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Firm competitiveness and the European Union emissions trading scheme ☆

Hei Sing (Ron) Chan [a], Shanjun Li [b], Fan Zhang [c,*]

[a] Department of Economics, University of Maryland, 3114 Tydings Hall, College Park, MD 20742, United States
[b] Dyson School of Applied Economics and Management, 405 Warren Hall, Cornell University, Ithaca, NY 14853, United States
[c] World Bank, 1818H ST NW, Washington, DC 20006, United States

HIGHLIGHTS

- We examine the impact of European Union Emissions Trading Scheme (EU ETS) on firms' unit material costs, employment and revenue during 2005–2009.
- EU ETS had no impact on the performance of cement and iron and steel industries.
- EU ETS was associated with increased material costs and revenue of the power industry.
- We find no evidence of negative impact on firm competitiveness from EU ETS during 2005–2009.

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ABSTRACT

The European Union Emissions Trading Scheme is the first international cap-and-trade program for CO_2 and the largest carbon pricing regime in the world. A principle concern over the Emissions Trading Scheme is the potential impact on the competitiveness of industry. Using a panel of 5873 firms in 10 European countries during 2001–2009, this paper seeks to assess the impact of the carbon regulation on three variables through which the effects on firm competitiveness may manifest—unit material costs, employment and revenue. Our analysis focuses on three most polluting industries covered under the program-power, cement, and iron and steel. Empirical results indicate that the emissions trading program had different impacts across these three sectors. While no impacts are found on any of the three variables in cement and iron and steel industries, our analysis suggests a positive effect on both material costs and revenue in the power sector: the effect on material costs likely reflects the costs to comply with emissions constraints or other parallel renewable incentive programs while that on revenue may partly due to cost pass-through to consumers in a market less exposed to competition outside EU. Overall our findings do not substantiate concerns over carbon leakage, job loss and industry competitiveness at least during the study period.

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1. Introduction

The European Union Emissions Trading Scheme (EU ETS) is the world's first large implementation of a CO_2 cap-and-trade system. Launched in 2005, it forms the centerpiece of EU's climate policy to reduce greenhouse gas emissions by 20 percent below 1990 levels before 2020. Under the system, each EU member state sets an annual cap limiting total CO_2 emissions from electric utilities and energy-intensive industrial plants. The government then divides the cap into individual allowances to emit one ton of CO_2 and allocates them to participating firms. At the end of every compliance year, each firm must deduct enough allowances from its account to cover its emissions for that year. Firms can trade allowances among each other, purchasing extra allowances if they emitted more, selling or saving allowances if they emitted less.[1] The EU's trading scheme effectively puts a price on carbon emissions via the trading price for

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* Corresponding author. Tel.: +1 202 473 1000.
E-mail addresses: chan@econ.umd.edu (H.S.Chan), SL2448@cornell.edu (S. Li), fzhang1@worldbank.org (F. Zhang).

[1] Banking of excess allowances for future years is allowed within the first compliance period (phase I of EUETS during 2005–2007), and is mandatory after 2012.

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allowances. Today more than 12,000 power generators and heavy manufacturing units in 30 countries are covered by the system.

Emissions trading programs such as the EU ETS have gained popularity over the past two decades as a market-based policy instrument to minimize the costs of environmental regulation. Experience in the United States has shown that well-designed emissions trading programs can reduce policy costs by between 15 and 90 percent compared to traditional command-and-control program (Schmalensee and Stavins, 2012; Carlson et al., 2000; Ellerman et al., 2000; Keohane, 2006). Although the cost-effectiveness of carbon trading is widely acknowledged, a major unresolved issue in the debate over EU ETS is whether it would impose an unsustainable burden on the industry.

The conventional wisdom is that environmental regulations even based on the market-based approaches could divert productive investment (Rose, 1983) or reduce operating flexibility (Joshi et al., 1997), therefore adversely affect firm productivity (Jaffe et al., 1995). More importantly, because EU was the first to impose carbon regulation, there is concern that such unilateral action would hinder the competitiveness of EU firms in the global market. Proponents of this view hold that stringent environmental regulations could actually enhance productivity growth by stimulating innovation and efficiency (i.e., the Porter hypothesis, Porter, 1991). Another concern is that emission-intensive firms in EU could relocate to regions with no or lesser carbon restrictions. The economic relocation would be accompanied by loss of jobs and market shares, as well as carbon leakage whereby emissions reduction in EU could be more than offset by increases elsewhere.

Two strands of literature have addressed the above questions on competitiveness and carbon leakage. The first are *ex ante* studies to simulate the potential carbon leakage in a range of energy-intensive manufacturing sectors. Based on assumptions on CO_2 prices, demand elasticities and trade exposure, these studies project leakage rates ranging from very low to significant at 30 percent or more (Ponssard and Walker, 2008; Demailly and Quirion, 2008; Reinaud, 2008 etc.). For example, Demailly and Quirion (2008) examines the impact on cement industry under a euro 20 per ton CO_2 price. They found that the leakage rates range from 0.5 to 25 percent among EU-27 countries with a mean value of 6 percent.

The literature on *ex post* empirical analysis is relatively thin. Abrell et al. (2011) assess the impact of EU ETS on firm competitiveness based on data of 2000 European firms during 2005–2008. They find no statistically significant impact of EU ETS on firm value added, profit margin or employment. Anger and Oberndorfer (2008) examine the impact of EU ETS on firm revenue and employment based on a sample of German firms over the period of 2005–2006. Their analysis suggests that the initial allocation of allowances did not affect revenue and the employment, therefore the impact of carbon regulation on firm competitiveness is likely to be modest. Jaraite and Maria (2011) investigate the effect of Phase 1 (2005–2007) EU ETS on productivity growth of the power generating sector using macro-level data of 24 European countries during 1996–2007. They find that carbon pricing had a positive impact on technological change. Overall, the existing empirical literature seems to find little evidence to support the hypothesis that EU ETS would have a large adverse impact on competitiveness.

In this paper, we measure the effect of EU ETS on firm unit material cost, employment and turnover based on a panel of 5873 firms in the electric power, cement and steel industry from 10 European countries[2] during 2005–2009. The power sector is the most heavily affected by the carbon regulation. During the sample period, the sector was short by around 440 million allowances[3] and was a net buyer of allowances within EU. The cement and iron industries are vulnerable to carbon leakage as both are tradable industries and cannot pass through increased energy costs into product prices without incurring a loss of market share. All together, the three (power, cement, iron and steel) sectors account for 86.76 percent of carbon emissions in the EU and constitutes 86.98 percent of total demand and 85.33 percent of total supply of carbon allowances.

We match firm financial data from the AMADEUS database maintained by Bureau van Dijk with emission traction records reported in the Community Independent Transaction Log (CITL) run by the European Commission. We then use participant and nonparticipant firms of similar sizes within the same industry category to construct the control and treatment groups. Using a fixed effects specification, we estimate the impact of carbon trading, as well as the initial allocation of allowances on firm competitiveness. Our analysis differs from previous research in two ways. First, unlike the study of Abrell et al. (2011) that uses firms from different (non-ETS) industries as the counterfactual, we compare performance of regulated and unregulated firms within the same industry. In doing so, we avoid potential bias by omitted variables characterizing time-variant differences among industries. Second, our study covers more industries, more countries and a longer period of the trading program than other studies. Therefore, our paper provides additional evidence on the impacts of the carbon regulation.

The results from this study suggest that EU ETS had different impacts across sectors. Our results show that the program may have resulted in higher material costs of the power industry on average by about 5 percent during 2005–2007 (Phase 1) and 8 percent during 2008–2009 (Phase 2). Since power sector as a whole faced a binding constraint of CO_2 emissions during the study period, rising material costs could reflect the compliance costs associated with purchasing allowances and/or substituting low-cost coal with more expensive fuel such as natural gas to mitigate emissions. It could also reflect the costs to comply with parallel renewable incentive programs. In addition, the turnover of the power companies on average increased by 30 percent in Phase 2. This could imply that fossil-fuel power generation companies have passed through compliance costs to ratepayers, resulting in higher electricity prices and higher revenue. On the other hand, the trading scheme seems to have had no statistically significant impacts on any of the three variables in the cement and iron and steel sectors. The differences between ETS and non-ETS firms in these two industries in material costs, employment and turnover are statistically insignificant. This finding suggests that there is likely to be no shift of production elsewhere. The free allocation of emission allowances gave firms a source of revenue and this could partially explain the limited impact of EU ETS so far.

The remainder of the paper is organized in the following. Section 2 provides a background of EU ETS. Section 3 describes data. Section 4 discusses the empirical strategy. Section 5 presents the results and Section 6 concludes.

2. The EU emissions trading scheme

The EU ETS was approved by European Commission in 2003 and officially launched in 2005. It was set up with three phases. Phase 1, from 2005 through 2007, was intended as much to gain business buy-in and develop institutions as to achieve

[2] Austria, Belgium, Czech Republic, France, Germany, Great Britain, Italy, Netherlands, Poland and Spain.

[3] These numbers are determined using the sample of 10 countries used in this study due to the need to identify power plants from the combustion sector.

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