

Green Investments and Firm Performance: International and Irish Evidence

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Results are based on analysis of strictly controlled Research Microdata Files provided by Ireland's Central Statistics Office (CSO). The CSO does not take any responsibility for the views expressed or the outputs generated from this research.

Environmental Quality and Firm Performance: Do They Go Together?

International evidence – reviewed recently by Dechezleprêtre et al. (2019)

- Environmental regulations tend to improve environmental performance while the causal effect on firm performance is not clear cut

Negative effects

- Environmental regulations lead to increased costs and lower productivity due to constraints on an optimal allocation of resources

Positive effects - Porter and van der Linde (1995), Ambec and Lanoie (2008)

- Policy induced innovation improves both the environmental and firm performance via **two main channels**:

Increased revenue: better access to certain markets; differentiated products; sales of new cleaner technologies

Reduced production costs: cost of materials, energy, services; cost of capital; cost of labour

International Evidence

Investment in pollution abatement technologies (proxy for firms' environmental performance) and firms' productivity

- **Insignificant effects:** US - Gray and Shadbegian (2003); Shadbegian and Gray (2005)
- **Weak negative effects :** Spain - Ayerbe and Gorriz (2001); Sweden - Broberg et al. (2013); Mexico - Sanchez-Vargas et al. (2013)

Short term costs vs benefits in the longer run

- **Negative effects on financial performance in the short run, improved financial performance in the longer run:** US - Khanna and Damon (1999); Czech Republic - Horváthová (2012)
- **Improved firms' financial performance in the short and long run, stronger effect in the long run:** US - Rassier and Earnhart (2011)

Research Contribution and Novelties

What impacts have green investments on firm performance?

Green investments

- Investment in plant and equipment for pollution control
- Investment in plant and equipment linked to cleaner technologies

Economic performance outcomes

- Output
- Productivity
- Export intensity
- Energy intensity

- **Novelties**

- New evidence from Ireland
- Identify the direct impact (causal effect) of green investments on a range of firm performance outcomes

Econometric Methodology

Key challenge

- Unobserved firm performance in the absence of green investments

Difference-in-differences propensity score matching (Blundell and Costa Dias 2000)

- Estimate the propensity of firms to engage in green investments conditional on observed firm characteristics before investing – estimate propensity score

$$P(GINV_{it} = 1) = F(X_{it-1}, I_t, R_r, T_t)$$

- Construct a control group using the estimated propensity score: for every firm with green investment find a similar firm with no green investments

One-to-one nearest neighbour matching method

- Compare the (observed) performance of firms with green investments before and after investment with their counterfactual (unobserved) performance – their performance in the absence of green investments

$$\beta = \sum_{i \in GINV} \left[\Delta y_i - \sum_{j \in C} (p_i, p_j) \Delta y_j \right]$$

Data

Census of Industrial Production (CIP) 2008-2016

- Firms with whole or primary activity in industrial production
 - 9,295 firm-year observations with information on investment in capital assets

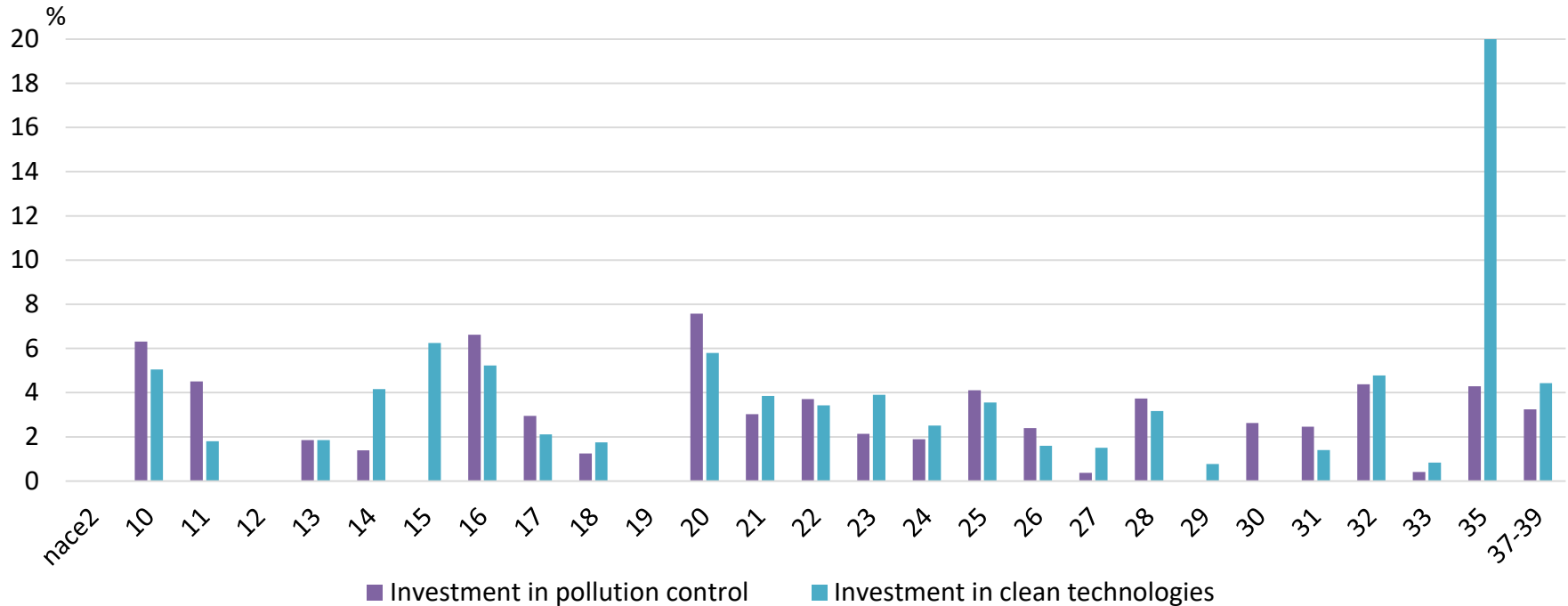
Green Investments

- Investment in plant and equipment for pollution control
 - 12.5% of all firms with information on investment in capital assets
- Investment in plant and equipment linked to cleaner technologies
 - 11.3% of all firms with information on investment in capital assets

Additional Information

Turnover, gross value added, employment, fuel and power usage, exports, imports, nationality of ownership, primary activity, location, sales to affiliates

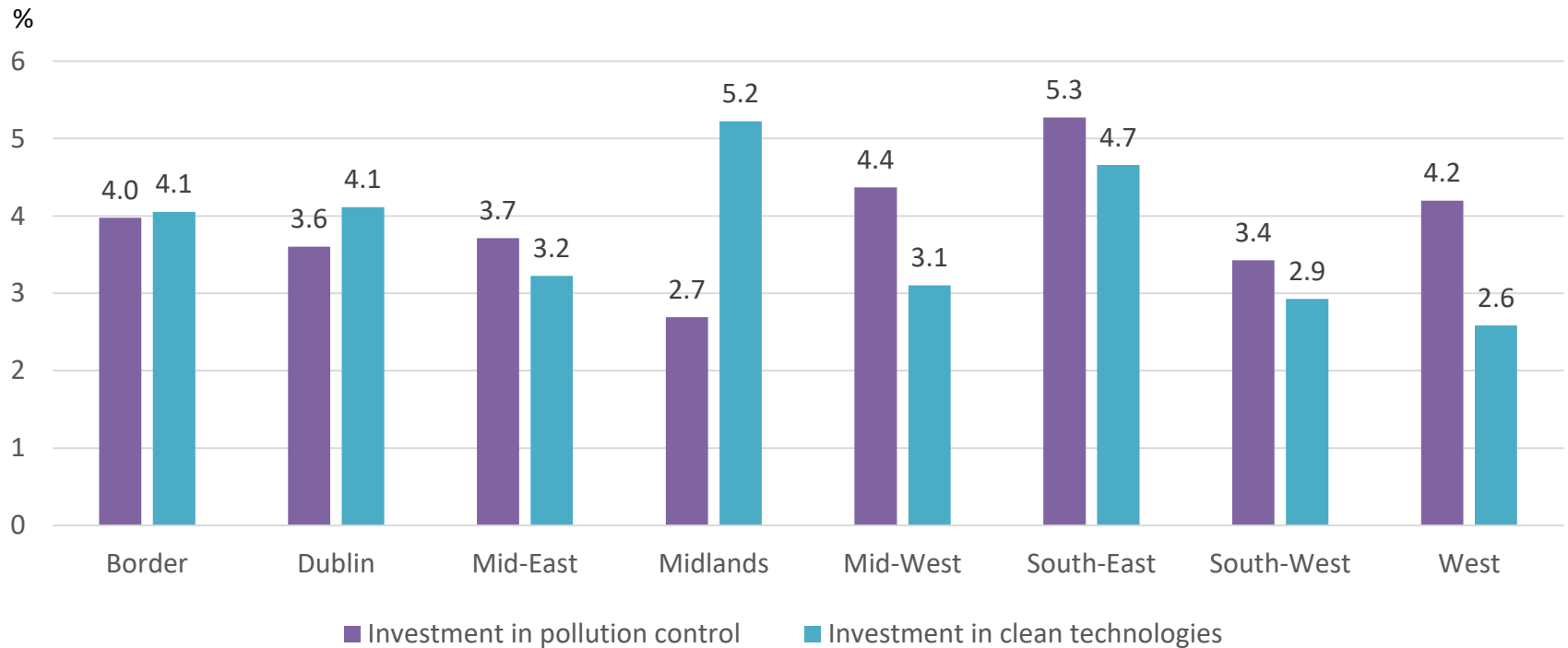
Green Investment Rates by Industry, 2008-2016



Source: Own calculations based on data from the Census of Industrial Production, 2008-2016.

Note: **10 Manufacture of food products**; **11 Manufacture of beverages**; 12 Manufacture of tobacco products; 13 Manufacture of textiles; 14 Manufacture of wearing apparel; 15 Manufacture of leather and related products; **16 Manufacture of wood and products of wood and cork**; except furniture; manufacture of articles of straw and plaiting materials; 17 Manufacture of paper and paper products; 18 Printing of reproduction of recorded media; 19 Manufacture of coke and refined petroleum products; **20 Manufacture of chemicals and chemical products**; 21 Manufacture of basic pharmaceutical products and pharmaceutical preparations; 22 Manufacture of rubber and plastic products; 23 Manufacture of other non-metallic mineral products; 24 Manufacture of basic metals; 25 Manufacture of fabricated metal products, except machinery and equipment; 26 Manufacture of computer, electronic and optical products; 27 Manufacture of electrical equipment; 28 Manufacture of machinery and equipment n.e.c.; 29 Manufacture of motor vehicles, trailers and semi-trailers; 30 Manufacture of other transport equipment; 31 Manufacture of furniture; 32 Other manufacturing; 33 Repair and installation of machinery and equipment; **35 Electricity, gas, steam and air conditioning supply**; 37 Sewerage; 38 collection, treatment and disposal activities; materials recovery; 39 Remediation activities and other waste management services

Green Investment Rates by Region, 2008-2016



Source: Own calculations based on data from the Census of Industrial Production, 2008-2016.

What Factors Drive Firms' Green Investments?

Firm-specific Factors

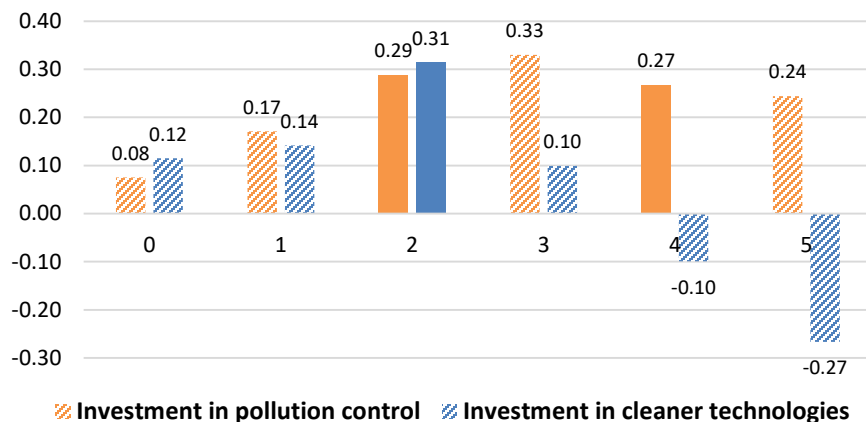
- **Firm size**
 - Larger firms are more likely to invest in pollution control and in cleaner technologies
- **Firm age**
 - Mature firms are more likely to invest in pollution control
- **Ownership**
 - Irish-owned firms are more likely to invest in pollution control and in cleaner technologies

External Factors

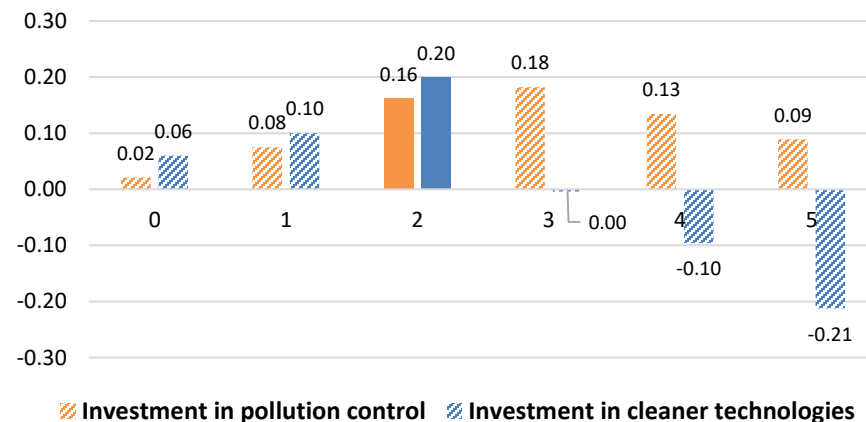
- **Exposure to international markets**
 - Importers are more likely to invest in pollution control
 - Exporters are more likely to invest in cleaner technologies
- **Supply chain linkages**
 - Firms with supply chain linkages more likely to invest in pollution control and in cleaner technologies

Green Investments and Firm Performance

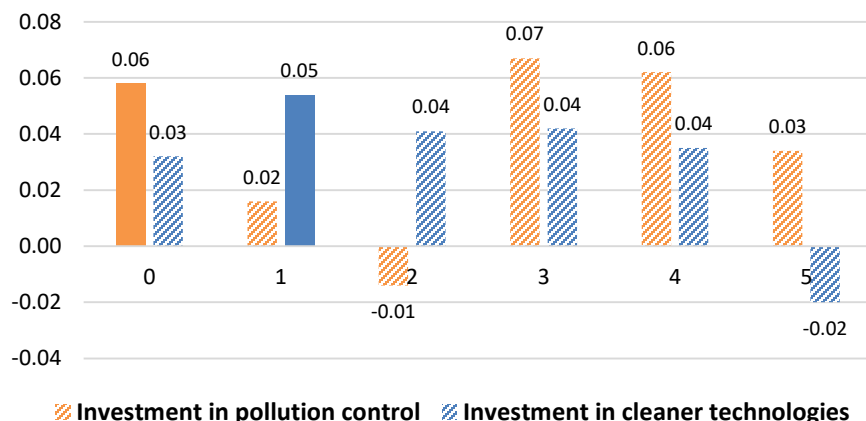
Gross value added



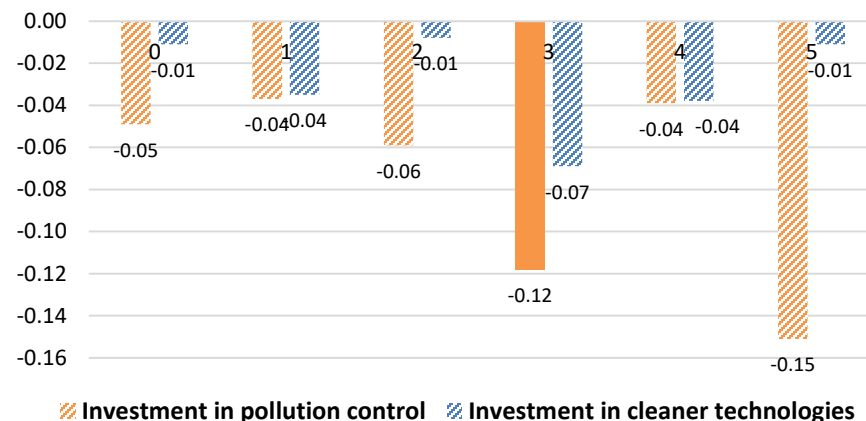
Labour productivity



Export intensity



Energy intensity



Source: Own estimates using data from the Census of Industrial Production, 2008-2016.

Notes: A solid fill indicates statistical significance at the 10 per cent level.

Main Takeaways from Preliminary Findings

Factors that influence firms' engagement in green investments

- Firms' size, age, nationality of ownership
- Exposure to international markets
- Supply chain linkages

Environmental and firm performance appear to go together

- No evidence of short-term adverse effects of green investments on firms' performance
- Green investments could improve firms' performance in the short run
 - Increased growth of output, productivity and export intensity
 - Reduced energy intensity

Further Research

Are the effects of green investments on firm performance conditioned by firm and sector characteristics?

- Firm size
- Firm ownership
- Firm productivity
- Firm participation in global value chains
- Technology intensity
- Energy intensity

References

- Ambec, S. and P. Lanoie (2008).** “Does It Pay to Be Green? A Systematic Overview”, *Academy of Management Perspectives*, 22(4): 45-62.
- Ayerbe, C. G. and C. G. Gorriz (2001).** “The Effects of Environmental Regulations on the Productivity of Large Companies: An Empirical Analysis of the Spanish Case”, *Journal of Management and Governance*, 5:129-52.
- Blundell, R. and M. Costa Dias (2000).** “Evaluation Methods for Non-Experimental Data”, *Fiscal Studies*, 21: 427-468.
- Broberg, T., P. Marklund, E. Samakovlis and H. Hammar (2013).** “Testing the Porter Hypothesis: The Effects of Environmental Investments on Efficiency in Swedish Industry”, *Journal of Productivity Analysis*, 40(1): 43-56.
- Dechezleprêtre, A., T. Koźluk, T. Kruse, d. Nachtigall, A. de Serres (2019).** “Do Environmental and Economic Performance Go Together? A Review of Micro-level Empirical Evidence from the Past Decade or So”, *International Review of Environmental and Resource Economics*, 13:1-118.
- Gray, W. B. and R. J. Shadbegian (2003).** “Plant Vintage, Technology and Environmental Regulation”, *Journal of Environmental Economics and Management*, 46(3): 384-402.
- Horváthová, E. (2012).** “The Impact of Environmental Performance on Firm Performance: Short-Term Costs and Long-Term Benefits?” *Ecological Economics*, 84: 91-7.
- Khanna, D. and L. A. Damon (1999).** “EPA’s Voluntary 33/50 Program: Impact on Toxic Releases and Economic Performance of Firms”, *Journal of Environmental Economics and Management*, 37(1): 1-25.
- Porter, M. E. and C. van der Linde (1995).** “Toward a New Conception of the Environment-Competitiveness Relationship”, *Journal of Economic Perspectives*, 9(4): 97-118.
- Rassier, D. G. and D. Earnhart (2011).** “Short-Run and Long-Run Implications of Environmental Regulation on Financial Performance”, *Contemporary Economic Policy*, 29(3):357-73.
- Sanchez-Vargas, A., R. Mansilla-Sanchez and A. Aguilar-Ibarra (2013).** “An Empirical Analysis of the Nonlinear Relationship Between Environmental Regulation and Manufacturing Productivity”, *Journal of Applied Economics*, 16(2): 357-72.
- Shadbegian, R. J. and W. B. Gray (2005).** “Pollution Abatement Expenditures and Plant-Level Productivity: A Production Function Approach”, *Ecological Economics*, 54: 196-208.