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## Environment for Development Research Brief

# Emissions Trading Schemes and Directed Technological Change: Evidence from China

Many countries have implemented policies to tackle climate change, with Emissions Trading Schemes (ETS) being one of the foremost attempts. Under such schemes, firms receive emission allowances. The firms that are covered by the rules are required to submit allowances for their emissions or, if they emit more than the allocated allowances, to purchase emission reduction from other firms. This imposes an emission price for carbon emissions and provides a cost-effective way for firms to comply. Such a policy changes the relative price of energy inputs and therefore affects the type of technologies developed.

As the world's largest carbon emitter, China accounts for more than a quarter of global carbon emissions. With the target of efficiently reducing greenhouse gas emissions by 2020, China launched the pilot ETS in 2013. These schemes currently cover more than 3,000 industrial firms and entities in 8 provinces and municipalities, whose carbon emissions account for about 11 percent of China's total. My research shows that the pilot ETS in China encourages green innovation, or technology development that allows firms to reduce emissions more efficiently and at lower cost.

- The overall effect is positive though modest.
- Emission price matters. The policy significantly induced green innovation in two of the regions Shanghai and Beijing, which have some of the highest carbon emission price levels among all the regions.
- Firms' output per worker matters. The policy significantly induced green innovation for firms with high output per worker, which are the firms that potentially have high capital and worker productivity.

The policy implications of these findings are twofold. First, effectiveness differs across the pilot regions. A potential explanation for this is the regional differences in the policy design, which leads to very different carbon prices, and therefore provides different incentives for green innovation across regions. Second, the increase in green innovation is primarily driven by decisions to invest more by regulated firms that already have high output per worker. Technology entry to green innovation is less likely to be induced for the firms at the higher end of output per worker. The findings show that firms innovate more once they've taken a first step. This indicates that an important policy challenge is to encourage the regulated firms to start innovation in green technologies. This is especially important for firms that are larger and more productive.

**This brief is based on:** *Emissions Trading Scheme and Directed Technological Change: Evidence from China*, Efd Discussion Paper Series 20-36, October 2020, by Ruijie Tian, University of Gothenburg, Sweden.

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