



CAN ENVIRONMENTAL POLICY ENCOURAGE TECHNICAL CHANGE? EMISSION TAXES AND R&D INVESTMENT IN POLLUTING FIRMS

BACKGROUND AND RESEARCH AIM



Policies promoting cleaner production technologies can reduce climate change risks and environmental concerns without majorly impacting long-term economic growth. This has led to extensive research on how environmental policies affect the development of cleaner products and technologies. A less-explored aspect is how these policies can encourage polluting firms to invest in new technologies that enable transformative changes in their production processes. While studies emphasize the importance of technology spending in firms' pollution reduction efforts, there is limited evidence on how environmental policies can incentivize such investments. This study addresses the research gap by examining the impact of country-level taxes on emissions from dirty manufacturing on technology spending in highly polluting firms. In particular, focus is placed on understanding how taxes on sulfur oxide (SO_x) emissions affect firm investment in research and development (R&D).

RESEARCH METHODS

The primary sample used in this study consisted of around 33,500 firm-years across 18 countries over the period 1990 to 2012. This sample was obtained through merging two data sources. Data on SO_x taxes by country and year was derived from OECD data sourced from the Environmental Stringency Index data set and the Policy Instruments for the Environment (PINE) Database, while information of firm-level R&D investment came from the Compustat Global and North America databases. The Compustat firms from countries with pollution tax data was then matched with patenting metrics from the Worldwide Patent Statistical Database (PATSTAT). For some tests, daily market price data from the Compustat Global Security Daily file, was incorporated.

POLLUTION TAXES AND INTENSITY

Considerable cross- and within-country variation in Pollution taxes, during the sample period, were found. Figure 1. shows the evolution of taxation on sulphur oxides (SO_x) by country. The sample also included 10 countries with no SO_x tax: Austria, Belgium, Finland, Germany, Greece, Ireland, Netherlands, Norway, Sweden, and the UK.

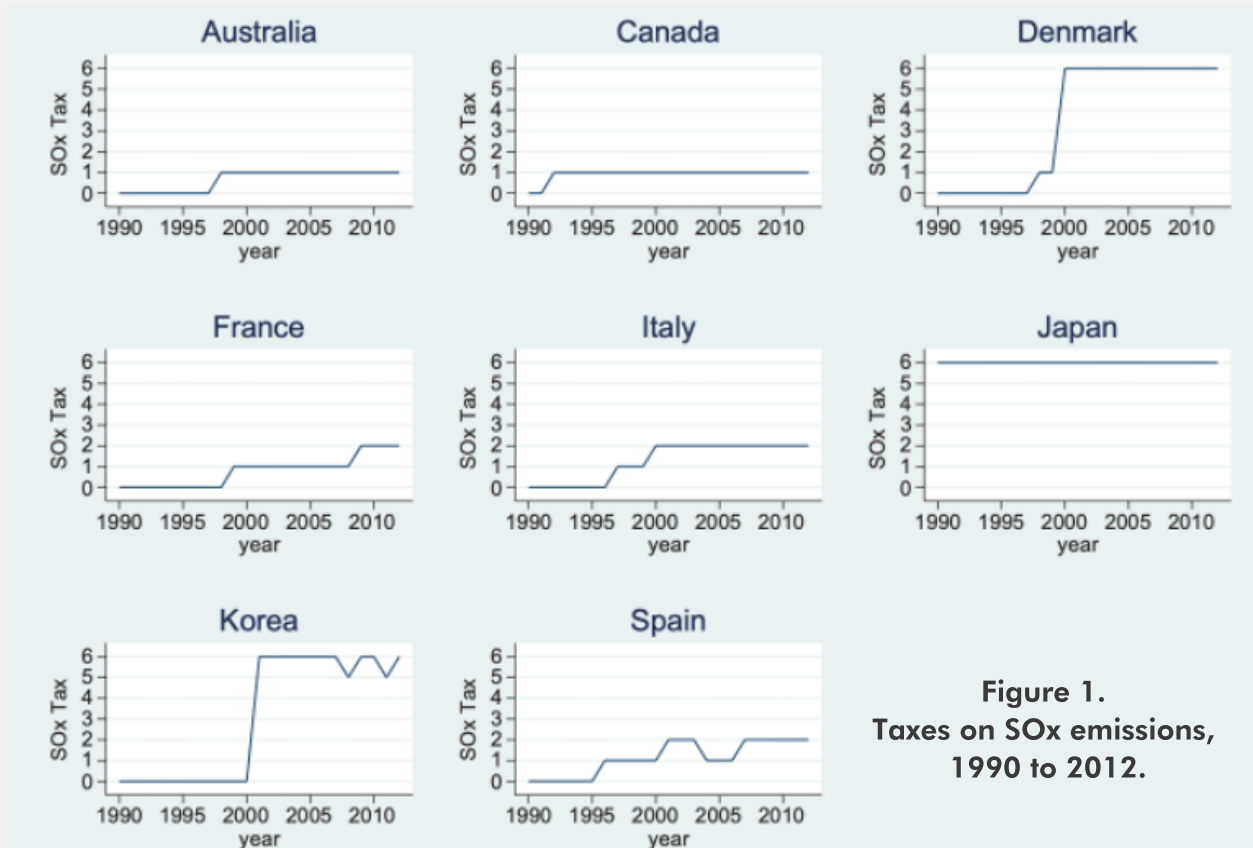


Figure 1.
Taxes on SO_x emissions,
1990 to 2012.

To understand the differential impact of higher pollution taxes in industries with a higher tendency to emit SO_x, industries were sorted according to how pollution intensive their production technologies are. Information from Levinson (2009) on pounds of SO_x emissions per unit of output (SO_x emissions) was used. The Hydraulic cement manufacturing was found to be the industry with the highest pollution intensity. The intersection of the firm-level data on R&D and patenting and the industry-level information on pollution intensity resulted in 107 distinct manufacturing industries being used in the study.

POLLUTION TAXES AND R&D INVESTMENT

To evaluate the effects of pollution taxes, R&D was modelled as a function of output (sales). Different versions of the equation were used to further understand the differences in the response to Pollution taxes across firms with differing exposures to SO_x taxation. To implement these tests, firms were sorted into quartiles based on SO_x emissions intensity in the firm's Standard Industrial Classification (SIC) industry.

FINDINGS



The study found that higher taxes on SO_x emissions are associated with a substantial increase in firm-level R&D spending. Pollution taxes were found to have relatively stronger effects on R&D in sectors with dirtier production technologies. In contrast to R&D, the study showed that pollution taxes do not lead to more patenting in high-pollution firms, suggesting that firms increase R&D to improve their ability to use and assimilate external knowledge rather than to develop new innovations. The R&D response to pollution taxes was concentrated in sectors where external knowledge is easier to acquire.

IMPLICATIONS FOR PRACTICE AND FUTURE RESEARCH



The research contributes to the empirical literature on how innovative activity responds to environmental policies and regulations. New evidence on the micro-level linkages through which market-based environmental policies can influence technical change are provided. The study shows that tax policy can also encourage the technology investments which allow firms to broadly overhaul the way they produce, in order to reduce pollution at the source. Practically, the findings suggest that investment in technological absorptive capacity is a first-order response when non-innovative firms with dirty production technologies face higher emissions taxes. Further research could focus on other legal and institutional determinants, including financial market conditions, of R&D investment in order to gain a better understanding of how these factors influence the effectiveness of environmental policies at encouraging the development and use of clean technologies.

ACADEMIC REFERENCE

Brown, J.R., Martinsson, G. and Thomann, C. 2022. 'Can Environmental Policy Encourage Technical Change? Emissions Taxes and R&D Investment in Polluting Firms'. *The Review of Financial Studies*, 35(10), pp. 4518-450.