Climate Policy and Regional Inequality: A Comparative Analysis of the European Union and China

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Abstract. Climate policy has moved to the center of global governance debates. It sits at the intersection of emission reduction goals and regional economic realities, and the tension between those two things is genuinely complicated. This paper looks at how the European Union (EU) and China have approached that challenge, comparing their governance frameworks, the tools they rely on, and the uneven impacts those tools produce across different regions. The analysis shows that the EU has built a market-centered system around the EU Emissions Trading System (ETS), backed by multi-level governance and what it calls "just transition" mechanisms; China, meanwhile, has taken a more hands-on, state-led approach, using policy experimentation and administrative intervention alongside gradually expanding market tools. In both cases, the regional effects are uneven, places with stronger technology bases and more diversified economies tend to come out ahead, while carbon-heavy, resource-dependent regions feel the pressure far more acutely. The paper also reflects on what purely qualitative analysis can and cannot tell us and suggests some directions for future research that takes a more quantitative approach.

Keywords: Climate Policy, Regional Development, Carbon Neutrality, Governance Model, Comparative Analysis.

1 Introduction

There is probably no issue on the global governance agenda right now that is more pressing, or more politically loaded, than climate change. The push toward carbon neutrality has become a central organizing principle for policymakers, and the instruments they choose to get there have real, tangible consequences for regional economies, workers, and communities. The EU and China are arguably the two most important actors in this space, not just because of their scale, but because they have approached the problem in fundamentally different ways. Understanding those differences matters, both for academic analysis and for practical policymaking.

The existing literature has done a solid job examining carbon pricing mechanisms and their effects within single economies. But there is surprisingly little work that directly compares how different governance systems shape the relationship between climate policy and regional development. Most studies either focus on the EU's market-oriented logic or China's state-driven model — rarely both, and rarely in a

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way that explicitly traces how institutional differences produce different regional outcomes.

This paper tries to fill that gap. Taking the EU and China as parallel cases, it examines their respective climate policy frameworks, analyzes how those policies play out across regions, and draws out what the comparison reveals about the broader question of how to balance emission reduction with regional equity. The goal is not just to describe what each system does, but to understand why it does it that way — and what the tradeoffs look like.

2 Literature Review

2.1 Climate Policy and Carbon Neutrality

Carbon trading and carbon taxation have become the go-to instruments for putting a price on emissions, and for good reasons, they work by forcing companies to internalize costs they would otherwise ignore. The EU ETS is the clearest example of the carbon trading approach on a scale. As the world's largest carbon market, it has demonstrated that market mechanisms can drive meaningful emission reductions. But the early years of the ETS also exposed some real vulnerabilities: allowance allocation problems, price volatility, and data limitations that made the system harder to manage than anyone anticipated. Getting the design right turned out to be a lot more complicated than the theory suggested.

Carbon taxation has been widely adopted across Europe too, and Computable General Equilibrium (CGE) modeling work suggests it can significantly cut emissions in countries like Germany, France, Poland, and the UK. The catch, of course, is that the economic impacts vary quite a bit depending on the country's energy mix and industrial structure — which is something that gets glossed over in more aggregate analyses.

China's approach is different in some important ways. The national ETS was built on lessons from regional pilot programs, which is a sensible way to develop policy under uncertainty [1]. But compared to the EU, China's system is still much more heavily shaped by government intervention — particularly when it comes to quota allocation and market oversight. The debate about how effective China's carbon pricing has been is still ongoing. Some researchers see real progress; others argue that price volatility and regulatory uncertainty have blunted the impact.

The bottom line from the existing literature is that both economies rely on carbon pricing, but in quite different ways. The EU has a more mature, market-driven system; China's is still evolving under strong state guidance. Neither is a finished project.

2.2 Climate Policy and Regional Development

There is a growing body of work looking at how climate policy reshapes regional economies, and the picture it paints is not particularly tidy. In Europe, the green transition has accelerated the decline of carbon-intensive industries in some regions

while creating new opportunities in others. Germany's energy transition is often cited as an example of how large-scale structural change can drive innovation — but that story is a lot messier at the regional level, especially in areas that depended heavily on coal. The benefits of green investment tend to cluster in regions that already have strong institutions and diversified economies; the costs tend to fall hardest on places that don't.

Whether climate policy ultimately reduces or worsens regional inequality is genuinely contested in the literature. There are researchers who argue that the green transition creates new openings for lagging regions, and others who think the opposite — that the transition reinforces existing disparities because economic resilience is so unevenly distributed. Both views have some empirical support, which tells you something about how context-dependent these dynamics are.

In China, the picture is broadly similar. Low-carbon pilot policies have been shown to promote structural transformation and technological upgrading, but the effects are not evenly distributed. Eastern regions with more diversified economies and stronger financial capacity have generally fared better; resource-heavy regions in the central and western provinces have faced tougher adjustment pressures. Again, the question of whether these policies lead to regional convergence or divergence is actively debated, without a clear consensus yet.

Across both contexts, the common thread is that climate policy effects depend heavily on what else is happening — what supporting policies are in place, what institutional capacity looks like, and how willing governments are to manage the distributional consequences. Studies that ignore these factors tend to be missed a lot.

2.3 Government and Market in Climate Governance

The question of how to balance government intervention and market mechanisms in climate governance has attracted a lot of attention, and for good reason — it cuts to the heart of how climate policy actually works in practice. In Europe, the governance model is typically described as a hybrid: strong regulatory frameworks combined with market-based instruments. The ETS is the classic example — governments set the cap, markets determine where emission reductions happen. Multi-level governance adds another layer, with coordination running from the EU down to national governments and local authorities.

China's model is more explicitly state-led, at least for now. Central government sets the direction; policy experimentation — like the low-carbon pilot programs — allows for gradual learning and adjustment. Market mechanisms are being incorporated, but slowly, and they sit within a framework that remains heavily shaped by administrative decision-making.

The broader point from the literature is that neither pure market logic nor pure government control is sufficient on its own. Both the EU and China are operating hybrid models, just with different emphases. What is less well understood is how that balance affects policy outcomes across different institutional contexts — which is exactly the kind of question a comparative analysis can help address.

3 Climate Policy and Regional Development in the European Union

3.1 Policy Framework: From Market Logic to Adaptive Governance

The EU ETS is the backbone of European climate governance [2]. It started as something of an experiment and has evolved considerably since — through multiple structural phases, the introduction of the Market Stability Reserve, and the gradual expansion of coverage to aviation and maritime transport. What makes it interesting is that its effectiveness has never depended solely on carbon pricing. Institutional design matters enormously: how allowances are allocated, how the reserve operates, how oversight is structured.

The recent push to integrate carbon dioxide removal (CDR) into the system says something important about where EU climate governance is heading [3]. CDR is not like conventional mitigation — it requires bridging geological sequestration with carbon accounting systems, which is genuinely complicated. The fact that the EU is trying to do it reflects what might be called a capacity for "reflexive governance": the ability to update the system as understanding evolves.

The Carbon Border Adjustment Mechanism (CBAM) is another telling development. CBAM extends the internal logic of the ETS to imports — essentially charging carbon prices on goods coming from countries with weaker climate rules. This tackles the carbon leakage problem while also aligning trade policy with climate goals [4]. It signals that EU climate governance has moved beyond just managing internal emissions; it is now trying to shape the external environment too.

The overall picture is of a system that remains market-centered but is increasingly supplemented by strategic institutional intervention. That combination is probably more resilient than a purely market-based approach would be, especially given the turbulence of the current global economic environment.

3.2 Structural Divergence: The Triple Determinants of Regional Outcomes

EU climate mandates apply uniformly across all member states. In practice, the outcomes look very different depending on where you are. Regions with strong technology endowments and diversified industrial bases — like the wind-energy clusters in northern Germany or the Netherlands' circular economy ecosystem — are well-placed to absorb carbon constraints and turn them into growth opportunities. For these places, the transition is less a disruption than an acceleration of something already underway [5].

Contrast that with regions where the economy is tightly bound up with coal extraction or heavy manufacturing — Silesia in Poland, or the Jiu Valley in Romania. There, carbon pricing hits more like a shock than an incentive [6]. The lock-in effects of existing fossil-fuel infrastructure are powerful; decommissioning assets prematurely risks creating "stranded regions" where structural unemployment and capital flight reinforce each other. The path out is not obvious.

Governance capacity shapes how severe these pressures become. Regions with strong institutions can attract green investment, coordinate retraining programs, and build the social acceptance needed to sustain the transition. Those with weaker institutional capacity often experience something more like "transition fatigue" — a sense that the costs of climate policy are real and immediate while the benefits are distant and uncertain. This is not just an economic problem; it is a political one too [7].

The implication is that treating regional divergence as an incidental byproduct of otherwise well-designed policy is probably a mistake. It is structurally embedded, and addressing it requires moving beyond one-size-fits-all approaches toward something more place-sensitive.

3.3 Mechanisms for Equity: The Political Economy of Just Transition

The EU has tried to address these disparities through mechanisms like the Just Transition Fund and the broader Cohesion Policy frameworks — what you might call the "social pillar" of the European Green Deal [8]. The logic is twofold: provide immediate compensation to offset industrial decline, while also investing in the longer-term infrastructure needed for alternative development pathways. The ambition is that no region gets left behind.

Whether the money is sufficient is a different question. Critics have pointed out, persuasively, that the JTF's budget looks rather modest when measured against the scale of structural disruption facing places like Upper Silesia or parts of southeastern Europe. Macroeconomic modeling suggests that a truly just transition for highly dependent economies would require fiscal resources well beyond current EU allocations. This tension between symbolic commitment and material adequacy is not going away.

But these mechanisms are not just about economics. They serve a vital political function: by mitigating the worst asymmetric costs of the transition, they help preserve the social cohesion that the EU's decarbonization agenda depends on. In an era of rising populism, the "geography of discontent" is a real political risk [9]. If workers and communities in industrial heartlands feel that the costs of climate policy are being loaded onto them while the benefits flow elsewhere, the political backlash could undermine the entire project. The just transition mechanisms exist, in part, to prevent that from happening. Whether they are doing so effectively enough is one of the central questions facing EU climate governance right now.

4 Climate Policy and Regional Development in China

4.1 Policy Framework

China's climate governance is structured around the "dual carbon" goals: peak carbon emissions before 2030, achieve carbon neutrality before 2060. These targets have gradually been woven into industrial policy, energy strategy, and regional development planning in ways that would have been hard to imagine even a decade

ago. The national ETS, which operates as a cap-and-trade system for the power sector, is the most visible market-based instrument [10]. It introduces carbon pricing signals and, in principle, pushes emission reductions toward the most cost-effective locations.

In practice, though, the picture is more complicated. There is an active debate in the literature about what China's climate governance model actually is. One side emphasizes the growing role of market-based instruments and argues that China is gradually moving toward something like an environmental governance system. The other side points to the continued dominance of centralized administrative control and argues that the system remains fundamentally state led. The empirical reality is probably best described as both: a hybrid model where market mechanisms operate within — and are substantially shaped by — strong state coordination [11].

That framing is not criticism. It may, in fact, be the only workable approach given China's particular combination of institutional context, development stage, and the scale of transformation required.

4.2 Regional Development Effects

The regional effects of China's climate policies are anything but uniform. Eastern regions like Guangdong and Jiangsu, with more service-oriented economies and stronger technological capacity, have generally been able to adapt to carbon constraints relatively well [12]. For these regions, climate policy has often functioned as a prompt for industrial upgrading and expansion of low-carbon sectors — a direction they were probably already heading in.

The situation looks quite different in central and western regions heavily dependent on coal and heavy manufacturing — Shanxi, Inner Mongolia, and similar. There, carbon pricing and emissions constraints impose real structural costs. The path to industrial transformation is slower, harder, and often requires fiscal support that local governments may not have. The political economy of this is sensitive; these are also regions that contribute significantly to national energy security, which complicates the picture further.

The debate in the literature about whether climate policies lead to regional convergence or divergence has not been resolved. Optimists point to the potential for carbon regulation to diffuse technology and drive structural upgrading across lagging regions over time [13]. Skeptics argue that existing disparities in industrial structure and innovation capacity tend to be reinforced under carbon constraints, leading to persistent divergence. Empirical evidence from pilot carbon trading studies suggests the pessimists have a point: emission reduction effects are generally stronger in regions with higher regulatory intensity and more advanced economies, which implies that regional capacity shapes outcomes as much as policy design does.

4.3 Government Role and Regional Imbalance

One of the defining features of China's climate governance is the combination of centralized policy design with decentralized implementation [14]. The national framework sets targets and institutional arrangements; local governments are

responsible for enforcement. This structure creates significant variation in how effectively policy translates into outcomes. Regions with stronger administrative capacity and stricter enforcement achieve more; regions with weaker governance capacity achieve less.

The deeper issue is that regional inequality in development capacity has not gone away [15]. Despite a unified national framework, differences in industrial base, economic development, and technological capability mean that both the responsibilities and the opportunities of the green transition are distributed unevenly. Developed regions can absorb transition costs and pivot to low-carbon growth pathways more readily, whereas less developed regions face structural adjustment pressures that can be genuinely destabilizing [16].

This reflects a broader tension that runs through China's climate governance: efficiency versus equity. Differentiated implementation may improve overall efficiency by letting regions follow paths consistent with their economic structure — but it may also reinforce existing inequalities by placing heavier adjustment burdens on already-vulnerable resource-dependent regions. How to manage that tension is one of the central challenges China's climate governance system faces over the coming decade.

5 Comparative Analysis

5.1 Differences in Policy Instruments and Their Institutional Roots

The EU and China have taken genuinely different approaches to climate policy, and those differences are not accidental — they reflect deep features of each system's institutional architecture. The EU's default is the market. ETS, in place since 2005, sets an overall emissions cap and lets firms trade allowances, so that emission reductions happen wherever they are cheapest across the economy. Gong Xiaoxuan's analysis of EU multi-level governance helps explain why this approach makes sense in the European context: with supranational institutions, member states, and sub-national authorities all involved in climate policy, coordination through rules and market tools is simply more workable than top-down administrative commands [17]. The ETS embodies this logic — a common cap at the supranational level, flexibility at the level of individual firms and member states. The 2021 introduction of CBAM added another dimension, extending the internal carbon pricing logic to imports of steel, cement, aluminum, and fertilizer from countries with weaker climate rules. This protects EU industries from unfair competition while also pushing the EU's climate norms outward.

China has taken a different path. Carbon market pilots launched in eight regions from 2013 and the national market for the power sector went live in 2021 [14]. suggests the system is still at an early stage: trading activity remains limited, and carbon prices have not been the primary driver of emission reductions so far. A large share of China's emission cuts has come through administrative intervention — government supervision, compliance requirements tied to performance assessments, penalties for violations. The finding that regions with higher shares of state-owned

enterprises tend to show stronger carbon reduction effects is revealing; it shows how much the system still depends on the government's ability to direct behavior through ownership and oversight rather than price signals alone.

These differences trace back to institutional foundations. The EU's multi-level governance structure, with its tradition of legal norms and negotiated policy, naturally gravitates toward instruments that all actors can agree on and follow without requiring direct commands — which market mechanisms and legally binding rules happen to fit well. China's institutional context is different. As Zhang Ping has argued, China's green transition involves structural friction costs — industrial decline, job losses, energy supply instability — that market forces cannot absorb on their own [13]. Government needs to use a combination of regulation, subsidy, industrial policy, and carbon market tools to keep the transition stable. The fact that most firms covered by China's ETS are state-owned also gives the government a practical enforcement mechanism that would simply not exist in a more private-sector-dominated economy.

5.2 Regional Inequality Outcomes and Their Causes

Both the EU and China face the challenge of uneven regional impacts from climate policy, but their institutional setups lead to quite different responses. In the EU, the multi-level governance framework includes redistribution mechanisms that help spread transition costs more evenly. The classification of climate policy as shared competence between the EU and member states creates space for flexible implementation and financial transfers to less developed regions. The ETS allowance allocation system accounts for different economic levels across member states, and part of the auction revenue flows back to regions that need more support. These arrangements do not eliminate regional inequality, but they provide a structural buffer.

China's situation is considerably more challenging. The friction costs of the green transition are very unevenly distributed: coastal eastern regions with stronger technology capacity and diversified industries are generally better positioned to benefit from the green shift, while coal- and steel-dependent regions in central and western China bear much higher adjustment costs, including stranded assets, unemployment, and fiscal pressure. Zhang Ping's analysis points to this as one of the central governance challenges of China's transition [13].

The root cause of the difference lies, again, in institutional arrangements. The EU has relatively mature cross-border fiscal transfer and policy coordination mechanisms built into its governance structure — a kind of safety net for regions hit hardest by the transition. China's regional economic gaps are much wider, and local governments vary enormously in fiscal capacity and governance ability. This is one of the reasons why market-based tools alone are not sufficient in the Chinese context; the central government has to play a more active coordinating role to manage the distributional consequences.

5.3 The Government-Market Relationship and Its Institutional Logic

At the deepest level, the contrast between the EU and China comes down to how each system balances the roles of state and market. In the EU, carbon pricing is central: by auctioning emission allowances and allowing prices to rise, the system turns the environmental cost of emissions into a real business expense, giving firms financial incentives to invest in cleaner technologies. EU carbon prices have exceeded 90 euros per ton, demonstrating that market mechanisms can generate significant behavioral change [2]. But this approach is not without costs — high carbon prices have pushed some energy-intensive industries to relocate outside the EU, which is part of what motivated the introduction of CBAM. And even within the EU's market-oriented system, government institutions are never absent: the European Commission, Parliament, and Council of Ministers all shape the rules and supervise implementation. This is market governance, but within a strong institutional framework.

Zhang Ping's concept of classified governance is useful for understanding China's approach [13]. Because China's green transition involves three overlapping structural shifts simultaneously — replacing fossil fuels with renewables, electrifying industrial processes, and developing the digital economy — the costs and readiness levels vary enormously across sectors. A single carbon price signal cannot drive transformation everywhere at once; different sectors are at different stages and face different constraints. So, China has used sector-specific tools: credit trading for the auto industry, allowance trading for the power sector, subsidies for renewables. The 2021 power rationing crisis was a sharp reminder of what can go wrong when aggregate emission targets are pursued without sufficient attention to sectoral readiness and energy security.

At a deeper level, the EU model reflects the conditions of a post-industrial society with mature legal systems and multi-level governance structures, where policy decisions emerge through negotiation among diverse actors rather than through top-down command. China's situation is fundamentally different: it is still industrializing, and it needs to hit carbon peak and carbon neutrality at roughly the same time as maintaining economic growth and employment stability. That requires a more active state role in coordinating resources, guiding industrial upgrading, and managing social costs. The divergence between the EU's market-oriented approach and China's state-coordinated model is not just a policy preference — it reflects real differences in development stage, institutional capacity, and historical tradition.

6 Conclusion

Climate policy is reshaping regional economic development in both the EU and China, and this paper has tried to show how and why. The comparison makes clear that climate governance is not just about emission reduction targets — it is about industrial restructuring, technological transformation, and who bears the costs of all of that. The EU and China share the broad objective of carbon neutrality, but they are

pursuing it through models that are quite different in their logic, their instruments, and their distributional consequences.

The EU's model centers on market mechanisms — the ETS above all — supported by multi-level governance and redistribution tools like the Just Transition Fund. It emphasizes regulatory coordination, carbon pricing, and institutionalized incentives. China's model is more explicitly state-led, with centralized coordination, administrative intervention, and gradual policy experimentation playing dominant roles alongside an expanding but still limited market system. These differences are not arbitrary; they reflect distinct institutional traditions, development stages, and relationships between state and market.

Both systems produce uneven regional outcomes. In both the EU and China, regions with stronger technology, more diversified economies, and better governance are better positioned to benefit from green transition policies. Resource-dependent and carbon-intensive regions face harder adjustment paths, with real consequences for workers and communities. Climate policy can promote green growth and intensify regional disparities at the same time — and if adequate supporting mechanisms are absent, it often does both.

The comparison also points to a broader design principle: effective climate governance requires a hybrid model that combines government coordination with market mechanisms, and that takes distributional consequences seriously. Excessive reliance on market efficiency can generate unequal regional burdens; excessive centralization can reduce flexibility and crowd out innovation. Getting that balance right is genuinely difficult, and neither the EU nor China has fully solved it.

For developed economies, the EU experience illustrates why institutional coordination and social compensation matter for maintaining political support for decarbonization. For developing countries, China's experience shows how strong state coordination and gradual experimentation can help manage structural pressures — though the regional equity challenges it generates are not trivial.

This paper has relied primarily on qualitative comparison and literature review, which has real limits. Future research that incorporates quantitative methods — econometric modeling, regional panel data — could provide more systematic evidence on long-term effects. Expanding the comparative scope to include more countries would also enrich the analysis considerably.

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