

Distributional Environmental Outcomes under Institutional and Resource Constraints: Evidence from China

Abstract

This dissertation examines how institutional and resource constraints shape distributional environmental outcomes in China. Moving beyond average changes in pollution, it studies how environmental risks and their consequences are distributed across regions and social groups. The dissertation is organized around three empirical chapters: the first two chapters study spatially differentiated water pollution regulation and economic policy uncertainty as two forms of institutional constraint, while the third chapter studies clean energy shortages during China's Coal-to-Gas transition as a form of resource constraint.

Chapter 1 studies the distributional effects of China's 11th Five Year Plan, which induced spatially differentiated water pollution abatement across a population of nearly 1.3 billion. The policy assigned abatement targets across regions based on their baseline water pollutant emissions and reduced water pollution overall. However, because these highly polluted areas were also relatively wealthier, the policy concentrated pollution abatement and reductions in polluting firm entry in higher socioeconomic status areas. As a result, while water pollution declined, disparities in tumor risk, cardiovascular disease, labor supply, and wages widened, particularly among populations without access to tap water. The analysis demonstrates that consideration of heterogeneous pollution vulnerability across the population may affect the overall benefits of a policy.

Chapter 2 examines economic policy uncertainty (EPU) as a form of institutional constraint related to policy predictability. It investigates whether and how EPU affects inequality in air pollution exposure across education groups. Using a shift-share instrumental variable based on world import demand to predict provincial fluctuations in EPU, the chapter constructs an individual-level panel linking individuals to local SO₂ concentrations and province-level EPU across multiple survey waves. The results show that higher EPU disproportionately increases air pollution exposure among individuals with lower levels of education. Mechanism analyses suggest that this effect operates mainly through changes in government regulatory behavior and firm-level emission decisions, linking policy predictability to the distribution of pollution exposure.

Chapter 3 turns to resource constraints in China's 2017 Coal-to-Gas transition. When clean energy demand expands faster than natural gas supply, administrative prioritization of natural gas for designated regions exposed non-pilot cities to shortages. The chapter measures this exposure by non-pilot cities' pre-policy dependence on natural gas for non-household uses, since these users were more vulnerable to supply reductions under scarcity. Using this measure in a continuous-treatment difference-in-differences design, the chapter shows that more exposed non-pilot cities experienced larger increases in PM_{2.5} concentrations after the policy. DID-IV estimates using historical natural gas pipeline shares as an instrument yield similar positive effects. Further analysis indicates that shortages constrained industrial combustion while increasing emissions from upstream fuel-related and power-generation sectors, and had larger effects in cities more dependent on natural gas within the clean energy mix. These findings suggest that the environmental consequences of energy transition depend not only on cleaner fuel adoption, but also on how scarce clean energy is allocated and diversified under constrained supply.

The dissertation as a whole highlights the importance of policy design, policy predictability, and resource availability for understanding distributional environmental outcomes. Spatially uneven policy design, economic policy uncertainty, and limited clean energy supply can redirect environmental benefits, shift pollution exposure, and generate unintended consequences across regions and social groups. The broader implication is that the design and evaluation of policies with environmental consequences can benefit from more explicit attention to equity, predictability, and resource feasibility, alongside aggregate pollution reduction.