Do Firms Reduce Emissions Efficiently?

Spurred by increased attention to climate change, many governments are adopting or expanding carbon pricing regulations, including carbon taxes and cap-and-trade systems (Narassimhan, Gallagher, Koester, & Alejo, 2018). Economists have long argued that these market based mechanisms will efficiently deliver the necessary emissions reductions by incentivizing companies to focus their resources on the most cost effective emission abatement strategies (Hsu, 2012; Muller, Mendelsohn, & Nordhaus, 2011; Pigou, 1920). Yet actually achieving these promised emissions reductions depends on strategic action by firms, whose decisions take place in strong institutional contexts and depend on other factors including behavioral constraints and imperfect information. Because carbon pricing is a core assumption in theoretical (Berger, Emmerling, & Tavoni, 2017) and empirical (Green, 2021) work attempting to understand and guide the ongoing transition to a low-carbon economy, it is critical that scholars understand the conditions under which firm emission reduction activities actually achieve the expected efficiency. If carbon pricing triggers responses that fail to achieve economic efficiency, models built on this assumption may be biased or less effective than anticipated (Ball, 2018).

In this proposal-based working paper, I derive hypotheses translating the efficiency assumption (Hsu, 2012; Pigou, 1920) into specific investment patterns that we might expect to see among companies that engage in emissions reduction initiatives and react rationally to carbon price signals. I then test these hypotheses using a sample of 2013 firms reporting emissions reduction initiatives in the Carbon Disclosure Project between 2013 and 2019. The hypotheses and analysis bridge two levels of analysis. First, I use initiative-level data to construct a marginal cost of abatement curve to identify whether firm-level emissions abatement activities exhibit increasing marginal costs over time, consistent with the efficiency assumption. I find that, in general, very few firms exhibit the increasing marginal abatement costs that are predicted by economic theory, and the majority of firms have abatement cost slopes that do not differ significantly from zero. The modal firm only invests in emissions abatement initiatives that are cost neutral or offer long-run cost savings, and this remains true among firms subject to carbon pricing mechanisms. This suggests that most firms have not historically pursued emissions reductions consistent with the theorized marginal cost optimization strategy.

The results of the initiative-level analysis yield marginal cost curves at the firm-level. I use these marginal cost curves as inputs to a firm level analysis, in which I study the conditions under which firms are more likely to demonstrate an upward-sloping abatement cost curve. I find that firms subject to carbon pricing, either carbon taxes, cap-and-trade systems, or internal shadow pricing, are no more likely to pursue the efficient emissions reduction activities compared to firms not subject to carbon pricing. Thus, while much theory and policy has been built around the assumption that firms aiming to reduce their emissions will use price signals to achieve efficient emissions reduction, the empirical evidence suggests that few firms pursue this path.

This study offers initial evidence that cost-efficiency does not seem to be the organizing principle for most firms' emissions abatement programs. Yet this begs the question: if not cost efficiency, then what strategy guides firms' decarbonization path? This question is the focus of the second part of my dissertation, an early-stage working paper that I have not submitted to ARCS-Ivey. The second study takes up this question and applies the strategic choice framework (Child, 1997) to the same CDP data to *characterize corporate decarbonization strategies, understand if they are consistent with patterns described by management theory,* and *evaluate the conditions under*

which firms pursue each type of strategy. The second study will characterize decarbonization strategies based on the features of the initiatives that the firm undertakes. In navigating the process of setting climate targets and adjusting technology and processes to achieve those targets, firms face strategic choices between alternative pathways, characterized by different sequences of actions to manage emissions. These alternative pathways may prioritize different features of available emission reduction technologies. For example, firms might prioritize initiative timeline, volume of emissions reduction, relationship with core technology or processes, cost, regulatory concerns, or public perception.

The main results of this in-depth study of past corporate actions will be a set of decarbonization archetypes derived from the real-world practices of companies worldwide. I believe that it will useful to practitioners because it provides a framework to understand the pathways that companies take to achieve decarbonization; decision makers may use this framework to evaluate their own decarbonization plans and chart a course that matches their own goals and priorities. The results can also help grassroots activists or policy makers identify the underlying motives that drive corporate actors towards more (or less) effective decarbonization activities, and thereby identify levers that may more effectively motivate corporate action.

Together, both studies contribute to the growing literature on corporate environmental impact, and particularly, on corporate responses to climate change. It is increasingly clear that climate change presents the ultimate grand challenge (Howard-Grenville, Buckle, Hoskins, & George, 2014; Wickert, Post, Doh, Prescott, & Prencipe, 2020) and that companies must engage with their climate impact in order to retain their perceived legitimacy and social license to operate (Ioannou & Hawn, 2019). Given this imperative, companies see emissions reduction as a core strategic objective, yet the literature offers little guidance for companies who wish to achieve this objective alongside their other core goals. By making an in-depth investigation of corporate decarbonization practices, I hope to provide evidence that contributes to scholarship on corporate sustainability, and provide actionable insights that leaders can use to manage their own decarbonization transitions.

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