How Can Environmental Regulation Impact Markets and Trade Patterns? Part 2

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The Porter Hypothesis holds that rising levels of stringency of environmental regulation can raise the competitiveness of the regulating country by encouraging innovation. This contrasts with the prediction of the Pollution Haven Hypothesis, the subject of Part 1 of this series.

What is the Porter Hypothesis?

The previous paper by Farber and Downing (2021) reviewed and examined the literature on the empirical evidence of environmental regulation (ER) effects on firm competitiveness through the Pollution Haven Hypothesis (PHH).[1] While the impact of ER on global industry competitiveness is complex, some scholars find a positive relationship between ER stringency and firm-level competitiveness that cannot be explained by the PHH; rather, it is consistent with what is known as the Porter Hypothesis (PH).[2]

The PH holds that ER stringency improves environmental performance and can produce firm-level efficiency gains by spurring innovation that can improve competitiveness.[3] The hypothesis suggests that flexible, yet strict ER causes firms to innovate (i.e., be "first-movers") through process improvements and the introduction of cleaner technology that reduces pollution.[4] For example, the PH suggests that environmental policies can create a Pareto improvement (winners only) through the first-mover advantage (FMA). The FMA aids domestic industries by encouraging more rapid technological development as firms compete.[5] Porter suggested the FMA incentivizes innovation, increases investment in R&D, and accelerates retirement of old capital and deployment of new technology that complies with new ER.

Additionally, cost savings that accrue to the firm might exceed increased abatement costs, resulting in a net gain (increase in productivity).[6] In imperfectly competitive markets, firms can gain a competitive advantage through a combination of barriers to entry and ER-induced proprietary "green technology". In their review, *The Porter Hypothesis at 20*, Ambec et al. (2013) contended that increased ER leads to increased barriers to entry as new firms cannot afford the new pollution abatement capital required to begin production in highly regulated industries.

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[1] The PHH holds that, given a reduction in trade barriers, domestic firms in pollution-intensive industries will relocate production to regions with less stringent EP to take advantage of the implicit competitive advantage.

[2] The PH was first formulated by Porter and van der Linde in the article "Toward a New Conception of the Environment-Competitiveness Relationship" in 1995.

[3] We present two versions of the PH where innovation is investment in R&D or new capital, productivity is output per unit of input, and competitiveness performance relative to competitors: (1) the "weak" version asserts that stricter EP stimulates innovation, such as research and development (R&D) investment; and (2) the "strong" version claims stricter EP improves competitiveness.

[4] ER can achieve environmental protection goals in several ways. For example, market-based regulation (flexible) induces emissions-reducing changes to production methods, e.g., through carbon tax and emissions trading. Alternatively, command-and-control (non-flexible) can also be applied, such as with preset emissions standards, and best available technology standards (BAT).

[5] Ambec, Stefan, et al., "The Porter Hypothesis at 20," REEP, 7(1), Winter 2013.

[6] For example, IKEA turned a cost into a small profit by reducing unsorted waste. Additionally, IKEA achieved cost savings by retrofitting stores with fluorescent lighting. EPA.

Empirical Work

Existing literature provides varying results of the PH effect. In a meta-analysis covering 103 articles published from 1982–2015, Cohen and Tubb (2018) found the relationship between ER and productivity or competitiveness as likely to be ambiguous. One possible explanation for conflicting empirical results is that firm and industry composition and heterogeneity may affect the extent to which innovation and productivity can occur.

Jaffe and Palmer (1997) did not find a statistically significant positive relationship between pollution abatement cost increases and R&D investment.[7] Nelson et al. (1993) and Gray and Shabegian (1998, 2003) found a negative relationship between pollution abatement costs and innovation. The authors observed that ER within electricity generation and paper manufacturing lead to aging capital in both markets, driving a decrease in overall capital investment.[8] However, these capital investment studies were performed under command-type regulations, contrary to the market-based approach, consistent with the PH. Cohen and Tubb (2018) found that out of 17 studies that restrict results to statistical significance, flexible ER is more likely to exhibit positive results than command and control ER.

Leeuwen and Mohnen (2016) observed a positive relationship between strict ER and innovation but could not corroborate a positive relationship between ER stringency and productivity. Additionally, Brunnermeier and Cohen (2003), Popp (2003, 2006), Arimura (2007) and Lanoie et al. (2007) found a statistically significant positive relationship when they restrict measurement of innovation to pollution abatement patents. Findings by van Berman and Bui (2001), Alpay et al. (2002), and Lanoie et al. (2008) found that stricter ERs bring about modest long-term productivity gains. Albrizio et al. (2014) found that tightening policy stringency increases short-term productivity, but it had no effect on productivity in the long-term in the aggregate.[9] The authors observed small increases in productivity in high productivity firms; inversely, the authors observed a decrease in productivity among low productivity firms. The authors concluded that these benefits and costs are unlikely to have a substantial effect on the aggregate economy, and that the net effect of stringent environmental policies on aggregate productivity are small and of indeterminate sign.

The combined literature on the Pollution Haven Hypothesis and the Porter Hypothesis does not indicate either a clear "race to the bottom" (PHH) or "competition through innovation" (PH) across industries, types of regulations, and measures of ER stringency and outcomes. Significantly, environmental benefits created by ER stringency are not typically included in tests of either PH or PHH. Combining such benefits with other economic effects studied in the literature will provide a more holistic analysis of social welfare.

Sources: Farber, Jared, and Downing, Dixie, "How Can;" Berman, Eli, and Bui, Linda T.M, "Environmental;" Alpay, Abru, Kerkvliet, Joe, and Buccola, Steven, "Productivity Growth;" Lanoie, Paul, Patry, Michel, and Lajeunesse, Richard, "Environmental regulations;" Gans, Joshua, "Innovation and;" Gray, Wayne, and Shadbegian, Ronald, "Environmental;" Ambec, Stefan, Cohen, Mark, Elgie, Stewart, and Lanoie, Paul, "Porter;" Cohen and Tubb, "The Impact of;" Brunnermeier and Cohen, "Determinants of;" Popp, "Pollution control;" Arimura, Toshi, Hibiki, Akira, and Katyama, Hajime, "Is a Voluntary;" Albrizio, Silvia and Botta, E, "Do Environmental;" Leeuwen, George and Mohnen, Pierre, "Revisiting the;" Jaffe, Adam and Palmer, Karen, "Environmental Regulation;" and Cohen, Mark and Tubb, Adeline, "The Impact."

[7] Referencing PH "Weak" Version.

[8] Overall decrease in capital investment occurs by incentivizing paper mills to reallocate investment from productive capital to abatement capital.

[9] Referencing PH "Strong" Version.