency, offset criteria and price management measures.

2.3. The Gap in the Existing ETS Knowledge

A review of the existing literature reveals an emerging gap. On one hand, the stories of the EU's and China's ETSs demonstrate that the ETS needs to evolve in reaction to the changing political-economic circumstance. As showed in Section 2.2.1, the EU ETS has gone through several rounds of reform to cope with various challenges. In China, the policymakers also design and adjust the ETS as they gained experience from the past and the regional trials. On the other hand, however, as showed in Section 2.2.2, prevalent research perspectives on the ETS are still static that either focuses on the design features or evaluates the potential impacts. There lacks a dynamic lens as to how the ETS continuously evolves adapting to the changing political-economic context, let alone a comparison on such dynamics in different jurisdictions.

Comparative ETS studies also have the same weakness (Stephan and Lane 2015; Narassimhan et al. 2018; Wettestad and Gulbrandsen 2018). They often attribute the ETS variations to the unique political-economic settings where they operate, but fail to note that the variations may converge or diverge as policymakers constantly adjust the systems to cope with different challenges. That is to say, while the differences are regarded as the variables that are determined by the different political, economic and institutional contexts, it is overlooked that both the ETS and the operational context are variables with a constant dynamic. It is thus of importance to include such dynamics into the comparison, as it maps out the development trajectories of the ETS in different jurisdictions, and answers the question in Wettestad and Gulbrandsen (2018: 5) why the ETS proliferation has seen both convergence and divergence.

While an existing knowledge gap has been identified, it still needs to search for a viable approach to address the gap. The next section will do this by inquiring the political fundamental of the ETS.

2.4. Theoretical Consideration to the Knowledge Gap

2.4.1. The Political Fundamental of the ETS

A comparison of the ETS reactions to different challenges requires an in-depth analysis of the political decision-making of the system. This logic is fundamentally determined by the nature of the ETS as a socio-political institution. The market-based climate policy presents a new type of governance that seeks to achieve a political target through market forces, bridging the domains of the state and the market. Since climate change is regarded as the largest market failure in human history (Stern 2006), the ETS offers a solution to address this failure by using market forces in turn, but the manoeuvre of the market forces is carried out by the state. This can be explained through both theoretical and empirical standpoints. Theoretically, it relates to the nature of the market and why a political perspective is essential in the study of a market. Empirically, it looks into the development of a global carbon economy and the role of the state in it.

The market originally only served as a subordinate branch of economics with the essence of "the making a price by haggling between buyers and sellers" (Condliffe 1950: 301). Then it started to embrace a broad definition and scope in human society (Polanyi 1957). Since the industrial revolution, the market has no longer been defined as merely a meeting place for truck, barter and trade, but as a self-regulating and self-containing system that consists solely of "changing prices and quantities to which individual economic actors respond" (Gilpin 2001: 38). The market economy implies an economy only directed by the price mechanism, in which individual producers and consumers make decisions based on the changes in relevant prices and market opportunities. The price, at least in the long-term and a pure universe of economics, is determined by the objective economic law of supply and demand, suggesting that any change of the relevant price of a good will create

an incentive or disincentive for an individual to acquire more or less of the good (Ibid.). Such a system is capable of reorganising the society without outside interference or help – which certainly deserves to be called self-regulating, and the next stage it brought in humankind's history is an attempt to set up a global self-regulating market (Polanyi 1957). The market economy, once established, tends to embrace every aspect of the society into the realm of market relations: it dissolves traditional structures and social relations, and through commercialisation brings every facet of traditional society into the orbit of the price mechanism – "everything has its price, and its value is its price" (Goldthorpe 1978: 194). Thus, instead of the economy being incorporated into social relations, social relations now are embedded in the economic systems. Once embedded, the market will force a reorganisation of the society into an economic and political sphere in order to make the market work properly (Polanyi 1957; Gilpin 1987).

Yet, although in a pure economic universe the market economy should be self-regulating and independent from outside interference, given the fact that the market constitutes a powerful source of social and political changes to the society and incorporates every facet of the society into its realm, the market itself is also a socio-political system that can be populated by a range of powerful actors. Therefore, whereas the market is studied by economists as an institution with impersonal economic factors, scholars in politics and sociology interpret it as a socio-political system that may influence and be influenced by powerful actors. They believe that social, political and economic institutions are all significant, as these institutions can determine, or at least affect, the incentives shaping the interactions between different groups as well as individuals in the market system (Strange 1994; Gilpin 2001). Of these institutions, the most important one is nation-states whose behaviours may have a powerful impact on the nature and functions of the market. The evolution of the state as a definitive form of political institution in Europe and latterly in the rest of the world is closely associated with the emergence of global capitalism; and while there are different forms of capitalist economic systems, they all heavily rely on political authorities to provide essential institutional and legal frameworks that the market cannot supply alone (Beeson 2006).

The state and the market are interdependent. On one hand, the state creates and enforces the property rights in order to sustain the market functions; on

the other the market helps accumulate capitals and create substantial sources of revenues that sustain the state (Schwartz 2000). Meanwhile, they both will make an impact on each other with untended results. In a modern market economy, the market forces constitute the sole institution that facilitates trade and enable the distribution and resource allocation in a society – or in the words of Adam Smith: the invisible hand. However, as the market can bring about a profound socio-political change to society, social institutions will also attempt to protect themselves against market forces or even to seize the opportunities to gain an advantageous position. To this end, it is undoubtedly that states will try to manipulate the market forces in their favour. In addition, the capacity of modern states in defining, allocating and enforcing property rights has also given it a distinctive source of market-shaping power that enables nation-states to influence the market (Campbell and Lindberg 1990). This tendency of the state even has been manifested before the emergence of the market economy as in the mercantilism: by liberalising trade through the extension of the scope of governmental regulation, nation-states tried to submerge the market as an accessory feature of the social authority for the purpose of augmenting state power at the expense of other states' power (John et al. 1915).

The discussion of the very nature of the market indicates a critical idea in ETS analysis: the political process is the precondition for a market to exist and function. The political forces consist of the basis of a market, providing essential institutional and legal frameworks that sustain the market. One could even argue that the market can never be depoliticised, as political actors are always involved in the regulation of the market. (Lederer 2012). The ETS in this regard presents a prominent example. Emissions trading can be comprehended as an attempt of the state to address a market failure by establishing another market. In this case, the state becomes the precondition for the carbon market in the first place. Voluntary carbon markets seem to be a counterexample, but this will be justified later. The understanding of the political process is thereby necessary for the ETS analysis, as it fundamentally determines the structure and functioning of the ETS.

The experience of the ETS also suggests that carbon markets are primarily political. Emissions trading is built on the expectation that by allowing the transactions of emitting entitlement, industries will seek to profit from tailored abatement strategies based on their own circumstances (Austin 1999). And

the profiting opportunity within the ETS will also flourish various trading intermediates and financers. The emergence of emissions trading thereby will create a burgeoning carbon economy that is inducted to the 'Climate Capitalism' (Newell and Paterson 2010). This carbon economy did not exist before the Kyoto Protocol, as carbon pollution was not attached with property rights. The story started from the CDM and the Joint Implementation (JI) in the Kyoto Protocol with the expectation that countries who faced international abatement obligations and higher reduction costs can offset their emissions more cheaply by investing decarbonisation projects in other countries (Grubb 2003).

The CDM and JI projects included renewable energy, energy efficiency and carbon capture. The operation of the mechanisms was highly complex, as projects needed to ensure that they can really reduce emissions. To do so, project designers were required to demonstrate what would be the emission scenario in the absence of the project, and how many emissions can be reduced through the project. In addition, they also needed to show that the project is financially dependent on the CDM or JI, and without the revenue from the CDM or JI market, the project will not be financially viable. All these procedures had to go through the designated national authority in relevant countries and the CDM office (Yamin 2005). While the highly complex procedure raised concerns over its efficiency and effectiveness, it ensured the credibility of the project. In the wake of the Kyoto markets, a variety of regional and national carbon markets were established that follow the same operational logic.

In these mandatory markets, carbon credits are the commodities as they can be priced, traded and hedged, and many profit-making strategies and secondary markets are also developed. In addition, the CDM could also serve as a linkage among different regional and national markets, making carbon credits in different countries comparable and thereby laying a basis for an international carbon market (ibid). For instance, the EU ETS was designed with a linkage to the CDM, which means that companies in the EU ETS were allowed to buy CDM credits to comply with their caps. The strict verification procedure of the CDM ensured that every offset credit traded to the EU ETS truly represented the reduction of emissions in other countries, and would not undermine the creditability of the EU ETS.

Contrary to the mandatory ETS, such as the CDM and the EU ETS, voluntary markets emerged as a bottom-up response to the need of climate mitigation. They had similar structures to the compliance one, but also with several different characteristics (Bayon, Hawn and Hamilton 2007). Projects in voluntary markets were usually verified by third-party firms rather than national designated authorities, which significantly lowered the transaction costs and time. In addition, buyers in voluntary markets were more concerned with the specific projects where their money was invested in. Their participation in carbon offsetting was primarily because they wished to use those projects to enhance their public image. So there was little space for a secondary market, as no corporate wanted to buy credits from a project that other firms had already used for public relations. Also, the various standards of regulation and verification made it difficult to trade credits across different markets (Newell and Paterson 2010). The market liquidity of voluntary markets was thus lower than the compliance markets. Last, as there was no mandatory obligation, participation in voluntary markets depended solely on the willingness of the firms. The stringency and effectiveness of the markets were thereby in doubt (Fahrenthold and Mufson 2007).

The voluntary markets had its doomsday in 2010 when the Chicago Climate Exchange was closed after 9 consecutive zero-transaction months. The failure highlights the fundamental difference between mandatory and voluntary carbon markets that companies can always exit from a voluntary ETS (Zhu 2017). A mandatory authority is thus vital for the survival and enforcement of the ETS. One should note that the ETS is not neutral like other markets, as it is deliberately built to address certain socio-political problems – climate change mitigation (Knox-Hayes 2010). To do so, the ETS has to be designed and implemented in coordination with the country's macro-climate strategy. Political institutions are therefore the foundation of the ETS, which justifies a political research perspective in ETS analysis.

2.4.2. Neoinstitutionalist Perspective as an Approach to ETS Comparison

Neoinstitutionalism has been a prevalent methodological approach in comparative socio-political studies, given its explanatory strength on the issues of why and how formal and informal mechanisms or certain

configurations of actors emerge and being apposite over time. It originates from the traditionalist organisational studies, combined with the modifications from Behaviouralist, contending that any given mechanism or institution is socially constructed and embedded in their institutional environments (Meyer and Scott 1983; March and Olsen 1984; Zucker 1988; Christensen and Molin 1995). The use of the term 'institution' in the name of Neoinstitutionalism refers to the idea that organisations or mechanisms that adopt certain structures or practices to fit their institutional contexts can be considered as 'institutionalised' (Meyer and Rowan 1977). Its explanatory strength is thus suitable for the analysis of this thesis, as it offers a view as to why a simple economic logic of trading emissions has been implemented so differently in the EU and China, and how their institutionalised ETSs have developed differently in reaction to the changing political-economic environment.

A key idea from Neoinstitutionalism is Historical Institutionalism and Path Dependence, which contends that the institutional legacies of the past constrain the current options in institutional innovation (Hausner, Jessop and Nielson 1995; Capoccia 2016). Institutions, as defined by Streeck and Thelen (2005: 9), are "distributional instruments laden with power implications". By selectively exposing relational actors to certain ideas or circumstances, institutions can change or shape their broader identities of interests and preferences (e.g. Granovetter 1985), and thus influence their decisions and behaviours in the future. Early historical political economists, back to Polanyi (1957), also argue that the formation and operation of the market are heavily guided by state regulations, suggesting that state institutions can effectively influence economic actors through the market. This logic underlines a coherence between a country's existing institutional context and its ETS practice, thus explaining the varying ETS practices in comparative studies. Through the lens of Historical Institutionalism and Path Dependence, it is expected that countries will develop their ETSs differently to conform to their unique political, economic and institutional circumstances, and that their ETSs will also react differently to analogous challenges.

While the Historical Institutionalism and Path Dependence highlight the coherence between a country’s past development pathway and current ETS practice, they do not answer the question why a certain type of ETS practice is compatible with the country’s existing institutional setting and prevail over others. Institutional Complementarity thus offers an explanatory view on this.

This theory is often used to account for the diversities of socio-economic systems by referring to the situations of the interdependence of institutions in different socio-political-economic facets (Hall and Soskice 2001; Hall and Gingerich 2009). The concept of complementarity was originally used in an economic sense, indicating a scenario that two goods are said to be complementary if a fall in the price of one will lead to a rise in the demand of the other. Aoki (1994) then extends this idea into socio-economic studies, contending that institutions are complementary when the enhancement of one will assist the provision of the other. Hall and Soskice (2001: 17) further extend this idea, suggesting that "two institutions can be said to be complementary if the presence (or efficiency) of one increases the returns from the other". The idea of Institutional Complementarity could also help explain the ETS diversities, as countries need to modify their system design to fit their institutional uniqueness and thus maximise the benefits and effectiveness of the policy. For instance, Schreifels et al. (2012) and Zhang (2015) find that emissions trading in China has been closely associated with administrative leverage to incentivise local governments and state-owned industries, which is clearly designed as a complementary advantage to China's political-economic system. Doubt-counting is another feature complementary to the institutional reality of China's controlled energy market (Munnings et al. 2016; Zeng et al. 2018).

As to the analytical vocabulary, Actor-Centred Institutionalism (ACI) provides a lens for the analysis of institutional changes. The ACI starts from the assumption that social phenomena should be understood as the outcome of the interactions among institutional actors. These interactions are structured and the outcomes are shaped by the characteristics of the institutional setting where they take place (Scharpf 1997; Aoki 2007; Mahoney and Thelen 2010). It provides an approach to the study on the problem of governance, especially in the fields related to state regulation and intervention (Boessen 2008). The ETS as a socio-economic system involves multiple stakeholders from government regulators, public and private actors. In this regard, the ACI offers a descriptive language to identify key actors, and to examine their orientations and capabilities within the system, their relations and interacting strategies, and how the broad institutional setting has constrained their behaviours (Scharpf 1997).

Through the ACI, a comparative institutional analysis understands institutional diversities as the consequence of the varieties of interactions among relational actors. This interacting process is influenced by various variables including actor characteristics, actor constellation and the broad institutional setting and policy environment (Scharpf 1997: 44). The actor characteristics refer to actors' orientations and capabilities. The orientations denote the preference and perception of the actor when dealing with a specific problem. Once a socio-economic problem is recognised, an actor needs to firstly perceive this problem in terms of the cause, the outcome associated and its related interests. Interests include the calculated reasoning of actors concerning the costs and benefits of the available courses of action (Jupille and Caporaso 1999), which will significantly determine their reacting preferences. In addition to material interests, non-material factors such as the actor's cultural and social role and norm-related identities will also affect its preference and perception (Scharpf 1997). Orientations are highly complex, as actors are constrained by their bounded rationality. With a theoretically rational choice prerequisite, actors are assumed to take optimal reactions based on the calculations of all relevant interests. However, in reality, since actors do not possess complete information regarding the problem as well as the responses of other actors, their orientations and actions are highly institutionally embedded, and it is common for them to change their preferences during the course (Eising 2000). While the orientations indicate an actor's position in terms of one problem and its solution, the capability presents its abilities to achieve its preference and position. It includes all action resources that allow an actor to affect the outcome in certain aspects and to a certain degree, such as material endowments, human capital, privileged access to information, technological resources and political power (Scharpf 1997).

In addition, actors are often situated in a complex actor-constellation. The actor-constellation is a static picture of actors' interrelationships, depicting how a set of actors have been institutionalised in a particular order that constrains their interacting strategies (Ostrom 2005; 2008; Mahoney and Thelen 2010). This order of interactions specifies how a problem will be recognised and resolved through a set of actors' interactions (Witte 2006). It codifies where and how the interactions happen among a group of relational actors. The constellations are framed by the broad institutional setting. Institutions used in the ACI approach includes both formal and informal meanings. The formal definition of institutions refers to those legally set

procedures that reflect official rules, while the informal includes non-verbal, non-official current practices developed by actors during their daily interactions, such as social norms and traditions (Scharpf 1997). Both formal and informal institutions constitute a broad institutional setting that frames a particular order of constellations and thus constrains the actors' interacting process.

In the ACI framework, institutions are treated as a dynamic process of institutionalisation that is constantly constructed by the strategic behaviours of actors (Jackson 2010). The institution as a representation of equilibrium is produced and repeatedly reproduced as an outcome of the strategic interplays among all relational actors (Aoki 2007). While pre-existing institutions constrain actors' cognition and behaviours, actors may also deviate or reinterpret these institutions to adapt to new circumstances. This shares a common agenda with the Historical Institutionalism that attempts to understand the dynamic process of co-constitution between actors and institutions in a given historical period (Jackson 2010). It suggests that both institutions and actors are constantly shaped by each other. Yet, one should be cautious about this viewpoint, as it may bring a great danger to treat both institutions and actors as constantly changing variables in empirical studies.

The benefit of viewing institutions as a dynamic process is that it shows how the previous interplays of actors have gradually produced existing institutions that are in line with all actors' expectations and interests. Institutions are not built overnight but are produced and reproduced by the interactions of actors over time. The historical understanding of institutions exhibits how the existing institutions have been established and reformed in a recursive or dialectical fashion to adapt to the broad institutional context they reside in. In comparative ETS analysis, this enables us to pay attention to the historical development of the ETS, which thus demonstrates how the institutional varieties have been forged by the different interacting processes of actors respectively. It describes how the ETSs have been established and repeatedly reformed in order to be complementary to the distinctive institutional settings and various political-economic challenges. By this means, we see institutions (the ETS in our case) evolving through trial-and-error with repeated reforms and modifications until they are made compatible with and complementary to the broad political, economic and institutional contexts. This enables us to firstly pay attention to the historical development and the existing institutional

settings of the ETSs so as to understand how they are formed and how they will react to different political-economic challenges over time.

Chapter 3
Methodology

3.1. Analytical Framework

Chapter 2 has identified the existing knowledge gap and reviewed several neoinstitutionalist ideas that may contribute to the analysis of the gap. But they are still rudimentary and unstructured that need further development. In this section, they are developed into a sound analytical framework that facilitates the research design of the thesis.

The existing knowledge gap is the absence of an analysis of the ETS development in reaction to the changing political-economic environment. This research seeks to fill this gap by presenting how the EU's and China's ETSs have evolved and reacted differently to similar political and economic challenges. The comparison could show how the respective institutional embedment has determined the abilities of the EU's and China's ETSs to cope with contextual disturbances. To do so, it requires an analytical framework to guide the analysis and comparison. The next three sections shall form such a framework by incorporating three theoretical insights: the resilience concept in socio-ecological research, the collective choice theory and the polycentric-monocentric governance continuum.

3.1.1. A Conceptual Framework of ETS Resilience

The resilience concept in socio-ecological research constitutes the first component of the ETS resilience framework. It sets a working definition to describe the ability of the ETS to cope with contextual disturbances and forms the basis for subsequent discussion. This will outline an overall picture of the process of approaching the knowledge gap and capturing the key variables and contexts in the research.

To this end, the ETS at first needs to be justified as a type of socio-ecological system. The concept of socio-ecological system initially emerged as an approach to those systems relating to both social and natural facets (Folke 2006; Young 2010; Aligica and Tarko 2014). The social facet refers to those human-made dimensions such as economic, political, cultural and technological institutions, whereas the natural facet refers to the layers of

planet earth such as the environmental and ecological systems. It has a broad spectrum that includes those social institutions that are established to govern human-environment relations, which are now commonly known as the environmental or resource regimes (Young 2010).

Similarly, the ETS also has the connectedness of social and ecological facets. The social facet denotes its human-made dimension which is designed as an artificial market to trade commodities that did not exist before. In this market, the commodities – carbon allowances are not real products but factitious goods created through a process of technical measurement. The scarcity of the commodities is not determined by the real production but by the decision of the governing authority. The natural facet refers to the purpose of the ETS – climate change mitigation in which the human society seeks to manage the limited capacity of the earth in absorbing the emissions produced by the society. In the Paris Agreement, this was further materialised in numerical terms: the consumable capacity of the earth in absorbing GHG emissions can only allow the average temperature to increase by 1.5 degrees Celsius by 2050. In this way, the ETS can be regarded as a type of socio-ecological system as it intends to govern limited natural resources through human-made institutions.

Socio-ecological systems once established are constantly facing a variety of disturbances in their operational contexts. Disturbances may happen in relation to either the ecological or the social aspect of the system, impeding its normal functions. The idea of resilience was thus introduced to feature the ability of the system to address those disturbances. The concept of resilience was initially developed in ecological studies in the 1960s as a critical approach to the then predominant single-equilibrium paradigm thoughts (Holling 1961; 1973; Rosenzweig 1971). It was soon proliferated to multiple disciplines, including psychological, social, economic, engineering and organisational studies. One of the most important strands in those resilience studies is the socio-ecological system resilience thinking.

A general definition of socio-ecological system resilience can be offered as the ability of a system to withstand disturbances and still maintain its vital functions (Holling 1961; 1973; Allenby and Fink 2000; Folke 2006; The Infrastructure Security Partnership 2006; Haimes 2009; Vugrin et al. 2010;

Pregenzer 2011; Aligica and Tarko 2014). Based on different research variables and contexts, many studies have sought to interpret this general definition via multiple conceptual frameworks. For instance, one of the initial resilience pilot studies by Holling (1973) emphasises the persistence of the system in the face of a disturbance. Drawing from the case of the Great Lake ecosystem, he argues that a homogeneous environment is less resilient to abrupt changes, whereas a heterogeneous structure may enhance its resilience. Folke (2006), against the common wisdom treating disturbances as negative events to the system, views disturbances as an opportunity for system innovation and renewal. This conceptualisation has a sharp contrast to the single-equilibrium paradigm that seeks to recover the ecosystem back to its original state after the disturbance. Instead, it adds a sense of adaptive dynamic to depict the developmental state of the ecosystem (a similar argument is also seen in Carpenter and Gunderson 2001). The critique of the single-equilibrium paradigm can also be found in Manyena's (2006) work, which conceptualises resilience as a process in which the ecosystem not only recovers from but also adapts to the environmental shocks without altering its fundamentals. Other conceptualisation works that hold a dynamic and adaptive perspective on resilience can be seen in O'Neil (1999), Walker et al. (2004) and Smit and Wandel (2006).

Socio-ecological resilience focuses on both the robustness and adaptability of the system. Robustness indicates the system’s buffer capacity to the disturbance, which can be understood as the amount of disturbance that can be absorbed by the system that allows the system to function within the current state (Folke 2006). Adaptability refers to the system’s ability to learn and adapt to the changing environment after disturbance. It suggests that disturbances are unavoidable and the system needs to prepare for them and learn how to live with them (Carpenter and Gunderson 2001; Berkes et al. 2003). To cope with the effect of the disturbance and sustain its functions, a resilient system should not only absorb the impact but also improve itself to adapt to the changing environment. It can either adjust the existing configuration or introduce new components to improve adaptability. But this does not mean that the system can always innovate or transform into a new more desired state. As each disturbance and its effect are unique, it is difficult to predict how the system would react (Paine et al. 1998; O’Neill 1999). This is also the reason why the resilience approach has been developed as opposed to the engineering resilience view, and indicates that there exists a multi-equilibrium

state (Folke 2006). In this way, disturbances are considered as not merely a challenge, but also an opportunity for the renewal and transformation of the system (Gunderson and Holling 2002; Walker et al. 2004).

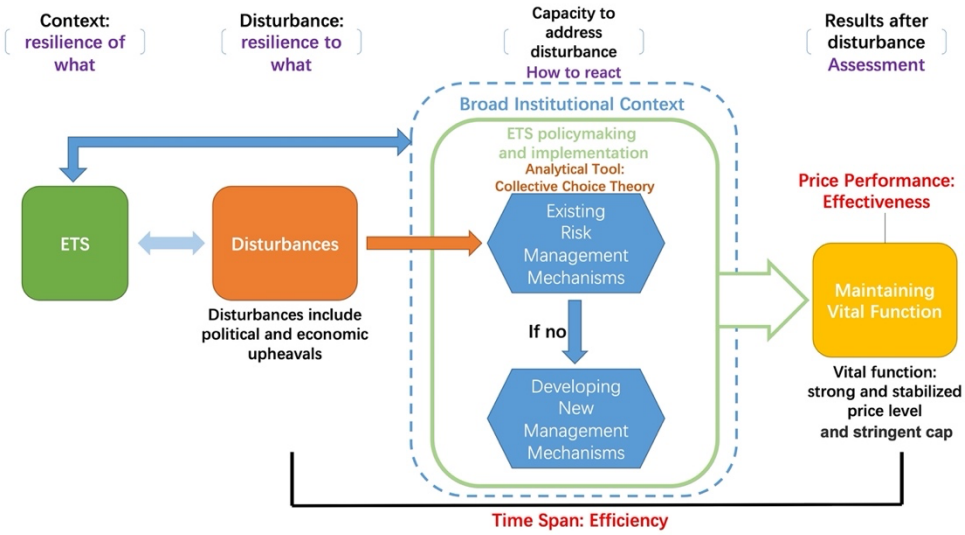
Resilience research usually has two perspectives. The first is a temporal perspective that divides the entire case into several procedural stages. For instance, Zhang (2006) and Mayunga (2007) divide a resilience study into four stages: (1) pre-disaster; (2) disaster; (3) restoration; and (4) long-term recovery. In the work of the Resilience Alliance (2010), resilience is conceptualised through five key procedural elements to offer an operational framework for assessment: (1) defining the focal system; (2) system dynamics; (3) cross-scale interactions; (4) governance systems; and (5) acting on the assessment. The UK's Department for International Development (DFID 2011) also defines four common elements of a resilience concept through the same reasoning: (1) context; (2) disturbance; (3) capacity; and (4) reaction. In the study of community resilience to the earthquake in Pakistan, Ainuddin and Routary (2012) propose a framework consisting of four steps: (1) identifying disaster characteristics; (2) determining community vulnerability; (3) raising risk awareness and preparedness; and (4) improving social and economic resources.

The second is a focal point on the key capitals or factors determining the resilient capacity of the system/community, relating to the question of how the system/community has addressed the impact. For instance, in the research of community resilience to disasters, Mayunga (2007) recognises five capitals determining the level of resilience: (1) social; (2) economic; (3) human; (4) physical; and (5) natural capitals. Berkes (2007) concludes four components that are important to system resilience: (1) the acknowledgement that uncertainty is inevitable; (2) diversity is important for system resilience; (3) learning different types of knowledge can facilitate resilience; and (4) the ability to renew and reorganise itself is essential for system resilience. Ostrom (2009) defines four constituent elements in the resilience of self-organised resource regimes: (1) resource systems; (2) resource unit; (3) users; and (4) governance systems. Biggs, Schluter and Schoon (2015) identify seven principles that can facilitate the building of system resilience in the face of changes: (1) maintaining diversity and redundancy; (2) managing connectivity; (3) managing slow variables and feedbacks; (4) fostering complex adaptive

systems thinking; (5) encouraging learning; (6) broadening participation; and (7) promoting polycentric governance systems.

The conceptualisation of ETS resilience in this research also follows the above reasoning by firstly setting up a procedural frame that identifies the key research stages and properties, and then by further looking into the key capitals and factors determining the resilience capacity of the ETS. First of all, adapted from the general definitions in many socio-ecological resilience studies (e.g. Holling 1961; 1973; Allenby and Fink 2000; Folke 2006; The Infrastructure Security Partnership 2006; Haimes 2009; Vugrin et al. 2010; Pregenzer 2011; Aligica and Tarko 2014), ETS resilience can be conceptualised as the ability of an ETS to withstand disturbance in order to maintain its vital functions.

Figure 3.1 ETS Resilience Framework



Drawing lessons from the research by the Resilience Alliance (2010) and the DFID (2011), the ETS resilience framework can be constructed through the strategic questions of (1) resilience of what, (2) resilience to what, (3) how the system has reacted and (4) is the system resilience or not. By answering those questions, it identifies four key research properties in relation to the ETS resilience framework: (1) context; (2) disturbance; (3) capacity; and (4) result.

The first question denotes the subject of resilience correlating to the property of 'context'. In a general resilience definition, it could be an ecological system, a social community or an economic-political organisation. A thorough description of the context is crucial to the assessment of ETS resilience, as it provides a detailed comparison of the conditions before, during and after the disturbance, and also maps out the broad social, political and economic settings that constrain the resilient capacity of the system (Adger et al. 2002; Ostrom 2009). Therefore, in ETS resilience, the context indicates the ETS and the broad institutional settings it operates in.

The second question denotes the object of resilience correlating to the property of 'disturbance' that refers to the sudden changes external to the system. The types of disturbances may vary based on different scenarios. As a socio-ecological system, the ETS can be impacted by not only natural disasters but also social, political and economic upheavals. Sometimes, disturbances could also trigger a chain reaction that finally impacts the ETS. For instance, the 2011 Fukushima earthquake caused a significant nuclear disaster in Japan. The natural catastrophe had a profound impact on the country's energy system, as nuclear plants were shut down due to security concerns. As a consequence, the country experienced a severe electricity shortfall, and had to increase its consumption of fossil fuels (McCurry 2015; Kimura and Nishio 2015; Taghizadeh-Hesary, Yoshino and Rasoulinezhad 2017). The earthquake also indirectly affected the ETS in Japan. The policy reactions of the government after the earthquake blunted the Tokyo ETS. The electricity shortfall forced the government to introduce mandatory energy efficiency policies. As a result, the 2011 electricity demand reduced by more than 15% to the 2010 level, undermining the ETS functioning (Kaneko 2014; Wakabayashi and Kimura 2018). The work on a nationwide ETS was also stalled because of the energy crisis (Kaneko 2014; McGarrity 2014).

The third question relates to the property of 'capacity' that indicates the system's ability to address the impact of the disturbance. It requires two layers of examination. The first is to what extent the system has been affected by the disturbance, which is measured through the degrees of exposure and sensitivity. The second is how many resources and assets can be mobilised by the system to address the disturbance, which is the focal point of many resilience research.

The last question relates to the property of ‘result’, which refers to the assessment of resilience. The result indicates the eventual outcomes of the interactions between the system and the disturbance. It may have different results ranging from the best scenario – bouncing back better to the worst scenario in which the system collapses.

The assessment of resilience constitutes the most important part of the research. Resilience has been regarded as a positive feature of the system, because it could maintain the vital functions of the system despite fluctuations in the system or the system’s operational environment. Thereby, to assess how resilient is an ETS, we must at the outset define what are the desired functions of the ETS that we seek to preserve when facing disturbances. The mechanism of the ETS is to reduce emissions by firstly setting a cap of emissions in certain industries, and then by commoditising those emissions to achieve the reduction target most cost-effectively. In this process, it has two functions vital for its effect: the function to set a stringent emission cap and the function to sustain a stable, appropriate price to incentivise emission reduction at the most cost-effective level.

Setting a stringent cap is vital, as it concerns the very purpose of the ETS: reducing emissions. A key advantage of emissions trading to carbon taxation is that it can provide a definite policy outcome. By setting a cap (either absolute or intensity-based), the government ensures that there exists a minimum level of emission reduction effect of the policy. Sustaining a stable, appropriate price is also vital, as it concerns another advantage of emissions trading: abating emissions at the most cost-effective level. In theory, the carbon price should be flexible in the ETS since it is the resultant form of the interplay of market supply and demand. The changing price thus reflects the dynamics of emission abatement costs, which is more cost-effective than a fixed carbon tax. However, the experience of the EU ETS after 2010 has shown that this price flexibility also exposed the ETS to the risk of price volatility and policy failure. Thereby, the ETS price should not merely reflect the abatement cost, but also provide a price signal to industries for low-carbon investment (Boute and Zhang 2019). From this point of view, it is argued that the ETS should provide price stability and predictability so that industries can

make medium- and long-term investment strategies (Bailey, Gouldson and Newell 2010; Grubb 2012).

In short, a resilient ETS can maintain its functions of providing a stringent cap and a sufficiently strong, stable price despite fluctuations in the system or its environment. Moreover, as aforementioned, a key conceptual development of socio-ecological resilience is the emphasis on the adaptive capacity of the system. Rather than being persistent to the impact of disturbances, a resilient system should also be adaptive to the changing circumstance and take the opportunity to transform into a new more desired state. It can improve its adaptability by either adjusting the existing configuration or introducing new components.

Therefore, the ETS resilient research should contain two possible scenarios, corresponding to the robust and adaptive features of a resilient system. First, if the ETS is sufficiently robust, its existing configuration could ensure that the disturbance makes little impact on the system's vital functions. Second, if the impact of disturbance exceeds the system's absorptive capacity and paralyses its vital functions, a resilient ETS should soon adapt to the new environment and restore the functions to the pre-disruption or a new desired state. To further materialise the assessment of ETS resilience, this research proposes two measuring dimensions: effectiveness and efficiency. Effectiveness refers to the performance of the ETS's vital functions before and after the disturbance. In the first scenario, it indicates whether the ETS is sufficiently robust that the vital functions of the system are not affected significantly by the disturbance (Bocquillon and Maltby 2017). In the second scenario, it indicates to what extent the system has been affected by the disturbance and whether the system has successfully bounced back to equilibrium. Efficiency denotes how long in the second scenario the system could successfully restore to the pre-disruption or a new desired state after the disturbance. The two dimensions together offer criteria for the assessment of ETS resilience in terms of the system's robustness and adaptability to the disturbance.

As explained, a stringent cap and price stability are the key functions that a resilient ETS is capable of maintaining or restoring in the face disturbances. But what are the determinants of this capability? This requires an examination

of the political economy realm of the ETS. As argued by Adger et al. (2002) and Ostrom (2009), the resilience of a system must be seen within the context of the broad social, political and economic settings. The ETS is a type of expression of the power relations rooted in the government's consideration of socio-economic development and climate mitigation. Ervine (2017) contends that three typical design features have been the main contributors to the global phenomenon of low carbon prices: the loose emissions caps, the inclusion of carbon offsets and the allocation of free allowances to heavy polluters. Those features have interacted with each other and with the events external to the system, which have resulted in the low prices of carbon markets in the last decade. The market design of the ETS globally has been highly politicised, as their regulatory frameworks have institutionalised mechanisms preventing the emergence of higher carbon prices indispensable in achieving the emission reduction targets (ibid). Therefore, instead of being a free market that allows the supply-demand relations to discover the correct price of carbon abatement, the ETS by far has largely been circumscribed by the entrenched power structures in relation to the government's political-economic consideration and interests.

Newell and Paterson (2010) regard the ETS as a type of climate capitalism by which the power of financial capital seeks to address the problems associated with the rise of finance. It represents a solution to the problem caused by the accumulation of a financially led regime while simultaneously providing a new round of opportunity for this accumulation. In this way, the development of the ETS, as argued by Paterson (2010), signifies a recurrent tension within capitalism between accumulation and legitimation. The logic is that while the search for a climate policy to reduce GHG emissions is based on the motivation of political rightness and legitimacy, the specific solution developed as a cost-effective strategy in reality is another round of opportunity for capital accumulation. From this point of view, the ETS can be regarded as a policy by which the government seeks to reconcile the interests of climate mitigation (legitimation) and economic growth (accumulation). That is, the ETS cap and price are determined by the political economy of the ETS nested in the government's effort of crafting a subtle balance between the two considerations. Therefore, to understand why an ETS is resilient or not to a certain disturbance, we need to look into the impact of the disturbance on the government's climate-economic consideration and the broad political

economy setting of the ETS. The next section offers an analytical lens to this process.

3.1.2. Collective Choice: An Analytical Perspective to the ETS Decision-making

While the concept of resilience defines the ability of the ETS to cope with contextual disturbances, and identifies key research properties in this process, it does not include a descriptive language as to how the ETS will react to the disturbance. Based on the neoinstitutionalist approach, this section proposes the collective choice theory as a tool to set forth the process of how the ETS decides its reacting strategy to the disturbance.

To understand the rationale, it needs to first look at the social facet of the ETS. As a socio-ecological system, the ETS touches one of the most basic spheres in humanity studies – institution. The ETS itself is an institution – a set of rules devised to administrate those human activities involving carbon emissions (the definitions of institution see North 1990; Hassenforder and Barone 2018). More importantly, as a newly devised institution, the ETS is still in a constantly evolving process at both spatial and temporal scales. Spatially, the last decade has witnessed the ETS proliferation globally. Contrary to the common wisdom that policy proliferation would result in convergence of policies and practices, the ETS development has shown more divergence as they need to fit the unique national context and institutional constrains (Narassimhan et al. 2018; Wettestad and Gulbrandsen 2018). Temporally, the ETS has to evolve to cope with various new challenges. This is particularly evident in the EU ETS, where the legislation has been repeatedly improved to fit the changing circumstance (Wettestad 2009; 2014; Skjarseth 2010).

To analyse the institutional change and diversity of the ETS, the collective choice theory serves as an appropriate approach (Libecap 1989; Ostrom 2005; 2008; Mahoney and Thelen 2010). It has the theoretical alliance with the aforementioned neoinstitutionalist perspectives in Chapter 2.4. The theory interprets institutions as arenas where all actors acting on their interests compete for limited resources; and institutional change is thus regarded as a process in which all actors bargain, lobby, vote and compete to maximise their interests. It treats rules and contexts as key variables in determining the different outcomes of institutional change. Rules may have formal and

informal types. They shape the types of actors within the institution and the strategies that actors are likely to pursue (Ostrom 2005). Institutional change is often initiated by those losing actors under the existing institution, and ended in the form of rule replacement (Mahoney and Thelen 2010). Context portrays those factors and circumstances that determine the interacting process among actors, such as power asymmetries, elite capture, policy coalitions and veto players (Sabatier 1999; Tsebelis 2002; Ribot 2006; Mahoney and Thelen 2010).

Following the approach of Ostrom's (2005), the collective choice theory has two basic variables in its analysis: participants and an action arena. When confronted with exogenous changes, they interact with each other and yield outcomes that in turn affect themselves. The action arena represents those rules and contextual factors shaping actors and their strategies, which situates in a multi-layer nested hierarchy of arenas. Namely, the action arena, while constraining actors, is also subject to a higher set of rules. Rules are crucial not only because they constrain actors and their strategies, but also because they define the preconditions for institutional change. In the collective choice theory, an institutional change occurs when there exists a minimum coalition of actors that agree to change (Libecap 1989; Ostrom 2005). The minimum does not denote a majority of quantity but a majority of power. Actors may have unequal power in different action arenas that are predefined by the higher set of rules. For instance, in a circumstance where power is distributed unequally such as the dictatorship, a dictating actor can solely constitute a minimum coalition for institutional change, whereas in a highly dispersed circumstance such as the democracy, a coalition may require many actors.

The collective choice theory has its analytical potential in the ETS decision-making in response to the disturbance. Following its logic, this research interprets an ETS as an arena where stakeholders compete to maximise their interests relative to emissions trading and carbon abatement. It thus understands ETS decision-making as the outcome of several rounds of competing and negotiating among stakeholders. When confronted with a disturbance, each stakeholder will calculate their expected costs and benefits, and then decides their strategies to the ETS decision-making. The arena context will process the input and decide whether a minimum coalition is reached to initiate an institutional change. This context is predefined by the higher set of rules, which is usually the broad political context of the ETS.

Moreover, the spatial diversity of the ETS in different jurisdictions can be understood as the consequence of their different rules and contexts. By doing so, it provides a systematic account as to how the ETS will decide its strategy in response to an external disturbance, and why ETSs may have different reacting strategies to similar disturbances.

3.1.3. A Comparative Continuum to the ETS Decision-making

As demonstrated in the last section, the institutional context and rules constitute crucial variables in the collective choice analysis and the ETS resilience framework, as they define stakeholders' interests and strategies in reaction to the disturbance. However, how to depict the institutional context and rules of an ETS? This question becomes even more difficult along with the global proliferation of the ETS. In the last decade, many countries and regions have established ETSs. While some operate in the context with a mature market and a transparent political system, some are with a relatively immature market and a centralised political system. The divergence of domestic conditions and practices highlights the importance of a continuum to depict the institutional context and rules of the ETS in different jurisdictions. Such a continuum is not only important to this research, but may also to future comparative ETS studies. This section is to tackle this difficulty by proposing a polycentric-monocentric continuum to describe the different institutional contexts and rules of the ETSs globally.

The concept of polycentricity was firstly formulated by Michael Polanyi (1951) to describe the social organisational structure in which individual actors are free to propose their objectives independently under a general set of rules. In a polycentric system, there is no single unitary power; instead, all actors are independent decision-making centres acting on their own interests within a specific domain. The overlap, redundancy and duplication of responsibility and functions will not lead to inefficient and fragmented chaos, but will open an opportunity for a constantly trial-and-error evolutionary process towards the optimal practice (Polanyi 1951; Jordan et al. 2014; Carlisle and Gruby 2017). This idea was soon diffused to governance studies to describe the governance structure where coexist multiple governing authorities at different scales. Each authority can independently exercise its functions and responsibility within its own realm. Actors in a polycentric system are not only restricted to formal governmental units, but can derive from public, private and voluntary sectors

even if they are not formally assigned with public roles (Aligica and Tarko 2012; McGinnis and Ostrom 2012; Jordan et al. 2014). A typical example of polycentricity in the field of climate governance is the ETS proliferation at multiple scales outside the United Nations Framework Convention on Climate Change (UNFCCC). The proliferation is initiated by various authorities with similar goals loosely guided by the climate regime of the UNFCCC (Paterson et al. 2013).

Monocentricity constitutes the logical opposite of polycentricity. Inferred from the definition of polycentricity, monocentricity can be defined as the system where the power of determining and enforcing the rules is vested in a single unitary actor (Aligica and Tarko 2012; Jordan et al. 2014). Contrary to polycentricity, monocentricity sees the overlapping functions and activities of actors as incoherent and a misallocation of resources. To avoid chaos and fragmentation, governance should be centralised to a single authority in order to reach the optimum state.

Polycentricity and monocentricity present two types of antagonistic logic in terms of their interpretations on the dispersion of authority and overlapping functions. Polycentricity allows the coexistence of various ideas and methods applied at different levels by multiple actors. It considers this a positive competition among various solutions to a governance problem. Ostrom (2005) contends that polycentricity has better institutional resilience to new social-environmental challenges. In a hierarchical system, because of the high information transaction costs and impossible monitoring over the duty enforcement of higher authorities, responses to new problems are usually ineffective and time-consuming. However, in a polycentric system, this can be solved by multiple self-governance units with various means at different levels, which provides an overall optimal solution (Aligica and Tarko 2014). Better solutions can be found more efficiently through the experiments of various actors and soon learned by others. The institutional diversity and the emphasis on the social experimentation of various ideas and methods, in Ostrom's thought, strengthen the system's ability to cope with new social-environmental problems, therefore enhancing the system's resilience. To its contrary, monocentricity sees the dispersion of authority and duplication of functions as "generating something described as chaotic" (Aligica and Tarko 2014: 244). The governance in which the authority is centralised to a single power should be more efficient.

While the comparison of the two models has been a central topic in governance studies (e.g. Lankford and Hepworth 2010; Wegerich et al. 2012; Aligica and Tarko 2014; Klok et al. 2018), this thesis has no attempt to assert which one is superior. Rather, by constructing a polycentric-monocentric paradigm, it seeks to establish a horizontal continuum with polycentricity on one end and monocentricity on the other. By doing so, the continuum can be used to indicate the degree of authority dispersion in ETS decision-making. Every ETS can find itself situated somewhere in the continuum. When the ETS is close to the polycentric end, it denotes that the decision-making authority is more decentralised with multiple actors that can influence the decision-making process. In this circumstance, in order to initiate an institutional change, a winning coalition would require a large number of actors. On the contrary, if it is close to the monocentric end, then the ETS is more centralised where the vast power has been centralised to a single unit that can solely influence the decision-making. This paradigm enables us to include the global diversified ETSs into a single continuum based on their degrees of authority dispersion. For instance, while the EU ETS can be regarded as a model close to the polycentric end given its high degree of authority dispersion of decision-making, China's ETS falls into the monocentric end due to its centralised political system and bureaucratic traditions (a full explanation of the rationale is in Chapter 4.1 and Chapter 6.1).

The continuum underpins the collective choice approach by describing the contextual arena for actors' interactions. It outlines the contextual rules that constrain the interactions of stakeholders in the ETS decision-making in response to the disturbance. In a polycentric structure, the high degree of authority dispersion would allow different actors and interests to lobby, bargain and compete to influence the decision-making. By contrast in a monocentric-like model, the interactions of actors will be more hierarchical because of the highly vested authority within limited actors.

3.1.4. A Summary of the ETS Resilience Analytical Framework

The three theoretical components together constitute an analytical framework of ETS resilience that facilitates the research design. Based on the concept of resilience in socio-ecological studies, it firstly conceptualises ETS resilience as the ability of the ETS to cope with contextual disturbances. This provides

an overarching framework that identifies key research properties and assessing criteria. Then the collective choice theory serves to understand the process of ETS decision-making in response to the disturbance. The collective choice theory has its theoretical alliance with the neoinstitutionalist perspectives in Chapter 2.4 that considers institutional contexts as key variables that shape the strategies of relational actors and influence the overall institutional behaviours. It interprets institutional changes as the consequence of a series of interactions between actors and the institutional arenas they situate in. Then, to fit a comparative frame, a polycentric-monocentric continuum is introduced to depict the variety of contextual characteristics of ETS decision-making, underpinning the collective choice analysis.

The ETS resilience analytical framework thereby informs the research design of the thesis. First, it needs to map out the key disturbances and their impacts on the EU's and China's ETSs, and to define the contextual characteristics of their ETS decision-making. Second, it can conduct the analysis by processing relational actors' strategies and their contextual rules through the perspective of the collective choice theory. Third, with the analysis, the resilience of the EU's and China's ETSs to contextual disturbances can be assessed based on the criteria of effectiveness and efficiency through the comparison of ETS vital functions before and after the disturbance. Last, a discussion can be then invited based on the analysis and comparison of resilience between the EU's and China's ETSs.

3.2. Research Design

Given the analytical framework, a comparative multi-case study based on a qualitative method is the most appropriate approach to the research. This thesis is not concerned with the statistical performance of the ETS in carbon abatement or market efficiency, but intends to understand how the varying institutional embedment has constrained the abilities of the ETSs to address different contextual disturbances. As explained in the last section, this requires an in-depth analysis of the political decision-making of the ETS through the interactions between policy stakeholders and the institutional settings where they situate. A multi-case comparison based on qualitative data from a

systematic literature review and stakeholder interviews thereby presents the best research design option.

3.2.1. The Multi-Case Comparative Approach

Comparative case studies usually cover two or more cases to produce "generalised knowledge about causal questions – how and why particular programmes or policies work or fail to work" (Goodrick 2014: 1). It emphasises the comparison within and across contexts, and therefore facilitates the understanding of how different contextual features influence the policy initiatives. This methodological focus sits well with the research object that seeks to explore how the institutional embedment has constrained the ETS's resilience to external disturbances.

The case study approach has the advantage to produce pragmatic knowledge in social science research by situating the analysis and interpretations in the specific context of the research phenomenon, especially when the boundaries between the research phenomenon and contexts are not clear (Flyvbjerg 2001; 2006; Yin 2003). The comparative case approach, by incorporating the strength of contextual analysis of the case study, further includes the analysis and synthesis of the similarities, differences and patterns across two or more cases, examining how the contextual differences have influenced the success or failure of similar policy initiatives (Goodrick 2014). This line of reasoning therefore fits the methodological need of the thesis that seeks to explore how the contextual uniqueness of the EU and China has determined their ETS resilience to various disturbances, and, through comparison, to produce generalised knowledge of how the institutional embedment of the ETS determines its resilience.

The selection of the EU and China is based on the consideration that they are the key actors in global climate politics that both opted for the ETS but with distinctive institutional contexts. The EU as the frontrunner has experimented with the ETS for 15 years, and many of its experience has been considered as the generalised knowledge in this regard. By contrast, China's ETS has been a surprise to many experts given its uniqueness in the political and economic contexts especially when compared with the EU. The contextual differences between the EU and China thus informed a feasible basis for a comparative study.

Furthermore, the research chooses two cases on each side to form a multi-case comparison in order to analyse the argument within each context and also across different contexts, and to ensure that the conclusive knowledge is generalised and testable (Yin 2003). The political and economic disturbances selected are highly analogous, minimising the potentially confounding background variables (Lijphart 2016). With respect to the political disturbance, the research chooses the EU enlargement in 2004 and the ministerial reform of the Chinese government in 2018, both of which have significantly influenced the institutional settings of ETS decision-making. With respect to the economic disturbance, the economic recession from 2008 in the EU and the economic slowdown of China in recent years have presented similar challenges to the ETS by adding more economic consideration to the policy and the broad climate ambition.

While the selected cases are highly comparable, the differences in the developmental stages between the EU's and China's ETSs may constitute a methodological challenge. The EU ETS has been in place for more than 10 years with several rounds of reform. The system is highly developed with a mature market basis and a transparent decision-making process. With such a long operational period, many of the consequences and impacts of its policy reactions to the disturbances have already unfolded, providing substantial empirical evidence to the study. By contrast, in China the ETS has only been introduced for several years with its national system still in the trial phase, and there still lacks sufficient clarification on the rules of law and information disclosure. Moreover, the ministerial reform only happened in 2018 and the economic slowdown is still an ongoing phenomenon, which means that both the impacts and the government's reactions are still unclear at the moment. The materials and supporting evidence in China's ETS were thus less than in the EU ETS, which may lead to asymmetrical analysis in the thesis.

3.2.2. The Qualitative Research Method

A qualitative research strategy consisting of data from documentary materials and semi-structured stakeholder interviews is the most appropriate method for this study. Qualitative research is concerned with words rather than numbers. Epistemologically it serves as an interpretivist approach that stresses the understanding of the research phenomenon through the interpretation of that

world by participants. Ontologically it has a constructivist position that regards the social properties as the outcomes of the interactions between individuals rather than the world separated from those involved in its construction (Bryman 2012). Although quantitative research has been widely used in the ETS studies as exemplified in Chapter 2.2, the analysis of the politics of the ETS and its evolution requires a qualitative inquiry because they involve actions and thoughts of the individuals and institutions with their own values and beliefs. Those variables are not reflected in numbers and cannot be measured quantitively. The examination of them requires a qualitative insight on the particular contexts they situate through a constructivist view and by an interpretive approach.

Qualitative data in this study were collected from documentary materials and interview materials. The former includes primary and secondary sources such as legal documents, official reports and files, academic studies, publications from concerning actors, newspaper articles and websites. They were all collected in the original format. Official documents such as legal acts and governmental files were considered as the most valuable and influential materials as they represent official standpoints, whereas other interpretative secondary materials were collected and analysed with caution. Concerning China's part, as many government ministries and departments have released documents regarding the ETS, the supremacy of documents was ordered based on the ranking of the agencies in China's administrative hierarchy to fit the political tradition. Data from documentary materials not only served to pin down the key concepts and terms that helped to design the following interviews, but also directly provided empirical evidence to the analysis. As a climate policy, the understanding of the ETS is principally reflected in the legislative provisions and relevant official documents. Interpretations of those texts consisted of a key component of the analysis. Publications of the actors also assisted to construct a rough view of their standpoints, and thereby to structure the interviewing strategy beforehand. For some analysed events that drew much attention and lasted for a long time, documentary materials were rich and could be easily retrieved. But for other events, materials were difficult to collect as they have been rarely noted or addressed. Therefore, fieldwork interviews were necessary to provide additional information to the research.

Semi-structured interviews were conducted to provide primary data with also the aim of data triangulation. Qualitative interviews with actors involved in the

ETS policymaking and the research community offers a vital way of understanding the politics of the ETS (for a strategy of the qualitative interview in politics research e.g. Beamer 2002). While admittedly the opinions of the public are important to the climate policy and the ETS itself also involves many industries and companies, it is not the case in the ETS policymaking where there are only a few stakeholders have the actual influence. In the EU ETS, the policymaking, particularly after the reform in 2008 involves a group of actors in Brussels such as the EU legislative institutions and the representatives of NGOs and industries, whereas national governments, civil groups and industries at the member state level only influence the ETS policy via their representatives in Brussels. In China, the ETS is handled by a handful of government officials and experts, leaving little room for NGOs, industries and other civil groups. Despite some rumours that large state-owned enterprises may have the connection to the policymaking, they have been never confirmed by written records or interviews. The sampling scale of qualitative interviews thereby is sufficient to provide data for the analysis.

A total of 54 interviews were conducted during 2018 and 2019 with 50 individuals across the ETS community in Europe and China. The interviewees were sampled through a process of discovery in the field and the snowballing strategy. The researcher at first conferred with individuals engaging in the ETS or relevant topics to source an initial bank of interviewees, and then snowballed from those interviews to contact with more potential interviewees until a certain degree of data sufficient to the analysis. Among them, 33 interviews were conducted in a face-to-face manner, whereas 21 were conducted online due to the availability of the interviewer or interviewees. The online interviews were conducted via either Skype or WeChat. The face-to-face interviews were taken place in a variety of locations such as private offices and public spaces based on the interviewees' preference. They usually lasted around 1-2 hours. A rough guide was designed each time before the interview based on the interviewee's role, the organisation he/she belongs to and the information gap in the written materials; but the interviewees also had the freedom to express their opinions and bring up new topics. Given the changing circumstance of the ETS in China, the fieldwork lasted for around two years so that follow-up interviews and new interviews were arranged to gain additional information.

Table 3.1 Semi-Structured Interviews Conducted within the Study[3]

	EU	China	Total
Academic	5	7	12
Government	5	6	11
Independent Commentator	3	3	6
Industry	6	7	13
NGO	6	6	12
Total	25	29	54

(Note: follow-up interviews were counted again in the table; and interviews involved both sides were counted in only one side in the table)

Based on the interviewees' positions and their organisations in relation to the ETS, interviews are classified into five types covering a range of stakeholders involved in the EU's and China's ETSs. They are academic, government, NGO, industry and independent commentator. The sampling of interviewees ensured a roughly even distribution among the categories and between the EU and China. The categorisation was based on the consideration of the organisational background and positions of the interviewees. The category of academic refers to those interviewees who work in the ETS research community. They provided constructive ideas to the study and also critical thoughts for data triangulation. The category of government is interviewees who work in the government departments or government-funding research institutions and public organisations. In China, research institutes funded by the government are critical in ETS policymaking, as they provide policy advice and clarification. The categories of NGO and industry present two somewhat opposing standpoints, which together offered a comprehensive picture of realities to the ETS. The category of independent commentator served as a supplement to the interviews. Independent commentators are those who work as freelancers or in the press. Their work is closely related to the ETS but often from an outsider's position as they do not have the formal role

[3] A full list of interviews please see Appendix A

participating in the ETS policymaking. Their positions and opinions regarding the ETS and climate policy also vary, which thus enriched the interview data.

During each interview, the researcher reexplained the research to the interviewee, and reconfirmed the permission to the interview and recording at the beginning. A consent form was signed and kept confidential by the researcher. All but four interviews were recorded through audio-recording and transcribed verbatim afterwards. Four interviews were not recorded audibly but were allowed to make notes at the scene at the request of the interviewees.

To keep confidentiality, interviewees' anonymity was ensured by given code names, which took the form of a single excel spreadsheet containing participants' names, contact details and given code names. Recording, transcripts and data analysis were only stored and referred to using code names. The excel document and data were stored in the same device but in different file locations. Data of the same type were stored in the same folder. Different files in the same folder were named in a consistent pattern. The data collection and handling processes of the research followed a strict code of conduct approved by the University of Leeds Ethics Committee [Ethics Reference Number: AREA 17-079].

Funded by the Climate Research Bursary Fund from the Priestley International Centre for Climate in the University of Leeds, and by the Research Training and Support Grant in the School of Earth and Environment in the University of Leeds, the interviewer conducted 31 face-to-face interviews in Brussels, London, Beijing, Shanghai, Shenzhen and Hong Kong during May to June and September to December in 2018. A brief of the fieldwork was submitted at the request of the Climate Research Bursary Fund shortly after the trip. There is no conflict of interest between the subjects involved in the research and the funding institutions.

As this research constructs the stories of how the EU’s and China’s ETSs have responded to the changing political-economic environment, the narrative analysis was used as the primary data analytical strategy, which was supplemented by the critical discourse analysis (Fairclough 1995; 2003; Bryman 2012; Allen 2017). After collecting the narratives of interviewees and

the existing written records, the narrative analysis allowed the researcher to interpret the construction of those narratives and finally reconstruct the stories, while the critical discourse analysis facilitated the understanding of different discourses of climate politics between the EU and China.

Narrative analysis was the primary method as the information from interviews was mostly the accounts with a temporal sequence. The stories of the interviewees and their opinions on the disturbances thus reflected their contextual perceptions. By critically eliciting the interviewees' reconstructed accounts of the connections between events and contexts and by cross-checking with the accounts from other interviewees, the interviewer was able to reconstruct the stories of events without being implicated in a partial position (Coffey and Atkinson 1996; Miller 2000). Besides, critical discourse analysis which includes both linguistic and political dimensions was used as a supplementary method to further comprehend and examine the accounts of the interviewees (Fairclough 1995; Dryzek 2013). This was used to add more information to narrative analysis and also served as a way of triangulation.

All interview data were transcribed by the author. Concerning transcription, 29 interviews were conducted and coded in English, while 25 were in Chinese and then translated to English by the author due to the consideration of confidentiality. The translation of certain technical terms and keywords were cross-checked with substantial official documents and reports to ensure the accuracy of the translation. While the interviews with native speakers (both English and Chinese) were transcribed verbatim, the interviews with non-native speakers were processed through intelligent transcription to clean up grammar mistakes and non-subjective manner of speaking.

After transcription, all collected data were coded through a combination of deductive and inductive approaches in two rounds. In the first round of coding, guided by the ETS resilience framework developed in the research, the author started with a set of codes compatible with the framework but also simultaneously inductively came up with new codes when sifting through the data. In this process, the descriptive and structural coding tactics were used to identify the data based on the semi-structured interview questions for subsequent categorising.

After the first round of coding, all data were organised into different categories based on their concepts and relevance to the topics in the research. Four general categories were classified in this research corresponding to the four empirical cases. Then, all data were further grouped to 35 sub-categories based on their standpoints and relevance. The second round of coding was conducted to re-examine and re-organise the codes. In this phase, a combination of theoretical and content analysis coding was used to support the ETS resilience framework.

In addition, the critical discourse analysis strategy was used as a supplementary method. This was to examine how the language texts (both the spoken texts of the interviews and the existing written records) of the EU and China have reflected their different social, economic and political interpretations of climate politics and the ETS in particular. The discourse analysis was used by Lo (2016) arguing that China has justified the ETS by deconstructing and reconstructing the concept and aligning it with the power asymmetries of global carbon pricing and the country's development interests. This has underlined the importance of discourse analysis in comparative ETS studies, as it explained how the policy can be realised within distinctive political-economic embedment through linguistic and socio-cognitive reinterpretation (Fischer 2003; Carvalho 2005). As indicated in Chapter 2, the EU's and China's ETSs have shown different orientations due to their varying considerations and motivations behind. By critically reviewing their climate discourses (both the interview narratives and existing written records in this research), the research could further examine whether the differences of their textual or verbal expressions are rooted in their wider social, cultural and political structures (Fairclough 1995; 2003).

All the work of coding was conducted in the NVivo software provided by the University. After qualitative coding and analysis, all the codes and categories were used to construct the final narratives. They were structured and quoted in a temporal order to narrate the four stories of how the EU's and China's ETSs have reacted to the changing political-economic environment. After narratives, they were also quoted based on their categories in the analytical sections to support the arguments of each chapter.

3.2.3. Ensuring Research Quality

There are contentious discussions on the criteria of assessing qualitative research (e.g. Mason 1996; Flick 2006; Bryman 2013). The traditional approach deriving from the quantitative research convention has two criteria: reliability and validity (Bryman 2013). LeCompte and Goetz (1982) further elaborate them into four aspects: external reliability, internal reliability, internal validity and external validity. However, arguing that qualitative research should be evaluated according to different criteria, some scholars also develop alternative criteria. For instance, Lincoln and Guba (1985) and Guba and Lincoln (1994) propose two primary criteria for assessing qualitative research: trustworthiness and authenticity, each of which consists of several sub-criteria. They share some similarities with the traditional criteria of reliability and validity by LeCompte and Goetz (1982), but also with modifications fitting the qualitative realm. This research adopted the criteria of trustworthiness and authenticity. Efforts to meeting the criteria are as follows:

3.2.3.1. Trustworthiness

- Credibility:

Data triangulation was the strategy to ensure the credibility of the research. The findings from the systematic literature review and fieldwork interviews were frequently cross-checked with each other, ensuring data coherence from various sources. For instance, data collected from a single interview was triangulated not only with the pre-collected written records but also with those interviews that had relational information.

- Transferability:

The analytical framework of ETS resilience proposed in the research showed its transferability in the application of four case studies in the EU and China. In the thesis, the researcher provided many details of the conditions and the processes of applying such a framework in the empirical chapters across different case contexts. The readers thereby could assess whether the research framework and findings are transferable to their own settings.

- Dependability:

A strategy of audit trail was used to ensure that the findings of the research are consistent and repeatable. Supervision meetings throughout the research provided scrutiny to the research design and practices. In each research phase, the researcher reported his research decisions, preliminary findings, reflective thoughts during the fieldwork, analytical strategies and emergence of findings. This has ensured transparency and comprehensiveness of the research to auditors.

- Confirmability:

The researcher's positionality is an unavoidable factor in qualitative research, especially in the interpretative study where data are elicited from a process of interpersonal communication and then reproduced by the researcher into a certain account of social reality (Yanow 2000). My national background and prior knowledge are evident factors in the choice of the comparison between the EU and China. As a Chinese national, I started my study of the EU's environmental and climate policies since my postgraduate in the UK. The normative, cultural and other contextual differences of their practices on climate change and the ETSs informed my PhD project and this research topic from the very beginning. Besides, such a background has also facilitated me with a position of 'outsider' to both sides that allowed me a critical distance during data collection and analysis. But throughout the research my own positionality has never provided me with any practical privilege or advantageous opportunity. The audit trail also served as scrutiny to ensure research rigour and to avoid research bias.

3.2.3.2. Authenticity

- Fairness:

Throughout the research, the researcher interviewed with stakeholders from various sources with different positions and interests concerning the ETS. The sampling strategy ensured that interviewees were picked equally in terms of their organisational background. A strict code of data analysis ensured that their opinions were fairly reproduced and represented in the research.

Chapter 4
EU ETS Resilience to the EU Enlargement

This chapter presents an empirical case of the EU ETS's resilience to the impact of the EU enlargement in 2004. With the inclusion of eight Central and Eastern European Countries (CEECs) and two Mediterranean countries, the socio-economic disparities between new and old member states brought divergent views and priorities to the EU's climate policy. There were also compositional changes in the EU's institutional settings that could affect the decision-making dynamics of the EU ETS. It is thus of importance to investigate whether the enlargement has made an impact on the EU ETS and how the EU ETS has coped with the disturbance.

Following the ETS resilience framework, this chapter has four sections. The first section looks at the institutional settings of the EU ETS, and provides the rationale to interpret its decision-making structure as a polycentric model. By doing so, it describes the contextual arena and rules for the interactions of stakeholders to facilitate the following analysis. The second section defines the enlargement as a disturbance to the ETS through the discussions of its potential impacts. The third section proceeds with the analysis of resilience by examining the institutional and policy dynamics of the ETS after the enlargement. It firstly looks into the institutional dynamics of the EU legislative triumvirate, and then examines the performance and the policy changes of the ETS. The last section offers a summary to the case.

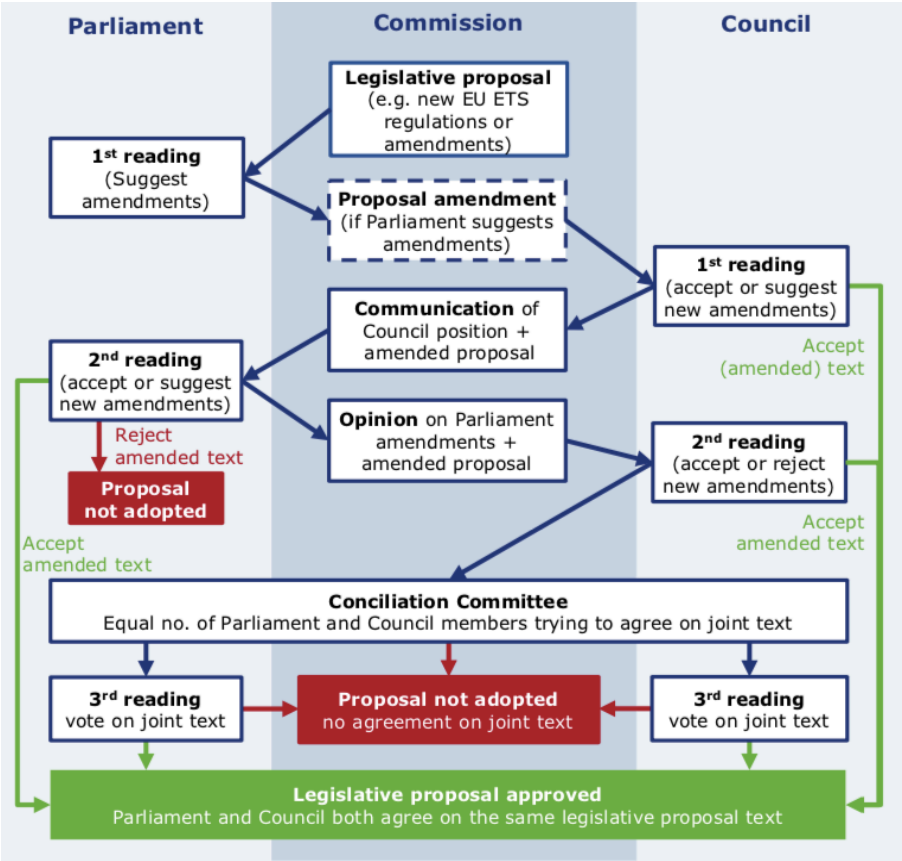
4.1. EU ETS Decision-Making as a Polycentric Model

As explained in the analytical framework, the ETS decision-making is understood as the outcome of several rounds of competing and negotiating among stakeholders. When confronted with a disturbance, stakeholders will decide their strategies to the decision-making based on the calculus of interests. Their input will be then processed by the contextual arena and rules to output the ETS decision. In this framework, the contextual rules and stakeholders are the key variables. Therefore, to proceed with the ETS resilience analysis, it needs to first describe the contextual rules and stakeholders of the system.

The EU ETS belongs to the broad policy block of the EU's environmental and climate legislation, which is based on the Single Europe Act (SEA) in 1986. As climate legislation, the ETS falls into the Union's authority. This means that all decisions of the ETS are decided at the EU level. The SEA has introduced an increased number of cases in which the Council can make decisions through Qualified Majority Voting (QMV) rather than unanimity. This simplified procedure was designed to accelerate the then time-consuming decision-making process in the Council in the search of a unanimous agreement among member states. After the SEA, unanimity is no longer applied to policies in relation to the single market, only except policies of taxation, the free movement of persons and the rights of employed persons (European Union 1986). More importantly, the SEA specifies that the EU's environmental legislation fits the QMV procedure. In the subsequent Maastricht and Amsterdam Treaties, the Parliament has also gained a statutory role in the assessment and approval of environmental legislation in the EU. Together, now the Parliament and the Council share a co-decision making status in the EU's environmental legislation.

With respect to the EU ETS in particular, there are three EU institutions involved in the ETS policymaking: the Commission, the Council and the Parliament (European Commission 2015b). The Commission, often described as the bureaucracy of the EU, is the only institution with the competence to initiate a legislative proposal. It is also the Commission's responsibility to provide evidence and analytical reports to advance an agenda and to lever stakeholders towards a commonly agreed decision. This process is also known as the entrepreneurial leadership of the Commission (Skjærseth and Wettestad 2008; 2010a; 2010b). From the very beginning of the EU ETS, the Commission has demonstrated this entrepreneurial role. In the 1990s, as the introduction of a carbon tax proved impossible within the EU's legislative setting, the Commission decided to adopt emissions trading as an alternative. Since then, the Commission managed to craft a common ground for all stakeholders by providing convincing evidence, exploring mutual interests and negotiating possible solutions (ibid). The Commission has played an important role in the introduction of the EU ETS. It has also successfully concreted its leading position by later centralising the authority of cap-setting and allocation.

Figure 4.1 EU ETS Legislative Procedure



Source: European Commission (2015b)

However, the Commission does not play a dominant role in the ETS decision-making. Its competence is strategically constrained by the EU's legislative procedure, as the approval of its policy proposals is subject to the Parliament and the Council. Taking the ETS as an instance, any new proposal or amendment to the ETS will be initiated by the Commission, and then submitted to the Parliament for first reading. The Parliament can approve the proposal or suggest amendments based on its own calculation of interests. Then the proposal will be transferred to the Council. Again, the Council can accept the proposal or table new amendments. Both the Parliament and the Council have three rounds of reading; and after two rounds of reading, they can form a conciliation committee to reach an agreed text. The proposal will be failed if they cannot mutually agree after three rounds of reading, which means that either the Parliament or the Council in practice can veto the proposal (European Commission 2015b). Thereby, when drafting the policy, the Commission has to take into consideration the interests of the Parliament and the Council in order to secure the success of its policymaking (Interview 3; 5). The significance of the co-decision procedure to the EU ETS is that it

provides more opportunities for various interests and actors to participate in the ETS decision-making, as stakeholders could input their interests and opinions to either of the EU triumvirate.

In addition to the formal legislative process among the triumvirate, there are also informal institutional settings adding complementary dimensions to the ETS decision-making. The first is the Commission's role as a policy broker. Being the only actor with the competence to initiate policy proposals, the Commission has the strong willingness to ensure the approval of its proposals (Skjærseth and Wettestad 2010a). However, the formal fixed EU policymaking procedure often poses great difficulty for interest trade-offs, concessions and compromises between the co-legislators. So when the agenda is not progressing, the Commission can act as a mediator among stakeholders (Héritier 1998; Nugent 2002). It can organise consulting meetings, provide funds to specific research and facilitate networks and mobilisation to indirectly influence the opinions of stakeholders. By doing so, it can strategically lever various stakeholders towards a commonly agreed agenda. The theory of the Commission's entrepreneurial leadership in the initiation of the EU ETS has demonstrated such a case (Skjarseth and Wettestad 2008; 2010a).

Another informal institutional setting relates to the intra-Council decision-making process. When member states negotiating proposals, there exists an unwritten commitment to consensus-building. Regardless of which voting procedure is applied, there is a strong tendency towards unanimity. In this intra-Council negotiation process, the rotating Presidency plays a key mediator role. The Presidency is responsible for hosting meetings at all levels. When facing a deadlock in the negotiation, it may bring necessary compromises in order to forward progress (Nugent 2002; Hayes-Renshaw 2002). Although some policies can be approved by QMV, the Council may still strive for a unanimous approval sometimes even with compromises and concessions.

With the formal and informal institutional settings, there exists a strong tendency towards unanimously consensus-building within the EU's decision-making process. Formally, the checks and balances among the three EU institutions ensure that none of them can monopolise the legislative process. While the Commission has the sole right to initiate policy proposals, both the

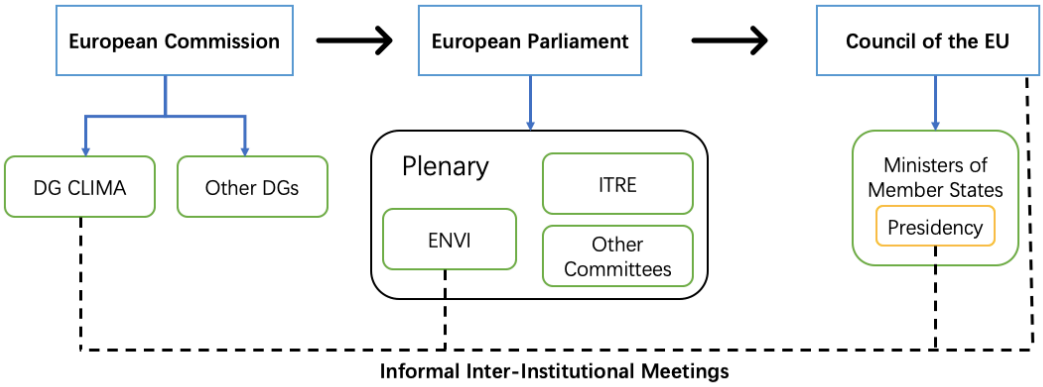
Parliament and the Council have the veto power. There is no single institution controlling the policymaking process, and the policy needs to be agreed on by all the three institutions. This characterises a consensus-building feature as the approval of the policy requires a commonly agreed ground among stakeholders. Moreover, some informal institutional settings also put additional weights to this consensus-building atmosphere. The strategic role of the Commission as a policy broker gives more flexibility to the EU's decision-making. To ensure the approval of the proposal, the Commission has to take into consideration the positions and interests of the co-legislators when drafting the policy. When levering stakeholders towards an agreed text, it needs to make necessary concessions and compromises at times. In this process, various interests related to the policy will be weighed by the Commission and included in the proposal. Within the Council, the convention for unanimity also strengthens the consensus-building tendency, ensuring that even under a majority voting procedure, the Council still respects every member state's interests.

This consensus-building convention creates conditions for a polycentric ETS decision-making structure. A polycentric system can be defined as a non-hierarchical institutional system that allows the co-existence of various decision-making centres with different values and objectives, providing an arena for an evolutionary competition among different ideas and methods of those centres. (Aligica and Tarko 2012; McGinnis and Ostrom 2012; Jordan *et al.* 2014). This definition contains five key features: the co-existence of many decision-making centres; a certain degree of autonomy and independence possessed by those centres; a shared common ideal or abstract goal; a single system of overarching rules; and an evolutionary competition among those centres. By examining the compatibility of those features to the EU ETS decision-making, it finds that the EU ETS decision-making can be regarded as a polycentric system.

First, there are a number of stakeholders involved in the EU ETS decision-making, including the Commission, the Council, the Parliament, relevant business sectors, NGOs, civil groups and academic experts. Within each stakeholder, there could also be some divided interests. For instance, the Council represents the collective standpoint of all member states, but not all members have the same opinion and interest concerning the ETS. Similar circumstances also exist in the Commission and the Parliament. While the

Directorate-General Climate (DG CLIMA) is responsible for the issue of emissions trading in the Commission, other DG departments with relational interests could also express opinions to the DG CLIMA. The Parliament's work on the ETS is primarily supported by two key committees: the Environment. Public Health and Food Safety Committee (ENVI) and the Industry, Research and Energy Committee (ITRE), and they may also have conflicted interests at times (European Commission 2015b). Under the consensus-building atmosphere of the ETS decision-making, the ETS policy can be seen as a collective choice resulted from a series of interactions among those stakeholders through both formal and informal institutional settings. In this process, each stakeholder with individual interests can be regarded as a decision-making centre acting on their own interests.

Figure 4.2 Channels for Stakeholder-Engagement in the ETS Policymaking



As demonstrated in Figure 4.2, the three EU institutions provide various channels for stakeholders to input their interests to the ETS policymaking. From the very beginning, the DG CLIMA is responsible for drafting policy proposals. It will conduct consultation meetings to hear opinions from different stakeholders. Other DG departments can coordinate their relevant interests to the DG CLIMA. In the Parliament, the ENVI is the responsible committee, but the ITRE and other committees can input its interests to the ENVI. Besides, Members of the Parliament (MPs) can table their opinions directly in the plenary. In the Council, delegations of member states provide channels for interest groups to express their positions at the member state level. Within this structure, there are multiple channels for a stakeholder to affect the ETS policymaking. For instance, industries could affect the ETS policymaking by participating in the consultation of the Commission, expressing concerns to

the MPs in the Parliament or persuading the national delegation in the Council (Interview 8; 9; 18; 48). Similarly, NGOs could also input their opinions through the different channels in the EU triumvirate (Interview 2; 4; 6; 16). Moreover, there are informal contacts among the EU triumvirate to coordinate their standpoints.

Second, stakeholders also have a certain degree of autonomy and independence. While some stakeholders may have some advantages, there is no coercive power that can control the decision-making process arbitrarily. For instance, the Commission is usually viewed as the bureaucracy in an increasingly centralised EU ETS, and its entrepreneurial epistemic leadership is crucial for advancing ETS policies. However, it still cannot control the ETS decisions unitarily. Formally, its legislative power is constrained by the co-legislators (Council of the European Union 2016). Informally, the policy broker role means that sometimes the Commission has to make concessions and compromises to other stakeholders in order to progress the policymaking (Interview 5). The checks and balances among the EU institutions and the consensus-building atmosphere ensure that all stakeholders could operate independently within their range to influence the ETS policy, providing a single set of rules for the system.

Third, a common ideal is shared by all stakeholders: the ETS is an effective way of addressing climate change. There also exists a positive competition among stakeholders. The Commission has the strong motivation in driving ambitious ETS policies based on its bureaucratic interests, as an ambitious EU ETS could strengthen the Union's legitimacy. It is believed that the international leadership in climate change is one of the key pillars for the EU's legitimacy (European Commission 2010; Lenschow and Sprungck 2010). In addition, the EU's institutional context leaves spaces for bottom-up efforts. Article 130t in the SEA has ruled that member states can introduce more stringent measures compatible with the existing EU environmental regulations (European Union 1986). In practice, the introduction of a carbon floor price in the UK and similar policy debates in other countries suggest that there exists a competition among stakeholders within the EU ETS. Over time it can be observed that the EU ETS situates in a progressing trajectory towards a harmonised market with more stringent measures.

Therefore, despite some deviations from the conventional polycentric definition in governance studies (e.g. Polanyi 1951; Ostrom, Tiebout and Warren 1961; Ostrom 2000; 2010), the EU ETS decision-making presents a certain level of a polycentric feature with a high degree of authority dispersion. Fortified by the broad EU institutional settings, when debating policies stakeholders can act as independent decision-making centres that are free to bring various ideas and methods. Emissions trading is commonly believed as an effective way to address climate change, and interactions among stakeholders have truly resulted in a progressing ETS over time. Those features suggest that the pattern of the EU ETS decision-making situates somewhere near the polycentric end in the polycentric-monocentric paradigm of the ETS resilience framework.

4.2. The EU Enlargement as a Disturbance and Its Impacts

The EU enlargement in 2004 marked a significant change to the EU's environmental governance. The accession of ten countries signified the largest change ever in the history of the Union in terms of its population and numbers of member states. Given the socio-economic disparities between new and old member states, there were good reasons to doubt whether the enlargement would be a threat to the EU environmental politics. First, new member states lacked sufficient motivation on climate issues. Post-socialist countries of the CEECs were still in the midst of an economic and social transition, indicating that economic development rather than environmental protection and climate mitigation was the political priority (Homeyer 2004). In the face of significant burdens of implementing hundreds of environmental *acquis communautaire* after the accession, those countries would be reluctant to introduce further ambitious climate legislation (Burns, Carter and Worsfold 2012). Second, the weak administrative capacity and inefficient bureaucratic systems in those countries also led to concerns over their abilities to comply with EU climate policies (Homeyer 2004; Skjarseth and Wettestad 2007). Third, in contrast to old members, new member states usually had weaker domestic environmental groups and green parties. There lacked sufficient social mobilisation and public awareness on climate issues, which means that the political pressure for climate legislation was low.

The concerns of decision-making and implementation deficiencies after the enlargement was backed by the leader-laggard theory in EU environmental governance (Andersen and Liefferink 1997). This theory roots in the liberal intergovernmental theory, arguing that the EU's environmental governance essentially reflects the interests of member states, and primarily depends on the structural balance between the leading and laggard member states (Homeyer 2004). From this perspective, the accession of the CEECs would add significant weights to the laggard group and thus break the structural balance within the Union. In this scenario, the enlargement would increase the implementation deficiency of existing climate policies and weaken the future demand for ambitious climate policymaking.

Concerning the ETS in particular, the enlargement constituted a political disturbance. First, new member states had different interests with existing members on climate governance. They had less pressure on international climate commitments. Within the UNFCCC, all CEECs were categorised as 'Economic in Transition' that belonged to the Annex B Parties in the Kyoto Protocol committing to only a constrained level of mitigation targets. Considering the massive scale of economic restructuring of those countries in the 1990s, the targets were relatively easy to reach (Skjarseth and Wettestad 2008). The significant reduction of emissions in the post-Communist period could even situate the CEECs on the supply side of the ETS. While the enthusiasm for participating in climate mitigation was relatively low, new members had more concerns over the economic impact of carbon pricing on their industries.

Second, the initial design of the EU ETS did not reflect their interests either. To respond to climate change and meet the Kyoto target, the Commission launched the European Climate Change Programme in 2000. A domestic ETS was later proposed as a central piece of this programme. The Commission formally put forward an ETS proposal in 2001, and had it approved in 2003. The ETS decision-making was finalised before the enlargement. During the policymaking, although new members were allowed to attend the final negotiations as observers, their influence was quite limited, and the ETS was set as a pre-condition for the accession. That is, the EU ETS could be seen as a policy product of those front-runner member states that barely reflected the interests of the new member states.

Third, the enlargement also changed the decision-making landscape in the EU triumvirate. The decision-making in the Council and the Parliament were both affected by the accession of new members. In the Council, decisions of climate policy including the ETS are determined through the QMV. After the enlargement, the QMV in the Council commanded 232 out of 321 votes. Ten new member states together consisted of 84 votes, which means that they could simply veto a policy by obtaining the support of another country with ten or more votes in the Council. Also, the Treaty of Nice in 2001 introduced a triple majority rule that has further complicated EU decision-making. The rule requires that the decisions in the Council need not only a qualified majority but also an absolute majority of the number of member states and the least representation of 62% of the total EU population if a member requests (Burns, Carter and Worsfold 2012). Given the increased disparities among member states in terms of their climate outlooks and capabilities brought by the enlargement, it was anticipated that the climate legislative status quo would be almost impossible to be progressed (Tsebelis and Yataganas 2002). The accession of ten new member states would affect the standpoint of the Council on climate legislation.

In the Parliament, there were also concerns that the influx of MPs from new member states would water down the Parliament's green character. The Parliament has long been regarded as the greenest actor in the triumvirate, injecting momentum to the EU's progressive climate legislation (Burns, Carter and Worsfold 2012). While the Commission sometimes may take a softer attitude in environmental legislation for pragmatic consideration, the Parliament has strongly advocated for ambitious legislation. For instance, at the beginning of the ETS policymaking, while the Commission proposed a relatively loose system design to gain support of stakeholders, the Parliament held a more strict position that tabled around 80 amendments. With its power in the co-decision procedure, the Parliament was expected to serve as the firewall for a greener Europe in the face of the rising concerns of international competitiveness and economic growth. However, the enlargement could undermine the Parliament's green position. There were concerns that MPs from new member states may stand with their national lines expressing a reluctant attitude on climate issues. While the struggling of green groups in those countries indicated little public interest in climate mitigation, the pressure of economic catch-up could even lobby their MPs in the Parliament

to block further climate legislation. Therefore, the changing dynamics brought by the enlargement in both the Council and the Parliament led to the speculation that progressive climate legislation would be much more difficult to be advanced after 2004 (Schreurs 2004).

As a result, the EU enlargement in 2004 was assumed to make an impact on the EU ETS that constituted a typical disturbance to the system through the lens of ETS resilience. New member states did not have the interests in progressing such a system, as pricing carbon emissions would pose additional costs to their domestic industries which relied on traditional fossil fuels with outdated technologies. They also gained significant institutional weights within the EU's legislative setting, making it possible to block further ETS policies. In the Council, they could coordinate their positions with the existing laggard group to strengthen an opposite alliance. In the Parliament, MPs from new member states could stand with their national fronts to water down the Parliament's green position. As to implementation, their weak administrative capacity and inefficient bureaucratic systems could impede the ETS implementation. The ETS was initially designed as a decentralised structure where national governments held the authority of cap-setting and allocation. New member states could thus undermine the system by setting overgenerous caps to domestic industries, wrecking the price mechanism of the ETS.

Therefore, it is of importance to investigate whether the ETS functioning has been affected by the EU enlargement, and, if so, how the system has managed to withstand the impact. As the enlargement only constituted a political disturbance that did not have a direct impact on the ETS price, an examination of the EU ETS resilience rests primarily on how the enlargement has affected the ETS policy dynamics including both the policymaking process and policy outcomes.

4.3. Policy Dynamics after the Enlargement

4.3.1. Institutional Dynamics

The most straightforward impact of the enlargement is the compositional changes and new issues it brought to the Parliament and the Council (Juncos

and Pomorska 2007; 2008). The concerns were that the accession of new members in the Parliament and the Council would alter their decision-making positions and perturb the negotiating atmosphere.

With respect to the Parliament, although the enlargement did make an impact on its behaviours in environmental legislation (Burns, Carter and Worsfold 2012), empirical evidence suggested that the Parliament still acted as the most ambitious legislator in the ETS. For instance, it was the Parliament that proposed a more stringent MSR mechanism and a future review over the LRF in Phase 4 legislation. Compared with the Commission and the Council, the Parliament has remained the most ambitious actor in ETS legislation.

Two lines of reasoning may provide explanations for this. First, the Parliament has successfully socialised new MPs into the existing transnational party fronts. After 2004, MPs from new member states held roughly 22% of seats in the Parliament. The then speculation assumed that new MPs would vote in favour of their national interests, forming a powerful obstacle to progressive environmental legislation. However, in reality, new MPs have immediately joined their transnational party groups (Hix, Noury and Gerard 2007; Schmitt and Thomassen 2009). Interviews with the Parliament and relevant stakeholders also confirmed that concerning the EU ETS, MPs usually voted in line with their transnational parties rather than national fronts (Interview 6; 10; 14). Despite the critiques that the Parliament has been less radical on environmental issues after the enlargement (Burns and Carter 2010; Burns, Carter and Worsfold 2012), there was no evidence proving that new MPs have formed a bloc within the Parliament to oppose progressive climate legislation. Ideological identities rather than national interests were the key factor behind MPs' voting preference.

> *At the committee level, MPs usually follow their party positions, whereas at the plenary level they sometimes follow their national positions. But it should be noted that this is not only restricted to new MPs, but happens in general. MPs from old member states also sometimes follow their national interests and oppose progressive ETS policy. (Interview10)*

> *There was no major divide between those MPs from old and new member states in the Parliament. Their voting preference was largely shaped by their party differences, not national identities. (Interview 14)*

Another explanation concerns the legislative procedure within the Parliament. The Parliament organises its legislative work through 20 specialised standing committees. MPs are divided into different committees responsible for instructing legislative proposals, drafting amendments to the plenary and appointing negotiation teams to negotiate with the Council. When the Commission submits a proposal, the most relevant committee will be responsible for drafting the Parliament's opinion. For instance, the ETS competence is shared by the ENVI and ITRE in the Parliament. While the ENVI is the major responsible committee, issues related to carbon leakage and the innovation and modernisation funds also fall into the competence of the ITRE acting as an associated committee. Within the committees, individual MPs are selected to be rapporteurs who are responsible for handling the legislative proposal from the Commission, leading negotiations with other institutions and reporting the committee's opinions to the plenary (Council of the European Union 2016). As the rapporteurs control the drafting process, they hold great power in the Parliament's legislative work, and to a large extent decide the position of the Parliament on the proposals. They are responsible for consulting with experts when analysing the proposal, and organising hearing sessions for various related political groups. They then will make recommendations to the committee on what potion it should take. They are also responsible for presenting reports to the plenary and leading negotiations with the Commission and the Council.

The institutions of the committee and the rapporteur acted as a guarding force of the Parliament to the impact of the enlargement. First, they ensure the expertise of the Parliament in handling extensive legislative proposals. Before the Parliament makes decisions through the plenary, its opinions regarding the proposal were mainly drafted by the rapporteur and discussed with related committees. The rapporteur receives support from the committee's staff, and concerning technical issues he/she could also receive support from external experts. Other committee members can propose amendments to the draft, which can be referred to the plenary. This guaranteed that the drafted opinion came from a group of professional MPs and experts within the Parliament. Despite that the Parliament decides its opinion through the plenary, the

opinion is mainly framed by a group of expert MPs from a technical perspective. Besides, within the committee, there are also several groups of MPs and shadow rapporteurs negotiating different positions regarding the proposal. By doing so, the committee can process various interests at a smaller scale before the plenary that further enhances the efficiency of decision-making.

> *Through the mechanism of shadow rapporteurs, there could form a common text agreed by different groups and parties. This could further strengthen the position of the committee in the plenary discussion. (Interview 10)*

> *Of course MPs can still table their amendments in the plenary, but usually it is difficult to do so individually. You have to at least have 78 or more. But through the committee, they could process different opinions from different parties. (Interview 11)*

Second, the rapporteur has also acted as a liaison officer with the Commission and the Council to reduce the impact of the structural change in the Parliament. The current EU legislative procedure requires the approval of both the Parliament and the Council. While this procedure ensures the accountability and transparency of EU legislation, it makes the legislative procedure a time-consuming process. Both the Parliament and the Council have three rounds of reading on the proposal, and there is a conciliation process for them to negotiate a compromised text if an accepted proposal cannot be reached. If a compromise text cannot be agreed upon, then the proposal is officially failed. To avoid this situation, a mechanism of 'trilogues' or 'fast track' based on the informal contacts among the triumvirate now has been widely used. The trilogues are usually attended by the rapporteur, the competent committee chair, a representative from the Commission and the delegation representatives from the Council. Compared with formal conciliation meetings, those informal meetings are more flexible to arrange and usually just involve a handful of representatives from the triumvirate. It is thus easier for them to find a common ground for the proposal beforehand to facilitate an agreement between the co-legislators (Council of the European Union 2016).

> *The benefits of increased contacts among them (the EU triumvirate) are obvious. They can negotiate a proposal that is widely accepted by all, and when you hand this proposal to the Parliament and Council, you can convince them that the text is already negotiated and accepted by the other institutions. (Interview 49)*

While this approach caused critiques over the transparency and democracy of the EU legislative procedure, particularly to the Parliament as the only directly elected EU institution (European Ombudsman 2016), it has indeed helped reduce the impact of the enlargement on the legislative capacity of the Parliament. Through informal trilogues, it is easier for the co-legislators to agree on the proposal in their first reading, as the text has already been negotiated through intra- and inter-institutional contacts. Statistics show that while no legislative proposal was passed in the first reading of the Parliament during 1993-1999, there were 85% of proposals approved in the first reading during 2009-2014 (European Parliament 2009; 2014). Also, the centralisation of the Parliament's legislative power could buffer the compositional change brought by the enlargement. The opinions discussed in the plenary are usually drafted by a group of specialised MPs within the committee and have already been negotiated substantially through the informal contacts with the Commission and the Council (Interview 19). As now most of the legislation is approved in the Parliament's first reading, it means that the Parliament's opinions are usually framed by those specialised MPs and the committee rather than the plenary. Therefore, the speculation that the accession of MPs from new member states may undermine the Parliament's position on climate legislation has found less supportive evidence in reality.

> *There are a few cases that opposite opinions are expressed in the plenary. But usually parties prefer to express their opinions in the committee rather than in the plenary. (Interview 17)*

However, it should be noted that the Parliament's resilience to the compositional change was at the cost of its democratic accountability and reputation as an environmental champion in the Union. While trilogues have proven effective in accelerating the legislative process, it has a problem in transparency and legitimacy. The public often lacks access to such backroom deals, making it difficult to scrutinise the performance of the involved

institutions. As the only directly elected EU institution, the Parliament holds the democratic accountability of the EU's legislation. This explains why it has been reformed from a relatively weak 'talking shop' to a co-legislator in the Union (Servent 2015). However, the specialisation of its legislative power to a handful of MPs raises concerns over its accountability to EU citizens. In addition to the general public, green political groups may also find it difficult to have their opinions heard in the Parliament (Burns 2013). The trilogues could also deradicalise the Parliament's position on climate issues. During trilogues, representatives from the Parliament and the Council would seek to agree on a common text based on their initial positions, which would be subsequently voted in the plenary with a large chance of approval in the first reading. This means that the proposal and its amendments were the outcomes of a series of inter-institutional compromises. While trilogues were more successful in securing the approval of its proposed amendments, these amendments might be less radical than the initial position of the Parliament (Burns, Carter and Worsfold 2012). This was also reflected in the ETS decision-making. For instance, while interviews with the Commission and the Parliament have all revealed concerns that the 2.2% LRF is not sufficient to further stimulate the reduction of emissions of the ETS in Phase 4 (Interview 2; 5; 16), this did not cause any dissent in the official opinions of all the triumvirate. But overall, despite the cost of its progressive position, the application of informal inter-institutional contacts has helped reduce the impact of the compositional change in the Parliament.

With respect to the Council, the speculation that a strengthened laggard group could potentially hinder further progressive climate legislation has also found less support in reality. First, given the increasingly diversified interests on energy and climate issues, new member states did not form a coherent bloc. Before 2004, there was speculation that due to socio-economic disparities, they would align with the existing laggard members to resist progressive environmental legislation in the Council (Schreurs 2004). However, this speculation overlooked the fact that new members also have different interests in energy security and climate governance. They may share a common position on some issues occasionally, but also diverge on others. An example was the division of the Visegrád Group. The four Visegrád countries – Czech, Hungary, Poland and Slovakia are usually perceived as a naturally heterogonous group given their geographical proximity, common socialist histories and economic development priorities. Concerning the ETS, it was

predicted that they would act as a laggard group to block progressive ETS policies due to the concerns of energy security and economic growth. Yet, there have seen increasing cracks among them. On one hand, Poland still showed great dissatisfaction towards the ETS as it strongly opposed progressive measures that could drive the price up, complained about the recent rebound of the carbon price and called for necessary intervention from the EU (Visegrád Group 2018). It even brought the complaint regarding the MSR to the European Court of Justice (Morgan 2018). On the other hand, however, Czech has deviated from the group by supporting a more stringent MSR in Phase 4 (MacDonald 2017).

> *It was a surprise to us that the policy amendment improving the MSR stringency came from the Council rather than the Parliament. (Interview 2)*

> *We should notice that CEECs also fell apart (on climate policymaking). (Interview 16)*

> *CEE countries are not always a firm coalition. Now although Poland still seems resistant to ambitious climate policies, other CEE countries like Czech are more open to progressive policies and targets. (Interview 44)*

Second, the voting behaviours of new member states have been socialised by the Council's consensus-building convention. As aforementioned, the Council has the informal institutional convention of consensus-building in the intra-Council decision-making process. Although the QMV is applied to environmental legislation, in practice it has been often used as a negotiating leverage to persuade resisting members. National governments barely cast opposing votes or abstain from voting in the Council. Hosli et al. (2011) find that even after the enlargement it was rare to see contested voting in the Council. Member states would try to negotiate a compromised text before the voting rather than expressing dissent via the formal procedure. New member states are less likely to vote against the majority than old members (ibid).

> *The negotiated text with the Parliament and Commission sometimes are used to persuade some member states in the Council. (Interview 49)*

It is always difficult for a single member state to vote against the majority of the Council. (Interview 52)

Besides, the accession of 10 new members also changed the legislative routine in the Council. Before the enlargement, the Council was able to function as a negotiating platform for all 15 members. Representatives could submit their individual opinions, and negotiations were able to be conducted either bilaterally or multilaterally. The Council meetings were held in a ‘tour of table’ style by which each member could express their positions on the table to others. However, with 10 more participants, it became difficult to continue this approach. The 'tour of table' was removed as member states have to share their speaking time. This means that they have to agree on a common position and co-draft amendments before the meeting. Under such a circumstance, member states are difficult to influence the Council individually; instead, they have to find enough allies in the Council to table amendments (Hagemann and De Clerch-Sachsse 2007; House of Lords 2009).

Now during the meeting, it is difficult to let every country discuss their positions individually, because there is not enough time. Instead, they can discuss and bring their opinions together. (Interview 12)

Last, the use of trilogues also helped water down the influence of new member states. Informal trilogues among the triumvirate have greatly facilitated the co-decision procedure, completing most of the legislation in the first reading in the Council. They were usually conducted at the very early stage of the co-decision procedure, with only a limited group of representatives and officials from the Council attending the meetings. This means that most of the legislation was negotiated not at an ambassadorial level but a working group level. Even in the first reading, the negotiations were usually attended by permanent representatives rather than ministers. In fact, only when it comes to the conciliation stage, ministers would start to involve in the negotiation. Hence, the use of trilogues now has watered down the influence of national governments, as most of the Council's decisions were made at an early stage conducted by those permanent representatives and the Presidency in the Council (Interview 17). Moreover, the outcomes of the trilogues mechanism also brought another effect in the intra-Council negotiations. In the trilogues,

the Parliament and the Council would discuss their initial positions regarding the proposal. Their positions could be then used in the intra-Council negotiations to persuade resisting members (Baier from House of Lord 2009: 40).

> *To the Council, only the representatives and the Presidency participate in the inter-institutional meetings. Not every member state can participate in those meetings. (Interview 17)*

With respect to the Commission, its legislative role as an entrepreneurial leader and policy mediator has proved instrumental in buffering the impact. It faced both opportunities and challenges from the enlargement. On one hand, with more MPs and member states, it became more difficult for the Parliament and the Council to have a single voice when making decisions. This has allowed the Commission more power to function as a mediator among stakeholders to strategically smooth out the policymaking process. On the other, with more diversified interests in the Union, it was also challenging to advance its policy initiatives accommodating all stakeholders. Hence, the Commission sometimes had to make compromises on its proposals to secure the approval. As a consequence, the development of the EU ETS has seen an increasingly powerful but less ambitious Commission.

> *The EU ETS is a product of the political realities, so when making policies you need to take into consideration the political feasibility. (Interview 3)*

Before the enlargement, with fewer members in the Council it was relatively easy to put together opposing minorities to block a proposal from the Commission. As the enlargement expanded the size of the Council and the Parliament, it became more difficult to form blocking minorities to oppose a proposal. In this sense, the Commission has indirectly gained more advantages from the enlargement (Lebrecht from House of Lords 2009: 21). However, the accession of new member states also made it difficult to find solutions fitting all stakeholders, which means that the Commission had to further enhance its entrepreneurship to secure its proposals. Under the co-decision procedure, the Commission is entitled with the authority of not only reconciling positions between the Parliament and the Council, but also

advising the co-legislators on policies and relevant technical issues. To this end, the Commission needs to participate in every step of the legislation in the co-legislators. The mechanism of trilogues has further strengthened this close connection, giving the Commission more advantages when setting policy-agendas and drafting proposals. One of the positive effects of the trilogues is that now the three EU institutions know each other much better than before. The Commission can thus draft its proposals taking into consideration the positions of the co-legislators. Interviews also confirmed that when drafting the ETS proposals, the Commission has included its predictions on the co-legislators (Interview 3; 5). By doing so, the proposal would face less contested opinions. However, this entrepreneurial strategy also indicated some necessary trade-offs in the proposal.

In addition to the Commission's increased influence in preparing policy proposals, it also gained more power in the ETS implementation after the enlargement. Although there are still contested explanations on the reasons why the EU ETS was centralised in Phase 3 (Wettestad 2009; Bausch et al. 2017), managing diversity within the system was clearly an important factor behind the scene. Due to the uncertainty and inexperience in emissions trading, the EU ETS was initially established as a decentralised system despite the strong preference of the Commission and Parliament for a centralised system. As a result, the ETS in its first two phases was more like an aggregate of many individual national ETSs. The overall ambitiousness of the ETS emerged from bottom-up as member states were responsible for proposing their individual NAPs. There was no total cap issued from Brussels, and the sum of all NAPs constituted the total cap of the system.

However, the decentralised system soon proved problematic. First, decentralising the authority of allocation to member states caused strong concerns of competitiveness and free-rider. While some members considered generous NAPs necessary to economic growth, it was unfair to the countries with stringent ones. Generous NAPs also brought about disputes with the Commission which served as a watchdog to the system. The dispute was especially fierce in the NAP II process when Poland and Czech sued the Commission for substantially cutting off their suggested NAPs. They claimed that this would hurt their growing economies and undermine their efforts of catching up with richer member states (Borowski 2007). Second, a decentralised system also proved administratively cumbersome to both

member states and the Commission. At the beginning of the system, due to the lack of historical data and limited time, national governments were struggling with the accuracy of data and the coverage of installations. This difficult situation was further aggravated by the strong industrial lobbying and conflicts with other ministries especially in those new member states (Skjarseth and Wettestad 2007). Meanwhile, the Commission also faced a considerable workload. The NAPs submitted by member states were usually not on time and lacked essential elements for assessment. The enlargement further increased the Commission's burdensome. It had to assess more than 20 NAPs sometimes even without reliable data (Wettestad 2009). All those difficulties led to the ETS reform in Phase that centralised the competence of cap-setting and allocation to the Commission. Given its increased competence after the enlargement and the reform, the Commission has been a beneficiary from the enlargement.

> *About the centralisation, I haven't heard any critique on it. This is a guarantee to the concerns of competitiveness among member states, and I haven't heard any suggestion to go back to decentralisation. (Interview 5)*

Overall, the decision-making process of the EU ETS has been less impacted by the enlargement. Under the co-decision procedure, there is no single EU institution can dominate the ETS policymaking process. The three EU institutions work independently from each other, and act on behalf of different interests. The policymaking of the ETS requires the consensus among the triumvirate so that the drift of one or two institutions is not sufficient to deviate the whole ETS trajectory. Through informal trilogues, the EU has strengthened the coordination among the three institutions that could effectively buffer the impact of external changes. Thereby, concerning the enlargement, its impact was firstly buffered by the coordination of interests among the EU triumvirate through trilogues. In the Parliament, MPs were successfully socialised by their transnational fronts rather than national interests. The specialisation of legislative work in the committees and rapporteurs also reduced the impact of the compositional change. In the Council, evidence showed that new member states did not align to constitute a laggard bloc. Instead, they faced diversified interests and positions on climate issues. Within the Council's decision-making procedure, the increase of members also diluted the influence of any single country. With more voices in the Council, it was easier for the

Presidency to control the intra-institutional negotiations, and to use trilogues to persuade resisting countries. As to the Commission, it has gained more competence after enlargement. With more diversified interests, it was more difficult in the Parliament and the Council to form enough opposing votes to block the Commission's proposals. Also, the enlargement caused significant burdens in the work of EU institutions and member states, which drove them to a more centralised approach as a solution. In legislation, the trilogues have been increasingly used to expedite the legislative process. In administration, the ETS governance was centralised from national governments to the Commission to harmonise national diversities and avoid administrative burdens. All those tendencies have given the Commission more competence in practice.

Yet, despite with little changes in the EU's institutional behaviours, the enlargement has brought some institutional dynamics to the ETS. Given the socio-economic disparities between new and old member states, the EU needed to make compromises to manage divergence. This compromise-making process was further facilitated by the trilogues. Through a closer institutional contact, the Commission would draft its proposals in view of the expected opinions of the co-legislators. Similarly, the Parliament and the Council would also table amendments in consideration of the other two institutions. While the trilogues have indeed improved legislative efficiency, it has also limited the possibility of EU institutions to table more progressive opinions. Moreover, the socio-economic disparities and decentralised system design also affected the implementation and market equilibrium of the ETS. The next section will analyse how the implementation and market performance has been impacted by the enlargement.

4.3.2. Performance Dynamics

Despite the little impact on the institutional dynamics, the enlargement had an impact on the ETS performance. In the first NAP period, new member states were required to submit their NAPs by 1 May 2004, but most of them failed to meet the deadline. For instance, among the Visegrád countries, Hungary and Slovakia managed to have their NAPs accepted by the Commission in 2004 with several months delay, whereas Czech's NAP was accepted in 2005 and Poland's in 2006. The delay significantly postponed their market establishment. Some countries did not have their registries in place at the

beginning of the ETS, and Poland did not even link its registry completely to the system until mid-2006. In the second NAP period, the delay also occurred except for only 3 new members (Skjarseth and Wettestad 2007). Admittedly, the delay was not only restricted to new member states, as all countries were struggling with data collection and accuracy. Yet, it should be noted that the delay of new member states was often due to the lengthy dispute with the Commission over their generous NAPs (Skjarseth and Wettestad 2007; 2008).

In addition to implementation, the enlargement also brought about policy compromises in a harmonised ETS. The problem of surplus allowances from overgenerous allocation and the lengthy dispute between member states and the Commission finally led to the reform in 2008 that centralised the authority of cap-setting and allocation to the Commission in Phase 3. The system was tightened up by an EU-wide cap with increased auctioning proportion and standard benchmarks. The purpose of the reform was to harmonise national diversities within the system to prevent a race to the bottom outcome (Wettestad, Eikeland and Nilsson 2012). Yet, considering the socio-economic disparities between new and old member states, the ETS also introduced solidarity measures for those economically less developed members.

The first measure related to the power sector. Since Phase 3, covered power generators cannot receive free allowances but need to pay for all their emissions. However, considering that some least wealthy members still relied on traditional fossil fuels in their power sector, there was a derogation under Article 10c of the EU ETS Directive 2009/29/EC that allowed certain members to give transitional free allowances to existing power plants until the end of Phase 3, and the proportion of free allowances in the annual emissions would gradually decrease from 70% to 0% (European Union 2009). According to the criteria defined in the article, eight countries that joint the EU in 2004 were eligible, of which six finally decided to make use of the derogation – Cyprus, Czech, Estonia, Hungary, Lithuania, Poland, along with Bulgaria and Romania that joint the EU in 2007. This transitional measure was due to be ruled out after Phase 3, but the EU decided to continue this policy in Phase 4 although with stricter procedural rules (European Union 2018). While the initial purpose of the transitional free allocation was to generate investment in clean technologies or energy diversification, in practice the majority of investment so far has been distributed to lignite-fired or coal-powered plants in Bulgaria, Czech, Poland and Romania. During 2013-2017, 56% and 30% of transitional

free allocations were allocated to lignite and coal-powered plants respectively (EEA 2018).

In addition to transitional free allowances, new members also gained more share in the total auctioning volume that constituted an additional revenue. In accordance with Article 10 of the ETS Phase 3 Directive, while 88% of auctioned allowances were distributed to all member states based on their emissions share, 10% of allowances were distributed to the least wealthy members for market solidarity and economic growth. Revenues generated from those allowances can be used by them for decarbonisation investment and climate change adaption. The remaining 2% of allowances were given as a 'Kyoto Bonus' to member states which had reduced their GHG emissions by at least 20% in 2005. Clearly, this bonus was designed for new members as they were much easier to reach the threshold due to the large-scale economic reconstructing in the 1990s. All nine countries eligible for the bonus were new member states: Bulgaria, Czech, Estonia, Hungary, Latvia, Lithuania, Poland, Romania and Slovakia. Poland and Romania together accounted for more than half of the share.

> *There are thresholds for Article 10, and member states know that it was not given for free but with conditions. Considering that central and eastern European members have lower costs of carbon mitigation and many outdated facilities, the inflow of those funds is also a good thing for them. (Interview 5)*

In Phase 4, the ETS will also retain some solidarity provisions. The 10% of the auctioning volume will be retained in Phase 4 for the least wealthy member states for market solidarity and economic growth. A modernisation fund is also established to provide investment in 10 lower-income member states to modernise their power sectors and energy systems and enhance energy efficiency. 2% of auctioned allowances in Phase 4 will constitute the fund. As defined in the Directive, there are 10 countries eligible for the fund – Bulgaria, Czech Estonia, Croatia, Latvia, Lithuania, Hungary, Poland, Romania and Slovakia, all of which are new members after 2004. Among them, Poland accounts for 43% of the share (European Union 2018). Statistics show that during 2013-2015 the total revenue from auctioning were 11.9 billion euros (European Commission 2017a). Given the amount of money generated from

auctioning, the modernisation fund and 10% solidarity allowances will constitute a huge source of revenue for new member states.

> *About the modernisation fund, there was difference between the MPs from Eastern and Western members. MPs from CEECs widely asked for compensations in the ETS to compensate for the economic gap. About the solidarity policies, at least the Commission thought it is necessary. That is also why it was in the Commission's proposal. (Interview 10)*

> *Although those solidarity measures make compromises to new member states, they also increase the influence of the ETS. (Interview 16)*

The enlargement also made an impact on the market equilibrium and carbon price. At the beginning of the EU ETS, almost all member states allocated surplus allowances to their industries, bringing about 4% more allowances than the actual emissions in 2005 (Skjarseth and Wettestad 2010b). Compared with old members, new members faced less pressure from the Kyoto commitment and domestic climate policies due to the large-scale economic reconstructing in the 1990s. Hence, they could allocate excess allowances while still complying with their Kyoto targets. For instance, three Visegrád countries allocated more allowances than their actual emissions in 2005 with an average of more than 10% of overallocation (Table 4.1). The excess allowances immediately hit the market. As a result of an EU-wide overallocation, the carbon price dropped rapidly from over 20 euros in 2005 to almost zero in 2007.

Table 4.1 NAPs and Actual Emissions of Poland, Czech and Hungary in 2005

Country	Poland	Czech	Hungary
NAP 1 cap ($MtCO_2$ per year)	239.1	97.5	31.27
2005 actual emissions ($MtCO_2$ per year)	210	82.5	27.46
Amount of overallocation	12%	15.4%	12%

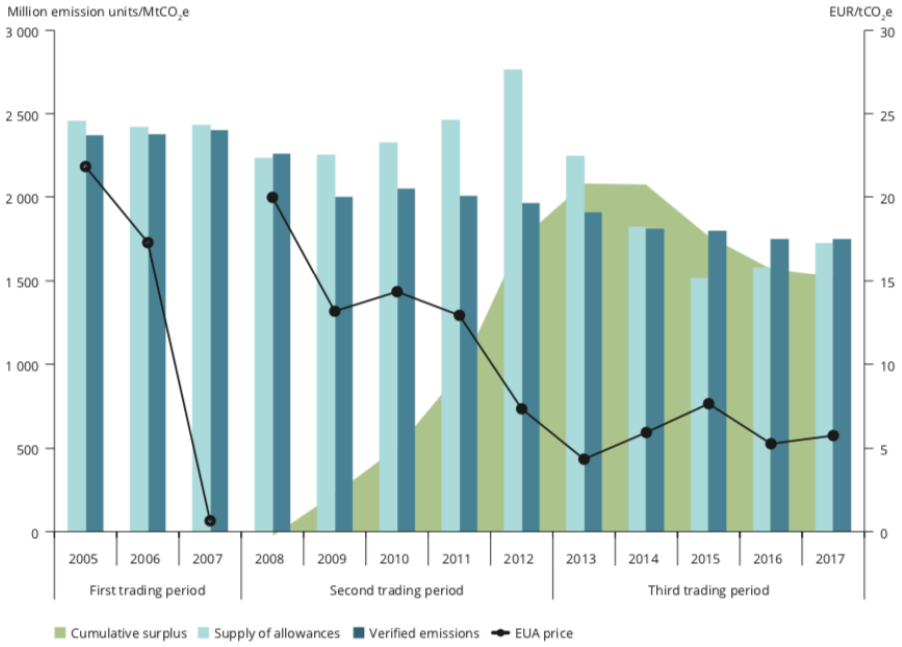
Source: Adapted from WWF (2006)

The overallocation also resulted in considerable windfall profits. At the beginning of the system, almost all allowances were handed out for free. However, as companies received more allowances than their actual emissions, they could sell those excess emissions for profits in the market. Even during Phase 3 when auctioning was the default method for allocation in the power sector, there were still more than 40% of allowances available for free allocation due to the concern of carbon leakage. Also, as there is a price for emissions, companies could let their customers pay the price despite that they received allowances for free. Carbon Market Watch (2016) finds that during 2008-2015 energy-intensive industries had made over 25 billion euro of windfall profits. Moreover, cheap international offsets became another source of windfall profits. Since international offsets were allowed in the ETS, companies could use a certain amount of cheaper international credits for compliance and sell the saved allowances in the ETS. It should be noted that while most power generators can no longer make such profits as they need to pay all their emissions since Phase 3, power generators in the eight countries with transitional free allowances can still receive their allowances for free and subsequently make windfall profits.

Disputes also arose in regard to carbon price fluctuations and relevant policies. New member states, particularly Poland which sources most of its electricity from coal and lignite, are more sensitive to a high carbon price. Thereby, any measure that may tighten up the supply of allowances in the market may cause strong opposition. In a decentralised ETS, rows were often sparked pivotal to the NAPs, as the Commission intended to cut off the overgenerous NAPs of new member states. This was particularly striking in the NAP II process, when the Commission decided to significantly cut off the NAPs of Estonia and Poland by 47.8% and 26.7% respectively. Estonia and Poland retaliated by referring the Commission to the European Court of First Instance, contending that this was beyond the Commission's power (CMS 2009; Elsworth 2010). Since Phase 3, the spotlight switched to the MSR – the policy that could curb the supply of allowances and further raise the carbon price. Poland again took it to the EU Court, arguing that this policy was an intrusion to the exclusive competence of member states as it could seriously influence their energy mix (Morgan 2018). Despite being dismissed, this has highlighted the strong concern of new member states on a stringent ETS. This concern was echoed in 2018, as the energy minister of Poland called for intervention

from the EU when the carbon price surged to above 25 euros in mid-September (Twidale 2018).

Figure 4.3 Supply-Demand, Surplus and Price in the EU ETS 2005-2017[4]



Source: EEA (2018)

Since the very beginning, the EU ETS has suffered from an oversupply, which resulted in a relatively low carbon price for around 10 years. Whereas the oversupply can be attributed to the economic recession since 2008 as industrial demand of allowances shrank substantially, the supply side should also be responsible for the market disequilibrium. This was particularly true in Phase 1 when the economic crisis did not breakout. The total allowances allocated were 4% more than the actual emissions (Skjarseth and Wettestad 2010b), and the price soon plummeted to almost zero in less than two years. Although all member states were responsible for the oversupply, the enlargement has nevertheless aggravated the situation. Compared with old members, new member states were generally in a more advantageous position in the share of the allocation volume and reduction targets. In the first

[4] *In Phase 1-2, the supply of allowances was apparently more than market demand, resulting in a significant price fall. Even since industrial demand started to drop substantially in 2008 due to the economic recession, the supply still kept increasing annually throughout Phase 2. The total surplus of allowances peaked at the end of Phase 2, further depressing carbon price in Phase 3. Whereas the shrink of industrial demand in the ETS was due to economic crisis, the increase of supply at the time was mainly the fault of ETS decision-making*

two phases, their NAPs were usually more generous than Western members while still complying with their Kyoto targets (WWF 2006; WWF, CAN and agree.net 2007). Since Phase 3, they have also received preferential policies of free allowances and subsidies that may hinder the increase of carbon price in the market.

4.4. Summary: EU ETS Resilience to the EU Enlargement

Overall, the EU ETS has been relatively resilient to the impact of the enlargement, as the ETS legislative settings successfully buffered the compositional changes and the policy soon adapted to the changing political environment. Contrary to the speculation before the enlargement, the EU's polycentric decision-making structure showed strength in buffering the compositional changes in the EU triumvirate. The impacts were firstly absorbed by the three EU institutions respectively, and then by their positional coordination. In the Parliament, a blocking bloc did not materialise as new MPs were socialised by their national party fronts. The mechanism of trilogues has also centralised most of the Parliament's legislative power to a group of specialised MPs. In the Council, the expansion of the membership watered down the influence of individual member states, but strengthened the influence of the Presidency and the other two EU institutions. The positions of the Parliament and the Commission were used to persuade resisting members in intra-Council negotiations. Due to interest heterogeneity, new members also found it difficult to form a blocking group in climate legislation. As to the Commission, it has gained more competence in the ETS after the enlargement. The increased contacts among the EU triumvirate have facilitated it a better understanding of the co-legislators' positions that could be included in its policy proposals. The Commission's entrepreneurial leadership has also played a more important role in sustaining the ETS in the face of more diversified interests.

The ETS policy itself also soon adapted to the changing context. Within the polycentric structure, as no single institution can dominate the legislative process, the EU needs to make compromises to facilitate a common ground and gain the support of new member states. It has introduced solidarities measures to compensate for the socio-economic disparities between member states. Less developed members can have more share in their ETS allocation

and more free allowances. Multi-billion funds were also established to facilitate investment in modernising their power sectors and energy systems. The EU also reformed the system in Phase 3 to centralised the power of ETS implementation to address the problems of administrative inefficiency and political disputes that were partly caused by the enlargement.

Empirical evidence suggests that the enlargement did not cause major disruptions to the ETS vital functions. Although it might contribute to or amplify some market fluctuations, it was not the major factor. In terms of the criterion of effectiveness, the enlargement did make an impact on cap-setting and price stability. In the first two phases, the accession of new member states aggravated the oversupply of allowances in the system as they allocated more allowances than their actual emissions which brought about price volatility in the ETS. However, it should be noted that the problems of market oversupply and price volatility in Phase 1-2 were largely due to the inexperience of the ETS policymaking, and it is also unfair to impute the problem of overallocation solely to the new member states as most of the countries did the same. In terms of the criterion of efficiency, the EU ETS proved resilient as it soon adapted to the new political environment. It has introduced solidarity measures to rally the support of new member states, and also centralised the power of ETS implementation in Phase 3 to harmonise the market.

Chapter 5
EU ETS Resilience to the Economic Recession

This chapter presents an empirical case of the EU ETS resilience to the impact of the economic recession from 2008. The deteriorating economic environment since 2008 paralysed the ETS with abundant surplus allowances and the plummeted carbon price. The flawed ETS design thus called for policy reactions from the EU. Through the lens of ETS resilience, the economic recession constituted a typical disturbance to the system, and this chapter proceeds with an assessment of the ETS resilience to the impact of the economic recession.

As explained in the previous chapter, the EU ETS decision-making can be interpreted as a polycentric model given its high degree of authority dispersion. In this model, fortified by the broad institutional settings, stakeholders are able to input their ideas and interests to the ETS policymaking via the triumvirate. The consensus-building atmosphere will process various interests and search for a common ground of policy accommodating stakeholders. While the polycentric model proved resilient to the compositional changes brought by the EU enlargement, this chapter examines how it performed to the impact of the economic recession.

The chapter has four sections. The first section defines the economic recession as a disturbance to the ETS by showing its impacts on the system. The second section proceeds with the analysis of resilience by looking into the policy dynamics of the ETS in reaction to the impact. The third section assesses the EU's policy reactions based on the dimensions of efficiency and effectiveness. The last section provides a summary to the case.

5.1. The Economic Recession as a Disturbance and Its Impacts

In 2008, a global economic recession emerged that hit many European countries. The recession also impacted the EU ETS. At the time, the supply of allowances in the ETS was fixed without the consideration of possible economic fluctuations. The market was also inundated with cheap international offsets. Therefore, while industrial demand dropped rapidly due

to the deteriorating economic environment, the supply kept increasing annually as planed throughout Phase 2. The structural deficiency finally resulted in substantial surplus allowances in the market at the beginning of Phase 3. In 2013, the system had a surplus of around 2.1 billion allowances, and the number was expected to increase to more than 2.6 billion at the end of Phase 3 (Erbach 2014). Along with the cumulative surplus, the carbon price plummeted from almost 30 euros in 2008 to less than 10 euros in 2010 and finally to around 4 euros in 2013. The ETS functioning was seriously wrecked by the economic recession (Declercq, Delarue and William 2010; Laing *et al.* 2013; Koch *et al.* 2014).

Table 5.1 The Supple-Demand of Allowances in the EU ETS 2008-2011

In Mt	2008	2009	2010	2011	Total
Supply: issued allowances and used international credits	2076	2105	2204	2336	8720
Demand: verified emissions	2100	1860	1919	1886	7765
Cumulative surplus	-24	244	285	450	955

Source: European Commission (2012)

The economic recession had several implications for the EU ETS. The most striking one was the significant drop of industrial demand for allowances. Due to the decrease of industrial activities and production, in 2008-2009 the European power sector had 175 million tons fewer emissions than a business-as-usual scenario (Declercq, Delarue and William 2010). In 2009, the EU's emissions decreased by 6.9% compared to the level of 2008, which was about 17.3% below the 1990 baseline and was thus very close to its 2020 emission reduction target (EEA 2010). While the EU ETS did make a contribution, most of the reductions were caused by the economic recession (Cambridge Econometrics 2009; ENDS Europe 2009; New Carbon Finance 2009; Laing *et al.* 2013). The weakened industrial demand soon had an impact in the ETS, as the price plummeted immediately from 30 euros in 2008 to less than 10 euros in 2009. In the meantime, the continuous oversupply of allowances further aggravated the situation. As a result, at the beginning of Phase 3, the cumulative surplus of allowances was projected to reach a level equivalent to

80% of the annual emissions of the EU ETS (Berghmans and Stephan 2012), depressing the carbon price to almost 3 euros. Since then, the carbon price had remained at a low level for several years.

In addition to a low carbon price, the economic recession also undermined the effectiveness of the ETS by increasing the marginal profits of using fossil fuels. As many energy prices, particularly coal, suffered from substantial falls due to the deteriorating economic environment, power generators found it more profitable to use cheaper solid fossil fuels. This also increased the threshold for a theoretical carbon price that could incentivise industries to switch from traditional fuels to clean energies. The lower carbon price and cheaper energy prices therefore disincentivised industries' abating efforts. Moreover, the price spread between the EU ETS allowances and international offsets motivated industries to use more cheap international offsets while banking or selling their allowances, which further imbalanced the supply-demand dynamics in the system (Skjarseth 2010; Berghmans and Stephan 2012).

Through the lens of ETS resilience, the economic recession constituted a typical disturbance that required a rapid reaction from the EU. Due to the market surplus and price volatility, the ETS could not provide a correct price signal incentivising emission reduction and low-carbon investment. The malfunction of the system significantly undermined the market confidence of many stakeholders (Interview2; 5; 6; 16). The crisis called for necessary policy intervention from the EU.

> *For the time of almost ten years, the price was almost meaningless. (Interview 2)*

> *They have been working on that (the EU ETS) for a decade, but they didn't see any improvement, and what is the added value of me working on that if it is not getting any better? (Interview 6)*

At the time, the EU faced several policy options to the crisis. It could choose either a price-based or a quantity-based policy. For instance, the EU could opt for a price-based policy by setting a regulatory price range with pre-defined maximum and minimum auctioning prices for the allocation. This would

provide the most certainty to the system, as the price range would reduce the risk of supply-demand fluctuations and ensure the certainty for industries' decision-making on long-term investment. Quantity-based policies include measures that correct the price by adjusting the supply-demand relations. On the supply side, the EU could correct the ETS cap fitting the changing demand, or set up an allowances reserve to adjust the release of supply. On the demand side, it could expand the coverage of the ETS to increase market demand.

There were pros and cons in each of those measures. However, it should be noted that the policy option made by the authority was not solely based on a cost-efficiency calculus, but also constrained by its institutional context (May 1986; McDonnell and Elmore 1987). The institutional context here refers to the system of rules, procedures and processes characterising the environment where the policymakers choose or design a policy instrument. The policymakers will take into consideration those contextual factors when comparing different policy solutions. For instance, the EU ETS can be regarded as such a policy that was chosen by the EU through a series of contextual consideration. The Commission initially preferred a carbon tax, but soon realised that it was impossible within the then EU's institutional context. The ETS was thus introduced as a policy alternative.

In addition to the institutional context, the normative values and belief of the policymakers could also constrain the policy choices (McDonnell and Elmore 1987). Political ideology and philosophy play a key role in shaping the policymakers' preference when facing different policy options. Here, the EU ETS also offers an example. Previous studies and interviews all confirm that apart from the political realities, the option for an ETS was also related to the change of personnel in the then Commission (Lefevere 2005; Skjarseth and Wettestad 2008; Interview 5; 17). Soon after the Kyoto Protocol, most of the staff in the Commission's DG Environment including the head of the unit were replaced by a group of people who before worked on the initiative of the carbon tax in the 1990s (Klaassen 1999; Lefevere 2005; Skjarseth and Wettestad 2008). Their belief in the ETS was not simply due to the cost-effective calculus, but also rooted in their intellectual values.

In short, the EU needed to introduce new policies to address the impact of the economic recession. Through the ETS resilience framework, the impact exceeded the absorptive capacity of the system, which required the system to introduce new policies to adapt to the changing environment. The assessment thus should focus on whether those policies can restore the ETS vital functions (effectiveness) and how long those policies can take effect (efficiency). Also, during the policymaking process, the institutional context and the policymakers' normative values and belief constituted key variables.

5.2. Policy Dynamics to the Economic Recession

5.2.1. The Short-Term Remedy

Although the problems of market surplus and price volatility arose in 2009, the formal institutional reactions of the EU only began in 2012. In its report on the state of the ETS in 2012, the Commission identified several factors contributing to the cumulative surplus, including the economic recession, the oversupply of allowances and the use of international offsets (European Commission 2012). Due to the anticipation that negotiations on a long-term structural solution would take years, the Commission tabled a temporary measure to stop the rapid build-up of surplus as a short-term remedy. This measure would backload some auctioning allowances in 2014-2016 to the later years in Phase 3, so that it could rebalance the supply-demand of the ETS in the coming years, which would buy some time for the negotiations on a long-term structural solution. The number of backloaded allowances was set at 900 million, with 200 million in 2014, 300 million in 2015 and 400 million in 2016. The 900 million allowances would be released back to the market in 2019-2020, so the policy would not change the overall supply in Phase 3.

As a temporary measure, the effect of the backloading was relatively limited. It was only designed to stop a further fall of the carbon price in the next three years so that the EU could negotiate a long-term solution. It would not change the total supply of the system in Phase 3. This could to some extent address the concerns of market intervention and its future impact on the ETS (Interview 11; 49).

> *We didn't change the total quantity of supplied allowances. We just changed the time when we should allocate those allowances. It is reasonable because at that time there were already many surplus allowances in the market, so holding those allowances would not lead to a shortage in the market. (Interview 11)*

However, it had little effect on the already crashed carbon price and market imbalance. The Commission also admitted that it was only expected to "stop the bleeding" and would not bring the price back to the levels expected before the crisis (European Parliament 2013: 5). From this view of point, the backloading can be regarded as a temporary policy compromise due to the concerns of economic consequences and ETS functioning. On one hand, it only proposed to adjust the timeframe of market supply in order to gather more support from stakeholders. On the other, curbing the cumulative surplus in the short term could strengthen the confidence of industries and investors on the ETS.

> *At the time the carbon price was around 4 euros, and was supposed to be at around 30 euros. But the backloading was only expected to counteract a further fall of the carbon price in a short term. And the Commission's assessment also confirmed that the backloading would not bring the price to the level before. (Interview 11)*

> *To introduce a price control policy or change the cap or the LRF would certainly cause disputes in the EU, and of course need more time. But the situation at that time was already serious as the price was only around 3 euros. So the EU needed to do something to show its determination in the ETS. (Interview 42)*

Although the idea of market intervention to the structural surplus received support from stakeholders, opinions towards the backloading were somewhat controversial. Most industries, particularly the power sector, supported a short-term adjustment on the release of allowances (Interview 9). This can be understood from two lines of consideration. First, due to the massive windfall profits that they made from the market surplus, industries had lost their ground

in opposing market intervention in the ETS. Second, there were also fears that if the ETS failed the EU would introduce another policy alternative.

> *There are always discussions about a carbon tax in the EU, even we already have an ETS. So of course industries would worry if the ETS fails, the EU will introduce a more stringent policy to replace the ETS. (Interview 49)*

Besides, there were voices calling for a stronger backloading measure. They argued that the 900 million backloaded allowances were not sufficient to address the problem, as there were already around 2 billion surplus allowances in the system (Climate Markets and Investment Association 2012; Sandbag 2012).

On the other hand, there were also doubts whether such a short-term remedy was necessary if the EU decided to introduce a long-term structural reform in the ETS. For instance, the BusinessEurope stressed that short-term measures should be avoided as they would interfere with the discussion of the structural solutions (BusinessEurope 2012).

Some industries also did not like the idea of market intervention at all.

> *Some of our members were not happy with political intervention which was seen as too short-sighted; and in terms of legal security, constant intervention is not good for company. (Interview 8)*

Even within the Commission, there were concerns whether a backloading was in line with the economic principle of the ETS.

> *That (backloading) is completely outside the book of theory, because we were changing our allocation rules; we didn't like it, but we did what is necessary including market intervention through the backloading proposal. (Interview 5)*

The controversial opinions regarding the backloading were also reflected in the EU's legislative process (Interview 10). After the Commission submitted its proposal of backloading, the Parliament initially rejected it in the plenary in April 2013 by a marginal vote of 334 against 315, but then decided to adopt it in July with the amendment that only allowed a single backloading of maximum 900 million allowances. In the plenary debate, oppositions on the backloading were largely based on two strands of consideration. First, some MPs doubted its effectiveness, and called for a regulatory approach or a carbon tax as the long-term solution to the ETS (Interview 12). Second, many MPs concerned about the market consequences. They feared that once the backloading was approved, market intervention might be repeatedly used by the Commission in the future that would disturb the market order and jeopardise the economic fundamentals of emissions trading. Some MPs also feared that the intervention would increase the electricity price and aggravated the burden of energy-intensive industries in the wake of the economic recession (Interview 13; 14). The amendment proved that the market consequence of backloading was the primary concern of the Parliament.

Albeit some contested opinions, the backloading was finally approved by the co-legislators in December 2013. Its outcomes were somewhat mixed but mostly fell into the policymakers' anticipation. With respect to the market surplus, it effectively curbed the cumulation of surplus in the ETS. Statistics show that after implementation, the market surplus gradually decreased over time. From 2014 to 2017, while the surplus remained in 2014, it started to fall substantially to 1.78 billion in 2015, 1.69 billion in 2016 and 1.65 billion in 2017 (European Commission 2018). It showed strength in stabilising the level of surplus even in the years when the verified emissions declined (European Commission 2017b). However, with respect to the carbon price, the backloading had little effect. As anticipated, stabilising the level of the surplus could only stop a further fall of the price, but could not bring it back to the levels before the crisis. During 2014-2018, along with a stabilised surplus, the carbon price remained at less than 10 euros. Evidently, the backloading as a short-term remedy was not sufficient to restore the ETS circumstance, and a long-term structural solution was still needed.

5.2.2. The Long-Term Solution

In its 2012 ETS report, the Commission suggested six policy options to address the structural surplus (European Commission 2012). They were:

1. Increasing the EU's reduction target to 30% by 2020
2. Retiring a certain amount of allowances in Phase3
3. Revising the LRF earlier to correct the ETS cap
4. Extending the ETS coverage to other sectors
5. Limiting the use of international offsets
6. Introducing discretionary price management measures

The first option would increase the EU's 2020 reduction target from 20% to 30%. This would reduce the supply of allowances in the ETS, as the system had to either permanently retire a number of allowances or revise the LRF, which respectively referred to option 2 and 3. The Commission calculated that if the target was increased to 30%, the volume of retired allowances in the ETS would be around 1.4 billion equivalent to the level of the market surplus at the time. However, the difficulty was that changing the EU's 2020 target would not only affect the ETS but also the overall climate policy settings of the EU. The sectors not in the ETS but in the Effort Sharing legislation would also be affected.

The second option was to permanently retire some allowances in Phase 3 to reduce the surplus. The Commission suggested doing so through separate legislation to avoid fully revising the ETS Directive. Similar to the procedural logic of the backloading, by doing so the Commission could have a single use of the market intervention in the ETS while keeping the ETS legislative framework untouched. However, the weakness was that it did not provide a permanent solution to the structural deficiency of the ETS. Should there be another market imbalance in the future, the Commission has to make intervention again, which would increase the legislative burden and bring more uncertainty to the ETS.

The third option would reduce the surplus by revising the LRF. Enhancing the factor would decrease the annual supply in the market to gradually reduce the surplus. This could not only address the surplus problem, but also tighten up

the ambitiousness of the ETS in the long term. In fact, the then 1.74% LRF in the ETS could only lead to an over 70% reduction achievement by 2050, and could not reach the EU's 80-95% target. So the revision of the LRF in the ETS was already on the Commission's agenda.

The fourth option would reduce the surplus by expanding the ETS to sectors less affected by the economic recession. The Commission reported that while emissions in the ETS decreased by more than 11% in 2009, sectors outside the ETS only decreased by 4%. So the ETS could include some sectors to enhance its supply-demand stability in the face of economic cycles. However, including new sectors would increase the administrative burden of registration and MRV. In addition, in the case of fuel consumption in some sectors, including upstream producers or downstream users would also be a problem requiring more analysis and consultations.

The fifth option referred to the largest source of surplus in the ETS. The Commission calculated that international credits may account for around 75% of the total expected surplus in Phase 3. Only in 2012, there were over 500 million international credits used in the ETS (European Commission 2014a). International offsets were initially introduced as an opportunity that could not only reduce the compliance costs of European industries, but also incentivise low-carbon investment in developing countries. However, the price spread between the EU allowances and international credits made it profitable for industries to surrender more international credits while selling ETS allowances for windfall profits. Therefore, the Commission suggested to put more restrictions on the use of international offsets or even to prohibit after Phase 3 to contain the remaining surplus.

The last option suggested introducing a price management measure to directly contain the price fluctuations. The carbon price is the most important indicator in the ETS, as it indicates the costs of carbon abatement by which industries could decide their investment strategies. In the wake of the economic recession, although the total emissions in the ETS decreased substantially, the price remained at a low level that could not trigger necessary investment and technology innovation for the socio-economic transition towards a low-carbon pathway. The Commission therefore suggested two options to correct the price: a carbon price floor or a price management

reserve. A price floor is a minimum price level for the auctioning of allowances in the ETS. The strength of this instrument is that in the case of oversupply, the price can be guaranteed by a minimum price that provides the certainty for industries and investors on the costs of emissions. Alternatively, the EU could also control the price by establishing a market reserve. In the case of a price drop due to the surplus, the reserve could absorb excessive allowances, and thus restore the market equilibrium and bring the price back. In the opposite case, the reserve could release a certain number of allowances back to the market. The reserve could be established by using the surplus allowances in Phase 3.

Yet, the Commission warned that a price management measure may change the very nature of the ETS. The economic logic of emissions trading is that the supply-demand relations will find the most appropriate price for carbon abatement, so the authority should avoid intervention in the market. However, a price management measure would interfere in this logic. With the measure, the carbon price would become a product primarily determined by political decisions rather than market equilibrium. The ETS would have more regulatory characteristics. Moreover, the minimum price could also be perceived as a type of carbon taxation. Although legal analysis shows that a carbon price floor is not a tax that requires a fiscal provision in the Union (Wemaere 2016), it still received many contested opinions.

> *Although there could be discussions on a carbon price floor, but we should notice that the ETS is a market mechanism, so you should let the market work and determine the price. (Interview 9)*

> *Determining a minimum carbon price would be definitely difficult and highly politicalised…… If you can decide a minimum price to pay, why you need an ETS? And carbon tax is also more efficient, especially for medium and small companies, because they don't need to go through the administrative process. (Interview 18)*

Among the six options, the price management measure was the most controversial one. First, there were different views on whether the EU ETS as a quantity-based instrument really needs a strong price signal. Whereas some

argued that a strong price signal is necessary to incentivise low-carbon investment, there were also views that the ETS should primarily curb emissions through its quantity cap and a low carbon price simply implies that there is little need for additional abatement to meet the cap (European Commission 2014a).

> *Ultimately, what you want is just stay below the quota. (Interview 1)*

> *There is a cap, and the emissions are below the cap. Simply because the price is not what you expected does not mean the market is failed. (Interview15)*

> *It's a cap-and-trade system, so staying below the cap means that you are making less emissions. (Interview 48)*

Second, price management also faced normative critiques on the economic fundamental of the ETS. Some stakeholders highlighted that the strength of emissions trading rests on the assumption that the market equilibrium will find the true economic costs of carbon abatement, and a price management measure would confuse the price mechanism and undermine market stability (European Commission 2013).

Given the controversial views on price management, options focusing on the volume rather than the price received more support among stakeholders. Three policy solutions were later outlined by the Commission to address the surplus:

1. Early revision of the LRF,
2. Permanent retirement of some allowances
3. A market reserve to adjust the supply of allowance.

But they all have weaknesses. Concerning the LRF, its implementation would require coordination with the EU's 2030 and 2050 long-term climate targets. Also even if the LRF could be revised before 2020, it could only reduce the surplus in a gradual manner and could not restore the market balance in a

short term. Regarding the retirement of allowances, permanently removing the surplus would restore the market soon, but could not provide a sustained solution. The ETS would still be vulnerable to future disturbances. As to a market reserve, agreeing on a 'right' threshold to trigger the reserve would be very contentious and difficult (European Commission 2014a).

The 2012 report served as a consultation document to launch a 12-week online consultation for all stakeholders to discuss a long-term structural improvement of the ETS. The consultation lasted from 7 December 2012 to 28 February 2013. The Commission in addition organised two dedicated consultation meetings on 1 March and 17 April 2013. An expert meeting was also organised on 2 October 2013 to discuss available options. It was widely agreed among stakeholders that the ETS needs to increase its resilience to large-scale demand shocks. In the meantime, the Parliament and the Council also underlined the significance of the ETS and demanded actions of the Commission to enhance ETS effectiveness.

By weighing the potential impacts of different options and stakeholders' opinions, the Commission preferred a hybrid solution that combines the permanent retirement of allowances and the market reserve (European Commission 2014a). This new market stability reserve (MSR) has the advantages of both. On one hand, with the strength of retiring allowances, it could effectively address the structural surplus from the economic recession and the impacts of the EU's renewable energy and energy efficiency policies. On the other, it could also provide a sustained solution to future demand shocks.

> *It (MSR) is a little bit more orthodox (than the backloading and other intervention measures). (Interview 5)*

The Commission formally put forward a legislative proposal in January 2014 (European Commission 2014b). The proposed MSR would start from 2021. In every year after 2021, 12% of the total allowances in circulation two years earlier would be placed in the reserve if the amount was above 833 million. In the case when there were less than 400 million allowances in circulation, the reserve would release 100 million back to the market. In the case when there

were less than 100 million allowances in circulation, the reserve would release all its allowances back to the market. Those parameters would be reviewed again in 2026. With the parameters, the MSR would work independently with no need for any new institutions or political decisions. The Commission emphasised that the MSR only provides an instrument to adjust market equilibrium and to restore the carbon price. The total supply of the ETS in the long term would be remained (European Commission 2014a).

The initial MSR proposal was relatively loose. While the idea of the MSR received support from a majority of stakeholders, there were stakeholders calling for a more stringent MSR. First, some suggested an earlier implementation of the MSR in Phase 3, as they considered that implementing the reserve from 2021 would allow the structural surplus to accumulate. Given the fact that the backloaded 900 million allowances and unused allowances from the New Entrant's Reserve would be released back to the market at the end of Phase 3, the surplus might peak at the beginning of Phase 4 that could take the MSR many years to fully absorb. They thus argued that the structural surplus should be contained as early as possible to restore market confidence.

> *An early implementation of the reserve could restore the price as early as possible. The carbon price in the ETS was too low in the last ten years, and had little effect on industries. (Interview 52)*

> *Have the MSR from 2021 is too late to address the problem. (Interview 49)*

Second, some also advised to transfer the 900 backloaded allowances to the reserve rather than releasing back to the system. It was anticipated that if the 900 million allowances were released back in 2019-2020, there would be another surplus surge and price crash. Retaining those allowances would ensure a stable supply in the ETS.

> *There will be 300 million (allowances) released in 2019 and 600 million in 2020. This will certainly increase the surplus again, and is against the purpose of the MSR. (Interview 50)*

Third, as the proposed MSR featured no limit on the number of allowances it could store, there were also voices suggesting a permanent cancellation measure in the reserve (Interview 17; 44). With the ability to cancel allowances permanently when the surplus exceeding certain thresholds, the MSR could tighten up the overall ETS stringency based on market circumstance.

> *The 900 million allowances in the backloading was apparently redundant, and should be cancelled permanently rather than released back to the system. (Interview 44)*

In the Council, the MSR proposal received support from all members except for Poland which considered it as a market distortion that would raise the price artificially. In the meeting in December 2014, most of the parameters in the proposed MSR were widely accepted by members except for two issues: the timeframe and the backloaded allowances (Council of the European Union 2014). Some delegations argued that the MSR should be implemented before 2021 – sometime between 2017-2019 to address the structural surplus as early as possible. They also suggested transferring the backloaded allowances to the reserve to avoid another surplus surge at the end of Phase 3. In the meantime, some delegations were satisfied with the timeframe and thus opposed any change on the parameters. But a small number of them agreed to place the backloaded allowances in the reserve with the condition of implementing the MSR in 2021. In addition, member states also held different views on the frequency of review. Whereas some agreed to review the parameters in every five years, others considered that the Commission should review the MSR more frequently, such as in every three years. In short, the general opinion of the Council to the MSR was positive despite some voices for more stringent parameters.

In the Parliament, the Environment Committee's opinions were in line with most stakeholders that the MSR should be amended on its timeframe and be aligned with the backloading (Malmerjo and Porcelli 2015). It suggested having the reserve in place by 31 December 2018 to send an early signal to the market. In addition, it considered that releasing the backloaded allowances back would run against the purpose of the MSR and confuse the market. Thus the 900 allowances should be placed in the reserve. As to the reviewing

frequency, the Committee suggested having the first review within the first three years.

The position of the Committee proved important in the following trilogues, as showed in the agreed text after the inter-institutional negotiations in May 2015. In the text, representatives from the EU triumvirate agreed that the MSR should initiate in 2019 rather than 2021, with all backloaded allowances placed in the reserve. As the Council still faced different views among member states on the issues of timeframe and backloaded allowances, the outcome to some extent proved that the Parliament's position provided more momentum.

The agreed text was soon adopted by the co-legislators in October 2015 (European Union 2015). Contrast to the original proposal, the new text had several improvements. First, the reserve would start from 2019 rather than 2021. Second, it would hold all 900 million backloaded allowances in the reserve instead of releasing them back to the market. Third, it specified that within the first three years after the operation and at five-year intervals thereafter, the Commission would review the key parameters of the reserve and submit proposals to the co-legislators.

Evidently, the adopted MSR was largely in line with the Parliament's position, and was more ambitious than the Commission's original proposal. This showed the stronger determination of the EU in tightening up the supply in the ETS. However, it should be noted that the signal of the MSR was still ambiguous, as it did not have a limit on the total volume it could store and also had no competence to cancel surplus allowances. The total supply of the ETS was still determined by the pre-set cap whereas the MSR only provided an instrument to control the release of allowances. In theory, the problem of the long-term structural surplus was still not fixed yet.

Yet, before implementation, the MSR soon had another improvement through the ETS Phase 4 legislation. In line with the EU's 2030 Climate and Energy Policy Framework, the Commission in July 2015 revealed its ETS legislative proposal for 2021-2030. In the proposal, whereas the Commission enhanced several ETS benchmarks including enhancing the LRF to 2.2%, the MSR remained largely untouched. But when it came to the co-legislators, after a

lengthy process the Parliament adopted its position in 2017 by tabling several amendments in relation to the MSR (European Parliament 2016; 2017; Erbach 2017). It suggested doubling the intake rate from 12% to 24% in the first four years to restore market equilibrium as early as possible. It also suggested cancelling 800 million allowances in the MSR as of 1 January 2021. Regarding the LRF, the Parliament advised enhancing the factor to 2.4%.

Not long after the Parliament's opinions, the Council also came to an agreement on its opinions towards the proposal (Council of the European Union 2017). Concerning the MSR, it endorsed the Parliament's position of doubling the intake rate to 24% until 2023. It also suggested after 2023 giving the MSR the competence of cancelling the allowances in the reserve that exceed the total amount of allowances auctioned in the previous year.

After the co-legislators adopted their positions, inter-institutional trilogues were organised to bridge their opinions. After six rounds of meetings, an agreed text was finally reached in November 2017. The EU institutions agreed that the MSR intake rate should be doubled in the first five years. In addition, the competence of cancelling surplus allowances proposed by the Council would also be brought forward from 2024 to 2023. But the LRF would remain at 2.2%. The agreed text was soon adopted by the co-legislators in 2018. The EU ETS finalised its policy reactions to the impact of the economic recession.

Empirical observations demonstrated that the decisions for the backloading and MSR were the inevitable outcome of the EU's polycentric decision-making context. Within this context, all stakeholders were allowed to express their positions independently, and their independence and output were secured by the fact that the ETS policymaking requires the consensus-building of all stakeholders. In the face of demand fluctuations, while some policy options might provide more certainty on economic and environmental performance, the backloading and MSR were chosen due to their institutional feasibility in this consensus-building context. A survey by the CDC Climat (I4CE 2014) shows that whereas an auctioning price floor was highly preferred by the public sector and epistemic community, industries were generally against the idea. By contrast, as a market-based measure, the MSR received the highest level of consensus among stakeholders (Desai, Alberola and Berghmans 2014).

Introducing a floor is not only impossible within the EU's legal context, but could also attract questions on the legitimacy of the ETS itself. (Interview 15)

The multi-stakeholder structure could make everyone happy, this to some extent ensures the positive effect of the ETS. Keep suppressing some stakeholders may not be a good idea. (Interview 16)

The idea of a market reserve was supported by industries and policymakers in the Commission. First, industries generally preferred a market reserve as it would to a large extent avoid frequent political intervention. The reserve was designed to function independently based on pre-set benchmarks. It would only adjust the release of allowances, while the price would still be primarily determined by market equilibrium. Compared with other policies such as the price floor or a rolling cap, a technically neutral reserve would still allow the market to determine the price and thus leave more flexibility to industries.

The MSR is a volume-based measure rather than a price-based one, so of course industries support it. The recent rise of the carbon price also proved that the MSR has a positive effect on the price and can also counteract the impact of overlapping policies. (Interview 7)

Doubling the intake rate is probably not a good idea. Although industries realised the problem of market surplus, but the surplus should be reduced in a long-term period instead of directly doubling the intake rate. But overall, the MSR is still better than a carbon price floor. (Interview 8)

Compared with a minimum auctioning price, the MSR still allows the supply-demand of the market to determine a carbon price. This provides a market-based solution to the ETS. (Interview 18)

Second, the policymakers in the Commission considered that a market reserve would not only receive more support from stakeholders, but also accommodate the economic tenet of emissions trading. Interviews showed

that the belief in the economic value was a key factor behind the Commission's preference for a market-neutral reserve (Interview 5; 14; 15; 17). They believed that the problem of emissions trading should be fixed through a market-based measure rather than regulatory intervention.

Moreover, the legislative process of the MSR also reflected the polycentric feature of the EU ETS policymaking. In both rounds of the MSR legislation, the Commission only provided relatively loose proposals, whereas the co-legislators tabled amendments to further tighten up the policy. In 2014, it was the Parliament that took a stronger position to tighten up the MSR by advancing its implementation to 2019 and retaining the backloaded allowances. Later in the Phase 4 legislation, the Council and the Parliament together put forward more amendments to the MSR. The Parliament suggested doubling the intake rate to 24%, and the Council endorsed its position and further suggested adding the competence of cancelling surplus allowances. The polycentric structure set up a stage for an evolutionary competition among the EU triumvirate concerning their ideas and methods on the MSR, which eventually had a complementary effect on the MSR.

5.3. Policy Evaluation

When the market demand dropped substantially in the wake of the economic recession, the EU ETS had no mechanism to cope with the sudden change. The market imbalance thus resulted in considerable surplus allowances and the carbon price plummeted significantly. During 2009-2013, the surplus kept growing with no intervention from the EU. In 2013, the surplus reached 2.1 billion and the price crashed to around 3 euros. The crisis exposed a striking deficiency of the EU ETS that the system did not have a mechanism to cope with sudden fluctuations in the market. In order to provide long-term predictability, the ETS Phase 3 was designed with an eight-year timespan. During the phase, the supply of allowances in each year was fixed by the pre-set cap and the LRF in accordance with the EU's long-term climate target. While this could provide more long-term certainty to industries and investors, it did not take into consideration possible economic fluctuations.

The EU took two steps to fix the deficiency. First, as a short-term remedy, the Commission decided to backload 900 million allowances from 2014-2016 to

2019-2020 to stop a further price fall and buy some time for the negotiations on a long-term structural solution. Then, after thorough discussions, it introduced the MSR to adjust the market supply. In the ETS Phase 4 reform, the MSR was further tightened up with the competence of cancelling surplus allowances. As aforementioned, since the impact of the recession exceeded the absorptive capacity of the system, the ETS resilience primarily rested on its adaptive capacity to the changing environment. This section will examine the resilience by looking at the criteria of efficiency and effectiveness.

Concerning the efficiency, it found that due to the institutional context of the EU policymaking, the introduction of new policies in the ETS was not efficient enough. The EU's policy reactions to the economic recession were relatively slow. When the structural surplus started to emerge in 2009, only until 2012 the Commission formally recognised the problem and intervened in 2014 with the backloading. It took nearly 5 years for the EU to react to the market crisis, while in the meantime the surplus had already amounted to 2.1 billion and the price crashed to 3 euros in 2013. Moreover, the MSR was also designed to take effect from 2019, which could only start to address the surplus after 10 years since the problem arose.

The slow reactions were mainly due to the polycentric settings of the ETS policymaking. The consensus-building convention of the ETS was at the cost of its policy efficiency. In both the backloading and MSR cases, due to the controversial opinions on market intervention and the uncertainties of policy consequences, the policymaking caused many disputes in the co-legislators. This was particularly evident in the Parliament where the backloading was initially rejected and then adopted with an amendment.

Although the inter-institutional negotiations had greatly accelerated the legislative process, the ETS legislation still averagely took 1-2 years for adoption. The most striking case was the legislation of the EU ETS Phase 4 that took around 3 years for approval. Moreover, the relatively late timeframe of implementation also proved that the policy reactions were slow. Taking the MSR as an example, although the proposal was submitted in 2015, its implementation was initially set in 2021 and then amended to 2019.

Concerning the effectiveness, the effects of the backloading and MSR were mixed. The backloading only temporarily stopped the accumulation of surplus at the time while the carbon price still remained at a low level for years. The Commission's statistics show that despite some decrease, the structural surplus in the ETS was still above 1.6 billion. Accordingly, the carbon price was depressed at around 5 euros for almost 6 years. During the years, the system failed to deliver a correct price signal to industries and investors.

Table 5.2 Surplus Trend in the ETS 2013-2017

Year	2013	2014	2015	2016	2017
Surplus (Billion)	2.1	2.1	1.78	1.69	1.65

Source: European Commission (2017; 2018)

As to the MSR, despite the recent price surge, the long-term stability of the ETS still faces uncertainty. In 2018, soon after the adoption of the ETS Phase 4 Directive, the carbon price rose beyond a double-digit level for the first time since Phase 3. The Directive enhanced several key benchmarks, including a higher LRF and a reinforced MSR that would further reduce the surplus. The anticipation on a more stringent ETS thus strengthened market confidence as the carbon price surged from 8 euros in February 2018 to above 20 euros in 2019.

Figure 5.1 Price Trend in the ETS 2013-2017

Source: Sandbag Carbon Price Viewer (Online)

In May 2019, the Commission published the total number of allowances in circulation: 1.654 billion. The MSR thus would absorb around 400 million surplus allowances in the coming year from the market corresponding to its 24% intake rate. With such a pace, the current 1.65 billion surplus allowances

could be reduced below the threshold before 2023. Also, with the competence of cancelling allowances, around 2.4 billion allowances could be invalidated by 2023, and 2.6 billion in total by 2030 (I4CE and Enerdata 2018).

However, there are still uncertainties on the effect of the MSR. As a quantity-based instrument, the MSR's effect on the carbon price is still less certain than price-based instruments. Without a price corridor, the market price could still experience strong volatility in a short term. For instance, in 2018 when the price surged to 25 euros on 10 September as a result of the optimistic ETS prospect, Poland stood out and called for market intervention. The political announcement soon had an impact as the price plummeted to 18 euros in three days. It showed that the carbon price is not simply determined by market equilibrium, as institutional or political events could also bring about price variations.

> *Part of the problems was that we were not explicit about the objective of the EU ETS. Some people thought about it as primarily an efficient way to deliver the 2020 target at least cost. But actually the reality is that we are trying to transform our energy system over a period of decades, and that's why investment really matters. A lot people never really clearly distinguish the operational price signal from investment price signal. For operational price signal, all you need to know is what the carbon price today or tomorrow and I need to run my gas plant or coal plant. For investment signal, you need to have some sense of what you think what is the future price is going to be and of the confidence that makes you willing to risk billions of pounds on investment. That is completely different propositions. So if this instrument (the EU ETS) is supposed to affect investment, there have to be some stronger sense of security around the price. (Interview 15)*

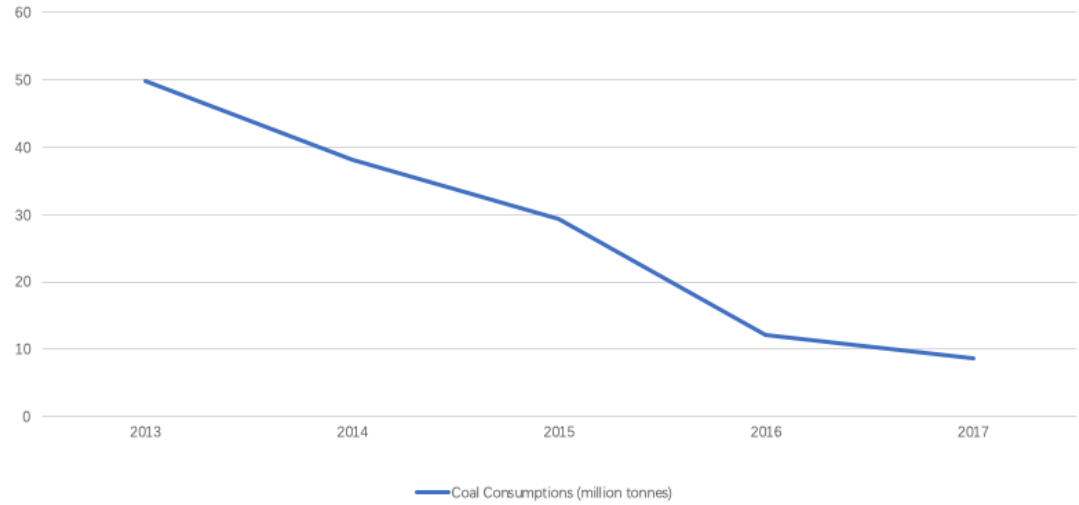
Price-based instruments like a carbon price floor have been often discussed as a supplement to the ETS. Some argue that a hybrid model combining a cap-and-trade system and a price floor could outperform the ETS by providing more certainty on the price (e.g. Philibert 2009; Goulder and Schein 2013).

Although the MSR was introduced as a substitute to the carbon price floor, NGOs still prefer a carbon price floor. (Interview 2)

The MSR is not sufficient, and we are still trying to push the policy of auction reserve price. (Interview 6)

In this regard, the UK's carbon price floor policy set an example. The EU's environmental legislation allows member states to set more stringent complementary measures. In 2013, following the price failure in the ETS, the UK introduced its own national carbon price floor to underpin the ETS price. The price floor comprised the price from the EU ETS and an additional price called Carbon Price Support predefined by the UK government. The Carbon Price Support was initially designed at a rate of £16 and was due to increase to £30 in 2020 and to £70 in 2030. However, in 2015 the UK government decided to freeze the price at £18 until 2020 due to the concerns of competitive disadvantages of the UK's industries to their European counterparts. Although the floor price did not increase to its initially designed level, the policy has nevertheless brought about more climate outcomes in the UK than a business-as-usual scenario. While other ETS members were struggling with a relatively low carbon price, a stronger price signal in the UK encouraged its industries to transit to a low-carbon development trajectory faster. Since implementation, the price floor has led to a significant fall of coal consumption in the UK's power sector. Particularly in 2016, the doubling of price floor to £18 contributed to the closure of several coal stations (Hirst 2018). The coal consumption decreased from 49.86 million tons in 2013 to 8.70 million in 2017 (UK Government 2018). In the meantime, the coal generation in Europe only decreased by 34% from 2012 to 2017 (Sandbag 2017). The Carbon Price Support also accounted for 73% of the reduction in the UK's coal generation from 2012 to 2016 (Aurora Energy Research 2018). Evidently, a stronger price signal in the UK has been instrumental in driving its power sector to reduce the consumption of traditional solid fuels and switch to cleaner energies.

Figure 5.2 Coal Consumption of UK's Major Power Producers 2013-2017



Source: UK Government (2018)

The success of the UK's carbon price floor triggered discussions in other countries about setting their own national price floors, such as in France and the Netherlands. However, this bottom-up trend in the EU ETS also came with concerns. Setting a national price floor might force domestic industries to shift their emissions from one country to another. Power industries could also import power from neighbouring countries through interconnectors. Without an EU-wide price floor, these concerns could hinder the spread of such a policy in member states. In practice, the concern of competitiveness has already taken effect in the UK. In 2014, the Confederation of British Industry asked the government to freeze the price floor in order to minimise the price spread between the UK's carbon price and the EU ETS price, claiming that a higher carbon price in the UK put its energy-intensive and trade-exposed industries "at a considerable competitive disadvantage" (Confederation of British Industry 2014). Due to the concern of competitiveness, in 2015 the UK government decided to freeze the price floor level at £18 until 2020 (Her Majesty's Treasury 2014). Without a harmonised policy within the EU ETS, the concerns of leakage and competitiveness would hinder the bottom-up efforts of member states.

> *Because of the tax (the UK's carbon price floor), the UK needs less and less allowances which will further decrease the carbon price and lead to more emissions in Europe. So unless there is an EU-wide price floor, this*

approach is meaningless. Although this approach is good to a single country, there is no benefit to the whole Europe. (Interview 5)

Although a price floor can make emissions in one country more expensive, it will also lead to more emissions in other countries. (Interview 9)

From the UK's experience, actually industries could accept a carbon price floor. The difficulty rests on the EU's institutional setting. (Interview 16)

5.4. Summary: EU ETS Resilience to the Economic Recession

Compared with the case of the enlargement, the EU ETS has been less resilient to the impact of the recession. The ETS lacked both robustness and adaptability to the disturbance. At first, due to design flaws, the system could not buffer the fluctuations of allowance demand, as the market supply was fixed with no adjusting mechanisms. As a result, the surplus allowances accumulated and the price plummeted significantly. It took years for the EU to introduce policies to address the problem of market disequilibrium while the system provided little incentive of carbon abatement for industries.

At first, it is clear that the impact of the recession exceeded the buffer capacity of the ETS and threatened its vital functions. The system had no flexible mechanisms to adjust the supply to fit the changing market demand. The accumulation of surplus allowances and market disequilibrium seriously undermined market confidence, as the price plummeted to almost 3 euros in 2013. In such a circumstance, the EU needed new policies to adapt to the changing context and restore the vital functions of the ETS. However, in terms of efficiency, the EU has acted slowly to the disturbance. It took five years to introduce the backloading policy which can only temporarily stop the accumulation of market surplus, and took another five years to initiate the MSR as a permanent solution. It was until 2018 the carbon price recovered to a double-digit level while for years the ETS provided little incentive for industries.

In terms of effectiveness, the ETS has successfully restored the vital functions of cap stringency and price stability, but there are still potential risks. While the backloading did temporarily stop the accumulation of surplus allowances, it had little effect on the carbon price and market confidence. The total cap of the ETS in Phase 3 was not changed as all backloaded allowances would be released back. Predictions on the long-term structural surplus thus kept depressing the price at a low level. Concerning the MSR, the policy has indeed brought about positive outcomes since 2018, as the price has recovered to above 20 euros and the surplus allowances are also expected to be reduced by 400 million in the coming year. The MSR has proved instrumental in securing the long-term market balance, especially with the competence of cancelling surplus allowances in the reserve. However, its effect on price stability is still in doubt. It should be noted that the recent recovery of the carbon price is largely due to the strengthened market confidence after the ETS Phase 4 legislation. It is not caused by the rebalancing of market supply-demand as now there are still around 1.6 billion surplus allowances. In reality, the carbon price formation is complicated that many factors could affect the price. The supply-demand stability solely could not secure the price stability. Some institutional or political disturbances could also cause price fluctuations as exemplified by the Polish case in 2018. In this regard, the ETS still cannot address short-term price instability. Moreover, the lack of an EU-wide carbon price corridor has also hindered some bottom-up efforts of the member states.

The EU's polycentric decision-making structure is a major reason why the system has been less resilient to the impact of the recession. Compared with the enlargement that affected the decision-making structure of the ETS, the economic recession directly affected the ETS market as the carbon price plummeted because of the surging surplus allowances. The EU needed to introduce new policies to intervene in the plummeted price, but due to its polycentric decision-making structure its policy reactions were not efficient. The lengthy process of policy discussions and consensus-building slowed down its policymaking. It took five years to introduce the backloading and another five years to initiate the MSR. The debates among different regulatory logics and the consensus-building among stakeholders not only slowed down the policymaking process, but also constrained the its options. Though a price-based mechanism is arguably the most straightforward and effective solution, the regulatory preference of the policymakers and the EU's institutional feasibility eventually championed the MSR.

Chapter 6
China ETS Resilience to the Ministerial Reform

This chapter presents the case of China's ETS resilience to the impact of the ministerial reform in 2018. It is of similarities to the case of the EU enlargement that altered the institutional dynamics and power structure of ETS decision-making. In 2018, the Chinese government reformed its ministerial configurations that changed the governance competence of many departments. Concerning environmental governance, it established a new Ministry of Ecology and Environment (MEE) to replace the Ministry of Environmental Protection (MEP). The MEE not only inherited the MEP's competence of environmental protection, but also integrated the competence of climate governance from the National Development and Reform Commission (NDRC). The power of ETS decision-making and implementation was thus transferred from the NDRC to the MEE.

In China's political system, there are power disparities between the NDRC and the MEE. As a macro-economic management agency, the NDRC holds a strong position in the political-economic system and has the influence to many other ministries. By contrast, the environmental agency in China has long been a relatively marginal ministry and been criticised for its weak capacity of enforcement. Their power disparities thus informed a concern of a potential impact on the ETS. This chapter attempts to investigate whether the reform would impact the ETS, and assess the resilience of the ETS to the impact.

Similar to the research logic of Chapter 4, the resilience research on China's ETS firstly looks at its institutional settings and provides the rationale to interpret its decision-making structure as a monocentric model. The interpretation of the monocentric model seems odd, as China's ETS now is decentralised into several regional pilots and a national system with no interconnection. To vindicate the logic, the first section provides an update of China's ETS to construe the governing logic of the government in the ETS, and then looks into the institutional settings of the ETS at the central government level to define its decision-making as a monocentric model. The second section describes the ministerial reform and its potential impact on the ETS. The third and fourth sections proceed with the analysis of resilience by examining the policy dynamics after the reform. The last section offers a summary to the case.

6.1. China's ETS Decision-Making as a Monocentric Model

Following the ETS resilience framework, the assessment of ETS resilience needs to first describe the contextual rules and stakeholders of the system. This section provides the rationale to interpret China's ETS decision-making as a monocentric model so as to proceed with the following analysis. Given the fact that now China's ETS is decentralised into eight regional pilots[5] and a national market, it seems odd to describe the ETS as a monocentric model. To justify the argument, this section looks into three aspects of China's ETS: background, development and institutional settings. The analysis of the three aspects demonstrates how the ETS has been contextualised into China's unique political-economic circumstances, and how those features have constrained its ETS decision-making as a monocentric model.

6.1.1. Background of China's ETS

Given the country's unique political-economic circumstances, it was a surprise when China decided to establish domestic ETSs. Unlike the EU, China's economy contains many non-market features that could hinder the implementation of the ETS (Lo 2013; Munnings et al. 2016). Yet, several regional pilots have been in place for years, and a national market is also in a trial phase. While China learned experience from the EU ETS, its ETS also contains variations fitting its unique domestic conditions. The understanding of China's governing logic on the ETS thus points to the importance of understanding why China decided to adopt the ETS and how the policy has been contextualised. This section thereby explores the factors shaping the governmental preference on the ETS.

6.1.1.1. Decarbonisation Policy Imperative

In the last several decades, along with the unparalleled economic growth, China has become the world's largest carbon emitter (Stensdal, Heggelund and Duan 2007). Now its emissions are larger than the United States (US) and the EU combined (PBL 2018). Even on a per capita base, China's CO2

[5] After the initiation of seven regional pilots, a Fujian pilot was established in 2016. As the pilot is still immature by the time of writing, the remaining of the research only focuses on the seven pilots.

emissions are higher than the EU and the world's averages (World Bank online database). The rise of emissions attracted much international pressure on China's international negotiation position (Engels, Qin and Sternfeld 2015). As a consequence, China needed to make more progressive efforts to address climate change.

China also has domestic concerns. Extreme weather hazards due to climate change, such as typhoons, drought, floods, cold and heat waves could impact the economy, especially the agriculture sector. The estimated annual economic losses from extreme weathers accounted for around 1-3% of China's Gross Domestic Product (GDP). In the long term, the rise of average temperature will affect regional water supply and vegetative growth (Sall 2013). Besides, concerns related to environmental, health and energy security issues also added momentum to the climate agenda. China's economy heavily relies on fossil fuels. In 2018, coal accounted for 59% of the total energy consumption (National Statistics Bureau of China 2019). The consumption of fossil fuels resulted in severe air pollution that caused great public dissatisfaction, becoming a potential threat to social peace and government legitimacy (Lin 2010). In 2018, 64.2% of the 338 monitored cities in China failed to reach the national air quality standard (National Statistics Bureau of China 2019). To reduce its dependence on energy import and improve air quality, China needed policies to promote energy efficiency and low-carbon development.

6.1.1.2. Policy Calculation: Why Emissions Trading

Decarbonisation can be approached through either regulatory or market-based policies. Despite the regulatory convention, China's decision for an ETS has political and institutional roots. First, the trial of emissions trading is consistent with the country's experimental policymaking convention. China's adaptive policymaking to new challenges hinges on the flexibility of local experiments (Heilmann and Perry 2011). When the government faces a new challenge, it will firstly experiment with various methods at the local level to find the most effective solution, and then promote to a larger scale. The ETS followed this convention. The central government initially established regional pilots across various geographic-economic conditions, and then drew experience to the national ETS. Yet, in the meantime, China does not rule out the use of other policies such as the subsidies and investment in renewable

energy and energy efficiency, the mandatory rules on the operation of factories and power plants, the low-carbon cities projects and the consideration of carbon taxation (Engels and Wang 2018). Now China is still in the experiment of various decarbonisation policies.

> *Crossing the river by feeling the stone. This is how the government experiments with different policy options, and carbon trading is clearly one of the experiments. (Interview 40)*

> *There is still possibility that the government introduces a carbo tax, or have the tax with the ETS together. (Interview 28)*

Second, China has political-economic stakes in the ETS. Emissions trading presents a neoliberal approach that seeks to address climate change by creating profitable opportunities for those who participate in the investment, production, financing and trading of carbon credits (Bumpus and Liverman 2008; Paterson 2012). The economic benefits were particularly evident in the CDM. As the largest hosting country China accounted for around 68% of the total CDM share as of 2012. This demonstrated a successful case of how curbing emissions can be transformed into a profitable business. Along with the decline of international demand after the Kyoto commitment period, a domestic ETS could provide additional demand to the thriving offset market in China. Moreover, the experience of unequal power distribution in the CDM also strengthened China's aspiration (Lo 2015; 2016a). As a recipient country, China was in a disadvantageous position in the CDM market whereas the market power was mainly controlled by the developed world. Through the ETS, China attempts to gain more influence in an emerging global ETS order and protect its market sovereignty.

Third, ideologically, emissions trading is consistent with the ruling party's guiding thoughts of 'Comprehensively Deepening the Reform'. The reform and opening-up policy has been instrumental to China's economic achievements. In its third Plenary Session of the 18th Party Central Committee, the Party reclaimed its determination to deepen the economic system reform by centreing the role of the market in allocating resources. The Session vowed that the government should reduce its role in the allocation of resources to

avoid government intervention and poor oversight, while the market should be promoted in resources allocation to optimise the efficiency and maximise benefits (Chinese Communist Party 2013). The ETS thus presented a typical example to the point by showing how the market mechanism can be used to reduce climate pollution, minimise abatement costs and promote socio-economic transition.

Last, previous engagement in pollutant trading also left institutional legacies. Before the ETS, China experienced two emissions trading activities: domestic SO2 trading projects and the CDM, both of which later shaped its ETS practices. China's interest in emissions trading can be traced back to as early as in the 1980s when the nationwide economic reform started to change the country's environmental governance (Tao and Mah 2009). In the 1990s, influenced by the US's Acid Rain Programme, China initiated its first round of SO2 trading projects in six cities. However, due to the lack of legal and administrative basis, the experiment only remained at the conceptual level (CRAES, EPPI and NDRC 2011). Then in the 2000s, in the collaboration with the US Environmental Protection Agency and several NGOs, China implemented another round of SO2 trading experiment in four provinces, three cities and one state-owned company (Tao and Mah 2009). In 2007, the first pollutant trading exchange was established in Zhejiang province, and the central government further escalated the trading to 11 provinces.

The performance of the SO2 trading was mixed. Although the experiment gained valuable experience, the market performance was disappointing in terms of market thickness, liquidity and transparency. The covered industries did not fully understand the idea and its benefits, but only regarded it as a regulatory policy to comply with (Lu 2011). The local authorities played too much administrative intervention (Tao and Mah 2009; Zhang et al. 2016). They arranged most of the transactions and directly suggested the price. Moreover, the experiment exposed the inadequate capacity of the environmental department. The SO2 trading administration was assigned to the MEP and its local affiliates. However, the local environmental bureaus often faced a dilemma between the MEP's administrative order and the local governments' economic priorities. In China's political system, local environmental bureaus were subordinate to the local governments. While they were responsible for enforcing the environmental policies from the MEP, their daily administrative operation was financed by the local governments. So

when facing conflicting interests, they had to favour local economic interests rather than the orders from the MEP by weakening policy enforcement (Chang and Wang 2010). Furthermore, the political weights between the governing authority and participants were not equal. The environmental administration only had a marginal ranking in the political system, whereas most of the covered firms were state-owned with rankings in the cadre system and had significant influence to the local economies (Wang et al. 2003). The imbalanced power thus hindered the implementation.

Contrast to the SO2 trading, the CDM demonstrated a successful case. China had no binding obligation in the Kyoto Protocol, but was eligible to sell offsets in the CDM. In 2005, it entered the CDM market and soon became the largest supplier. As of the end of the Kyoto period, it had the biggest share of the CDM projects, accounting for around 60% of all certificated offsets (Schreurs 2017). The CDM left valuable expertise of emissions trading to China. Many actors in the later ETS design and implementation were previously involved in the CDM. As international offsets were allowed to be traded in the EU ETS, many Chinese CDM participants also had opportunities to understand the EU ETS (Shen 2015). More importantly, the economic benefits from the CDM further strengthened China's belief and determination in the ETS (Sautter 2009; Thomas, Dargusch and Griffiths 2011).

Another legacy of the CDM related to the institutional settings. Unlike the SO2 trading, the authority of the CDM was designated to the NDRC. As a powerful macroeconomic planning and management agency, the NDRC had its own environmental and climate departments. The Department of Climate Change was responsible for international climate negotiations and cooperation, including the CDM. The designation of the NDRC was due to the unique institutional context of China's climate politics. Climate change was initially regarded as a technical and economic issue that was closely related to energy and economic policies (Tsang and Kolk 2010; Lo 2016a), and CO2 was not defined as a gaseous pollutant in China. Climate governance thus fell into the NDRC's competence. Contrast to the MEP, the NDRC had more influence on China's state-owned enterprises, which could facilitate the implementation of climate policies. Therefore, the NDRC was later designated to implement the ETS.

6.1.2 Development of China's ETS

Along with the economic growth, the rapid increase of emissions put China under great pressure in international climate negotiations. Critiques were particularly fierce when the 15th Conference of Parties in Copenhagen failed to deliver a binding post-Kyoto accord, and China was reportedly playing an obstructive role (Lo 2016b). To respond to the increasing international pressure, in 2009 for the first time China committed to a carbon reduction target. It pledged to reduce the carbon intensity by 40-45% per unit of GDP by 2020 to the 2005 level. To reach the target China needed more domestic mitigation efforts. In 2011, carbon trading was firstly revealed in China's most influential periodic policy guideline – the Five Year Plan for National Economic and Social Development (FYP). The FYP is a key characteristic of China's socialist economy, as it sets up a series of economic growth goals, maps out strategies for economic development and guides socio-political reforms for the country's next five years. In the 12th FYP (2011-2015), the ETS was included as a policy strategy to mitigate climate change (State Council of China 2011).

6.1.2.1. The Initiation of Regional Pilots

Following the 12th FYP, the NDRC was authorised to administrate the ETS. In October 2011, it revealed the plan to establish seven regional pilots through the Notice on the Commencement of Carbon Trading Pilot Projects. Four municipalities, two provinces and one special economic zone were selected to experiment with the ETS. They were Beijing, Shanghai, Tianjin, Chongqing, Guangdong, Hubei and Shenzhen that covered a variety of geographic, economic and social circumstances. Local Development and Reform Commissions (DRCs) were responsible for the design and implementation of the pilots. The idea was to experiment with various design features at a smaller scale, so that an internal learning process could produce experience for a nationwide system. As of October 2018, the seven pilots together had traded 250 million tons of CO2 with a total value of 6 billion yuan (MEE 2018). The seven pilots were built in 2013 and 2014. Their design demonstrates many features unique to China's political-economic context, and the implementation also exposes some weaknesses.

Table 6.1 Economic Statistics of Seven Regional Pilots in 2010-2011

	Beijing	Shanghai	Guangdong[1]	Shenzhen	Tianjin	Chongqing	Hubei
GDP (billion yuan)	1411.36	1716.598	4547.283	958.151	910.883	792.558	1580.609
GDP per capita (yuan)	75943	76074	44736	94296	72994	27596	27906
Primary Industry (billion yuan)	12.44	11.415	228.686	0.647	14.948	68.538	214.7
Second Industry (billion yuan)	338.84	721.832	2291.807	452.337	483.757	435.912	776.465
Tertiary Industry (billion yuan)	1060.28	983.351	2026.79	505.167	412.178	288.108	589.444
Industrial Structure (%)	1:24:75	1:42:57	5:50:45	0.1:47.2:52.7	2:53:45	9:55:36	14:49:37

Source: calculated based on data from Beijing Municipal Bureau of Statistics (2011); Chongqing Municipal Bureau of Statistics (2011); Guangdong Bureau of Statistics (2011); Hubei Bureau of Statistics (2011); Tianjin Municipal Bureau of Statistics (2011); Shanghai Municipal Bureau of Statistics (2011); Shenzhen Bureau of Statistics (2011).

[1] The statistics of Guangdong province include Shenzhen as a part

6.1.2.2. Features of the Pilots

The first feature is in the cap-setting. Unlike the EU, China only commits to a carbon intensity target. Therefore, all pilots set their caps based on the intensity targets. However, this is problematic as it is difficult to accurately predict economic growth and allocate allowances. So pilots adopt different measures to adjust their caps.

One approach is to reserve a large proportion of allowances for supply-side adjustments. For instance, in Guangdong, the government reserves a proportion of allowances so that it could adjust the allocation fitting the economic dynamics. In 2018, the pilot had a cap of 422 million tons in which 399 million was distributed and 23 million was reserved for new entrants and adjustment (Guangdong DRC 2018).

Another approach is to allow ex-post adjustments to the companies' allocation if fluctuations of production or emissions occur. For instance, in Shanghai, the regulator has two different allocation methods. For those industries receiving allowances based on grandfathering, the government allocates allowances for free. For those based on benchmarking, the received allowances are based on their production level in the previous year, but the allocation is subject to adjustment before the compliance date as the government could allocate more or reduce allowances based on the real production level (Shanghai DRC 2018). Beijing and Shenzhen also have similar mechanisms by which the regulators could adjust the allocation ex-post (Shenzhen Urban Development Research Centre 2015; Beijing MEEB 2019).

The second feature is the inclusion of both direct and indirect emissions. China's electricity market is still under strong government regulation and dominated by state-owned enterprises. The power sector is dominated by five state-owned companies, and the grid system is monopolised by two state-owned companies. The transmission, distribution and retailing of electricity are integrated by the grid companies (Zeng, Weishaar and Vedder 2018). The NDRC determines both the generation and retail prices, so the variations of the carbon price on producers cannot induce a pass-through of costs to downstream users. As a solution, all pilots include emissions of both upstream generators and major downstream users. This has two advantages. First, it could cut off industries' potential to reduce their emissions by shifting energy

sources. As electricity prices are fixed, if indirect emissions were excluded, industries could shift the consumption of fossil fuels to electricity to reduce emissions. Second, it could prevent carbon leakage through inter-grid power transmission. Most pilots, particularly those municipalities, rely heavily on electricity imported from other regions. For instance, Beijing imported around 60% of its electricity from other regions, and the proportion was expected to increase to beyond 70% at the end of 13th FYP period as a way to address the surging demand and local air pollution (Zhang 2015; Cnenergynews 2017). As the power generation and grid sectors are dominated by a handful of state-owned companies, they could simply reduce their emissions within the pilots by shifting their power output between different regions and importing more electricity from non-pilot regions. Therefore, all pilots use enterprise-based registration and include indirect emissions.

The third feature relates to price management strategies. Drawing lessons from the EU ETS, all pilots introduced mechanisms to contain price fluctuations. The use of domestic offsets is generally limited within 8% or 10%. In Guangdong, more than 70% of offsets must come from local projects (Guangdong DRC 2014; ICAP 2018). Also, all pilots have policies to reserve a certain proportion of allowances to adjust the market supply-demand when the price fluctuation exceeding pre-set thresholds. The thresholds of price variations are set based on a day-to-day interval. For instance, Shanghai initially set the threshold at 30% but then revised to 10% (Munnings et al. 2016; Shanghai Environment and Energy Exchange 2016). The government could temporarily limit or suspend trading when the price fluctuating more than 10% in one day. In Chongqing, in addition to a 20% threshold, the government requires companies must not sell more than 50% of their free-allocated allowances (Chongqing Government 2014; Chongqing Exchange 2017). Guangdong set a floor price of auctioning, which was initially set at 60 yuan but then gradually decreased to 5 yuan and was finally replaced by a reserve price policy (ICAP 2017; 2018). Contrast to the EU, the pilots have more restrictions on the transaction prices. However, it should be noted that those measures focus more on the day-to-day variations rather than the absolute level of the price, which means that they are more likely designed to prevent market speculation and price manipulation rather than supporting a strong price signal.

> *The government clearly worries more about price manipulation and market speculation. It has been repeatedly emphasised that carbon allowances are used for compliance not for speculation. (Interview 32)*

The last feature concerns the non-compliance penalties. In the EU ETS non-compliance faces 100 euros per allowance penalty. In China, by contrast, not all pilots have financial penalties; instead, they have administrative or quasi-administrative penalties. Some pilots include non-compliance in the company's credit record and disclose to the public (Shanghai Government 2013; Beijing Government 2014; Hubei Government 2014). Some pilots limit or prevent the access of non-compliance companies to the government's low-carbon preferential policies, financial support and subsidies (Shanghai Government 2013; Chongqing Government 2014; Hubei Government 2014; Shenzhen Government 2014). For non-compliance state-owned companies, the authorities could report to their supervision agency. The performance of the state-owned companies in the pilots is included in the cadre performance assessment (Hubei Government 2014; Shenzhen Government 2014). To encourage compliance, some pilots have preferential policies to compliance companies in low-carbon and energy-saving projects and funds (Hubei Government 2014; Guangdong Government 2014; Tianjin Government 2013).

Table 6.2 Design Features of Seven Regional Pilots in China

	Beijing	Shanghai	Guangdong	Shenzhen	Tianjin	Chongqing	Hubei
Emission Coverage (2012) mtCO2	188.1	297.7	610.5	83.45	215	250	463.1
Reduction Target (by 2020 to 2015 level)	20.5%	20.5%	20.5%	45% to 2005 level	20.5%	19.5%	19.5%
Covered Sectors	Power; Heating sector; Cement; Petrochemicals; Manufactures; Service sector; Public transport;	Airports; Aviation; Chemical fibre; Chemicals; Commercial; Power and heating; Water supply;	Power; Iron and Steel; Cement; Paper; Aviation; Petrochemicals ;	Power; Water; Gas; Manufactures ; Buildings; Port; Subway; Public transport;	Power; Heating; Iron and steel; Petrochemicals ; Chemicals;	Power; Electrolytic aluminium; Ferroalloys; Calcium carbide; Cement;	Power; Heating; Iron and Steel; Non-ferrous metals; Petrochemicals ; Chemicals; Textile; Cement; Glass; Building

		Hotels; Financial; Iron and steel; Petrochemicals; Ports; Shipping; Non-ferrous metals; Building materials; Paper; Railways; Rubber; Textile;				Caustic soda; Iron and steel;	materials; Pulp and paper; Ceramics; Automobiles and equipment manufactures; Food and beverage; medicine producers;
Points of Regulation	Direct and Indirect	Direct and Indirect	Direct and Indirect	Direct and Indirect	Direct and Indirect	Direct and Indirect	Direct and Indirect
Inclusion Thresholds (annually)	5,000 tCO2	For industry: 20,000 tCO2	20,000 tCO2 or 10,000 coal equivalent	For industry: 3,000 tCO2	20,000 tCO2	20,000 tCO2	10,000t coal consumption equivalent

		For transport and building: 10,000 tCO2		For public building: 20,000 m^2 For governmental building: 10,000 m^2			
Offset Limitation	5%, and at least 50% from local	5%	10%, and at least 70% from local	10%	10%	8%	10%, and offsets from cooperative regions are eligible
Price Management	Auction extra allowances if average price exceeds 150 yuan for 10 consecutive days; or buy	If price varies more than 5% in one day, trading will be temporarily suspended or limited	Floor auction price: in 2013 it was 60 yuan, then was lowered to 25 and increased to 40.	Sell extra allowances from a reserve at fixed price, or buy back up to 10% of the	Can buy or sell allowances to stabilize price	Companies must not sell more than 50% of their free allocation	8% of cap is kept as reserve; and day to day price fluctuation is restricted within 10%

	back if the price is blow 20 yuan			total allocation.			
Enforcement	Failing to submit or verify on time have up to 50,000 yuan fine; failing to surrender enough permits will be fined 3-5 times the average price over the past 6 months for each shorted allowance	Failing to submit or verify on time or provide fraudulent information will be fined ranging from 10,000 to 50,000 yuan. Non-compliance will be fined 50,000-100,000 yuan. Company will entry a credit system and published on	Failing to submit or verify on time will be fined between 10,000 and 50,000 yuan. Failing to surrender will be deducted twice the amount from the following year allocation and fined 50,000 yuan.	False information will be fined for the shorted allowances at the price three times the average in the past six months. Disturbing market order will be fined up to 100,000 yuan. Non-compliance are fined three times	Non-compliance will be disqualified for preferential financial support and other national supporting policies. No financial penalty.	No financial penalty; administrative punishments include media and public reporting, disqualification from energy saving and climate subsidies and associated awards for 3 years, and a record on state-owned company performance	Failing to submit or verify on time will be fined ranging from 10,000 to 30,000 yuan. Market manipulation face 150,000 yuan fine. Failing to surrender will be deducted twice the amount from the following year allocation and fined 1-3 times the

		internet, and face cancelation of ability to access special funds for energy conservation and emission reduction measures.		the average price in the past 6 months, and deducted the same amount from the next allocation		assessment system	average price for each shorted allowance with a maximum limit of 150,000 yuan.

Source: Ba (2018); Beijing Government (2014); Beijing MEEB (2019); Chongqing Government (2014); Chongqing Exchange (2017); Duan (2015); Guangdong DRC (2018); Hubei Government (2014); ICAP (2017; 2018); Shanghai DRC (2018); Shanghai Environment and Energy Exchange (2016); Shanghai Government (2013); Shenzhen Government (2014); Swartz (2016); Tianjin Government (2013); Zhang (2015)

6.1.2.3. Weaknesses of the Pilots

Apart from the features unique to the political-economic context, the pilots have also exposed several weaknesses. First, the pilots generally lack a strong legal basis. For instance, the EU ETS was established through the EU's legislative procedure and approved as an Environmental Directive. In China, the legal frameworks of the pilots are relatively weak, which subsequently undermines the stringency of enforcement and punishment. The pilots were generally established through the provincial legislation or administrative measures with only a relatively low ranking in China's legislative system (Jiang 2014; Munnings et al. 2016). Moreover, as CO2 in China is not defined as a type of pollutant gases, punishment concerning CO2 emissions is not subject to environmental law. Instead, the government can only punish non-compliance through the Administrative Penalty Law with only a maximum of 100,000 yuan penalty. In practice, financial penalties for non-compliance in pilots are mostly set between 10,000-100,000 yuan with little deterrence to industries. Administrative deterrence was thus introduced as an alternative to ensure compliance. However, this is still problematic as explanations of those administrative penalties are not clear. For instance, while some pilots include the performance of the state-owned companies in the performance assessment of their executives in the cadre system, there is no specification on how this would be assessed.

Second, the quantity and quality of data are poor. The cap-setting, allocation and MRV of the ETS all rely on complete and correct data. In China, data collection has several difficulties. Pilots did not have experience in collecting CO2 emissions data before (Munnings et al. 2016; Qi and Cheng 2018). As a result, data preparation for cap-setting and allocation in many pilots only began from 2009 to 2012. Moreover, unlike the EU ETS where the data are collected at the installation or facility level, in China the data are collected at the company level, further complicating the collection process. Also, due to the lack of historical data and experience, the calculation of emissions is mostly based on activity data, such as energy consumption or product output. The diverse measurements result in a variety of data sources in the pilots. Apart from the Bureau of Statistics, other agencies such as the DRC, the Bureau of Energy and the Commission of Economy and Information Technology also collect energy or product output data (Qi and Cheng 2018). The inconsistency of data thus complicates data collection and undermined data quality. For instance, there was a data difference of 1.4 gigatons of CO2

emissions between the national and provincial statistics in 2010 (Guan et al. 2012). The diverse data collection methods make it difficult to compare data between different pilots (Kong and Freeman 2013).

Third, market liquidity is low in all pilots. Market liquidity is crucial to the ETS, as price variations will adjust itself to the market equilibrium, reflecting the actual abatement costs. Also, it provides an informative price for secondary market transactions. Although there is no consensus on what is an appropriate level of liquidity, studies commonly argue that the market liquidity of the pilots was low (Jiang et al. 2016; Munnings et al. 2016; Zhao et al. 2016). There are several factors. Firstly, the pilots have overallocated allowances, so industries do not need to buy additional allowances. Secondly. The intensity-based cap combined with within-period adjustments makes it difficult for industries to calculate their allocated allowances and demand until the end of the compliance period. For instance, in Shenzhen, the price went through significant volatility along with the calculation of allocation and adjustment within the period in 2014 (Shenzhen Urban Development Research Centre 2015). Thirdly, industries also lack the awareness of emissions trading. Instead, they still treat the ETS as a mandate to comply with. Trading volumes and activities usually peak near the end of the contractual period, indicating that industries do not fully see the flexibility and benefits of emissions trading (Zhang 2015; Hu, Li and Tang 2017). Many transactions are also arranged by the government (Cong and Lo 2017). Last, the reduction of emissions might also be the result of other overlapping energy and environmental policies. The initiatives of energy efficiency and renewable energy could also contribute to emission reduction (Kong and Freeman 2013; Munnings et al. 2016).

> *Without sufficient training, some companies simply regarded the ETS as another mandatory policy on their emissions, and they just tried to limit their emissions below the cap rather than buying allowances from the market. (Interview 31)*

Last, policymakers still hold a cautious view on the ETS. Although some pilots encourage the exploration of relevant financial products, in practice the development of carbon finance is limited. Due to the concerns of financial risk and market security, China only allows spot trading in the ETS whereas trading futures contracts is off-limit. An explanation to this is that China seeks

to develop the ETS to secure its economic sovereignty in a thriving global carbon market, and the security of carbon finance constitutes a key part to this sovereignty (Lo 2015). Moreover, China concerns that carbon finance would bring more uncertainty to the ETS. Price stability is a key concern in the pilots as price fluctuations could affect industrial costs and economic growth. Many pilots accordingly introduced mechanisms to prevent market manipulation and speculation, such as the monitoring on the price trend and limiting the maximum allowances can be held or traded by a single entity (e.g. Beijing, Shanghai, Chongqing and Hubei). Regulators fear that a fully open and free carbon financial market would bring more uncertainty on the carbon price (Interview 29). Also, China lacks experience on the coordination between the regulatory institutions of the ETS and finance (Adams 2013). Another obstacle relates to the immature market infrastructure, as the concerns of frequent state intervention and data transparency could devalue the carbon allowances as a financial asset for investment (Cong and Lo 2017).

6.1.2.4. The Legislative Progress

As the regional pilots commenced, in December 2014 the NDRC issued the Interim Administrative Measure for Emissions Trading (the Measure hereafter). The Measure was drafted as a response to the request of the State Council to set up a legal basis for the ETS. It outlined several key principles consistent with those features of the pilots, and provided general guidance for the pilots to pave the way to the future national market. However, as an interim administrative regulation, it had legal weaknesses. The Measure was a type of departmental regulation of which the application was only restricted to the authority of the NDRC, and had the least power in China's legal system. Prominent evidence here was that in the Measure the NDRC could not set out any financial penalties to non-compliance but could only introduce administrative penalties. Furthermore, the Measure only provided a general set of rules in which some clauses were not specifically defined or explained. This was mainly due to the limited preparative time of the NDRC. In April 2014, the State Council listed an ETS legal framework as one of the working plans of the NDRC in that year (State Council of China 2014). Following the instruction, the NDRC submitted a legislative draft to the State Council on 23 October 2014 (NDRC 2014). However, given the heavy workload and lengthy legislative procedure of the State Council at the time, it was considered impossible to adopt the draft in five weeks. The NDRC was thus advised to

issue the draft as a departmental regulation to accomplish the task by the end of the year (Interview 39).

To address the legal weakness, in April 2015, the NDRC asked opinions from relevant government agencies and regional affiliates regarding the Measure. In July, it held a public hearing involving the stakeholders from the State Council, the pilots, state-owned companies, academics, the World Bank, NGOs and MRV agencies. Based on the feedback, the NDRC drafted a legislative proposal, the Administrative Measures for Emissions Trading (For Approval), and sent to the State Council for approval (NDRC 2016). Contrast to the Measure, the proposal had several improvements. First, it specified the authorities between the national and local DRCs. Unlike the Measure in which many rules regarding the governance of regional pilots were ambiguous, the proposal clearly defined the authorities of local DRCs. While local authorities still had discretionary power on the pilots, the use of the power had to be reviewed by the NDRC. Second, it added financial penalties regarding non-compliance in the market. Entities violating the MRV terms would be fined from 100,000 to 1,000,000 yuan. Non-compliance of surrendering would be fined 3-5 times the average price in the previous year for each missing allowance, and would be deducted the same amount of allowances in the following year. Third, carbon futures were included as an ETS commodity.

The proposal and its decision-making process indicated a key feature of China's ETS: centralisation. First, the NDRC and its local affiliates were the sole administrator of the ETS. Although some departments suggested establishing a joint body to coordinate the ETS policy, the NDRC rejected due to the concern of fragmentation (Interview 38). Second, the governance of the pilots was centralised to the NDRC via unified standards and methods. The NDRC determined the methods and standards of reporting and calculation in the pilots. While local DRCs still had discretionary power on system coverage, allocation and the use of offsets, they had to be reviewed and approved by the NDRC. Third, albeit some voices for a more prudent plan taking provincial economic disparities into consideration, the NDRC insisted on a nationwide unified principle in the proposal to ensure the preparative work of the national market (Interview 44). Last, carbon futures were formally included as an ETS commodity. Initially, the inclusion of carbon futures was opposed by the Securities Regulatory Commission (SRC) due to the concerns of insufficient

experience and market speculation. The NDRC, however, insisted to include carbon futures to enhance market liquidity (Interview 47).

6.1.2.5. The Commencement of the National Market

The ETS also received momentum from the top leadership. In 2015, China submitted its Intended Nationally Determined Contributions (INDC) to the Paris Agreement, committing that a national market would be launched based on the pilots (NDRC 2015). Soon after the INDC, China's leadership set out a timetable. In September 2015, China's President Xi visited the US and two countries made a joint presidential statement on climate change. In the statement, China committed to lowering its carbon intensity by 60-65% from the 2005 level by 2030. To reach the target, it pledged to launch a national ETS in 2017 covering key sectors such as power generation, iron and steel, chemicals, building materials, paper making and nonferrous metals (The White House 2015). The statement acted as a de facto working instruction to the NDRC.

To meet the timeline, the NDRC issued the Work Plan for Construction of the National Emissions Trading System (for Power Sector) in December 2017, announcing the commencement of the national ETS (NDRC 2017). The system would cover the power sector with the threshold of 26,000 tons of annual CO2 emissions or equivalent 10,000 coal consumption. It would include roughly 1,700 plants with more than 3 billion tons annual emissions, accounting for about one-third of the country's total emissions (People's Daily 2018). The work plan outlined three developmental phases. The first phase would take a year to build a mature market infrastructure of data collection, registry system and exchange platform. The second phase would take another year to simulate trading to test and improve the system design. The third phase would start from 2020 during which spot trading would be carried out only for compliance purpose. It was expected that along with the commencement of Phase 3 the market would gradually include other carbon commodities and industrial sectors. In the short term, the regional pilots would still operate in parallel to the national market with eligible plants gradually transferred to the national market.

The design of the national market is largely consistent with the principles outlined in the NDRC's 2016 proposal, but also with some differences. The

market is designed with unified standards and rules of allocation, MRV and trading set at the central government level. The threshold of converge is consistent with most pilots. However, some design features are indicating a difference. First, the system only covers the power sector rather than the sectors outlined in the China-US joint statement. This is largely due to technical consideration. Compared with other sectors, the power sector in China has a better data basis with well-developed industrial standards (Interview 41). Second, the market only allows spot trading for compliance purpose. In the short term only covered companies can trade their allocated allowances whereas other actors and carbon offsets are not eligible to participate in the market. Third, unlike the 2016 proposal, the national market is more cautious on carbon finance. The work plan reiterates the need to guard against potential financial risks. Carbon futures and other financial commodities are ruled out in the national market, which contradicts to the NDRC's opinion in the 2016 proposal. At the time of writing, the national market is still in the preparative period with the expectation that formal operation will begin sometime in 2021.

6.1.3. Institutional Settings of the ETS

The power structure of China's ETS is highly centralised with a top-down governance feature. First, the authority of climate governance and the ETS administration has been gradually centralised to a single institution. Second, the top leadership provides overwhelming momentum to the ETS agenda. To construe the reasoning, it needs to at first shed some light on the broad institutional settings of China's climate governance.

China's climate institutional settings have evolved over time, reflecting a changing recognition on the problem of climate change. When China decided to adopt the ETS in 2011, the landscape of its climate politics was fragmented. Actors related to climate governance approximately included the State Council Leading Group on Climate Change (SCLGCC), the NDRC, the MEP and the State Electricity Regulatory Commission (SERC).

The SCLGCC is the top leading actor of climate politics. It is an ad hoc supra-ministerial coordinating and consulting body with the aim of building consensus on the issues across the party, the government and the military system. It is responsible for coordinating climate change, energy conservation

and emission reduction policies across different ministries and departments. It is chaired by the Premier of the State Council, and consists of the members from relevant agencies. The SCLGCC does not formulate specific policies, but only issues guidance and principles about the general direction toward where all relevant bureaucracies should work. The opinions of the SCLGCC have considerable influence on the policy design and implementation, as they represent the general consensus among all relevant bureaucracies. The daily operation of the SCLGCC was managed by its general office in the NDRC. Since 2018 its routine work has been undertaken jointly by the MEE and the NDRC.

The SERC was an agency under the State Council responsible for the administration and regulation of the power and electricity sectors. Its relevance to climate change was based on its authority of supervising the emission reduction efforts of the power companies. In 2013, the SERC's functions were merged to the National Energy Administration (NEA) under the NDRC.

The MEP was established in 2008 to replace the former State Environmental Protection Administration. In 2018, it was restructured to the MEE. During 2008-2018, the MEP had no specific climate change department, and only played a secondary role to the NDRC on climate change with the responsibility of implementing the government's emission reduction targets. Yet, in 2018, the climate change department was reallocated from the NDRC to the MEE. Now, the MEE is the major actor in the country's climate change politics, including the ETS administration.

Before 2018, the NDRC was the competent authority of climate governance, including the administration of both international and domestic emissions trading projects. The NDRC, usually known as the 'mini State Council', is a macroeconomic management agency under the State Council with a higher rank than other ministries. It has strong control over the country's economy, with the functions to study and formulate socio-economic development policies and to guide the reform of the economic system. Before 2018, it had three subordinate departments relevant to climate governance: the Department of Climate Change, the Department of Resource Conservation and Environmental Protection and the NEA. Among them, the Department of

Climate Change was the leading institution on climate governance, whereas the latter two had overlapped functions on energy-related policies. It formulated strategies, plans and policies on climate change, led works in international climate negotiations and cooperation, and was responsible for the management of the CDM and ETS. In 2018, its functions were merged to the MEE.

The dynamics of China's institutional setting reflects a changing recognition on the issues of environmental protection and climate change. China's environmental governance has long been plagued by the fragmented and duplicated structure, as it was governed by various agencies at different levels. For instance, while the MEP was responsible for the regulation of environmental pollution, in practice the pollution could be governed by other related ministries. The pollution of underground water was regulated by the Ministry of National Land and Resources, and agriculture pollution was regulated by the Ministry of Agriculture.

As to climate change, China originally did not treat climate change as an environmental but as a technical and development challenge where the technical fixes were closely related to economic and energy policies. The recognition thus resulted in overlapping functions between the NDRC and the MEP. In 2007, the NDRC (2007) published China's first policy initiative on climate change: China's National Climate Change Programme, mapping out the policy strategies to address climate change. In relation to climate mitigation, energy became a policy priority. Underlined policy priorities included improving energy efficiency and conservation, developing renewable energies and intensifying relevant policies and innovations in the energy industry. As energy is a strategic issue to the country's economic development and social stability, the NDRC was designated as the climate regulator.

However, the divide between environmental and climate governance also increased coordinating costs and governance inefficiency. For example, before 2018 the emissions of Carbon Monoxide (CO) and CO2 were governed by different agencies, despite they are both coal-related gaseous pollutants. Whereas CO was regulated by the MEP as a polluting gas, CO2 was governed by the NDRC as climate-related emissions. Therefore, the 2018 ministerial reform marked a process of centralisation of climate governance, as now the

competence of climate and environmental administration has been merged to a single institution.

Similar centralisation was also reflected in the ETS. From 2011 to 2014, the ETS experiments were carried out by local governments and DRCs whereas there was no nationwide guidance to contain regional disparities. The NDRC then started to centralise the authority gradually to the national level. In 2014 it issued the Measure as a national ETS regulation to unify rules and methods among the pilots. In 2016, it sought to tighten up the discretionary power of the local DRCs through the legislative proposal. In the meantime, the suggestion of building a ministerial coordinating body was also rejected. In 2017, the trend of centralisation was further strengthened as a nationally uniform market was launched. The power structure indicates a typical monocentric structure where the power of ETS decision-making and implementation has been centralised to a single unitary actor (Aligica and Tarko 2012; Jordan et al. 2014).

Moreover, China's ETS has shown a top-down feature that the will of the top leadership provides overwhelming momentum to the ETS agenda. The political agenda of the ETS is often set by the top leadership or high-level decrees. As policymaking in China often lacks sufficient stakeholder engagement, the top-down approach ensures that the ETS agenda can be progressed on time. This was particularly evident in the ETS legislation, as the NDRC usually issued its legislative pieces near the deadline. In 2014, the NDRC issued the Measure as a departmental regulation to complete its task by the end of the year. In 2017, again it issued the work plan in December to meet the timeline set by the 2015 joint presidential statement. In both cases, the agendas were set by the country's top leadership or high-level decrees that became the impetus to the NDRC's work.

6.1.4. China's ETS as a Monocentric Model

In retrospect, although China's ETS now consists of eight regional pilots and a national market, their decision-making can be perceived as an integral whole given the proximities of their regulatory institutions, legal frameworks and system design. Moreover, a review of the background, development and institutional settings of the ETS finds several features unique to China's political-economic circumstances.

First, the NDRC acted as the unitary authority in the ETS whereas other stakeholders had little room to play. As China initially regarded climate change as a problem related to economic and energy policies, the NDRC was designated as the regulator for the CDM and the ETS. The powerful position of the NDRC within the administrative hierarchy was thus reflected in the ETS decision-making. It could facilitate the ETS implementation through its influence and control on the state-owned enterprises, the energy market and other regulators. The NDRC also rejected the suggestion of building a cross-ministerial coordinative body concerning the ETS. Another example was that in 2016 it included carbon futures in the ETS legislative proposal even though this was opposed by the SRC.

Second, there was a trend of centralisation in ETS governance. Over time, the NDRC centralised the authority from the pilots that paved the way towards a unified national market. It was expected that along with the progress of the national market, regional variations would be gradually unified as the sectors in the pilots merged to the national market. The discretionary power of the local authorities would also be withdrawn in a unified national market.

Third, the ETS agenda in China was largely progressed through a top-down approach. The commitments of the leaders and the decrees of the central government added overwhelming momentum to the ETS agenda, whereas the NDRC was responsible to fulfil the timeline.

Therefore, it can be concluded that China's ETS decision-making presents a monocentric feature with a low degree of authority dispersion. Constrained by China's broad institutional settings, the ETS was largely framed by the NDRC based on the will of the top leadership whereas other stakeholders had little influence. The power of the regional pilots has also been gradually centralised to the central government level, paving the way towards a unified national market in the future. Those features suggest that the pattern of China's ETS decision-making situates somewhere near the monocentric end in the polycentric-monocentric spectrum of the ETS resilience framework.

6.2. The Ministerial Reform as a Disturbance and Its Impacts

As China's ETS decision-making now has been justified as a monocentric model, the remaining of this chapter can proceed with an analysis of its resilience to the impact of the ministerial reform in 2018. The analysis has four sections. Section 6.2 introduces the 2018 ministerial reform and its potential impact, which defines it as a disturbance to the ETS. Section 6.3 examines the policy dynamics after the reform by focusing on the ETS legislative progress under the MEE in 2019. Section 6.4 proceeds with the resilience analysis through a comparison of the legislation between the MEE and the NDRC within China's unique political-economic context. The last section summarises.

6.2.1. Background: Change of Authority

Only three months after the commencement of the national market, China's ETS met a major change in its institutional arrangement. In February 2018, the Chinese Communist Party held the third Plenary Session of the 19th Central Committee, in which it approved the decision to deepen the Party and the County's institutional reform. The principle of the reform was to transform the governmental functions so that the market could play a decisive role in the allocation of resources and to strengthen the government competence of economic regulation, market supervision, social governance, public service and ecological-environmental protection. The reform involved many ministries under the State Council. In relation to environmental governance, the decision suggested establishing a new ministry to unify the country's regulation and administration of ecological and environmental issues.

Following the Party's decision, the State Council drafted its ministerial reform plan and submitted to the National People's Congress in March for approval. Concerning environmental governance, it proposed to establish the MEE to replace the MEP. The MEE would inherit the MEP's competence as well as the scattered administrative responsibility of many other ministries, including the climate competence from the NDRC. According to the plan, the MEE would take over the responsibility of climate governance including the ETS from the NDRC. The department of climate change under the NDRC would be merged to the MEE, and its local affiliates would be merged to the corresponding bureaus of ecology and environment at different levels. The proposal was then approved by the National People's Congress. In June 2018,

the MEE was further promoted as a co-implementing body with the NDRC for the SCLGCC. The promotion indicates that the MEE now has become the primary agency responsible for China's climate governance.

The 2018 ministerial reform was another round of China's efforts of mega-ministries reform, in which the government sought to eradicate governance fragmentation, duplication and individual departmental interests. Fragmentation was one of the key challenges in China's environmental governance, as many ministries were responsible for pollutant regulation, and climate change was also assigned to the NDRC rather than the MEP. Therefore, an empowered MEE was expected to untangle the departmental complexity, simplify administrative procedures, reduce bureaucracy and promote governance efficiency on environmental issues.

6.2.2. The Potential Impacts on the ETS

Evidently, the integration of environmental governance would improve administrative efficiency and lower coordination costs among different agencies. Although the MEE would benefit China's long plagued environmental governance, it could have a mixed effect on climate governance, particularly the ETS. The rationale of the speculation points to the competence disparities between the NDRC and the MEE.

The environmental agency in China had long been regarded as a marginal agency in the administrative hierarchy. Environmental institutions experienced several rounds of reform and development, signifying the country's increasing awareness of environmental protection. In the 1970s, the government started to pay attention to environmental governance. In 1973, it held the first National Conference of Environmental Protection, marking the initiation of environmental work. In 1974, the State Council established the Leading Group of Environmental Protection. With the earlier efforts, the first Environmental Protection Law was formally passed for trial implementation in 1979 (Yong and Gang 2008). However, it was not until the 1980s the central government built a formal environmental agency. After the second National Conference of Environmental Protection, the government set up the Environmental Protection Commission consisting of members from other bureaus and ministries to initiate new policies and inspect policy implementation. The Commission was subsequently promoted as the National Environmental

Protection Bureau (NEPB) under the Ministry of Urban-Rural Construction and Environmental Protection. In 1988, it was further promoted with an independent status from the Ministry and directly subordinated to the State Council (Tsang and Kolk 2010).

Along with the rapid economic growth from the 1980s, environmental problems in China became increasingly prominent, which in turn further amplified the difficulties faced by the environmental agency in terms of the problems it was designed to address and its inadequate administrative competence. In 1996, for the first time, the government released a five-year plan for environmental protection, in which it proposed several quantity objectives of curbing pollutant emissions (State Council 1996). In 1998, the NEPB was again upgraded from the sub-ministerial to ministerial level and renamed as the State Environmental Protection Administration (SEPA). Yet, albeit more momentum gained by the environmental agency in the 1990s, the deteriorating environment and weak law enforcement indicated that environmental protection was still perceived as a marginal topic in the country's political agenda (Tsang and Kolk 2010).

Since the 2000s, as environmental problems attracted more attention from the public, the government further strengthened the administrative competence of the environmental agency. In 2006, environmental goals were included in the country's 11th FYP. In 2007, the SEPA also issued regulations on the disclosure of environmental information to ensure public involvement in environmental protection (SEPA 2007). In 2008, the SEPA was further promoted as the MEP, and gained wider authority and power of environmental governance. The upgrade showed the government's determination in environmental protection, and a ministerial-level environmental agency was expected to tackle the problem of weak law enforcement at the local level.

The challenges of environmental protection in China are mainly due to the perception that protecting the environment is at the cost of economic growth and investment opportunities. In practice, environmental governance often meets the conflict of good design and poor enforcement. China's plagued environmental governance is commonly attributed to three factors: the lack of adequate resources, the conflicting priorities and the inadequate incentive structure (Schreurs 2017). While the institutional reform has given more power

to the environmental agency, local governments still lack the motivation to enforce regulations as they face more pressure on economic development and have no incentive in environmental protection. Local environmental agencies thus usually face a conflict between the environmental policies from the central government and the economic interests of local governments. In China's political system, although the local environmental agencies are responsible for the implementation of environmental law and orders from the central government, they are financially and institutionally subordinate to the corresponding local governments. Economic development thereby could be easily prioritised over environmental protection if there exists a conflict of interests or trade-off (Pittman and Zhang 2008; Chang and Wang 2010). This conflict could still exist after the 2018 ministerial reform. Although an empowered MEE was expected to address the problems of fragmentation and duplication, its fundamental institutional structure has not changed.

> *How to reconcile the orders from higher authority and the local interests is always a challenge to the local environmental departments. They have pressure from both the central government and the local government. (Interview 50)*

Unlike the environmental agency, the NDRC is a crucial department in China's political-economic system. The NDRC is a macroeconomic management agency under the State Council. It holds strong administrative power over the country's economy, responsible for making socio-economic policies and guiding economic system reforms. It has long been appreciated for its importance in the political-economic system, and earns its reputation as the 'mini State Council'. The State Council has 26 ministerial-level constituent departments and many directly-subordinate agencies. The NDRC has a higher bureaucratic rank than most of the other departments within the State Council.

Compared with the environmental agency, the NDRC has more strength in the ETS governance. First, it has the experience of emissions trading from the CDM. As the government initially perceived climate change as an issue closely related to economic and energy areas, the NDRC was designated as the authority of climate governance. It was responsible for participating in international cooperation and managing domestic CDM projects. Those work

allowed it to accumulate considerable expertise and capacity of emissions trading, which subsequently facilitated its work in the ETS.

Second, it has strong control in the energy market and energy-related policies. China originally had a Leading Group on Energy as the top leading body that coordinated energy policies across ministries. In 2008, it was reorganised as the National Energy Commission. In the same year, the NEA was established under the NDRC responsible for carrying out the work and instructions from the National Energy Commission and the NDRC regarding energy policies. The institutional arrangement indicates the strong influence of the NDRC in the design and implementation of energy policies. More importantly, the NDRC has the power of setting electricity prices. Given the importance of energy prices to the economy, the NDRC directly determines the electricity prices in China on both generation and retail sides. The controlled electricity market makes power generators impossible to pass on their carbon costs to downstream users in the ETS, forcing the pilots to include both direct and indirect emissions to motivate downstream industries to reduce emissions.

Last, given its power and influence in the political-economic system, the NDRC has more leverage to ETS stakeholders. One of the reasons behind the failure of previous SO2 trading was that state-owned companies could influence local environmental law enforcement with their economic weights (Tao and Mah 2009; Lu 2011). However, in the ETS, the NDRC could effectively motivate those companies through its administrative power. The toolkits include preferential rewards and coercive punishments. Its strength is also reflected in the coordination with other regulators. A prominent case here was in the 2016 ETS legislation. When the NDRC and the SRC had a debate over carbon finance, it rejected the latter's suggestion and insisted to include carbon futures as a commodity.

In addition to competence disparities, the NDRC and the environmental agency also have different ideologies in climate governance. While the NDRC supports the ETS as a mitigation policy, the environmental agency prefers a carbon tax. Prior to the commencement of the pilots, in the collaboration with the Ministry of Finance, the MEP proposed environmental taxation to curb emissions. However, due to the controversial opinions from a variety of stakeholders, the plan was finally dropped (Ministry of Finance 2016).

The competence disparities between the NDRC and the MEE thus constitutes a potential impact on the ETS. In China, emissions trading is closely related to two of the government's most concerned fields: economic development and energy security, both of which fall into the NDRC's competence. Before the reform, the coordination of the ETS with the two fields could be achieved within the NDRC. After the reform, however, the policy coordination would be challenging. The environmental agency in China has long been a relatively marginal and weak department, indicating a disadvantageous position of the MEE in the future ETS policy coordination. In addition, the experience of SO2 trading also suggests a potential implementation deficiency of the ETS under the administration of the environmental regulator (Tao and Mah 2009; Lu 2011). Therefore, through the lens of the ETS resilience framework, the 2018 ministerial reform can be perceived as a disturbance to China's ETS.

> *The formation of the MEE has a positive effect to integrate China's environmental governance. For example, now CO and CO2 are regulated by the same agency, while before they were regulated by the NDRC and the MEP respectively. However, it seems that the problem of enforcement may still exist, as local environmental branches still subordinate to, and heavily influenced by the local governments. (Interview 51)*

6.3. Policy Dynamics: A Comparison of ETS Legislation

A challenge to assess the impact of the ministerial reform is the lack of empirical evidence. The reform was started in 2018, but only until the end of the year, the transfer of the climate change departments was completed at all levels of the government. In addition, evidence in the market is also unclear as the market liquidity of the regional pilots has been low and the national market is still in the trial phase.

Nevertheless, there was still progress concerning the ETS after the reform. In April 2019, the MEE issued the Administrative Measures for Emissions Trading (For Seeking Opinions) to hear opinions from stakeholders (MEE

2019a). Based on the feedback, a formal legislative proposal would be then drafted and submitted to the State Council[1].

This is a key progress in China's ETS legal framework, and also the first ETS legislative work since the MEE took over the authority in 2018. The NDRC previously had two legal documents on the ETS respectively in 2014 and 2016. In 2014, it issued the Interim Administrative Measures for Emissions Trading as a guiding document (NDRC 2014). Due to the time limit, the document was only implemented as a departmental order and thus had a less binding effect. In 2016 it released the Administrative Measures for Emissions Trading (For Approval), and submitted to the State Council (NDRC 2016). However, due to the heavy legislative workload in the State Council, the draft in fact had never been approved. After the 2018 reform, as the MEE has become the new ETS administrator, it is thus necessary to issue another ETS legislation to fit the new political context.

The legislation progress thus provides an opportunity to compare the legislative changes between the NDRC and the MEE, by which it could preliminarily assess the impact of the ministerial reform on the ETS. The 2019 draft contains 27 provisions, reduced from 37 in 2016 and 48 in 2014. The reduction of provisions highlights its role as a legal basis, indicating that supplementary regulations will be designed accordingly by relevant regulators. For instance, although Article 10 confirms that carbon allowances are the owner's properties with legally binding effect, it does not denote which type of properties that carbon allowances belong to. In 2019, this was clarified by the Ministry of Finance through its departmental order, the Interim Administrative Measures on Accounting Treatment of Carbon Emissions Trading (Ministry of Finance 2019). With the clarification, carbon allowances thus can be processed by the companies[2].

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[1] In December 2020, the MEE formally release the ETS legislation as a departmental regulation.

[2] Before the Ministry of Finance defined the property type of carbo allowances, it was difficult for companies to deal with carbon allowances in their accounting system, such as the proceeding of the service fees and tax of allowances transactions, and information disclosure. The order thus provides a set of rules and procedures for companies to proceed with their carbon properties.

Compared with the NDRC's 2016 proposal, several provisions are deleted that need complementary regulations later. For instance, the provision concerning the manufacture of new energy vehicles is deleted, which means that the MEE may issue another regulation. Provisions concerning the exchange institutions and their responsibility are also deleted, indicating that a separate regulation may be released later. Other expected complementary regulations include the regulations on the cap-setting and allowances allocation.

Table 6.3 Deleted Provisions in the 2016 Legislation

Deleted Articles	Implications
Article 7. allowances reserves Article 8. allocation principles Article 9. allocation methods Article 10. free allocation Article 11. property definition Article 12. adjustment over the change of companies Article 13. distribution of remaining allowances Article 14. distribution of revenues	The MEE has already implied that a separate regulation on cap-setting and allocation will be issued.
Article 15. allowances for new energy vehicle manufacturers	A separate regulation may be designed.
Article 18. exchange entity Article 34. responsibility of exchange entity	A separate regulation on the exchange entity and its responsibility may be designed.
Article 29. supervision scope	This provision in 2016 is somewhat redundant.

There are also several key changes between the 2019 draft and the ETS legislation by the NDRC. First, it reaffirms the principles of carbon trading (Article 3). Emissions trading in China will operate based on the principles of

a combination of governmental guidance and the market mechanism. The target of emission reduction will be coordinated with the macroeconomic growth and other relevant policies. In the 2014 Measure, the NDRC initially included a provision of principles, but then deleted in 2016. The reaffirmation implies that governmental guidance will play a primary role in carbon trading while the market mechanism provides necessary flexibility on the price. Moreover, compared with the 2014 Measure, the draft adds that the emission reduction will be coordinated with the pace of economic growth and other policy targets. Allowances allocation will be determined based on a range of factors including reduction targets, economic growth and industrial sectoral reform, which means that the national climate target is no longer the only factor determining the market target (Article 7). Apparently, ensuring economic development and stability constitutes a priority in China's climate governance, and the government also realises that carbon trading requires coordination with other policy targets. Overall, the reaffirmation of principles indicates that China may still curb the use of market mechanisms in climate governance to ensure that emission reduction will not impact economic growth.

Second, the draft further elucidates transaction methods and principles (Articles 13 and 14). Article 13 specifies that agencies and staff of the registry system, the transaction platform and verification are not allowed to participate in carbon trading activities. Transactions are processed through the mechanisms of either centralised auction or transfer by agreement. Clarifying restrictions and methods of the transaction could prevent potential market risks and price manipulation.

Third, a new provision concerning the environmental agency's inspection competence is added (Article 18). The term rules that the central and local environmental agencies can launch inspection on covered companies, verification institutions and other participant entities. The inspection includes spot inspection, scrutiny of facilities and checking and copying relevant documents. Inspected entities are obligated to make explanations to the queries of the environmental agencies. In addition, environmental agencies can also carry out an investigation and obtain evidence from other relevant institutions and individuals. This term corresponds to the MEE's competence of environmental inspection, which allows the MEE and its local branches to inspect the enforcement and compliance of environmental law and regulations at the local level. As the 2019 draft relaxes several non-compliance penalties

in the ETS, the inspection mechanism could be a complementary measure ensuring market compliance. Accordingly, the draft also adds a provision over the penalties of non-compliance to inspection.

Table 6.4 Added Provisions in the 2019 Legislation

Added Provisions	Implications
Article 3. basic principles	Reasserting the importance of governmental guidance in the ETS
Article 5. coverage and registry system	There will be a national registry system and a national trading system. The registry system will be in Wuhan, Hubei, whereas the trading system will be in Shanghai.
Article 13. transaction methods	Methods include centralised auction and transfer by agreement. The former can be viewed as an exploration to carbon finance.
Article 14. transaction rules	The provision especially emphasises the prevention of market fraud, collusion and false information, highlighting the government's concerns over market order and potential risk.
Article 17. changes relating to installations	If the company is no longer qualified in the ETS due to shut down or breakdown, it legal successor will inherit all its liabilities in the ETS, but all free allowances shall be nulled.
Article 21. responsibility of transaction entity	While the 2016 legislation only set penalties for covered companies, this new provision specifies penalties regarding misconduct of all market participants.
Article 18. inspection	These two provisions are added to fit the MEE's inspection competence.

Article 22. penalties on non-compliance to inspection	
Article 24. additional terms	In 2016 only regulators may face criminal liabilities, now all market parties may face criminal liabilities if their violation of responsibility is serious.

Fourth, the draft centralises some authority from the local affiliates in the ETS. Many standards and criteria now are determined at the central level. In the NDRC's 2016 legislation, the thresholds of coverage can be determined by the NDRC, or local governments can submit their standards to the NDRC for approval. However, in the 2019 draft (Article 6), the types of greenhouse gases, industrial coverage and inclusion thresholds are all determined by the MEE, and local environmental agencies are responsible for listing all eligible companies to the local governments for approval and reporting to the MEE. Moreover, provisions concerning verification also indicate the centralisation of authority. Financially, the expense of verification will be included in the central government's budget, whereas in the 2016 legislation the costs of verification will be paid by local governments. Moreover, the qualification of verification institutions will be determined by the MEE. According to the draft (Article 8), the MEE will list all qualified verification institutions for covered companies to choose. The new regulation of verification is crucial to prevent local influence and a race to the bottom of market competition and bidding. Financially, including the verification costs in the central government's budget could reduce the influence of local governments in the ETS. Besides, a nationwide standard and a list of verification institutions could ensure the qualification of those institutions.

Table 6.5 Amended Provisions in the 2019 Legislation

Legislation 2016	Legislation 2019	Implication
Article 6. cap-setting	Article 7. allocation	National climate target is no longer the only factor determining the cap and allocation. Rather, the government will take emission

and allocation		reduction, economic growth and industrial sectoral reform into consideration.
Article 20. market adjustment	Article 16. market adjustment	The MEE further elucidates the measures that can be used for market adjustment, such as limitations on price variations, warns over potential risk, extra auctioning or buying back surplus allowances.
Article 21. monitoring Article 22. verification institution Article 23. report	Article 8. monitoring, verification and report	The MEE will list all qualified verification institutions in which the companies can choose. This implies that there will be national standards on the qualification of verification institutions and expertise. In addition, the cost of verification will also be included in the national budget, which is expected to reduce the influence from local governments.
Article 25. surrender Article 26. offsets	Article 11. surrender	The new provision elucidates that offsets that fit the MEE's standards can be used for surrendering, which implies that in the future there may be a further regulation on the standards of offsets. The provision also elucidates that covered companies should buy allowances if they have shortage on emissions quota by the 31st December of each year. As the MEE does not specify a compliance date in the draft, the 31st December may implies that in the future there will be national compliance date, which is different from the dates in all regional pilots that are generally in June or July.

Fifth, the draft has an ambiguous indication on the type of commodities and carbon finance. Unlike the legislation in 2016 and 2017, it deletes the provision of market commodities, and does not specify whether carbon futures are allowed or not. But in Article 13 it elucidates that participants can mortgage their allowances and transactions can be made via the centralised auction

method[3]. This can be viewed as an exploratory measure to the field of carbon finance. Carbon finance has always been a contentious topic in China's ETS, as it involves multiple regulatory agencies. In 2016 the NDRC rejected the opinion of the SRC and insisted to include carbon futures in the legislation, but the proposal was not approved in the end. In the same year, in response to the NDRC's inquiry, the SRC clarified that the centralised auction method that has widely been used in China's financial market cannot be applied to carbon trading activities (SRC 2016). In 2017, the NDRC changed its attitude. It started to stress the importance of preventing financial risks in carbon markets, and only allowed spot trading in the national market at the initial stage.

Therefore, the draft indicates a contradicting attitude on carbon finance, as the MEE decides to include a transaction method that was rejected by the SRC in 2016. Up to now it is not clear whether or not policymakers of the SRC and the MEE have reached a common understanding on carbon finance. This may require another regulation or explanation from the SRC. Compared with the NDRC, the MEE has less influence when coordinating with the financial regulator. Also, it does not possess much expertise in the financial market. The work on green finance in China by far has mainly been led by the Central Bank and the NDRC whereas the MEE only plays a secondary role. For instance, in 2016 China issued the Guidance on the Establishment of Green Finance Framework, which set up the plan of green finance development. Seven ministries and agencies were involved but the MEE only ranked fourth behind the Central Bank, the Ministry of Finance and the NDRC.

Last, compared with the NDRC's 2016 legislation, the draft changes many non-compliance penalties.

1. To covered companies, non-compliance penalties are lowered. In the 2016 legislation, violating regulations will be fined 100,000-1,000,000 yuan, while in 2019 the penalty is reduced to 50,000-200,000 yuan. In 2016 if the company fails to surrender sufficient allowances, for each missing allowance they need to pay 3-5 times the average price of the

[3] Centralised auction (集中竞价) is a transaction method that includes both call auction and continuous auction mechanisms. It has been only restricted to the transactions of certain commodities in China's financial market. By far, there is no further document or transaction to clarify or exemplify how this method will be used in the ETS.

previous year. They also need to pay a 3% additional price if exceeding the deadline. However, in the 2019 draft, non-compliance companies only need to pay 2-5 times the average price for each missing allowance.

2. Penalties regarding verification institutions are also lowered. In 2016, once being warned, if the verification institution does not correct by time, it will be fined 100,000-1,000,000 yuan. But in 2019, the penalty is lowered to 20,000-100,000 yuan.
3. As the draft includes no provisions on the market exchange institutions, the penalties over the responsibility of exchange institutions are not clear.
4. The draft adds a new penalty provision regarding inspection. Market participants who obstruct the inspection will be warned by the local environmental agency. Any further obstruction will be fined 20,000-100,000 yuan for companies or 1,000-5,000 yuan for individuals.
5. A new penalty concerning the violation of entity responsibility is added. Market participants who manipulate market transactions via fraud, collusion and false information will be warned and confiscated for their illegal incomes. If there is further violation after warning, participants will be fined for 3-5 times the amounts involved. If the circumstance is serious, participants will be banned from carbon trading activities for 3 years and all possessed allowances will be nulled.

Table 6.6 Comparison of Penalties between 2016 and 2019 Legislation

Misconduct	Penalties in 2016	Penalties in 2019	Changes
Covered entities: violating rules	Fine: 100,000 - 1,000,000 yuan	Fine: 50,000 - 200,000 yuan.	Lowered
Covered entities: failing to surrender	3-5 times the price (based on the average price level in the previous year) penalties for each missing allowance, and the	2-5 times the price (based on the average price level in the previous year)	Lowered

	missing quota will be deducted from the next year allocation. Once overdue, there will be an additional 3% fine every day.	penalties for each missing allowance.	
Verification institutions: violating rules	Once failed to correct after warning, there will be a fine between 100,000 - 1,000,000 yuan. If the circumstance is serious, its qualification will be cancelled. It also needs to compensate for any financial loss it caused.	All illegal income will be confiscated, with a fine between 20,000 - 100,000 yuan. If the circumstance is serious, its qualification will be cancelled.	Lowered
Transaction entities: violating rules	Non	All illegal income will be confiscated, with a fine between 5-10 times of all involved amount. If the circumstance is serious, all possessed allowances will be nulled, with a ban of 3 years to participate in carbon trading.	Added
Exchange institutions: violating rules	Fine: 100,000 - 1,000,000 yuan. If the circumstance is serious, its qualification will be suspended or cancelled, and it needs to compensate for any financial loss it caused.	Non	Deleted

Competent authorities: violating rules	Executive officers will receive disciplinary punishment. They will also have criminal liabilities if constitute a crime.	Executive officers will receive disciplinary punishment. They will also have criminal liabilities if constitute a crime.	No change
All entities: credit discipline	Misconducts will be included in the national credit recording system.	Misconducts will be included in the national credit recording system.	No change
All entities: non-compliance to inspection	Non	Fine: for entities 20,000 - 100,000 yuan; for individuals 1,000 - 50,000 yuan.	Added

6.4. Analysis: Implications to the ETS

As the legislative proposal was only released in 2019, and has not been approved by the State Council at the time of writing, it is far too early to argue that the ministerial reform has made an impact on the ETS already. However, the changes of the legislation have indicated some political and economic dynamics in the ETS context, by which some tentative remarks can be drawn.

First, it is obvious that the MEE has lowered many penalties compared with the NDRC's legislation. Financial penalties concerning non-compliance, surrendering and verification are lowered. As the MEE has not released its regulation on the exchange institutions, it is not clear whether penalties concerning the exchange entities will be lowered or not. Although two new penalties concerning transaction and inspection are added, the lowered financial penalties may affect market compliance in the future.

If compared with the regional pilots, the financial penalties in the 2019 draft are still higher. However, it should be noted that the pilots usually include administrative penalties to secure market compliance. As the national legislation, the MEE's proposal and the NDRC's former legislation did not have

any specific provision of administrative penalties. While there are provisions concerning credit disciplines ruling that non-compliance will be recorded in the credit management system, the terms are still vague on the consequences of the recording. In the pilots, although firms face lower financial punishments, their non-compliance could still cause de facto economic sanctions on their government subsidies or preferential policies. However, the competence of those sanctions is associated with the NDRC's power. As now the MEE is the ETS regulator, the deterrence would be less effective than the NDRC's. Therefore, in terms of the penalty stringency, the ministerial reform seems to have an impact on the ETS.

> *To firms, the order from the NDRC and the order from the environmental agency are different. Obviously they will pay more attention to the former. (Interview 20*)

> *The NDRC has more influence to firms, as it determines most of the policies that matter much to them. (Interview 32)*

Second, the refinement of the legislation indicates that further complementary regulations are needed. While some sub-regulations will be drafted by the MEE, some will be designed by or at least coordinated with other regulatory agencies. However, the weak position of the environmental agency in the administrative hierarchy could have an impact on policy coordination. The concern is especially salient in relation to issues of cap-setting and allocation and carbon finance.

Concerning the cap-setting and allocation, the 2019 draft elucidates that the ETS target will be coordinated with and determined by a variety of factors including the national climate target, macroeconomic growth, industrial structural reform and other relevant policies. This means that the cap-setting and allocation cannot be determined solely by the MEE. Instead, the MEE needs to coordinate the ETS target with other economic regulators, especially the NDRC. From this point of view, the ministerial reform seems to bring the old problem of China's environmental governance into the ETS, namely the dilemma or trade-off between environmental protection and economic development. By November 2019, the MEE had allegedly completed the draft

of two sub-regulations: the Cap-Setting and Allocation Scheme on National Emissions Trading and the Technical Guidance on Allowances Allocation in Power Sector. But as those regulations have not been released yet, it is unclear whether the lack of economic competence of the MEE has affected the ETS design.

> *The most important factor influencing the ETS is the Five Year Plan. Before the reform, the NDRC could coordinate the ETS with the FYP internally within itself. After the reform, the situation would be more complicated. The MEE needs to coordinate with the NDRC, and in this process the MEE situates in a disadvantageous position. (Interview 45)*

> *The MEE lacks the ability to influence the NDRC when the NDRC decides to deprioritise climate policy. (Interview 28)*

Another issue is the coordination of carbon finance regulation. China has a contradicting attitude on carbon finance, or more broadly, on green finance. On one hand, since 2016 China has made many efforts to develop green finance. In 2016, with the joint work from the NDRC, the Ministry of Finance, the MEP, the Banking Regulatory Commission, the Insurance Regulatory Commission and the SRC, the Central Bank released the document, the Guidance on the Establishment of Green Finance Framework, to initiate the development of green finance in China (People's Bank of China 2016). In 2017, the Central Bank further issued the Division of Work to Implement the Guidance on the Establishment of Green Finance Framework, which set up 25 tasks for responsible ministries to implement the 2016 document (People's Bank of China 2017a). For instance, as the climate competent authority, the NDRC was required to launch the national carbon market by 2017 to build the market infrastructure for carbon finance. The Central Bank has also started to release an annual report to review the development of green finance since 2017 (e.g. People's Bank of China 2017b; 2018; 2019). Meanwhile, local governments also had explorations. In 2017 eight cities in five provinces established reform and innovation zones of green finance. In 2018, the top leading body of China's climate politics – the SCLGCC reshuffled its members, and the Central Bank as the competent authority of the financial market was included (State Council 2018). In the same year, the Central Bank and the SRC established the Committee on Green Bonds Standard. The MEE also led

the work to establish the Committee on Climate Investment and Financing. In 2019, the momentum of green finance was further strengthened by the top leadership. The State Council issued the Development Plan for Guangdong-Hong Kong-Macao Greater Bay Area, in which it supported to establish a futures exchange in Guangzhou that will take carbon futures as the first commodity (Central Committee of the Communist Party of China and State Council 2019).

However, on the other hand, regulators still have concerns on carbon finance due to the potential risks and the inadequate market infrastructure. The concerns of potential risks usually appear in the financial regulator – the SRC. As aforementioned, in 2016, the NDRC had a debate with the SRC on carbon finance in the ETS legislation. Although the NDRC finally included carbon futures in the legislative proposal, the proposal was not approved in the end. Also, preventing financial risk evidently has become a key part in the 2019 legislative draft. The emphasis on governmental guidance, market adjustment mechanisms and the penalties on fraud, collusion and false information have all indicated the concerns of policymakers on the potential financial risks in the ETS.

> *Climate finance and the financialisation of carbon market are different. In China, the government likes the idea of climate finance because it can attract investment. But to the financialisation of carbon market, drawing lessons from the past stock market catastrophe, the government concerns about the potential risk in managing the market. (Interview 34)*

> *In regard to carbon finance, preventing financial risk is always the primary concern for policymakers. Unlike the carbon markets in America and Europe where carbon finance was initiated along with the spot trading, in China the lack of market infrastructure is not realistic to financialise the ETS at the beginning. (Interview 38)*

> *The ETS should mainly serve as a policy to reduce emissions. Therefore, it should avoid over-financialisation. (Interview 43)*

Based on the policy development in the last few years, it seems that there are still disputes among different regulators. The attitude of the government on carbon finance remains uncertain until further regulation being released. (Interview 54)

Moreover, inadequate market infrastructure also constitutes a concern about carbon finance. By far the ETS in China only has a low level of market liquidity that is not ideal to support the trading of carbon financial goods. Without an absolute climate target, the carbon price faces policy uncertainty. More importantly, spot trading and carbon finance are regulated by different authorities. The MEE is responsible for the regulation of spot trading, and the SRC will regulate carbon futures. However, they may have different views on the carbon price, as the former will consider more on the national climate targets whereas the latter concerns more on price discovery and hedging. As an environmental agency, the MEE cannot act as strongly as the NDRC when coordinating the ETS policies with other competent authorities. The competence disparities between the MEE and the NDRC thus may become an obstacle to the future ETS policy coordination on financial issues.

There are still many policy uncertainties in the ETS, which cannot guarantee a stable price in the medium and long term. This cannot attract long-term investment. (Interview 52)

The market infrastructure is not sufficient to support the trading of carbon futures now. The biggest concern is financial risk. The low market liquidity cannot attract financial institutions, and also has the risk of market manipulation. (Interview 53)

Third, the emphasis on government control and the coordination with economic growth constitutes another concern. The draft reasserts the market principle that prioritises the functions of governmental guidance over the market mechanism (Article 3). It also reiterates that the emission reduction will be coordinated with macroeconomic growth, industrial structural reform and other relevant policies (Article 3 and 7). While at times governmental intervention is necessary to prevent unexpected market fluctuations and stabilise the carbon price, over-intervention may also jeopardise the functions

of the market mechanism and further undermine the confidence of market investment. Contrast to the NDRC's proposal in 2016, it is obvious that the MEE's draft underlines the role of government control and economic growth.

> *The government has in many occasions reiterated that the ETS is primarily used for reducing emissions, not for speculation. So it is possible that the government would intervene in the market when it considers the situation is out of control or deviating from the purpose of emission reduction. (Interview 36)*

Fourth, the new competence of inspection constitutes an uncertainty to the ETS. In China, inspection is a key method for environmental agencies to ensure the enforcement of environmental regulations and law. With the inspection competence, the MEE could launch spot inspection on market participants and verification institutions, copy and examine relevant documents, scrutinise installations and facilities, and investigate market participants and other relevant companies and individuals. While the method could help prevent market fraud and ensure market compliance, it has a strong sense of regulatory feature. As there has no empirical case of inspection in the ETS yet, it is thus not clear now what consequence it may bring about.

> *Inspection is a common practice in the environmental regulation. As you know, it is a good approach to address the problem of enforcement at the local level. However, as this has not been used in the ETS. it is too early now to judge its consequence. (Interview 48)*

Fifth, the MEE has further centralised the authority from local affiliates. China initially took a bottom-up experiment that allowed the regional pilots to design their own markets. While this approach has helped accumulate valuable experience and expertise across various geo-economic circumstances, it has resulted in a fragmented ETS landscape. The pilots operate independently from each other with varying criteria and standards. The incompatibility of their market design thus may become an impediment to the ongoing national market. Moreover, in a decentralised structure, due to the concerns of local economic growth and competitiveness, local governments and state-owned

enterprises may have more opportunities to influence the ETS design and implementation. Thus, it is necessary for the MEE to centralise the authority to ensure market effectiveness.

> *Sooner or later, the national market will include all the pilots. So unifying the standards and criteria is necessary. A unified national market is also beneficial as this could prevent carbon leakage between different regions. (Interview 47)*

> *Due to their varying socio-economic development circumstances, different regions also face different abatement costs. So an unified national market is good for all. For those developed regions, this could reduce their complying costs in the ETS. For those less developed regions, they could also profit from their huge abatement potentials. (Interview 49)*

Overall, a comparison of legislative changes finds that the ministerial reform could make an impact on the ETS. A piece of preliminary evidence was reflected in the penalty stringency, as some financial penalties are lowered. Also, the emphasis on government control and economic growth implies an uncertainty to the future market stringency. Meanwhile, the provisions on carbon finance are still vague. Those problems could be further amplified by the MEE's weak administrative power in the future. Compared with the NDRC, the MEE has less power and influence in the administrative hierarchy, which could be the weakness when it coordinates the ETS with other economic and financial regulators.

6.5. Summary: China ETS Resilience to the Ministerial Reform

In 2018, China reformed its ministerial configuration, which reallocated the competence of climate governance from the NDRC to the MEE. This chapter has analysed how the reform would affect China’s ETS and assessed its ETS resilience to the impact. It finds that China’s ETS would be less resilient to the impact, due to its monocentric decision-making structure where the ETS policy is largely dependent on the competence of its governing authority.

The chapter has firstly reviewed the background, development and institutional settings of China's ETS, which provides the rationale to define its decision-making structure as a monocentric one. Although the ETS now is decentralised into eight regional pilots and a national market, given the NDRC's powerful position and authority in the administrative hierarchy, China's ETS authority is vested solely to the NDRC whereas other stakeholders have little influence. Besides, the ETS development in China has demonstrated the features of centralisation and top-down agenda-setting that underline the importance of the top leadership and the NDRC in ETS policymaking and implementation. Those features together indicate a monocentric structure of China's ETS decision-making.

Moreover, the experience of the SO2 trading, the CDM and the ETS development have shown the power disparities between the NDRC and the MEE. Compared with the environmental regulator, concerning the ETS the NDRC has more power and influence on relevant policies and stakeholders. It could facilitate the coordination of the ETS with the economic and energy policies, and also progress the ETS agenda through its influence in the administrative hierarchy. This was exemplified in the case of carbon finance in 2016 in which it prevailed in the debate with the SRC. It also has more influence on state-owned companies, which is crucial for market compliance. By contrast, the environmental regulator in China has long been a marginal actor in the government that lacks sufficient competence and influence in the ETS policy coordination and enforcement. The power disparities between the NDRC and the MEE thus are expected to affect the ETS in the future.

Therefore, within a monocentric decision-making structure, China's ETS would be less resilient to the change of authority in terms of both robustness and adaptability. As the ETS policy solely depends on the competence of the governing authority, the change of the authority would certainly affect the ETS particularly in two issues: cap-setting and allocation and carbon finance. Due to the prioritisation of economic development and the cautious attitude of the government in the financial market, the ETS policy concerning those fields would require close coordination with the economic and financial regulators, in which the MEE could situate in a disadvantageous position. This was further proved in the recent ETS legislation which has emphasised that the ETS cap

and allocation will be determined by taking into account not only the national emission reduction target but also the needs of economic growth, industrial restructuring, structural optimisation of the energy sector and control of air pollution. The legislation has also left carbon finance unclarified, indicating that the government may still be hesitant on the issue. It is thereby uncertain whether the ETS could soon adapt to the changing political context and sustaining the stringency of its vital functions.

Chapter 7
China ETS Resilience to the Economic Slowdown

This chapter presents the case of China's ETS resilience to the ongoing economic slowdown. The case has similarities to Chapter 5 that addresses the resilience of the EU ETS to the economic recession. In the last several years, due to a variety of factors, the rapid growth of the Chinese economy has started to slow down. The changing macroeconomic circumstance could impact the ETS, as the government could prioritise economic development over other political agendas. The stimulus package of the government in energy and economic policy could further boost carbon emissions and undermine the country's climate ambitiousness and the effect of the ETS. This chapter thereby attempts to examine how the economic slowdown would affect the ETS, and the resilience of the ETS to the impact.

The previous chapter has provided the rationale to define the decision-making of China's ETS as a type of monocentric model. In this model, the authority of ETS policymaking and implementation is vested in a single actor, whereas other stakeholders have limited influence. This model has shown its strength by progressing the ETS in a country that traditionally relies on command-and-control measures and lacks adequate market infrastructure to operate emissions trading. However, it also has the weakness as the ETS agenda and enforcement solely depend on the power of the competent authority and the will of the top leadership. Whereas before 2018 the powerful position of the NDRC could ensure the smooth progress of the ETS, now as the MEE becomes the ETS administrator, its competence and position within the political system indicate an uncertain prospect. Also, the ongoing economic slowdown accompanied by the government’s possible prioritisation of economic growth could further amplify the worry.

A key difference of this chapter with the previous three chapters is that China's ETS is still in an experimental stage that cannot fully reflect the change of the macro-economic circumstance. Also, the economic slowdown is still an ongoing phenomenon, and its impact on the ETS has not entirely unfolded. Therefore, the examination of evidence in this chapter is not only restricted to the ETS per se, but looks into the broad policy fields related to the ETS, such as energy and industrial policies. It takes an assumption-oriented approach to examine whether the economic slowdown has affected the ETS and the ETS

resilience to the impact. The assumption is tested through theoretical possibility and institutional feasibility supported by empirical evidence and observations.

The remaining is organised as follows. Section 7.1 defines the economic slowdown as an ETS disturbance. Section 7.2 offers the rationale and procedures for this assumption-oriented approach. Section 7.3 looks into the empirical evidence in relation to the economic slowdown and the ETS. Section 7.4 proceeds with the analysis. The last section offers a summary.

7.1. The Economic Slowdown as a Disturbance and Its Impacts

China's rapid economic development is slowing down. Although the country is still expanding faster than any other major economies, the growing pace is at its lowest level in the last three decades. The GDP growth rate dropped to 6.8% in 2017 and to 6.6% in 2018. In 2019, the GDP growth further slumped to 6.2% in the second quarter, and to 6% in the third and fourth quarters, which is the lowest rate since 1992. Other major economic statistics also indicate the same fact. The industrial output grew by 4.4% in 2019, the slowest pace since 2002. The net export peaked in 2015 and then started to decline yearly.

Statistics of domestic demand also suggest an economic downturn. The growth of retail sales dropped to 8% in 2019 from 10.7% in 2015 and 18.5% in 2011. Car sales, which is a significant proportion of China's economic output, started to decrease since 2018. The slump of domestic demand has also hit the investment sector. Despite the efforts to boost local governments' infrastructure investment, the growth rate of domestic fixed assets investment fell from 23.8% in 2010 and 2011 to 9.8% in 2015, 7.9% in 2016, 7% in 2017 and 5.9% in 2018. Companies have also struggled with less revenues. The profits of the enterprises above designed size have decreased since 2017 (Statistics in the above two paragraphs are all collected from National Statistics Bureau 2010-2019).

Factors leading to the economic slowdown are complicated (BBC 26 September 2019; CNN 19 July 2019; Financial Times 12 June 2019; 15 July

2019; 25 October 2019; New York Times 17 October 2019; South China Morning Post 16 September 2019). Internationally, the trade war with the US has a major effect on manufacture and export. Domestically, China also has been struggling to harness a high level of governmental debts. Years of economic stimulus policies have resulted in considerable debts for government, companies and households. The government as a response has started to tighten up financial regulations to prevent potential risks. However, the stricter regulations have also made companies more difficult to obtain financing, especially for private companies. Apart from the international and domestic challenges, the contingency of social circumstance could also hit the economy. A typical case here is the Covid-19 Pandemic. The rapid spread of the epidemic forced the government to take draconian quarantine measures including the extension of the lunar new year holidays and travel restrictions across the country. Those measures have posed a huge disruption on economic activities, especially on the manufacturing companies whose workers are mostly constrained in their homeplace. Due to the pandemic, industrial output in January and February shrank by 13.5% compared with 2019. Retail sales decreased by 20.5%, and fixed assets investment was 24.5% lower (Online data from the National Statistics Bureau website).

It is obvious that the rapid growth of China's economy is slowing down. Together with the recent challenge of the Covid-19, the slowing pace could further deepen this year. The economic challenge may have a mixed implication for climate policy. On one hand, the industrial activities and output will decline along with the economic slowdown, resulting in less consumption of energy and raw materials. This would have a positive effect on climate policy. As China has only committed to an intensity target, the less industrial output would bring about lower emissions that is beneficial to climate mitigation. China could also take this opportunity to tailor its excess capacity and energy inefficient industries. On the other, however, the slowdown could put more pressure of economic development on the government. Once the government perceives a necessary trade-off, it could prioritise economic development over climate mitigation by relaxing its regulations and ambitiousness of climate policy.

> *The pressure of economic downturn can impact China's climate policy, as the government may relax its policy stringency. (Interview 21)*

7.2. Economic Sensitiveness of China's ETS

Compared with the EU ETS and other systems, a unique feature of China's ETS is reflected in its economic context. As a developing country, China still has the pressure of economic growth, and how to accommodate the ETS with the burgeoning economy is a key concern for the policymakers. China does not have an absolute emissions target; instead, it has only committed to an intensity target and pledged to peak its emissions by 2030 in the Paris Agreement. That is, the country's emissions are still expected to rise for some time along with the rapid economic growth. The compatibility of emission reduction with economic development thus becomes a crucial factor influencing the government's climate policy. The adoption of the ETS constitutes a typical case in this regard. On one hand, China adopts the ETS as its major mitigation policy given the advantages of emissions trading in cost-effectiveness and other co-benefits. On the other, it does not want the ETS implemented at the cost of the country's economic growth. From this point of view, China's ETS could be more sensitive to the changing macroeconomic circumstance.

In reality, all carbon markets are sensitive to macroeconomic dynamics. As presented in Chapter 5, the 2008 economic crisis resulted in substantial surplus allowances in the EU ETS that depressed the carbon price at around 5 euros for years. In this case, the sensitiveness of the EU ETS was primarily due to the initial design flaws, as the supply of the system was fixed by the pre-set cap and the LRF. So when the demand fluctuated, the system could not respond to the market disequilibrium.

Yet, in China, this scenario will unlikely recur as the market supply is based on intensity targets with a combination of ex-ante and ex-post allocation methods. The pilots determine their caps every year to fit the changing economic circumstance. The frequent modification on the caps thus could prevent the scenario of long-term oversupply like in the EU ETS. In addition, most pilots have ex-post adjustment methods to modify the allocation at the company level based on their real emissions. The pilots could allocate more or take back excess allowances before the compliance date (Shenzhen Urban Development Research Centre 2015; Wang, Jotzo and Qi 2018; Shanghai

DRC 2018). The allocation is adjustable based on the change of market demand and industrial output in the system. The flexibility of market supply-demand therefore becomes a shield to potential economic fluctuations.

> *Now all the pilots have mechanisms that allocate allowances to fit the industrial output and demand, the problem of surplus is unlike to happen. (Interview 35)*

However, this does not mean that China's ETS is more resilient to economic changes. Rather, the economic deterioration could still undermine the ETS functioning through its impact on the government's overall climate ambitiousness.

> *There is always a dilemma between economic development and environmental policy in China. Although the dilemma is not as fierce as ten or twenty years ago, economic growth is still the top priority of the local governments. So the economic downturn would certainly put more pressure on the government on environmental policy. (Interview 39)*

The logic of this assumption can be unfolded in two steps: theoretical possibility and institutional feasibility. Theoretically, it assumes that economic deterioration may prioritise economic development over climate mitigation in the policymakers' agenda if they believe there is a trade-off. In practice, the concern of the potential side effects on the economy has long been a factor influencing China's climate policy. This was echoed from the very beginning when China perceived climate change as an economic-related issue and appointed the NDRC as the climate regulator. In addition, the burgeoning economy along with the sharp rise of energy consumption makes the government unwilling to commit an absolute reduction target. Economic consideration is also the reason why China opted for the ETS rather than a carbon tax as its mitigation policy. Compared with taxation, emissions trading offers a more cost-effective solution by which the government could minimise the industries' abatement cost, let along with its potential of creating new investment opportunities.

While the theoretical possibility explains why the government may curtail the ETS policy when facing economic deterioration, the government also needs the necessary means and capacity to do so. Institutional feasibility here indicates the ability of the government to control or intervene in the ETS. This ability is determined or constrained by the ETS's institutional context and legal status, which refers to the decision-making structure of the ETS. In a high level of institutional feasibility scenario, the government has more means and power to control or intervene in the ETS if it perceives a necessary trade-off between the economy and climate mitigation. In a low-level scenario, on the contrary, the government has less power and means to influence the ETS. For instance, before the introduction of the backloading and MSR, the EU had no means to promptly respond to the economic recession. Due to the institutional constraints and legal status of the ETS, it could only intervene in via formal legislative procedures. Even with the MSR, the system and the reserve still operate independently based on pre-set parameters. In this case, the EU ETS arguably has a low level of institutional feasibility for government manipulation, as the intervention needs to go through laborious legislative work in Brussels.

However, in China, the legal status and institutional design of the ETS grant the government more arbitrary power of market intervention. The legal basis of the ETS is built on the departmental regulation of the NDRC, which has the least binding force in the country's legal system (Jiang 2014). It could be easily overridden if there is a conflict of interest with higher legislation. In addition, the departmental regulation is formulated and enforced by the climate department, which is generally not subject to strict legislative procedure and scrutiny. The competent authority has more power to determine the rules. As demonstrated in Chapter 6, all the regional pilots in China have introduced market adjustment mechanisms. In the MEE's new legislative proposal, it also reasserts that the government could intervene in the market based on the need of economic circumstance and market stability (MEE 2019a). Moreover, within a monocentric structure, the power of ETS decision-making and implementation is vested in a single agency. There lack sufficient stakeholder-engagement and institutional settings to constrain the power of the government in the ETS.

Overall, in the assumption, the theoretical possibility indicates the motive of the government to curtain the ETS ambitiousness when facing economic deterioration, whereas the institutional feasibility indicates the government's

ability to do so. Both dimensions require further evidence to support. The next section thus reviews the recent development of the ETS and relevant policy fields to look for empirical evidence.

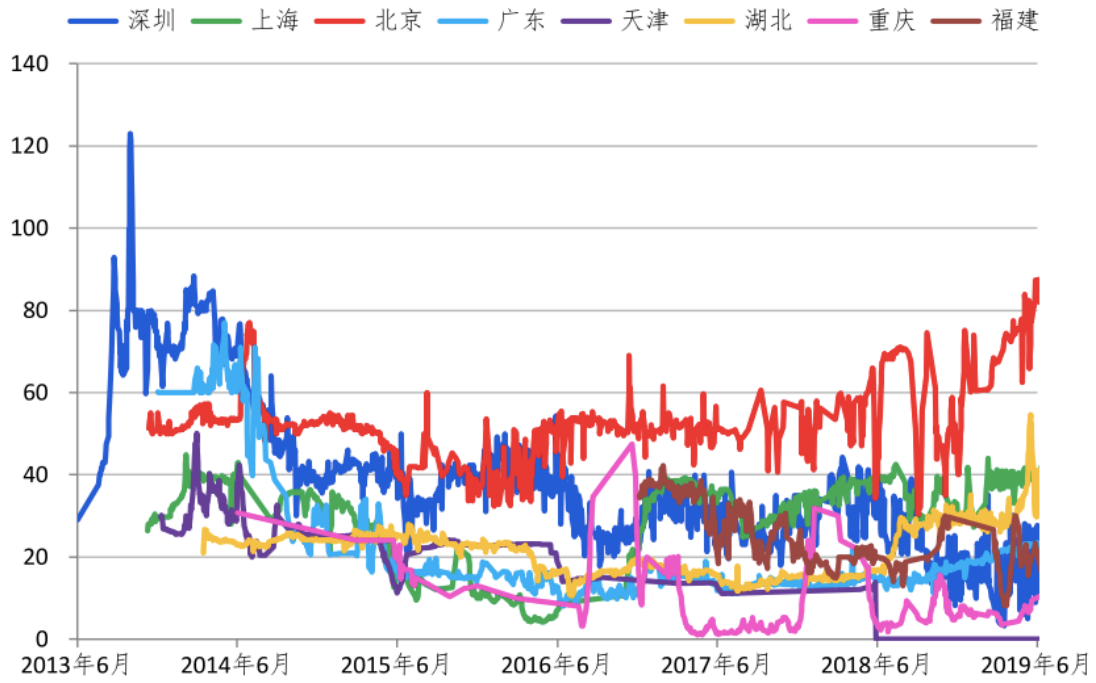
7.3. Preliminary Evidence: China's Climate Politics amid the Economic Slowdown

As aforementioned, because China's ETS is still at an immature stage that cannot fully reflect the macro-economic dynamics, the examination of empirical evidence in this section is not only restricted to the ETS performance, but also looks into the broad policy fields relevant to the ETS. Therefore, the first part of this section evaluates the ETS performance amid the economic slowdown. The second part reviews the most relevant policy field to the ETS: coal, and analyses how the policy of coal would affect the ETS within China's political-economic context amid the economic slowdown.

7.3.1. ETS Dynamics

Statistically, the pilots in China have shown little impact from the economic slowdown. As of June 2019, the seven pilots in total had traded 330 million allowances with the amount of 7.11 billion yuan. The trading volume showed a slight decrease in 2017-2018, but then bounced back to a historically high level in 2018-2019. Although the performance of the pilots has demonstrated divergence in terms of market liquidity, transaction volume and price, they all have largely remained at a stable state. For instance, Beijing has retained the market with the highest carbon price, while Guangdong has kept the largest share of transaction volume.

Figure 7.1 Price Trends in China's Regional Pilots



Source: Slater et al (2019)

Unlike the EU ETS, the prices in the pilots have shown little fluctuation amid the economic slowdown. The difference can be partly explained by their different market design. All pilots have a more flexible design of cap-setting and allocation. Compared with an absolute cap in the EU ETS, all pilots opt for an intensity-based cap combined with adjustment mechanisms. The cap and allocation are thus adjustable in accordance with market demand and economic growth. Also, it should be noted that most allowances are distributed for free and the prices have all remained at a low level. As shown in Figure 7.1, Beijing has the highest price among all pilots. In 2019, its average price was around 80 yuan, approximately 10 euros. Most of the pilots only had a price between 10-20 yuan in 2019, which are even lower than the EU ETS price in 2013.

> *The strength of the intensity-based cap is that it takes effect on the per unit of energy consumption. So you receive less allowances when you emit less emissions, and you receive more allowances when you emit more emissions. (Interview 30)*

Although the economic growth is slowing down, it is still growing. And if compared with other major economies, it still expanding quite fast. So the situation here is very different from the EU ETS in the economic recession. The industrial output and emissions are still growing in China, which means that the demand in the ETS is also growing. (Interview 40)

Economic uncertainty is a key concern of China's ETS. The uncertainty here primarily denotes the complex circumstance of economic growth. On one hand, China's economy is still expanding faster than other major economies. On the other, a series of factors now are affecting this expanding pace, making it more difficult to predict the growth rate. Consequently, the energy consumption and emissions become more unpredictable. To tackle this, all the pilots have reserved competence for government adjustment and intervention.

A difference between China and the EU's carbon markets is that the cap in China is flexible. This is because the energy consumption and industrial output are still growing, so the emissions are also growing. Therefore, the pilots have set up mechanisms to adjust their caps based on the change of the demand. (Interview 45)

Price management measures are introduced to contain potential price fluctuations. As indicated in the MEE's 2019 legislative proposal, the allocation will be determined by a combination of factors including the national reduction target, economic growth and industrial structural reform. Moreover, the proposal particularly emphasises market intervention, asserting that there should be mechanisms to contain potential price variations. Also, based on the need of economic circumstance and market stability, it could auction extra allowances or buy back surplus allowances, of which the costs will be included in the central government's budget.

The purpose of the ETS is to motivate industries to reduce emissions, but the emission reduction should not risk economic development and market stability. Therefore, the government pays much attention to potential market risks and set up various measures to prevent the risks. (Interview 38)

Duo to the cautious attitude of the government on the carbon price and the intensity-based system design, the problems of market surplus and price volatility that happened in the EU ETS will unlikely recur in China during the economic slowdown. Moreover, the relatively low carbon prices and market liquidity in the pilots could also not fully reflect the change of the macro-economic circumstance.

> *The market liquidity and price in the regional pilots now are not sufficient to reflect the economic dynamics. Sometimes firms do not see the price signal to decide their abatement strategies. (Interview 28)*

7.3.2. Pertinent Policy Dynamics

While the ETS has shown little impact, the economic slowdown could still affect the system via indirect ways. To address the economic slowdown and boost growth, the Chinese government usually prefers stimulus policy with large-scale infrastructure construction and investment, which would boost the consumption of fossil fuels, coal in particular. This would also boost GHG emissions. However, as aforementioned, in an intensity-based ETS scenario, the surge of energy consumption and emissions would not be reflected in the carbon price, as the cap is flexible based on the change of energy consumption and industrial output.

Yet, the stimulus in the consumption of fossil fuels obviously runs against the purpose of the ETS and undermines its effectiveness. Therefore, it is worthwhile to examine the energy policy dynamics amid the economic slowdown, and analyse how this would affect the ETS. This section looks into the recent policy dynamics of China's foremost energy – coal, to comprehend the government's attitude on economic growth and climate mitigation.

Coal is the most polluting fuel for climate change. Burning coal could produce up to twice the amount of CO2 as other fossil fuels, let along other environmentally hazardous particles causing serious air pollution. However, it is also the most important energy to China, accounting for 57.7% of the country's total energy mix in 2019 (National Statistics Bureau 2019). As a

result, in 2018, coal consumption accounted for more than 70% of CO2 emissions in China (online data from the Global Carbon Atlas).

In China, the ETS and the policy of coal are interrelated. On one hand, the ETS could influence coal consumption, as it puts a price on industries' emissions and therefore motivates them to consume less coal or burn more efficiently. The motivation of the carbon price is, theoretically, expected more prominent to China's power generators, as they cannot pass on their emissions costs to downstream users due to the government control on the electricity prices.

> *The policy of coal is probably the most influential field in relation to the ETS in China. Coal is the most important energy source in the power sector, and accounts for most GHG emissions. (Interview 28)*

However, on the other, the policy of coal could also affect the ETS, or more broadly China's climate policy in turn. Unlike other major economies that seek to phase out coal from their energy mix, China's coal consumption is still growing although the share in the energy mix is declining. China still needs more energy, including fossil fuels if necessary, to support the expanding economy and industrial output. This would obviously to some extent run against the climate policy that seeks to curb GHG emissions. From this point of view, the industrial and energy policy in China, which has a significant impact on coal and other fossil fuels, would affect the efficacy of the ETS. Thereby, it is of importance to examine whether China's industrial and energy policy amid the economic slowdown has made an impact on coal consumption and what consequences it may bring about to the ETS.

Coal and coal-related industries have experienced a dramatic circumstance in the last decade. Coal is the primary energy supporting the economy. Attracted by its affordability and mobile feasibility, China is the world's largest producer and consumer of coal. In 2013, it consumed around 4.24 billion tons of coal, reaching its highest level in history. However, soaring coal consumption also brought about environmental consequences. Many cities and regions have long been plagued by severe air pollution, which caused

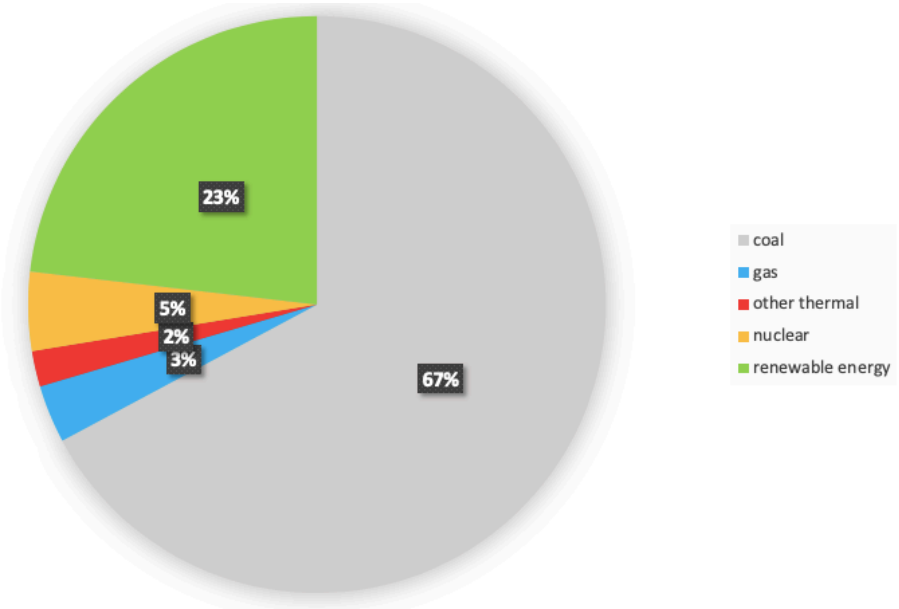
large-scale social dissatisfaction to the regime. To address public dissatisfaction, the government started to reduce its reliance on coal.

> *Addressing air pollution is obviously the primary motivation of the government to reduce coal consumption. But reducing coal consumption could also benefit climate mitigation. (Interview 22)*

Another reason why the government decided to reduce coal consumption is the overcapacity in the power sector. Given its affordability and reliability in electricity generation, coal is the primary fuel in China's power sector. In 2018, 60% of coal was consumed by the power sector, providing more than 67% of electricity in China (China Electricity Council 2018; China National Coal Association 2018). However, since 2013, as China peaked its coal consumption, it was clear that the massive scale of coal-fired plant construction has surpassed the country's electricity demand (China Electricity Council 2013).

> *As a result of more and more coal plants, many existing ones now only operate part-time. This is a waste of investment and capacity. (Interview 31)*

Figure 7.2 Energy Structure of China's Power Generation



Source: China Electricity Council (2018)

Historically, the authority of approving large-scale coal plant construction in China was held by the central government in order to optimise the layout of the energy sector in different provinces. However, due to incomplete information, the central government could not know the circumstance at the local level, and thus could not optimise the energy sector to fit the local need. In addition, the centralisation complicated the administrative procedure of approval and lowered governance efficiency.

As a response, in 2014 the government started to decentralise the authority of coal plant construction from the NDRC to provincial DRCs. In addition, the authority of environmental assessment of the construction was also decentralised from the MEP to provincial environmental bureaus in 2015. The decentralisation was on the intention that local authorities could make a better decision over coal plant construction based on their need. But this policy turned out to be harmful thereafter, as local governments rushed to grant construction projects to boost economic growth. As a result, many provinces had the problem of overcapacity (Shearer, Yu and Nace 2018).

> *Building coal plants is beneficial to local economies, as it can boost investment and construction in many sectors. (Interview 22)*

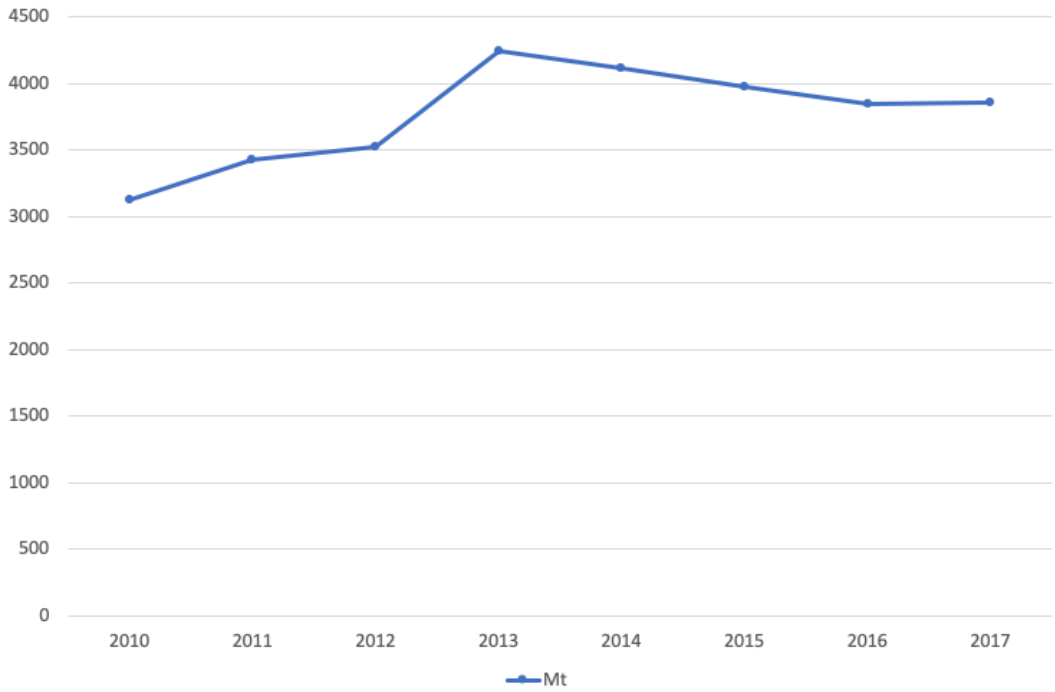
> *It is worthwhile to note that many large enterprises, such as steel companies also built their own coal plants. This further aggravated the problem of overcapacity. (Interview 35)*

The problem of overcapacity soon caught the attention of the central government. In 2016, the NDRC and the NEA established a warning system to assess the risk of coal power overcapacity, and many provinces were warned as the highest risk level (NDRC and NEA 2016a). In the same year, China revealed the 13th FYP to formulate the national strategies for the social-economic development in 2016-2020, which set out an 1100 Gigawatt (GW) cap on coal-fired power capacity during the five-year phase (State Council 2016). This further strengthened the government's determination to curb the overheated coal plant construction. In 2016 and 2017, the NDRC and NEA issued several regulations to temporarily suspend or cancel the construction

of coal plants in almost all provinces (NDRC and NEA 2016b; NEA 2016; 2017[4]). As a result, coal consumption dropped to 3.845 billion tons in 2016 – the lowest level since 2013.

> *The capacity of 1100GW cap in the 13th Five Year Plan is undoubtably the most powerful policy to limit the construction of coal plants, and local governments have to stop many ongoing projects to limit their capacity under the cap. (Interview 30)*

Figure 7.3 Trend of China's Coal Consumption



Source: National Statistics Bureau (2010; 2011; 2012; 2013; 2014; 2015; 2016; 2017)

However, due to the pressure of the economic slowdown, China's coal consumption has rebounded recently. After three years of consecutive decline, in 2017, the coal consumption rose by 0.4% to the 2016 level. In 2018 and 2019, the consumption further increased by 1% respectively (National

[4] The NEA in 2017 issued separate letters to 13 provinces to suspend their coal-fired plant construction during the 13th FYP period. They were Gansu, Guangxi, Guangdong, Henan, Inner Mongolia, Liaoning, Ningxia, Qinghai, Shandong, Shaanxi, Shanxi, Sichuan and Xinjiang

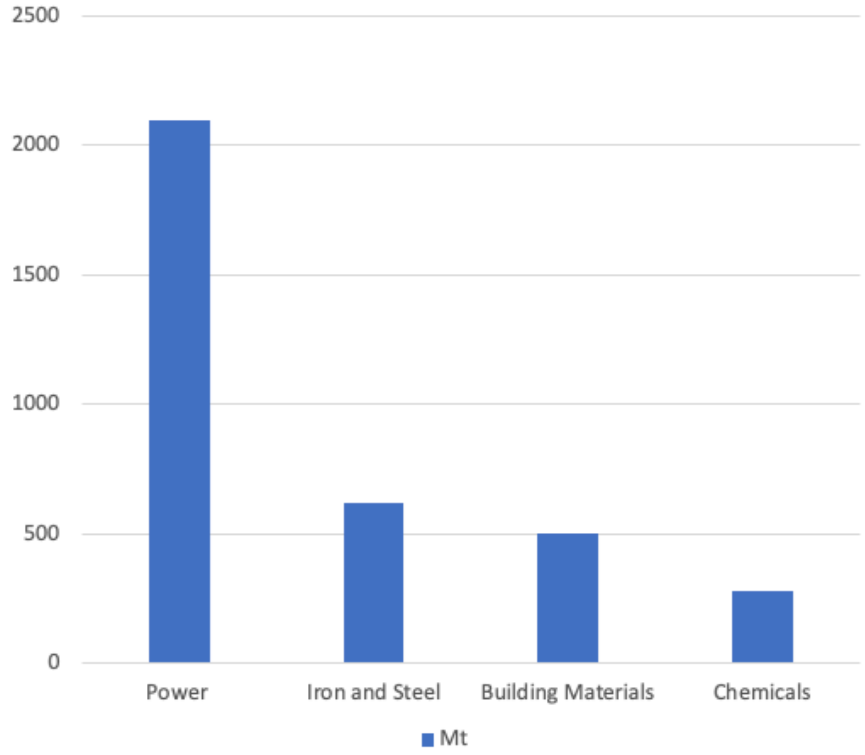
Statistics Bureau 2017; 2018; 2019). The rise of consumption in the power sector was the largest contributor. In 2017 and 2018, the coal consumption of the power sector increased by 4.9% and 6.4% respectively (Xinhua 28 February 2019). The consumption rebound has also led to more emissions. In 2018, China's CO2 emissions grew by around 3%, which is the largest increase since 2013 (Unearthed 28 February 2019).

The economic slowdown has a close relation to the rebound of coal consumption. Due to economic uncertainty, the Chinese government often uses economic stimulus packages to promote growth. Generally, the stimulus packages are approached through large-scale infrastructure investment and construction. Such an approach will certainly boost industrial output and energy demand in sectors such as iron and steel, cement and other building materials, which subsequently pushes up coal consumption and GHG emissions (IEA 2019). In 2018, those sectors accounted for 32% of the country's coal consumption, only behind the power sector (China National Coal Association 2018). The Unearthed also finds the correspondence between China's CO2 emissions and its debt growth, indicating that the increase of emissions from oil, gas, coal and cement sectors has been largely boosted by the government’s stimulus policy (Unearthed 21 September 2018). Since 2015, the stimulus policy in property and infrastructure sectors has become a key engine supporting the country's GDP growth (Financial Times 15 July 2015; 15 April 2016; 12 June 2019). More worryingly, due to the impact of the Covid-19 Pandemic, China's central bank recently has lowered the amount of cash reserve that banks are required to hold, in order to free up loans to industries to further stimulate the economy (The Wall Street Journal 13 March 2020).

> *The government is used to boost the economy via infrastructure investment and construction. However, given the substantial debts in local governments, the central government may be more cautious this time. But it may still put aside the stringency on fossil fuels to reduce the burdens of industries. (Interview 53)*

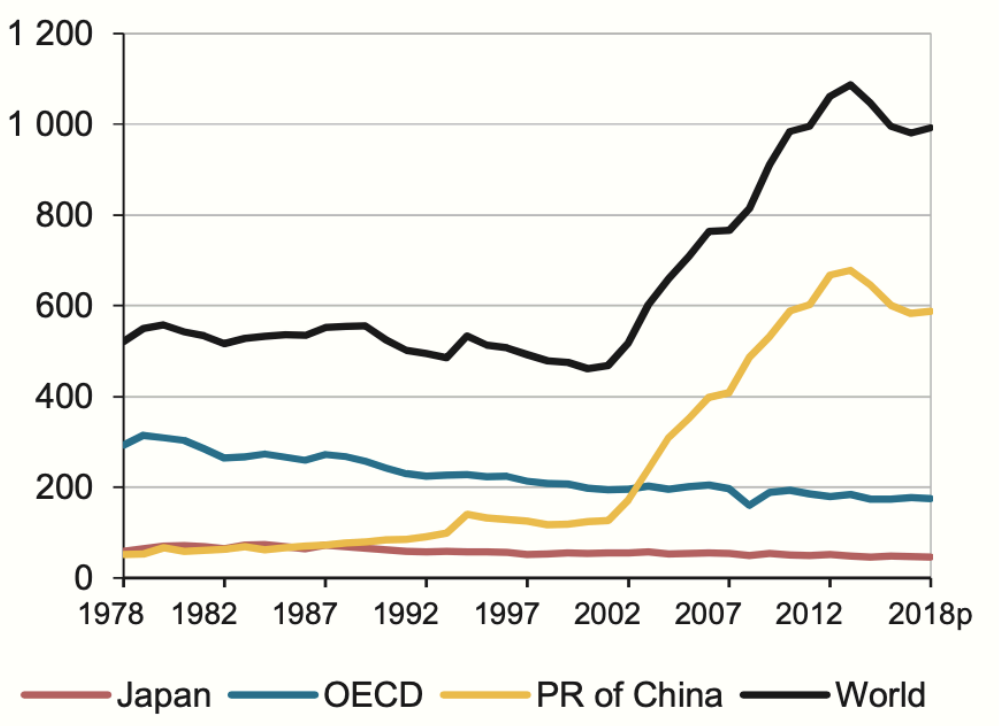
> *To some industries, coal is still a necessary material in the production process with no other practical alternative. (Interview 27)*

Figure 7.4 China's Coal Consumption in Major Sectors 2018



Source: China Coal Association (2018)

Figure 7.5 Trend of World Coking Coal (for Industrial Production) Consumption (Mt)



Source: IEA (2019)

The ambivalence on coal is also reflected in the government's environmental policy. The government realises that for a time coal will still be the country's primary energy and cannot be phased out easily. But the reliance on coal also faces the pressure of environmental protection and climate mitigation. As a result, the government has sought to strike a balance by exploring the technologies of energy efficiency and clean coal. To the power sector, a cost-efficient way is to upgrade the facilities to reduce pollution and emissions. In the 13th FYP for the Electricity Sector, the government set strict efficiency standards, and plants fail to meet the standards by 2020 will be no longer allowed to operate (NDRC and NEA 2016b). It also pledged to transform existing facilities to meet higher standards of efficiency and emissions. By 2018, China had upgraded more than 75% of existing coal facilities for low-emissions, amounting to 700 GW capacity (NEA 2019). Now, new coal-fired plants in China are generally cleaner than those in the US (Hart, Bassett, Johnson 2017). In addition, exporting low-emissions coal plants has become an important part of China's global investment strategy, particularly in the One Belt One Road Initiative. China has committed to more than 20 billion dollars to fund the construction of coal plants overseas, mostly in South Asia and Africa (Guardian 26 April 2019). This would obviously have an impact on global climate mitigation, as the World Bank and other international organisations have mostly refused to fund coal-related projects due to the concern of intensive carbon emissions. Also, it should be noted that even technology-advanced low-emissions coal plants are still high carbon-intensive. Research by the Nature Resources Defence Council finds that even an ultra-supercritical coal plant – the one with lower emissions and higher efficiency can only reduce by around 9% of CO2 emissions than a subcritical plant (NRDC 2017).

> *This is a pragmatic strategy. As you know, given the dominant position of coal in the country's energy mix, especially in the power sector, it is impossible to phase out coal in a short time. So improving efficiency and reducing emissions of those existing plants is the most pragmatic and economical way. (Interview 29)*

Besides the upgrade of facilities, clean coal technology has become another policy by which the government seeks to reconcile the economic and environmental interests of coal. For instance, in 2017 the Ministry of Science and Technology initiated the 2030 Technology Innovation project, in which it

identified several research fields that are of great importance to the country's development by 2030. Among those fields, two energy-related were involved – clean coal and smart grid. The government pledged 164 billion yuan investment in those fields to motivate relevant technology innovation. A more controversial case is the Guiding List for Green Industries revealed by the NDRC in 2019 (NDRC 2019). Green Sector in China has been a vague term due to the lack of a clear definition and classification. The government, financiers and industries thus found it difficult to make policies and investment decisions. The List was designed to formalise the scope of the Green Sector and to guide government policymaking and market investment. Industries and technologies included in the List could enjoy preferential policies and financial support of the government. However, the List has included clean coal, which means that technologies and industries of clean coal could receive preferential policies and support of the government. This proves somewhat controversial when globally coal has been treated as a polluting, un-green fossil fuel, and subsidies on coal have been gradually phased out by other major economies.

> *It is certainly a backward step to include clean coal in the Green List. For several years the government has tried to phase out coal. So the inclusion would send a confusing signal. (Interview 51)*

7.4. Resilience Assessment: the ETS amid the Economic Slowdown

Empirical evidence suggests that as the macroeconomic circumstance is changing, China's ETS and energy dynamics have demonstrated an unrelated state. Regardless of the up and down of fossil fuels consumption in response to the macroeconomic dynamics and the government's energy policy, the ETS has remained stable. This presents a sharp contrast to the EU ETS where the economic recession underlined a close correlation between the ETS and energy consumption (Aatola, Ollikainen, and Toppinen 2013; Lutz, Pigorsch, and Rotfuß 2013; Koch et al. 2014). From this perspective, it can be argued that China's ETS is more resilient to the macroeconomic disturbance, as the market has remained stable amid the economic slowdown.

The reasons can be elaborated from two points. First, the intensity-based market design could effectively prevent potential fluctuations of the market

supply-demand, which was a major factor for the EU ETS failure during the economic recession. The pilots have only a one-year compliance period or allocate allowances annually. There are also ex-ante or ex-post mechanisms to adjust the supply based on industrial output and demand. The flexibility could thus shield the ETS from unpredicted market fluctuations. However, this has the expense, as covered companies are uncertain on their allocations due to the frequent adjustment, and find it difficult to make decisions on allowances earmarking and long-term investment strategies. Regulated companies only know their allocations until the end of the compliance term, which is a key reason why market liquidity was usually low and most transactions took place before the compliance deadline (Munnings et al. 2016). Also, investment in energy-saving and low-carbon technologies usually takes time, but with only an annual compliance span industries could barely optimise their investment strategies (Liu and Fan 2018). Simply put, the flexibility of the ETS to the changing economic circumstance is at the cost of the market efficacy for the optimisation of industrial transformation and low-carbon investment.

The second reason is that the pilots now only have a low level of carbon prices and liquidity, which cannot fully reflect the dynamics of the macroeconomic circumstance and energy policy. In an intensity-based system, the price is not determined by the market supply-demand, but by a variety of factors most of which are dependent on the government. This is particularly evident in China where the government has both the will and means to influence the price.

> *The prices are not high and there are not many transactions, so it is difficult to reflect the economic environment. The compliance costs of the ETS only consist of a marginal cost to the companies. (Interview 28)*

> *Most allowances are distributed for free. So companies do not need to buy many allowances in the ETS. The cost of carbon allowances is quite small to the companies. (Interview 45)*

With respect to the will, the government concerns the impact of a high carbon price, as the rapid economic development is built on the growing energy consumption in which fossil fuels, particularly coal, have a dominant share. The government thus needs to manage the price at a proper level that can

motivate industries' low-carbon investment on one hand, and minimise the harm on economic development on the other.

With respect to the means, the government could influence the price in many ways. The primary one is through the allocation. In practice, the low carbon prices of the pilots are largely caused by overallocation. Initially, due to the lack of data, the pilots widely used grandfathering in allocation. This approach then has been gradually replaced by the method of benchmarking or a mix of both (e.g. in Guangdong, Shenzhen and Tianjin). However, free allocation is still overwhelmingly adopted, even for those industries with low or no carbon leakage possibility. By contrast, the power sector in the EU ETS needs to pay for all allowances. Also, the government has reserved the authority of market intervention. All pilots have established price manage mechanisms. Although those mechanisms have been barely triggered by far, theoretically they can contain the price when the government considers the price is too high.

> *The rapid development of the ETS in China is largely motivated by the government policy, whereas the awareness of participants is relatively low. The government dominates the ETS and has great influence on the price. (Interview 53)*

Moreover, overlapped policies and government subsidies could also influence the ETS functioning. A prominent case is reflected in the coal plants. Despite the abatement pressure of the ETS, they could receive considerable subsidies from the government for energy-saving and facility-upgrading. As motioned, given the fact that coal will still be the primary energy for China in the near future, the government has provided substantial subsidies and support for coal plants to reduce emissions. By 2018, more than 75% of facilities had been upgraded for low-emissions. Despite the environmental benefits, the government subsidies have to some extent undermined the effectiveness of the ETS in the power sector. In 2016, due to the national plan on electricity generation and its relevant policies, the coal plants in China received 305.7 billion yuan subsidies from the government (NRDC 2017). Among those, the upgrading of facilities in low-emissions received 119.4 billion yuan, and the price protection of on-grid electricity received 169.2 billion. More worryingly, it was estimated that the subsidies also resulted in a waste of renewable energy subsidies amounting to 17.1 billion yuan, as there was an oversupply in the

electricity market due to the subsidies on coal plants (ibid). Furthermore, it should be noted that the subsidies for the upgrading of coal plants cannot solve the problem of GHG emissions, as the upgrading and clean coal technologies mostly target the environmental pollution such as the pollutants of dust particles, SO2 and nitrogen oxides. The reduction of CO2 emissions is not a priority as it has little impact on air pollution. As a result, in 2018 the CO2 emissions from China's coal consumption amounted to 7.25 billion tons, accounting for around one-fifth of the world's total emissions (online data from the Global Carbon Atlas).

> *In comparison with the potential of CO2 emissions and greenhouse effect, the government concerns more about the consequence of air pollution from the coal. (Interview 51)*

> *From a long-term perspective, of course the economy will phase out coal sooner or later. But short-term rebound is still possible, if coal consumption proves more cheaper……Moreover, it should notice that the coal industry is still influential, especially in some regions. (Interview 43)*

Back to the assumption, empirical evidence by far preliminarily confirms that the economic slowdown could undermine the ETS functioning through its impact on the government's overall climate ambitiousness. Both the theoretical possibility and institutional feasibility of the assumption are supported by empirical findings. Concerning the theoretical possibility, the rebound of coal consumption recently has exemplified that the government is willing to prioritise economic development over climate mitigation in order to address the economic slowdown and boost growth. Concerning the institutional feasibility, observations have shown that the government possesses a range of tools to control or influence the carbon price. With free allocation and government subsidies, the carbon price has been stabilised at a low level. The intensity-based cap combined with untriggered market intervention measures could also ensure that the fluctuations of industrial activities will not hit the market equilibrium.

As a result, China's ETS has been more resilient to the economic slowdown. The contributors are linked to the country's unique political-economic context.

Unlike the EU ETS where policymakers have tried to minimise their influence in the market, in China the government does not disguise the intention to manipulate the ETS throughout. Both the ETS design and energy policy have shown that the government intends to maintain the carbon price at a stable level that would not hinder economic development. Therefore, the resilience of the ETS to the economic slowdown comes with a price, as the ETS performance has largely reflected the will of the government rather than the real abatement cost and investment opportunities. More worryingly, given the recent impact of the Covid-19 Pandemic, the government is expected to launch another round of stimulus policy and infrastructure investment to boost the economy, which may further marginalise climate mitigation and the ETS in the political agenda,

Moreover, the concern of weakened climate ambitiousness is further amplified by the recent ministerial reform and the monocentric decision-making of the ETS. As the ETS authority is vested in a single actor, the recent authority transfer from the NDRC to the MEE would downplay the ETS agenda, especially when the economic slowdown highlights the importance of policy coordination between economic development and climate mitigation. From this point of view, the monocentric decision-making of the ETS now could make it less resilient to the economic slowdown given the government's prioritisation of economic development.

7.5. Summary: China ETS Resilience to the Economic Slowdown

This chapter has analysed the impact of the ongoing economic slowdown on China’s ETS and assessed the ETS resilience to the impact. In addition to the evaluation of the ETS performance, it has also looked into the broad energy policy field to probe the government’s consideration between economic growth and climate mitigation. The rationale is that due to the intensity-based system design and immature market circumstances, the ETS performance alone cannot fully reflect the impact of the macroeconomic changes. It is thus necessary to investigate whether the government has prioritised economic development over climate mitigation, which would indirectly undermine the ETS stringency in the near future.

The examination of the hypothesis was approached in two steps: theoretical possibility and institutional feasibility. First, the experience has shown that in China economic development could be prioritised over environmental protection and climate mitigation if the government perceived a necessary trade-off. The economic stimulus policy often has been carried out through large-scale infrastructure investment and construction, which would boost the consumption of fossil fuels and GHG emissions. This has been further proved by the rebound of coal consumption recently. The flip-flopping of the government on coal reflects the dilemma between economic stability and climate mitigation, which could be further amplified as the government faces increasing pressure of economic development.

Then, the review of the system design and relevant policies has suggested that the government has multiple ways to contain the carbon price and the functioning of the ETS. Directly, it can control the price through either the allocation method or market intervention mechanisms. Indirectly, the policies and subsidies in the power sector, renewable energy, energy-saving and coal-related technologies can also undermine the ETS stringency. The prominent case here is the recent governmental subsidies in upgrading existing coal power plants, which would lower their compliance costs in the ETS.

The performance of the ETS has shown that the vital functions of the ETS have not been disrupted by the ongoing economic difficulty as there were no significant price fluctuations or market disequilibrium. The pilots have also introduced price management mechanisms to prevent potential price fluctuations. In this regard, China's ETS has shown robustness to the impact of the economic slowdown. There are two reasons behind this. First, the intensity-based system design combined with allocation adjustment mechanisms could effectively prevent potential fluctuations of the market supply-demand. Second, the pilots are still immature with low carbon prices and market liquidity that cannot fully reflect the macroeconomic dynamics.

However, the recent policy dynamics of coal has indicated that the government has prioritised economic growth over climate mitigation due to the economic pressure, which could marginalise the ETS in the political agenda. This has become more worrying as the authority of ETS governance has been transferred from the NDRC to the MEE. Within a monocentric decision-making

structure, the ETS agenda and implementation in China primarily depend on the competence of the governing authority. As the government now faces more pressure of economic growth and has shown its determination of economic prioritisation, the MEE could face more challenges in the future in sustaining the ETS stringency. The MEE has a disadvantageous role when coordinating the ETS target with the NDRC which has more economic considerations. In this regard, it is argued that the ETS could be less resilient to the economic slowdown in the near future, as its governing settings lack adaptability to the changing economic context. The stringency of the ETS functions could be affected due to the government's prioritisation of economic growth.

Chapter 8
A Comparison of the EU and China's ETSs

In the last two decades, many countries and regions have established ETSs to mitigate climate change. Among them, the EU and China represent two distinctive models where the political-economic conditions have shaped different policy practices. The previous four chapters have presented four cases of how their ETSs have performed differently to similar political and economic disturbances.

It is thus worthwhile to synthesise a comparison to underscore how institutional contexts have resulted in divergent practices and performance of their ETSs in response to similar disturbances. Previous comparative research has overwhelmingly focused on the market design of contextual factors, but lacked a dynamic perspective on the ETS development over time along with the changing political-economic conditions (Welfens et al. 2017; Zhang, Liu and Su 2017; Ervine 2018; Narassimhan et al. 2018; Wettestad and Gulbrandsen 2018; Zeng, Weishaar and Vedder 2018). However, such a perspective is of importance, as the empirical examination in this thesis has shown that the ETS can be affected by a variety of factors.

Moreover, the comparison between the EU's and China's ETSs could contribute to the research of ETS proliferation, as many countries now start to look at the potential of emissions trading. As the two most influential actors, the EU and China are obviously playing a leading and exemplary role in global climate governance, especially after the US decided to withdraw from the Paris Agreement. Lessons from the comparison are thus expected to provide valuable experience for those economies attempting to adopt the ETS.

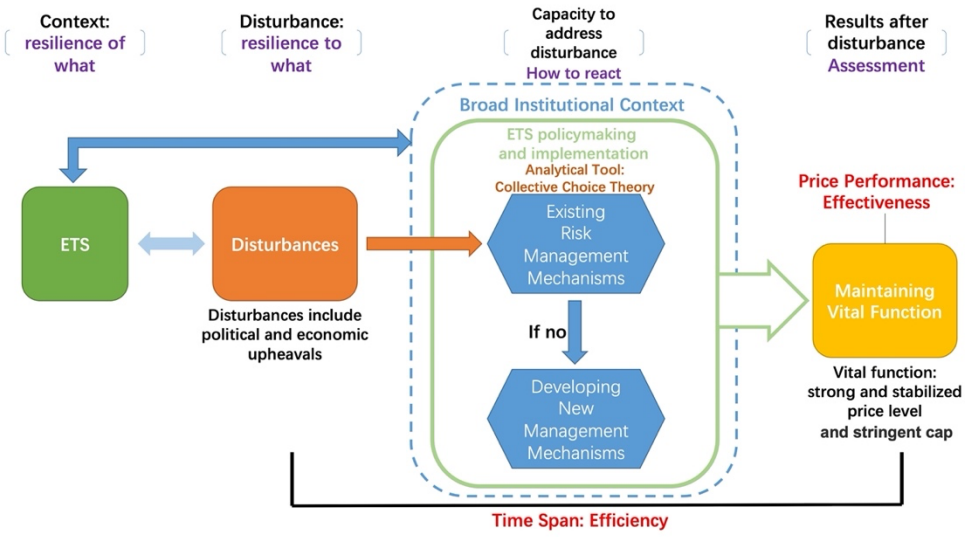
The comparison and discussion in this chapter consist of five sections. The first section is a reiteration of the analytical framing. It leads the analysis to comprehend the reasoning behind the ETS divergence between the EU and China. The second and third sections are a comparative review of the institutional contexts and system design between the EU's and China's ETSs, which provides an explanation of causality between them. The fourth section revisits the four empirical cases to show how different institutional settings

have shaped their resilient abilities to address varying political-economic disturbances. The last section provides a summary.

8.1. Analytical Framing

The conceptual framework of ETS resilience synthesised in this research provides a tool to understand the ETS functioning through a dynamic perspective. The ETS is not a static, but a continuously evolving system shaped by a range of variables. Adapted from socio-ecological studies, this thesis uses the concept of resilience to depict the ability of the ETS to buffer and address the impact of unexpected disturbances.

Figure 8.1 ETS Resilience Framework



As elaborated in Chapter 3.1, the assessment of ETS resilience is built on the collective choice theory combined with a polycentric-monocentric continuum. They offer an account of how the ETS changes itself in response to the external disturbance. In this process, the institutional change of the ETS is not spontaneous, but an unavoidable consequence of a series of interactions among relevant actors. Each actor within the ETS will decide their reacting strategies when confronted with a disturbance, and their strategies will be processed by the contextual rules of the ETS decision-making and then yield an overall response. The collective choice theory provides the reasoning

behind this process, while the polycentric-monocentric continuum portrays the contextual rules.

The ETS resilience framework presents a novel attempt to the field of ETS assessment. As mentioned in Chapter 2.2.2, previous research of ETS assessment has overwhelmingly concentrated on the quantitive performance of the ETS, such as on abatement performance, price formation, cost-effectiveness, transaction costs, market liquidity and financial attribute (Ellerman and Buchner 2008; Konidari and Mavrakis 2008; Venmans 2012; Hübler et al. 2014; Koch et al. 2014; Li and Lu 2015; Hu, Li and Tang 2017). By contrast, quantitive assessment has been rare, and lacks the focus on the political attribute of the ETS (e.g. Wittneben 2009 on the cost of the ETS to the public; Shen 2015 on the incentives and barriers to ETS participants; Liu and Fan 2018 on the attitudes of the cement sector to the ETS). The framework of ETS resilience thereby offers a new perspective by focusing on the ETS performance to varying political-economic disturbances.

The framework has shown its strength in leading the empirical inquiry in the previous four chapters. In Chapter 4, it examines the impact of the EU enlargement by calculating whether the accession of new members in the EU institutions would form a sufficient majority to block or undermine the ETS policy. It firstly identifies the interests and positions of new member states in relation to the ETS, and then inputs them into the polycentric ETS decision-making context. The examination finds that due to the polycentric decision-making feature, the accession of new member states could not form a sufficient majority to block the ETS. As a result, the EU ETS has shown high resilience to the impact of the EU enlargement.

In Chapter 5, as the ETS lacked risk management mechanisms to address the impact of the economic recession, the framework leads the inquiry by focusing on the dimensions of how fast the EU could introduce new policies to address the impact, and how effective those policies were. It finds that the EU ETS has shown a medium level of resilience, as the polycentric decision-making was time-consuming, and the effectiveness of both the backloading and MSR was limited.

In Chapter 6, the inquiry follows the same logic of Chapter 4 by calculating whether the change of the authority would form a sufficient majority to alter the ETS. It finds that within the monocentric decision-making model, the authority transfer from the NDRC to the MEE would fundamentally affect the importance and status of the ETS in the government's agenda and the political hierarchy due to the power disparities between the two agencies. As a result, China's ETS would be less resilient to the impact of the ministerial reform.

In Chapter 7, as the economic slowdown is still an ongoing phenomenon, the inquiry takes a slightly different approach. It firstly examines the prices in the pilots and finds no major disruption in the market performance. Then the inquiry turns to the broad institutional and policy context in relation to the ETS to assess the impact of the slowdown. It finds that the government's ambivalence on coal indicates a worrying prospect to the ETS, especially after the MEE took over the governance authority. Within a monocentric model, the ETS agenda is solely dependent on the competence and power of the MEE, which would affect the policy coordination of the ETS with existing economic and energy policies when the government faces more pressure of economic growth. Therefore, the ETS is expected to be less resilient to the impact of the economic slowdown in the near future.

Simply put, the ETS resilience framework synthesised in this thesis regards the divergence of the EU's and China's ETSs as an inevitable result of the institutional changes shaped by their different institutional contexts over time. Albeit the common logic of emissions trading, their ETSs have shown many differences, from market design and implementation to the varying institutional responses to similar contextual disturbances. This research argues that those differences are the outcomes of their different institutional contexts which constantly shape their ETS practices towards divergent directions. The remaining of this chapter follows this logic and demonstrates how the varying institutional contexts have led to different ETS practices and institutional responses to similar political-economic disturbances.

Another focus of the comparison is their ETS resilience. Although this research has no attempt to claim the superiority of an ETS model, it can nevertheless shed some light on the importance of institutional compatibility in ETS adaptation. Through the comparison, insights about the pros and cons

of different ETS models can be drawn and contribute to relevant research fields.

In addition, the assessment of ETS resilience focuses not only on the ETS performance throughout the disturbance, but also on the implications to the broad climate governance. From a context-based standpoint, as an artificial market, the ETS functioning is underpinned by the government's overall climate ambitiousness. While sometimes the disturbance has not impaired the ETS functioning directly, it could impact the government's long-term climate ambition which in turn undermines the ETS functioning.

8.2. Institutional Contexts

The institutional context refers to the broad political and economic environment where the ETS operates. Contextual factors are critical as they determine the way in which the ETS is practised, from the beginning of why emissions trading was chosen, to the decision-making and legislation of the ETS, to the market design and implementation.

Many studies have focused on the contextual factors to construe the origin of the EU ETS, interpreting it as an inevitable choice of the then political and institutional realities (Lefevere 2005; Skjarseth and Wettestad 2008; 2010a; Convey 2009). The EU was initially sceptic to emissions trading in the 1990s, but soon changed its attitude. Several contextual factors are attributed to. First, a carbon tax proved impossible within the EU's legislative procedure, as it would require unanimity (Convey 2009; Skjarseth and Wettestad 2008). Second, the Commission also changed its attitude after the reshuffle of staff in the DG Environment (Lefevere 2005; Skjarseth and Wettestad 2008). Many experts with economics background came in the office, and the idea of emissions trading gained more popularity due to its neoliberal economic appeal. Third, stakeholders also expressed their welcome to the ETS. The oil giants, BP and Shell, launched their own ETSs (Skjarseth and Wettestad 2010a). Some member states also launched or planned to launch national ETSs, adding more momentum to the EU. Last, the EU needed an EU-wide mitigation policy to comply with its Kyoto Protocol commitment, and the withdrawal of the US from the Protocol beefed up its resolve for such a policy (Convey 2009).

As more and more ETSs were established globally, the significance of contextual differences has been underscored by many comparative ETS research (Stephan and Lane 2015; Welfens et al. 2017; Zhang, Liu and Su 2017; Ervine 2018; Narassimhan et al. 2018; Wettestad and Gulbrandsen 2018; Zeng, Weishaar, and Vedder 2018). This is particularly evident when it comes to China where the ETS faces an entirely different circumstance from the EU. Given its political advantages, China was believed more convenient to implement a carbon tax. It was thus a surprise that the government opted for the ETS. Scholars again look at the contextual factors to explain the policy choice (Han et al. 2012; Zhang 2015; Lo 2016a; 2016b; Kong and Freeman 2017; Ba, Thiers and Liu 2018). First, the ETS indicated a profitable opportunity in an emerging global carbon market. As the largest beneficiary in the CDM, China saw the great potential of investment and economic benefits from the ETS. As more and more countries and regions started to launch their ETSs, a domestic ETS could help China to gain an upper hand in the future global ETS regime (Lo 2015; 2016). Second, the government also had experience and institutional legacies from its previous engagement in the CDM. With more than a decade of work on the CDM, the NDRC had more experience and expertise in emissions trading (Ba, Thiers and Liu 2018; Swartz 2016). In China, the competence of climate governance was initially designated to the NDRC, the country's economic management agency. Thereby, although the environmental agency has long championed an environmental tax, the NDRC preferred a market-based instrument given its experience in the CDM. Third, the ETS had more appeal on its compatibility with economic development (Kong and Freeman 2017). China needed to accommodate climate mitigation with its rapidly growing economy and energy consumption, even including coal. The government thereby had to strike a balance between carbon abatement and economic development, on which the ETS has a promising edge. The ETS provided not only another round of green capitalisation opportunities (Paterson 2010), but also flexibility on carbon pricing. The neoliberal economic account of the ETS promises a cost-effective strategy by which the government could minimise carbon abatement costs (Ervine 2018). Compared with a fixed tax rate, emissions trading is more flexible as the price could change based on market equilibrium and technology progress.

Yet, although contextual factors are indeed important variables accounting for the way in which the ETS has been crafted within a given circumstance, they are often fragmented or partial that lack a systematic account behind those factors and their corresponding relations. The weights on the political and economic contexts are somewhat not even. For instance, while contextual studies on the EU emphasise how the political realities have shaped its ETS practice (Lefevere 2005; Skjarseth and Wettestad 2008; 2010a; Convey 2009), economic factors are relatively marginalised. When it comes to China, the focus is almost the opposite. Attention has been paid more to the economic circumstance as it constitutes an entirely different scenario from the EU or other mature economies (Stephan and Lane 2015; Boute 2017; Kong and Freeman 2017; Wettestad and Gulbrandsen 2018), whereas its unique political realities have been downplayed. The empirical inquiry of this thesis thus contributes to this research gap by presenting two sets of comparison that relate to both the political and economic contexts of the EU's and China's ETSs. By doing so, it systematically explains how the distinctive political-economic contexts have shaped their different ETS practices, which facilitates the following discussion and analysis.

The political context refers to the decision-making structure of the ETS and the broad political environment it operates. In this thesis, a polycentric-monocentric continuum is used to depict the characteristics of varying political contexts between the EU's and China's ETSs. An interesting point to note here is that both of the ETSs have experienced a process of centralisation. In the EU, the ETS was initially designed as a decentralised system where the authority of cap-setting and allocation was held by member states. However, this approach soon proved problematic as member states were overgenerous in allocation. To prevent a race to the bottom, the EU has centralised the authority in Phase 3 (Wettestad 2009). In China, the ETS also presented a decentralised landscape at first. As demonstrated in Chapter 6.1, seven regional pilots were established with the local DRCs responsible for market design and implementation. Each pilot is independent from others with no system linkage. Then since 2014, the ETS legislation by the NDRC and the MEE has started to centralise the authority gradually to the central government level (NDRC 2014; 2016; 2017; MEE 2019a).

The centralisation of both sides can be understood as the outcomes of a learning-by-doing process. Due to the lack of experience, both the EU and

China at first chose a decentralised structure to contain potential risks. In the EU, the decentralisation could address the concerns of member states and industries on the uncertainty of the carbon price. In China, the heterogeneity of the pilots could test the ETS within various circumstances, exploring a way for the national ETS. However, along with the market operation and the accumulation of experience, both sides have realised that a uniform market with a single competent authority is vital for market liquidity and fairness.

Yet, besides a common process of centralisation, the political mechanisms of their ETS governance are strikingly different. In the EU, ETS decision-making can be characterised as a polycentric model. As justified in Chapter 4.1, the system was established as a piece of climate legislation through the EU's formal legislative procedure (Council of the European Union 2016). Within this model, each ETS stakeholder could find their own ways to input interests and influence the policy through different EU institutions. The whole process demonstrates a polycentric feature as there exist a variety of independent actors that can influence the overall policymaking. Their independence is guarded by the formal and informal institutional settings of the EU. Formally, the Ordinary Legislative Procedure provides checks and balances to the legislative power of the three EU institutions. Informally, the unwritten convention of consensus-building policymaking ensures that the interests of each stakeholder would be respected and addressed.

In China, however, ETS decision-making shows a strong monocentric feature. Chapter 6.1 has provided the rationale for this. The legal basis of the ETS is built on the departmental regulation of the NDRC rather than the formal legislation of the National Congress or the State Council. There is also little evidence suggesting that NGOs and industries have sufficient leverage or opportunity to influence the policymaking (Chang and Wang 2010), and the ETS agenda has been largely progressed by the resolve of the country's leadership (Goron and Cassisa 2017; Kong and Freeman 2017). For instance, in 2014 the NDRC had to issue the ETS legislation in December to comply with the timeline set by the State Council in that year. In 2017, again the NDRC launched the national ETS in December to fulfil the government's commitment. The ETS decision-making exhibits a top-down feature as the NDRC acted as the sole authority.

The economic contexts also can be distinguished from their different market systems. This is primarily reflected in their energy markets and state-enterprise relations. Despite subtle differences among member states (Knight 2011), the EU overall has a free energy market where the power sector could pass on the carbon costs to downstream users to achieve the theoretical efficacy of emissions trading (Boute 2017). By contrast, as explained in Chapter 6.1, China's energy market is still under strong governmental control, and dominated by state-owned enterprises (GIZ 2018; Zeng, Weishaar and Vedder 2018). The NDRC determines the electricity price directly. As to state-enterprise relations, in China, there are close ties between the government and the enterprises in the ETS, as most of the covered companies are state-owned. They have not just economic but also political motivation to comply with the ETS. In addition, the government could also use subsidies and preferential policies as leverage.

The different political-economic contexts of the EU and China indicate different ideologies and policy orientations of their ETSs (see Chapter 2.1). In the EU, reducing absolute emissions and complying with its international obligation were obviously the major aim, and to do so it clearly needed an EU-wide mitigation policy. Once the proposal of a carbon tax proved institutionally impossible, it soon turned to the ETS. Although the logic of cost-effectiveness indeed played a role behind the policy choice, what the EU needed in practice was a clear price signal on carbon abatement. This could also explain why the EU decided to correct the low carbon price during the recession..

In China, by contrast, the determining factor was primarily economic. Albeit with a national climate target, China's climate policy has been formulated with the consideration of economic development. The government has committed to an 18% reduction target of carbon intensity by 2020 to the 2005 level, and pledged to peak its emissions by 2030 or earlier. By 2018, the carbon intensity had already lowered by 45.8% to the 2005 level (MEE 2019b). Given the country's great abating potential, both the targets will likely to meet on time or even earlier. Thus, how to reduce the impact of carbon abatement on economic development became the primary consideration. This was also reflected in the initial institutional settings of its climate governance (see Chapter 6.1.3). To China, addressing climate change is not merely environmental, but a strategic issue closely related to the country's economic and energy policies (Tsang and Kolk 2010). At the very beginning, the

government even perceived climate change as a Western hoax attempting to contain the developing world. The backlash to the so-called climate conspiracy can be traced back as late as in 2010 in Copenhagen. As a result, the NDRC was designated as the climate regulator. In addition, China's early engagement in international climate politics was also economic (see Chapter 6.1.1.2). The country was the largest seller in the CDM, accounting for more than 60% of certificated offsets (Schreurs 2017). The government also set up a CDM fund from a levy on the CDM projects to support low-carbon growth and climate resilience activities. To China, climate mitigation also indicates potential economic benefits.

8.3. System Design

The varying institutional contexts of the EU and China are directly reflected in their ETS design. Undoubtedly, system design has been a principal focus in many ETS studies, especially for those with a comparative perspective. The EU ETS as a frontrunner usually serves as a standard model, and the discussion is often approached for potential linkage (Prag, Briner and Hood 2012; Carbon Market Watch 2015; Boute 2017), or highlight the unique contextual factors in those newcomers (Stephan and Lane 2015; Wettestad and Gulbrandsen 2018). There are also abundant studies comparing the ETS design between the EU and China (Welfens et al. 2017; Zhang, Liu and Su 2017; Narassimhan et al. 2018; Zeng, Weishaar, and Vedder 2018), or between the Chinese pilots (Duan 2015; Dong Ma and Sun 2016; Jiang et al. 2016; Munnings et al. 2016; Qi and Cheng 2018). Although many studies have devoted to the system design of the EU and China’s ETSs, this research contributes to this field by linking it to the analysis and comparison of institutional contexts and ETS resilience. With this, it shows an overall picture of how the distinctive political, economic and institutional contexts have shaped different system design of the EU’s and China’s ETSs, and how their varying contexts and design together have resulted in different resilient capacities to similar political-economic disturbances.

The differences of their system design are reflected in several aspects. First and foremost, the EU ETS is designed with an absolute cap, whereas China only has an intensity cap. In the EU ETS, the market supply is determined by the EU's long-term climate targets and the LRF. In the system, the supply is

fixed over the period. By contrast, China's ETS is based on an intensity target, and the cap is determined by the intensity factor and the real production level within the compliance span (Chapter 6.1.2.2). In most pilots, covered companies will receive a proportion of their allowances ex-ante, but the allocation will be calculated ex-post based on their industrial output and the intensity parameters. They will receive more allowances if production increases, or return excess allowances if production dwindles.

The differences in cap-setting and allocation thereby have informed different reacting strategies of the covered companies. In Europe, firms have a stable market prospect over their future allowances and the market supply. This provides predictability and certainty for them to make medium and long-term investment strategies regarding their carbon assets. Yet, this also comes with risks. The fixed market supply is vulnerable to the fluctuations of market demand. During the economic recession, the EU ETS suffered from a considerable market surplus when the demand dwindled suddenly (Chapter 5.1).

In China, the pros and cons are the opposite. The intensity-based cap requires a further adjustment on the allocation to match the real production level. The market prospect thus becomes uncertain as the production level may vary, and firms cannot fully make investment strategies regarding their carbon assets. The evidence here is that transactions were generally concentrated in the days close to the compliance deadline, as firms rushed to buy allowances (Duan 2015; Munnings et al. 2016). The prices also surged by the end of the compliance period due to the sudden increase of demand (Ba, Thiers and Liu 2018). However, the intensity-based design has proved resilient during the economic contraction, as a flexible cap could prevent potential market disequilibrium from fluctuated industrial demand (Chapter 7.3.1).

Second, the EU and China have different inclusion methods to fit different energy market circumstances. The EU ETS targets upstream users that use fossil fuels and produce carbon emissions in their industrial production. The carbon price will be passed on to downstream users. In a free and competitive market environment, the added carbon costs will motivate both upstream and downstream users to move towards a more clean and energy-efficient pathway. However, the pass-through effect cannot be achieved in China

where the energy market is controlled by the government. As both wholesale and retail electricity prices are determined by the central government, the power sector cannot pass on their carbon costs to downstream (Giz 2018). The ETS thus has included both direct and indirect emissions (Chapter 6.1.2.2). Albeit the problem of double-counting (Zeng, Weishaar, and Vedder 2018), such a method could motivate both upstream and downstream sectors to enhance energy efficiency.

Third, their attitudes on market intervention reflect different governance logics of emissions trading. The EU insists on the market principle of the ETS, avoiding governmental intervention as much as possible (Goron and Cassisa 2017). It did not include a market intervention measure at the beginning. Even during the economic recession, there were still fierce debates on whether or not the EU should intervene in the ETS (Chapter 5.2). As a result, both the backloading and the MSR have reflected that the EU sought to water down the regulatory characteristic of its market intervention. The backloading only temporarily postponed the auctioning from 2014-2016 to 2019-2020, ensuring that the total supply of the ETS would not change. The MSR was designed as a quantity-based mechanism that works independently and only affects the price indirectly through the market supply-demand.

The government in China, on the contrary, has a strong presence in the ETS. All regional pilots have introduced market intervention measures (Chapter 6.1.2.2). The recent ETS legislation also requires that intervention mechanisms should be introduced to stabilise market circumstance and prevent potential risks (Chapter 6.3; MEE 2019a). Moreover, governmental presence can also be observed in the market. Local authorities sometimes played a broker role to arrange transactions between sellers and buyers. Due to the lack of market liquidity and an informative price, they sometimes suggested the price for transactions (Cong and Lo 2017). Some pilots even postponed the compliance date to ensure a high compliance rate (Duan 2015; Goron and Cassisa 2017).

Last, the penalties concerning non-compliance indicate a difference. In the EU, the motivation for compliance is purely economic. The system has a financial penalty of 100 euros for each allowance that companies fail to surrender. In China, by contrast, the motivation and penalties are mixed with both economic

and political means (Chapter 6.1.2.2). Due to the legal status of the ETS, the pilots in China only have limited power on financial punishment (Jiang 2014). Non-compliance companies face a low level of financial penalties. To strengthen the motivation, the government introduced administrative measures, such as limiting the access to government subsidies and preferential policies. For state-owned companies, their performance in the ETS is also included in the country's cadre assessment system for their management.

8.4. ETS Resilience

The key development of this thesis is a dynamic view of the ETS in response to varying political-economic disturbances. As a climate policy and a de facto market, the ETS once established is continuously evolving in reaction to the changing environment and political-economic necessities. The evolvement includes not only the system design and implementation, but also the decision-making structure and competent authority.

Many studies have already noticed that the ETS evolves to fit the changing environment or to address a particular challenge. In the EU, the centralisation of the ETS in 2008 and the post-2012 policy innovation have attracted much attention (Wettestad 2009; 2014; Skjarseth and Wettestad 2010b; De Perthuis. and Trotignon 2014; Bausch, Gorlach and Mehling 2017). In China, based on the experience of the pilots, some studies have predicted or suggested changes of the ETS in the future (Duan 2015; Zhang 2015; Dong, Ma and Sun 2016; Zhao et al. 2016; Liu and Fan 2018; Jiang et al. 2018). Yet, a comparative view is still absent. Although those studies have noted that the ETS will evolve to adapt to different challenges, they often aim at isolated events. What lacks here is a systematic comparison of how the ETSs would react differently to similar challenges.

The four empirical cases in this thesis thereby provide an opportunity for such a comparison. Together they have shown how the ETSs would perform differently to similar political-economic challenges. Facilitated by the ETS resilience framework, it is able to analyse how their varying institutional contexts have shaped the divergence. In this section, two comparisons are presented: one on political and the other on economic.

8.4.1. Resilience to Political Challenges

The political comparison concerns the performance of the EU's and China's ETSs to address similar political changes. On the EU side, the EU enlargement in 2004 that included 10 new member states was selected. The case has been thoroughly presented in Chapter 4. The key challenges from the enlargement were that new member states had significant socio-economic disparities with the old members. Their energy structures were heavily dependent on fossil fuels and the governments prioritised economic growth over climate mitigation. Although the ETS was a pre-condition for the accession, they could still undermine or block the following ETS legislation through the Parliament and the Council (Andersen and Liefferink 1997; Homeyer 2004). The enlargement thereby can be regarded as a political challenge to the ETS (Chapter 4.2).

In China, there was a similar challenge. In 2018, the central government reorganised the ministerial configuration to enhance governance efficiency and eradicate fragmentation. The MEE was established to replace the MEP and to incorporate the fragmented environmental competence from other ministries. The NDRC's climate competence was reallocated to the MEE along with its local affiliates. Although the transfer of the authority did not change the personnel as the whole department of climate change under the NDRC was redirected to the MEE, the new department now has a very different status and power in the political system. As a macroeconomic management agency, the NDRC has a higher rank in the administrative hierarchy and has strong influence on state-owned companies in policy enforcement. The environmental agency, by contrast, has been a relatively marginal actor in the government (Tsang and Kolk 2010). China's environmental governance has long been plagued by the problem of weak enforcement due to the weak position of its competent authority in the political system. Especially at the local government level, local environmental departments faced the dilemma between the local economic interests and the environmental policy from the central government (Schreurs 2017). Such a dilemma also contributed to the failure of the previous SO2 trading experiments (Lu 2011). The ministerial reform thereby can be regarded as a political challenge to the ETS, given the power disparities between the NDRC and the MEE (Chapter 6.2).

Through the ETS resilience framework, this research finds that in the EU, a polycentric decision-making model showed strength in absorbing the impact of the enlargement in the ETS. As the legislative power is distributed among the three EU institutions, they could buffer the impact respectively (Chapter 4.3.1). First, in the Parliament, MPs were socialised by the established culture and mostly acted in line with their transnational party fronts rather than national interests. Second, in the Council, although new member states sometimes took a laggard position in the ETS, especially on the issues of full auctioning and market intervention, in practice the opponent could be overvoted through the procedure. There were also different views among the new member states. For instance, albeit as a natural alliance, the Visegrád Group split up on the recent issue of the market intervention measures. While Poland has been complaining about the MSR and the recent surge of the carbon price, Czech has become a supporter of a more stringent ETS (MacDonald 2017; Visegrád Group 2018). Last, albeit the criticism on transparency, the prevailing trilogues in the EU legislation could facilitate a common ground for the triumvirate that could reduce the influence of new member states in the co-legislators.

Besides, the consensus-building convention in the ETS legislation has been essential in adapting to the changing political context. The ETS has introduced solidarity measures to compensate for the socio-economic disparities among the member states (Chapter 4.3.2). The power sector of the new member states has been allowed to partly exempt from the full auctioning. Some ETS revenues have also been redirected to them to facilitate their energy transition. As a result, the ETS overall has been resilient to the political change. It managed to introduce market invention measures following the economic recession, and the system stringency has been tightened up over time in line with the EU's long-term climate target. The strengthened market confidence has also pushed up the carbon price significantly since 2018.

In comparison, the analysis indicates that China's ETS is less resilient to the political disturbance. As the national ETS is still in the trial, the assessment is based on a comparison of the ETS legislation under different competent authorities (Chapter 6.3). It finds that the new legislative proposal by the MEE has loosened several key elements. Given the MEE's limited competence, the

ETS could be less stringent in the future. First, all penalties in the legislation have been lowered. Second, the emphasis on the ETS coordination with the country's economic growth may amplify the MEE's disadvantage within the political system. The coordination would require policy bargaining and negotiations with those powerful economic agencies, such as the NDRC. As the environmental agency has long been a marginal actor in the government, the coordination could favour economic development over climate mitigation. Third, the policy recession on carbon finance implies a constrained competence of the MEE in financial governance. It should be noted that in 2016 the NDRC took a progressive move to include carbon finance in its proposal, which was clearly against the view of the financial regulator. Although the proposal was not approved, it showed a strong position of the NDRC in the ETS policymaking. But this strong character can be barely seen in the environmental authority. Due to the competent constraints, the MEE can only play a secondary role in the regulation of climate finance. The recent policy development has indicated that the regulation of climate finance would probably fall into the competence of the Central Bank, the SRC or the NDRC, whereas the MEE only has a supportive role (People's Bank of China 2016; 2017a). This further raises the concern of a fragmented ETS where spot trading and futures trading are regulated by authorities with different governance logics and policy priorities.

With a monocentric decision-making structure, China's ETS lacks both robustness and adaptability to the impact of the reform. As the stringency of the ETS solely depends on the competence of the governing authority, the change of the authority would affect the ETS in terms of the cap-setting and enforcement given the power disparities between the NDRC and the MEE. The MEE lacks the influence and power in the policy coordination if the NDRC decides to prioritise economic growth.

Overall, the comparison suggests that the different institutional contexts have shaped their varying abilities to address similar political challenges. In the EU, a polycentric decision-making model where multiple stakeholders are involved provided a resilient structure when there was a change in the political context. The impact of the enlargement was buffered through different institutions respectively and then through their institutional coordination. In this model, the new political power was not sufficient to constitute a majority force paralysing

the ETS and the overall ETS legislation soon adapted to the changing political environment.

However, in China where the ETS is governed through a monocentric model, the system is less resilient to the change of the competent authority. In this model, the legal basis of the system is built on the departmental regulation of the authority. The policymaking and implementation of the ETS are solely dependent on the competence and power of the authority, whereas other stakeholders have little means to influence the policy. Before the reform, the NDRC's strong position and power in the political system ensured a fast-track ETS development, particularly on the issues requiring policy coordination, such as carbon finance. After the reform, the competence of the MEE indicates a worrying prospect in this model. Although by far the impact has not fully unfolded yet, the recent ETS legislation of the MEE has implied such a possibility. More worryingly, considering the recent economic difficulties, the MEE's competent disadvantage could be further amplified when synergising the ETS with other economic and energy policies.

Back to the ETS resilience framework, through the lens of the collective choice theory, the polycentric-monocentric split between the EU and China has shown varying degrees of resilience to the changing political context. In the EU, the polycentric model is built on a multi-stakeholder engagement structure. In legislation, the ETS is fortified by the three EU institutions. There is also a wide agreement among stakeholders on the prospect of the ETS. Therefore, the accession of ten new member states could not form a minimum coalition leading to an institutional change of the ETS. By contrast, China's monocentric model proves less resilient, as the ETS power is vested in a single agency. In this model, the ETS agenda and enforcement are solely dependent on the power of the competent agency. Therefore, the change of the competent agency would constitute sufficient power to change the ETS circumstance.

8.4.2. Resilience to Economic Difficulties

The economic comparison concerns the resilience of their ETSs amid economic difficulties. On the EU side, the economic recession after 2008 constituted a significant challenge to the ETS (Chapter 5.1). The dwindling demand resulted in a substantial market surplus, and the carbon price tumbled as a result of the market disequilibrium. With a low carbon price, the ETS could

barely provide motivation for emission abatement and low-carbon investment. As to China, a similar economic challenge is also unfolding, although the impact is not as straightforward as in the EU. The Chinese economy is experiencing a slowdown due to a variety of factors. Although the ETS has felt less painful due to the intensity-based design, the economic slowdown could still affect the ETS through indirect ways (Chapter 7.3).

In the EU, the analysis finds that the polycentric model could not respond to the crisis in a timely manner (Chapter 5.2). At the time, the solution to the market turmoil was simple. As the fixed supply design was vulnerable to the changing market circumstance, the EU needed to introduce new policies to restore the market equilibrium, or more straightforwardly, to directly regulate a minimum carbon price. However, the polycentric model turned out to be time-consuming to do so. There were two ethical dilemmas prevailing among stakeholders regarding the solution: (1) should the EU intervene in the market, and if should, (2) which type of measure should be used? The first dilemma concerns the market principle of the ETS. In both the Parliament and the Council, there were voices contending that government intervention would be against the market principle of the ETS and send a confusing signal to the market. The second dilemma denotes a trade-off between policy certainty and market efficacy, which was somewhat entangled with the first dilemma. Namely, how can the new policy ensure a certain environmental outcome while still letting the market supply-demand decide the price.

The EU at first decided to backload three years' allocation to contain the market crisis (Chapter 5.2.1). The backloading only served as a temporary measure with limited effect, as the allowances would be released back in later years. This could buy some time so that policymakers could search for a permanent solution. Concerning the first dilemma, despite some opponent voices, most stakeholders agreed that the EU should act in response to the ETS turmoil. Concerning the second dilemma, several policy solutions were on the table. The EU could either adjust the market supply or correct the price to an effective level. A minimum price is arguably the most effective solution, as it could provide certainty to industries and investors regardless of the fluctuations of market equilibrium. But it faces both ethical and institutional difficulties. A minimum price obviously would breach the market principle that the price should be determined by the market supply-demand. Institutionally, it could also be regarded as a type of carbon taxation that requires unanimity

in the Council. As a result, the EU opted for the MSR, which as a quantity-based mechanism could strike a balance between policy efficacy and market ethics. It could reduce the market surplus while still letting the market supply-demand determine the price (Chapter 5.2.2).

Assessed from the dimensions of efficiency and effectiveness, the EU ETS has shown less resilience to the economic recession (Chapter 5.3). Concerning efficiency, the hesitation on market intervention and policy options took years while the ETS was left in turmoil. The carbon price tumbled for almost ten years, providing little motivation for the market. Given the pace of the MSR, the existing market surplus would also need years to be fully addressed. Concerning effectiveness, the recent price trend has sent a positive signal. The price started to rise in 2018, and has remained around 20 euros. With the recent ETS Phase 4 legislation, the ETS stringency has also been further tightened up. However, it should be noted that the price trend is boosted by the strengthened market confidence on the ETS prospect while has little to do with the real-time market equilibrium, as there are still around 1.6 billion surplus allowances in the market. Compared with a price-based mechanism, the MSR still faces uncertainty in providing long-term price stability.

On the Chinese side, the assessment is more complicated. In terms of the ETS performance, the pilots have shown stability amid the economic slowdown (Chapter 7.3.1). This can be explained from two points. First, the intensity-based design is more resilient to the fluctuations of industrial demand, as the supply is adjustable. Second, the low carbon prices and market liquidity cannot fully reflect the macroeconomic dynamics.

However, the economic slowdown could still impact the ETS in other ways. The analysis in this thesis pays attention to one of the most relevant fields to the ETS: coal (Chapter 7.3.2)[5]. In order to spur economic growth, the government has used stimulus policy with large-scale infrastructure investment and construction, which would boost the production and energy

[5] It is interesting to note that, in the EU, the Energy Union Strategy has also indicated how the broad energy and climate policy landscape would affect the ETS, highlighting the importance of policy coordination between the ETS and other relevant policy fields.

consumption of carbon-intensive industries. Empirical evidence suggests that China's coal consumption has already rebounded recently. To contain the environmental consequence of coal consumption, the government has provided considerable subsidies and support to the power sector and relevant technology innovation, which would undermine the ETS functioning. This has indicated that the Chinese government has prioritised economic growth over climate mitigation, which could marginalise the ETS in the political agenda.

The comparison of the economic cases shows a complex result. If only in terms of the ETS performance, China's ETS clearly has been more resilient than the EU's, as the intensity-based design has the advantage of preventing potential market fluctuations. But it should be noted that the carbon prices in the Chinese pilots are relatively low that cannot fully reflect the macroeconomic circumstance. The prices are even lower than the average level of the EU ETS during the recession. The carbon costs thus only constitute a marginal factor to the economic decisions of the government and companies in China.

In terms of the institutional reactions, the EU's polycentric model proved inefficient to address the market turmoil. In China, as the economic slowdown has not caused any disruption in the ETS yet, there is no empirical evidence in this regard. However, the recent energy and industrial policy dynamics have suggested a cloudy prospect to the ETS. The rebound of coal consumption indicates that the government has prioritised economic growth over climate mitigation amid the slowdown. As the environmental agency has a weak position and power in the political system, the precedence of economic development in the government's agenda could undermine the ETS stringency and enforcement in the future.

Back to the ETS resilience framework, in terms of the dimensions of efficiency and effectiveness, the EU ETS has been less resilient to the economic recession due to its polycentric model. As the system had no flexible mechanism to cope with the sudden decrease of market demand, the ETS resilience was thus dependent on its ability to introduce new intervening policies to adapt to the new environment. In terms of efficiency, the system could not duly respond to the crisis, as the polycentric model proved time-consuming in introducing new policies. In terms of effectiveness, the

policymaking in a polycentric model was also less radical though the ETS stringency has been tightened up. Within a polycentric structure, the EU needs to forge a compromise among stakeholders, which subsequently undermines its policy certainty and effectiveness (Chapter 5.2.2). Therefore, the polycentric model has been less resilient to the impact of the economic recession.

In China, by contrast, the evaluation is more complicated. In terms of efficiency, both the NDRC and the MEE's ETS legislation has emphasised the importance of market intervention policies. All the pilots have introduced price management measures. In addition, market intervention is also a topic that has attracted few controversial debates in the ETS by far. In terms of effectiveness, at the moment it is impossible to evaluate as the market intervention measures have not been triggered yet in the pilots due to the intensity-based system design and immature market performance. However, in a monocentric model, it is expected that the government intervention on the carbon price would be prompt and effective if the competent authority determines to do so. The concern primarily rests on whether or not the government would tighten up the ETS stringency amid the economic slowdown. The recent evidence has shown that the government lacks such determination.

8.5. Summary: Distinctive Contexts, Distinctive Practices

It is clear that the distinctive institutional contexts of the EU and China have led to different ETS trajectories, from policy orientations to system design and to the resilience to varying political-economic disturbances. Again, it should be stressed that the comparison has no attempt to argue the superiority of an ETS model. The intention is to show how the ETS evolves as a response to the changing political-economic environment, and how the varying institutional contexts could shape this evolvement to different trajectories.

Since the ETS started to proliferate across many countries and regions, there is a growing body of literature on individual systems (Skjarseth and Wettestad 2008; Duan 2015; Zhang 2015; Munnings et al. 2016 Gulbrandsen, Sammut and Wettestad 2017;), and on the comparison of different systems (Welfens et al. 2017; Narassimhan et al. 2018; Wettestad and Gulbrandsen 2018; ICAP

2019). Additional discussions can also be found in relation to either the political (Stephen and Lane 2015), cultural-cognitive (Knox-Hayes 2010; 2016), or the economic aspect of the ETS (Knight 2011; Boute 2017).

However, the question of why the ETSs have evolved and reacted differently to similar political-economic occurrences is a new area with no previous research by far. This question is of importance, as it points to the fundamental factors behind the ETS variations globally, and the materiality of ETS compatibility to the operational context. This thesis seeks to answer this question by providing a set of comparable cases in the EU and China where the ETS has been practised in distinctive ways.

In the EU, the ETS is a climate-oriented system with strong market characteristics. It has been designed in line with the EU's long-term climate targets. In the enlargement case, consensus-building has been a key term reflected in the discourses of stakeholders, indicating that compensation and compromises are necessary to integrate new member states into the EU's existing environmental settings and progress its climate ambition. Government intervention has been minimised as much as possible to provide certainty and predictability to the market. This has been highlighted in the recession case, in which the rhetoric of intervention has been a word that frequently appeared in the discourses and statements of the stakeholders. The polycentric model of decision-making has ensured political stability, but proved inefficient in response to the sudden market fluctuations.

In China, by contrast, the ETS is an economic-oriented system with strong mandatory characteristics. The intensity-based design stresses the combability of climate mitigation with the country's economic development. Government intervention has been highlighted in the ETS legislation. Market stability has also been increasingly emphasised since 2017 in various governmental statements. The monocentric model of decision-making shows vulnerability to the change of the competent authority, but has efficiency when enforcing the leadership's climate resolve. In terms of market performance, the intensity-based design has the advantage of preventing potential market fluctuations. However, due to market immaturity and the strong presence of the government, the ETS has performed more like a permission system where carbon abatement could barely be achieved at the most cost-effective level.

The differences underline their distinctive institutional contexts, which have shaped their ETSs towards different trajectories. In the EU, the mature market environment bonded with the EU’s climate targets has created a arguably standard ETS model. This has been further facilitated by the economic expertise of its policymakers that seek to minimise the governmental presence in the market. In comparison, in China both the economic and political circumstances are to some extent inhospitable to an ETS model like in the EU. The ETS has primarily depended on the competent authority whereas the general awareness and participation of stakeholders are low. Government intervention is prevailing not only in the ETS legislation but also in the trading section.

As pointed out in Chapter 2.3, the existing knowledge gap of ETS research is that the absence of a dynamic lens on how the ETS continuously evolves adapting to the changing political-economic context. The four empirical cases in the thesis thus fill this gap by showing how the EU's and China's ETSs have evolved to adapt to the changing environment. In the EU, the ETS was initially designed as a decentralised system. But this structure soon proved incompetent, as the system performance was paralysed by the concerns of competitiveness and overallocation. In addition, the enlargement also magnified socio-economic disparities within the market. As a response, the EU centralised the system in Phase 3, and introduced solidarity measures to compensate newcomers (Chapter 2.1.1 and Chapter 4.3.2). Then the ETS was seriously hit by the economic recession as the market surplus accumulated and the price plummeted. To adapt to the new economic environment, the EU introduced the backloading and the MSR to address the market surplus. In Phase 4 legislation, it further tightened up the system by enhancing the LRF and the MSR intake rate (Chapter 5.2). As a result, the EU ETS now is very different from the system at the beginning, as it needs to adapt to the changing political-economic realities.

In China, the transfer of authority from the NDRC to the MEE was a part of the government's efforts to integrate the country's fragmented environmental governance. Due to the initial perception of climate change and institutional convention, the competence of environmental governance was designated to different departments. The emissions of CO and CO2 were regulated by

different agencies. The fragmentation resulted in duplicated departmental functions and governance inefficiency. Also, the designation of the NDRC as the climate regulator was related to the initial perception of the government that climate change is an economic and energy-related issue. Therefore, the transfer of the ETS authority indicated a renewed perception of the government on climate change and a new political reality that the government seeks to integrate the country's environmental and climate governance into a single super-ministry (Chapter 6.2). Although the economic slowdown has not impacted the ETS yet, the MEE's ETS legislative proposal in 2019 has indicated several new elements that fit the new political-economic environment. For instance, the new provisions regarding inspection correspond to the new political condition, as the inspection has been widely used by the environmental regulator in China. Meanwhile, the emphasis on the coordination with the country's economic growth has indicated the attention of the government on the economic impact of the ETS, which could become a crucial element amid the ongoing economic slowdown (Chapter 6.3 and Chapter 7.4).

Both the EU and China's cases have shown that their ETSs have evolved as a response to the changing political-economic realities, which fills the existing knowledge gap pointed out in Chapter 2.3. More importantly, their stories have highlighted how the varying institutional contexts have shaped their distinctive practices and ETS trajectories in reaction to similar political-economic occurrences. Institutional contexts matter behind the ETS divergence ETS globally, but it should be noted that the divergence is still an ongoing process continuously shaped by new political-economic challenges. As exemplified in this thesis, even when facing similar challenges, the ETSs may still react in different ways. This underlines the importance of understanding the institutional contexts, particularly the decision-making structures, in ETS research.

In addition to the knowledge gap, the comparison of institutional contexts, market design and system resilience between the EU's and China's ETSs also contributes to a broader theoretical field. To the neoinstitutionalist field, it exemplifies how the ETSs have been designed in the ways complementary to their varying institutional contexts and constrained by their institutional conventions. This further provides empirical evidence to the Historical Institutionalism, Path Dependence and Institutional Complementarity

mentioned in Chapter 2.4.2. Moreover, the interpretation of the ETS as a type of socio-ecological system in this research opens up an opportunity to invite a wider range of theories in socio-ecological studies to the field of ETS research.

Chapter 9
Conclusion

The main aim of this thesis is to compare and analyse how the EU's and China's ETSs have reacted to similar political and economic disturbances. For that purpose, a framework of ETS resilience is conceptualised following a neoinstitutionalist approach. The framework consists of three theoretical components: the resilience concept in socio-ecological research, the collective choice theory and the polycentric-monocentric continuum. It conceptualises ETS resilience as the ability of the ETS to address various contextual disturbances, and suggests both efficiency and effectiveness as assessing criteria.

Applying the ETS resilience framework to the EU's and China's ETSs, it argues that the decision-making of the EU ETS denotes a polycentric model whereas China's ETS represents a monocentric model. In the EU ETS, the decision-making structure is featured with a high degree of authority dispersion. In this structure, each ETS stakeholder could find their own ways to input interests and influence the policy through different EU institutions. The whole process presents a polycentric feature as there exist a variety of independent actors that can influence the overall policymaking. Their independence is guarded by the formal and informal institutional settings of the EU.

By contrast, in China's ETS, the decision-making structure is featured with a low level of authority dispersion. The legal basis of the ETS is built on the departmental regulation of the NDRC. The power of ETS policymaking and implementation is vested to a single competent authority, whereas other stakeholders have little leverage and opportunity to influence the policy. Additionally, the ETS agenda has been primarily progressed by the will of the country's leadership.

As to the empirical investigation, there are four cases selected in the thesis. On the EU side, the chosen cases are the EU enlargement in 2004 and the economic recession from 2008. On the Chinese side, the cases are the ministerial reform in 2018 and the ongoing economic slowdown. They

respectively denote two similar political cases and two similar economic cases, which thus facilitates a comparison in Chapter 8.

In the EU, the enlargement in 2004 brought socio-economic disparities into the ETS policymaking in Brussels. It finds that the EU ETS proved resilient to the impact of the enlargement due to its polycentric model. The concerns of socio-economic disparities and policy priorities between old and new member states were buffered by the formal and informal institutional settings of the EU. Solidarity measures were also introduced in the ETS to ensure a smooth transition of the energy sector in new member states. The system has shown both robustness and adaptability to the changing political context.

As to the economic recession, it finds that the polycentric model was slow to respond to the impact of the recession. The multi-stakeholder engagement of policymaking proved inefficient to make the necessary intervention in the system. It took years for Brussels to introduce price management measures to cope with market surplus and price volatility. Additionally, the effectiveness of the backloading and the MSR was also questionable. The system has been slow to adapt to the changing economic context.

In China, the ministerial reform in 2018 that transferred the competence of climate governance from the NDRC to the MEE has presented a political challenge to the ETS. It finds that the reform would impact the ETS given the power disparities between the NDRC and the MEE. Within a monocentric model, the ETS policymaking and implementation are highly dependent on the competence of its governing authority. While the NDRC has a higher rank and power in China's administrative hierarchy, the MEE as an environmental regulator has long been regarded as a marginal actor in the political system. More importantly, the recent legislative progress has highlighted the importance of policy coordination in the ETS agenda, in which the MEE could situate in a disadvantageous position. Therefore, it is argued that China's ETS would be less resilient to the ministerial reform due to its monocentric decision-making model.

As to the ongoing economic slowdown, an examination of the recent ETS performance and pertinent policy dynamics finds that the slowdown would

affect the ETS in the near future although the ETS performance has remained stable recently. Due to the intensity-based system design and immature market circumstance, the economic deterioration would not lead to market surplus and price volatility like in the EU ETS. However, taking into account the recent ministerial reform and the monocentric model of the ETS decision-making, the slowdown still indicates a worrying prospect, as the government's prioritisation of economic development could marginalise the ETS agenda. This was echoed by the recent policy dynamics of coal. Therefore, it is expected that the ETS would be less resilient to the economic slowdown in the near future due to the prioritisation of economic development and the monocentric model of the ETS.

The comparison and synthesis of the empirical cases suggest that constrained by their distinctive institutional contexts, the EU's and China's ETSs have proved varying degrees of resilience to similar political-economic challenges. Characterised by a polycentric model, the EU ETS has proved more resilient to the impact of the EU enlargement, but acted slowly to the impact of the economic recession. By contrast, China's ETS would be more struggling to analogous political and economic challenges. With a monocentric model, its ETS is predominantly determined by the will of the top leadership and the competence of the governing agency. Politically, due to the power disparities between the NDRC and the MEE, the ministerial reform would downplay the importance of the ETS in the government's agenda and further affect the policy coordination with other regulators. Economically, although the ETS performance has remained stable amid the slowdown, the government's economic prioritisation, the ministerial reform and the recent energy policy dynamics together have suggested a worrying prospect to the ETS in the near future.

The empirical investigation thereby addresses the knowledge gap in existing ETS research by showing how the EU's and China's ETSs have evolved to adapt to the changing political-economic environment. It also underpins the framework of ETS resilience by showing how indigenous factors and institutional contexts have shaped the ETS resilience to varying political-economic disturbances, which provides theoretical insights to relevant fields.

Informed by a neoinstitutionalist approach, this research conceptualises ETS resilience as the ability of the ETS to address varying contextual disturbances. It provides a comprehensive picture of the socio-political realities in relation to this ability, facilitating further analysis and assessment. The framework consists of three theoretical components: the resilience concept in socio-ecological research, the collective choice theory and the monocentric-polycentric continuum. Each of them has theoretical contributions to knowledge.

First, the resilience concept in socio-ecological research has been adapted to provide an overall frame. The research interprets the ETS as a type of socio-ecological system that relates to both social and natural facets (Folke 2006; Young 2010; Aligica and Tarko 2014). The social facet refers to the human-made dimension of the ETS that is designed as an artificial market trading commodities that did not exist before. In this market, the commodities, carbon allowances, are not real products but factitious goods created through a process of technical measurement. The scarcity of the commodities is not determined by the real production but by the decision of the governing authority. The natural facet refers to the purpose of the ETS that seeks to contain the natural consequences of climate change. By doing so, this thesis links the ETS with the broad body of socio-ecological research, and introduces the concept of resilience into the realm of ETS research.

Second, the research adopts the collective choice theory as an analytical view to the ETS decision-making (Libecap 1989; Ostrom 2005; 2008; Mahoney and Thelen 2010). Following a neoinstitutionalist approach, it regards the varying institutional contexts as the variables behind the divergence of ETS practices, and offers a perspective to understand the process of ETS decision-making. Such an attempt highlights the value of in-depth qualitative understanding of the political and institutional complex in the ETS research.

Last, a polycentric-monocentric governance continuum serves to depict the varying institutional contexts of the ETSs. While the idea of polycentricity has long been used in governance research (Aligica and Tarko 2012; McGinnis and Ostrom 2012; Jordan et al. 2014), this thesis modifies the concept by aligning it with monocentricity to form a continuum signalling the degree of authority dispersion of the ETS. This is different from previous environmental

governance studies that perceived polycentric governance as a type of governance regime with multiple decision-making units acting at different levels (Carlisle and Gruby 2017; Paavola 2016; Kellner, Oberlack and Gerber 2019). Instead of regarding polycentricity and monocentricity as two polarised states, it proposes a new approach that aligns the two states to form a continuum to describe the institutional contexts of the ETS.

Policy implications can also be drawn from the thesis. To China, a prominent deficiency exposed in the comparison is that the system solely depends on the power of the competent authority in a monocentric model. As the ETS is built based on the departmental regulation, the system design and enforcement of the ETS are thus constrained within the regulatory agency's competent limits. This problem could be further amplified after the MEE took over the ETS authority. Therefore, building a stronger legal framework through the State Council now becomes a primary task to policymakers.

To the EU, the ETS can still be further improved if a price-based policy could be introduced. As argued in this thesis, the core function of the ETS is to provide a stabilised and strong price signal for carbon abatement. Despite the rebound of the carbon price recently, there is still a substantial market surplus in the system, which means that the current price is primarily based on the projection of the future rather than the current market equilibrium. However, the projection may still fluctuate along with the macroeconomic environment and technology innovation. By contrast, a minimum price would provide a more predictable scenario for companies to make long-term abatement strategies regardless of the macroeconomic fluctuations. To some extent, it combines the advantages of carbon taxation and cap-and-trade by providing both price certainty and flexibility.

At last, there are still some limitations in this research. This thesis has developed a new framework of ETS resilience, and applied it to a comparison between the EU's and China's ETSs through four empirical cases. To this end, it had to accumulate and analyse abundant data, and was thus difficult to present the full scale and dimensions of the cases. Some simplification and omission were made to fit the word limit. For instance, given the rich literature on the EU ETS, this research only described the background and development of China's ETS while skipped a corresponding part in the EU.

Another limitation was the asymmetry of materials between the EU and China. Both the cases of the EU enlargement and the economic recession have happened more than a decade with a large number of materials and data. By contrast, the cases of China's ministerial reform and economic slowdown are just recent or ongoing events with the impacts still unfolding at the moment. The materials on China's part were thus incomparable to the EU's, and many arguments and conclusions on China's ETS are still preliminary.

Yet, the limitations also indicate a potential future research avenue. For instance, concerning the EU, a study on the resilience of the ETS to Brexit would form an interesting comparison to the case of the EU enlargement. In addition, the ongoing Covid-19 Pandemic and its economic impacts would also affect both the EU's and China's ETS agendas in the near future, which provides a more comparable case of ETS resilience between them.

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Appendix A: List of Interviews

Number	Date	Category	Interview Venue
1	4.2018	Academic	London
2	5.2018	NGO	Brussels
3	5.2018	Government	Brussels
4	5.2018	NGO	Brussels
5	6.2018	Government	Brussels
6	6.2018	NGO	Brussels
7	6.2018	Industry	Brussels
8	6.2018	Industry	Brussels
9	6.2018	Industry	Brussels
10	6.2018	Government	Brussels
11	6.2018	Government	Brussels
12	6.2018	Government	Brussels
13	7.2018	Industry	Skype
14	7.2018	Independent	Skype
15	7.2018	Academic	London
16	7.2018	NGO	London
17	8.2018	Academic	Skype
18	8.2018	Industry	London
19	9.2018	Independent	London
20	9.2018	Academic	Skype
21	10.2018	Academic	Beijing
22	10.2018	NGO	Beijing
23	10.2018	Industry	Beijing
24	10.2018	Industry	Beijing
25	11.2018	NGO	Beijing
26	11.2018	NGO	Beijing

27	11.2018	Industry	Shanghai
28	11.2018	Academic	WeChat
29	11.2018	Government	Shanghai
30	11.2018	Government	Shanghai
31	11.2018	NGO	Shanghai
32	11.2018	Academic	Shanghai
33	11.2018	Government	Shenzhen
34	12.2018	Academic	Hong Kong
35	12.2018	NGO	Shenzhen
36	12.2018	Government	Shanghai
37	12.2018	Industry	Beijing
38	12.2018	Government	Beijing
39	2.2019	Independent	WeChat
40	3.2019	Academic	WeChat
41	3.2019	Industry	WeChat
42	3.2019	Independent	Skype
43	4.2019	Government	WeChat
44	4.2019	NGO	Skype
45	5.2019	NGO	WeChat
46	6.2019	Industry	WeChat
47	7.2019	Independent	WeChat
48	7.2019	Industry	Skype
49	7.2019	Academic	Skype
50	9.2019	Academic	WeChat
51	9.2019	Independent	WeChat
52	9.2019	NGO	Skype
53	10.2019	Academic	WeChat
54	12.2019	Industry	WeChat

Appendix B
Interview Materials[6]

B.1 Example Interview Protocol

General Protocol Guidance

1. Background research should be done thoroughly before the interview.
   - For academics and experts from NGOs, the interviewer should thoroughly read their previous works in order to understand their opinions and ideas ex-ante.
   - For officials and industry representatives, preliminary investigation should be done to learn their jobs and responsibilities within the ETS.
   - Information from background research should be used to structure interview questions and guide question orders. It will also help to narrow interview questions that will make use of limited interview time as possible and create meaningful data.
2. Using a note/script for the starting and end of the interview.
   - Script in the beginning will help the interviewer to explain critical details of the research, including what is the research about and how the interviewee's views are related to it.
   - It will also prompt the interviewer to explain the notion of informed consent, to ask the interviewee to sign the consent form, and to alleviate any concerns of the participant about the confidentiality.
   - At the end of interview, the script should provide interviewer's contact information. It should also inform that there might be a subsequent contact if there is a need for the interviewee to further clarify their views.
3. Questions should be designed with an open-ended style.
   - Open-ended questions allow interviewees to provide additional information. This may uncover as much about participants' views as possible.
   - Rather than asking questions with definite answers, questions should be asked with 'could please tell me about'. This phrase could invite interviewees to tell a story, leaving room for ideas, opinions and comments. It simplifies the questions general enough so interviewees could answer the questions in several directions.

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[6] The research title may vary in those example materials, as the researcher changed the title several times throughout.

4. Starting with some general questions and points.
    - General questions will allow interviewees to provide as much information as possible in the beginning. This would help the interviewer to probe key points and ask subsequent questions.
    - The merits of semi-structured interview are that it allows interviewees to freely express their views in their own terms without giving any definite answer. It also allows subsequent questions to follow up to uncover information sometimes not anticipated by the interviewer. This would encourage two-way communication during the interview, and thus function as an extension tool.
5. Starting with low risk or less confidential questions.
    - Low risk questions will help to relax interviewees so they could answer the questions more freely. Gradually enhancing the confidentiality of the questions may allow interviewees to provide more detailed information regarding some sensitive issues.

Script

(Beginning Script)

1. Introduction:

As I have mentioned in the email, I am conducting a comparative institutionalist study over the carbon markets in EU and China. It attempts to understand how their different institutional relations among key stakeholders/agencies have resulted in different ETS structures. In order to gain neutral and comprehensive opinions over the EU and China carbon markets, I am interviewing some academic experts who have experiences and expertise in this regard. During the interview, you will be asked to tell me about your understanding of the EU ETS. This may have to do with your opinions and understandings on the relationships among each relevant EU agencies in the ETS. Your previous experiences and activities in this regard will be valuable for me in understanding and analysing the information I have collected. The questions will ask you to think and explain how the different relational stakeholders interact with each other within the EU ETS, and how their varying interests and traditional practices have influenced their positions and manners throughout the EU ETS development.

2. Recording Instruction:

If it is ok with you, I will be recording our conversation. The purpose of this is that I can get all the details while be able to have an attentive conversation with you at the same time. I assure you that all your comments will remain confidential. All the comments from my interviews will be referenced anonymously in my thesis.

3. Consent Form:

Before we start please take a few minutes to read and sign this consent form. You can also keep a copy of this consent form. If you have any concerns about this, please do not hesitate to raise any question to me.

(Ending Script)

Thanks for your time and comments for this interview. Your opinions are extremely helpful for my research. I have included my contact information on the consent form, so if you have any concerns or questions about this interview, or if you want to further clarify some of your comments, please do not hesitate to contact anytime. Also, please forgive me if I have any followed up questions to ask and bother you again in the future. Thanks again for your useful comments and help in this interview.

Interview Questions

(Questions here only give some general points for the interviewer to guide the conversation. Additional questions may be raised during the interview based on the information provided by the interviewee. Also, these questions are not necessarily asked in all interviews, and will be selected based on the circumstance.)

Part 1: Comparison within the EU ETS

1. The EU was sceptical to the idea of emissions trading initially, but it soon changed its attitude after the Kyoto Negotiation. In your opinion, which actor was the major impetus behind this change of attitude?
    - Could you please further explain why you think actor ‘X’ was responsible for this change? And how it managed to do so?
2. How do you understand the EU ETS governance structure in its initial stage (phase 1 and 2)?
    - Who had the major authority in the governance at that time?
    - How would you evaluate this structure in terms of its effectiveness and results?
3. The EU ETS went through a profound reform in 2008, who you think was the major pusher behind?
4. Could you please tell me how you understand the role and strategy of each stakeholder in this reform?
5. By comparing with the ETS before and after the reform, how would you evaluate this reform? Does the reform really improve the EU ETS effectiveness and performance?
    - Why would you think the reformed EU ETS could better serve the EU climate ambition despite it still suffers from a relatively low carbon price now?

6. In terms of its governance structure and authority delegation, what are the differences between the EU ETS now and its initial phase?
7. In terms of its governance structure and authority delegation, do you think the EU ETS should be further reformed and improved?
    - If true, which part should be further improved and why?
    - Do you think these recommendations are politically feasible or preferred by various stakeholders within the EU now? And why?

Part 2: Comparison outside the EU ETS

8. Comparing with other carbon markets, what characteristics or conditions you think are unique to the EU circumstance that can barely be observed in other markets?
    - Specifically to China, what differences you think between EU and China could significantly influence their carbon market approaches?
9. Do you think companies from EU and China would respond to the carbon price differently?
    - If true, could you further explain how they will respond differently and why?
10. What are the differences between the carbon markets in EU and China in terms of their governance structure and authority delegation?
    - What factors you think may contribute to these differences?
11. By comparing the EU and China, do you think their distinct political systems have influenced their carbon market approaches?
    - If true, could you further explain how their carbon markets have been influenced?

B.2 Example Research Information Sheet

UNIVERSITY OF LEEDS

Carbon Markets in EU and China: A Comparative Institutionalist Study

Invitation

You are invited to take part in a research study entitled 'Carbon Markets in EU and China: A Comparative Institutionalist Study'. The following information is for your convenience and understanding, but please do not hesitate to ask for clarifications or more details should you need it.

What is the purpose of the project?

This project is a part of my PhD research in School of Earth and Environment at the University of Leeds, UK. This PhD study compares the institutional differences between the carbon markets in EU and China, and explains these differences with a comparative actor-centred institutionalist perspective. The research seeks to develop the idea of comparative institutional advantages in global carbon markets. My project supervisors are Prof. Jouni Paavola and Dr. Stephen Hall. The University of Leeds Research Ethics Committee has approved this project [Reference Number: AREA 17-079].

What will happen?

I will interview you in a one-on-one setting at your office or an agreed upon location of your convenience. You will be asked a series of questions, in English, and your response will be recorded for use in my research. I may ask you to provide information, recount events, or describe your experiences and understandings about issues related to the carbon market. The interview will take between 30-60 minutes. With your permission, the interview will be recorded in digital audio and subsequently transcribed. Once the transcript is finished, the voice recording will be disposed of.

What are my rights?

You can refuse to participate. You have the right to omit or refuse to respond to any question that I may ask. You will be given the right to withdraw at any point up to 30 August 2019. You also have the right to ask that any data you have supplied to me during the interview be withdrawn or destroyed. If you wish to withdraw from this study, let me know through the contact details overleaf at any time

Will my participation be confidential?

Participants will remain anonymous, the data will contain no personal information. With your permission, I may include information on your occupation but this

requires your explicit approval and the interview does not depend on it. The data collected during this study may be used in presentation at conference or in publications. However, any anonymity will be preserved.

Who do I contact for further information?

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Dr. Stephen Hall Email: S.Hall@leeds.ac.uk

The University of Leeds
For general enquiries
Website: http://www.leeds.ac.uk

Sustainability Research Institute:
Website: http://www.see.leeds.ac.uk/research/sri/

B.3 Example Participant Consent Form

UNIVERSITY OF LEEDS

Participant Consent Form

Date: _____

For the research project titled

Carbon Markets in EU and China: A Comparative Institutionalist Study

*Please initial next to statements where you agree

I confirm that I have read and understand the Information Sheet explaining the above research project and I have had opportunity to ask question about the project.	
The views I am sharing are those of my own, and not of my organisation.	
I agree to take part in the project. Taking part in the project will include being interviewed at a mutually convenient time up until 30 August 2019.	
I understand that my participation is voluntary and that I am free to withdraw at any time by email without giving any reason and without there being any negative consequences. If I chose to withdraw, all data related to me will be disposed of.	
I understand that the latest I can withdraw from this research project is 30 August 2019. After 30 August 2019 it will not be possible to withdraw.	
I understand my personal details such as phone number and address will not be revealed to people outside the project.	
I understand that my words may be quoted anonymously in publications, reports, web pages, and other research outputs.	

Name of Participant	
Participant's Signature	

Date	

Name of Researcher	
Researcher's Signature	
Date	

To be signed and dated in the presence of the participant.

Once this has been signed by all parties the participant should receive a copy of the signed and dated participant consent form, the letter/ pre-written script/ information sheet and any other written information provided to the participants. A copy of the signed and dated consent form should be kept with the project's main documents which must be kept in a secure location.

Contacts:

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