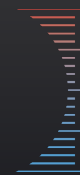




Environmental Policy and Directed Technological Change: Evidence from the European carbon market

Raphael Calel & Antoine Dechezleprêtre

Grantham Research Institute, London School of Economics

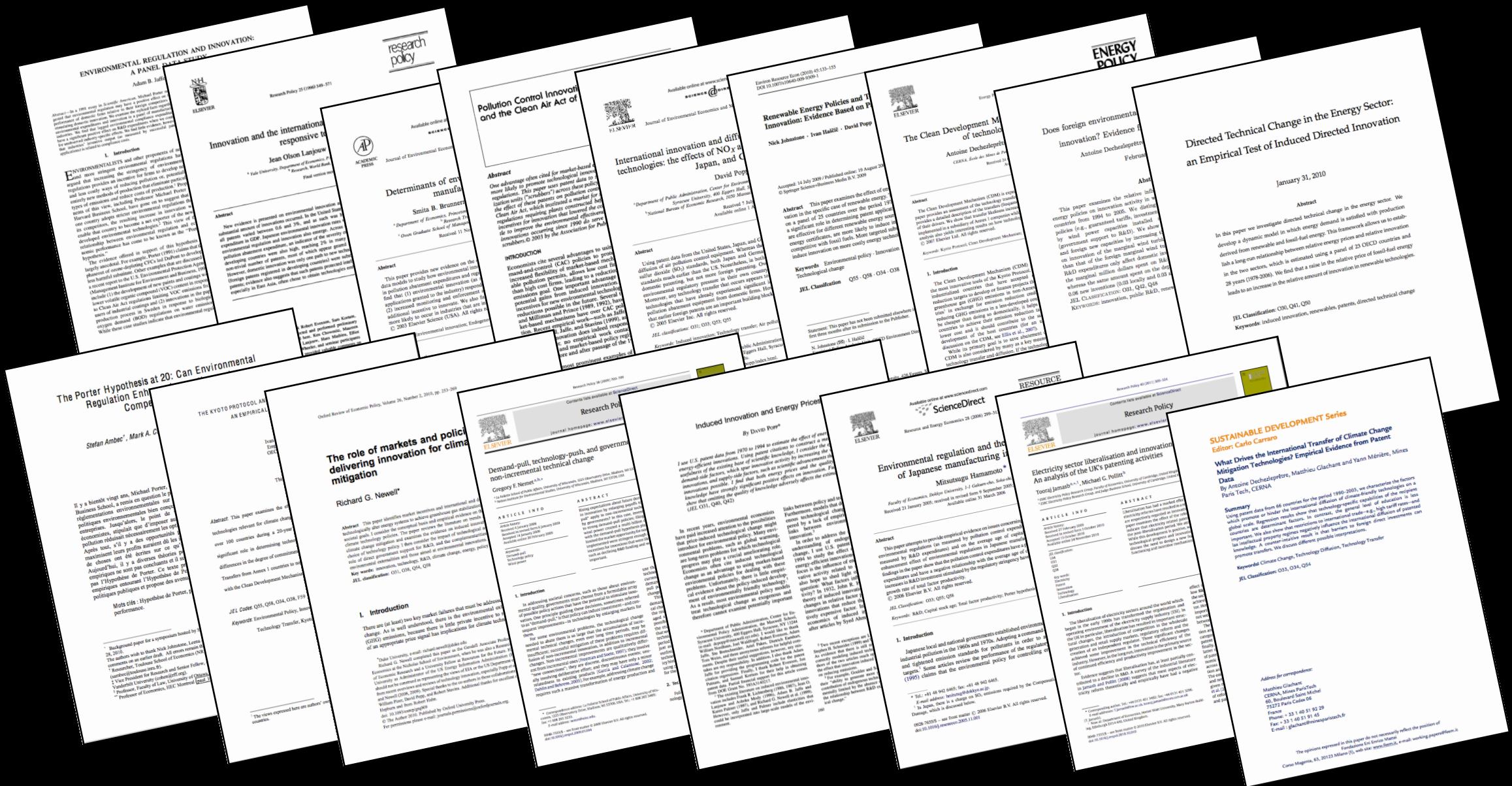


“The carbon emissions reduction targets will stimulate innovation in industry and enable manufacturers to take advantage of the transition to a low-carbon economy and thus enhance their long-term competitiveness. This regulation should give manufacturers a first mover advantage in world markets where similar CO₂ standards are likely to follow.”

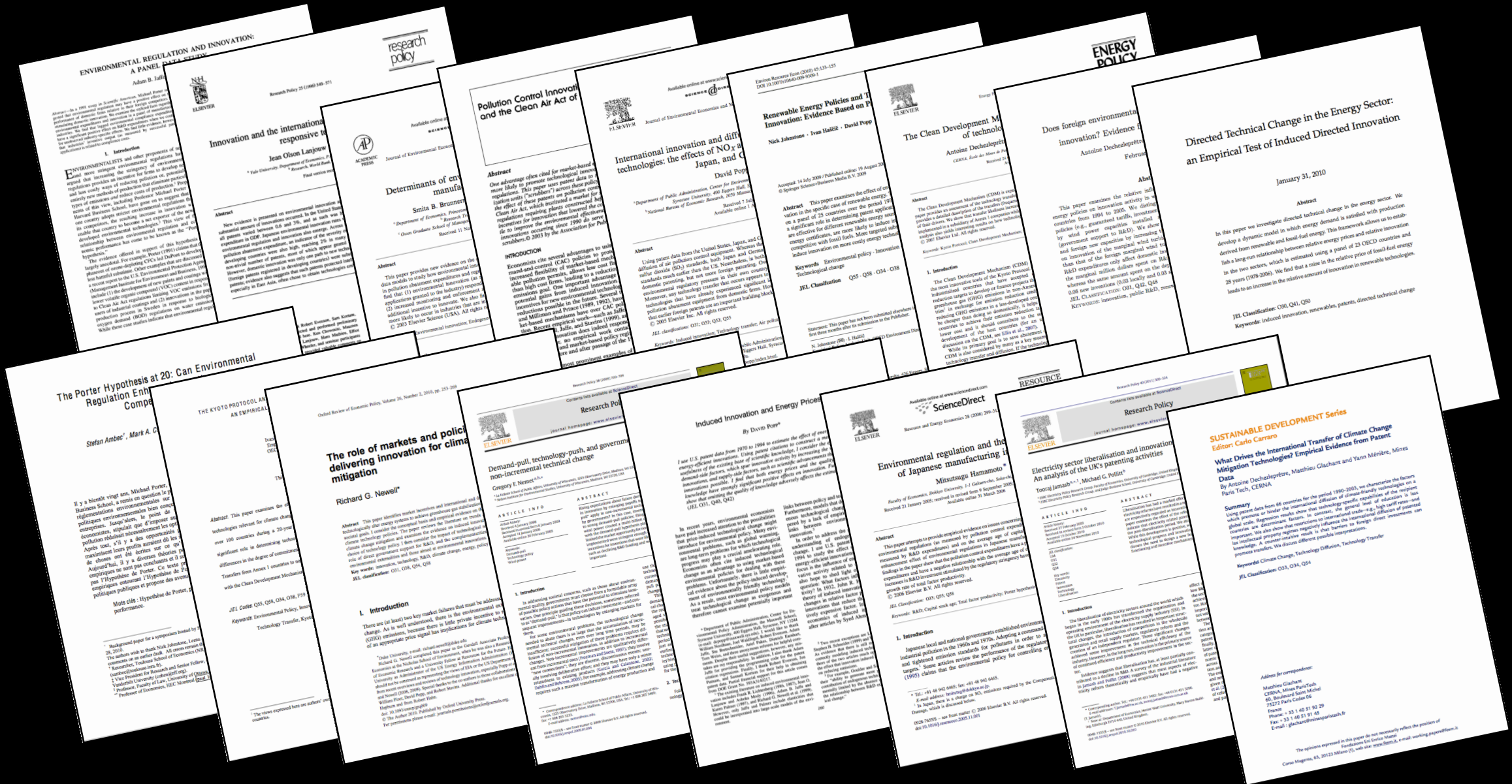
***– Connie Hedegaard (February 2011)
European Commissioner for Climate Action***

Does Environmental Policy Induce 'Green' Innovation?

Does Environmental Policy Induce 'Green' Innovation?



Does Environmental Policy Induce 'Green' Innovation?



Yes... mostly

What about the EU ETS?

What about the EU ETS?



What about the EU ETS?

Strong effect

Weak effect

No effect

Harvesting the Low-Carbon Cornucopia: HOW THE EUROPEAN UNION EMISSIONS TRADING SYSTEM (EU-ETS) IS SPURRING INNOVATION AND SCORING RESULTS



Energy Policy 38 (2010) 626–632

Contents lists available at ScienceDirect

Energy Policy

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Assessment of the impact of the European CO₂ emissions trading scheme on
the Portuguese chemical industry

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CO₂ emissions

European emissions trading scheme

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Technological change

Energy efficiency

Energy policy

1. Introduction

Climate change effect, which is the

derived from the

emissions reduction

Agenda 2000, the

aim of the EU ETS

agreed in 1997, was

agreed in 2002, by the

European Union

abatement, means

being economically

using industrial, or

possibly include

other relevant

other relevant

other relevant

other relevant

other relevant

other relevant

EU ETS and Investment Decisions



CLIMATE
POLICY
INITIATIVE

Climate
Strategies

Climate Change, Investment
and Carbon Markets and
Prices – Evidence from
Manager Interviews

Carbon Pricing for
Low-Carbon Investment Project

Ralf Martin, Mirabelle Muñiz and Ulrich Wagner

London School of Economics/ Imperial College/ Universidad Carlos III de Madrid

January 2011

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Economics

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COLD START FOR THE EU ETS

Contents lists available at ScienceDirect

Ecological Economics

journal homepage: www.elsevier.com/locate/ecolecon

The innovation impact of the EU Emission Trading System – Findings of company
case studies in the German power sector

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Keywords:

EU ETS

Carbon pricing

Technological change

Quantitative change

Power sector

1. Introduction

Despite the setback in Copenhagen (UNFCCC, 2009), the global

negotiations concerning a successor for the Kyoto Protocol (UNFCCC,

1997) as well as the implementation of a variety of climate policies

around the world (WBGU, 2009) document a growing political will to

limit climate change (UNFCCC, 1992). The consequence of the

European Union's climate policy mix is the EU Emission Trading

System – the EU ETS (EU, 2003). This market-based climate policy

instrument is primarily aimed at achieving cost-minimal emission

reductions in response to the EU's commitment to the Kyoto

Protocol (1997). However, the actual implementation of the EU

ETS has raised doubts about its capacity to trigger innovation

(Copenhagen and Berlin, 2009; Schmidt and Wey, 2005). Yet, there

are only a few empirical studies that have analyzed the innovation

impact of the EU ETS (Caron, 2010; Hoffmann, 2007; Rogge and

Schneider, 2009; Rogge and Schneider, 2009). In addition, these studies do

not cover all the aspects relevant for such an analysis (see Rogge

and Schneider, 2009) and do not consider the more stringent second

trading phase (2008–12) and the ambitious revision of the EU ETS

post-2012 (Schmidt et al., 2009). As a consequence, policy makers in

transitioning the current trading scheme may face difficulties

in assessing the innovation impact of the EU ETS.

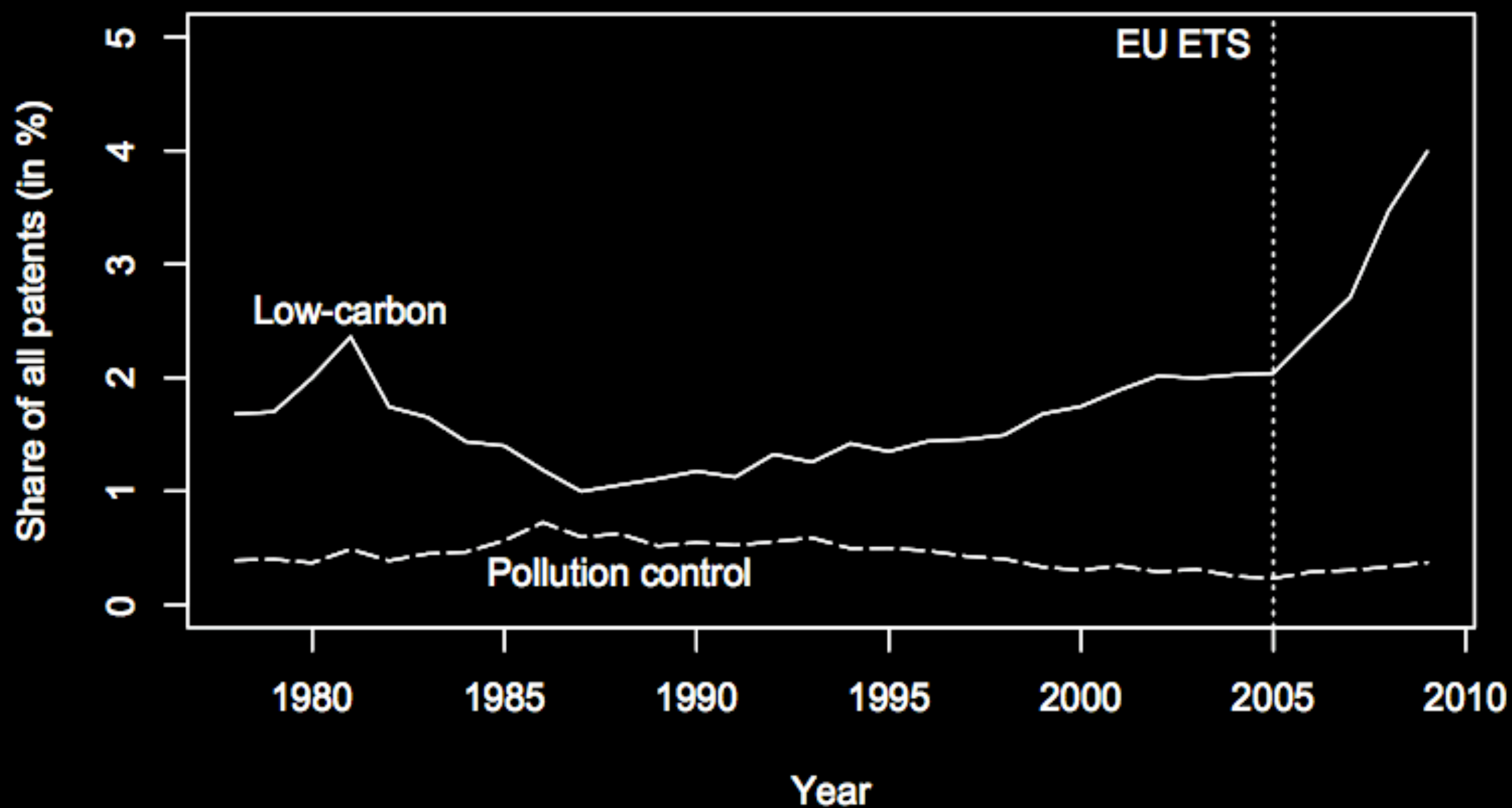
Against this background, this paper aims to provide a detailed

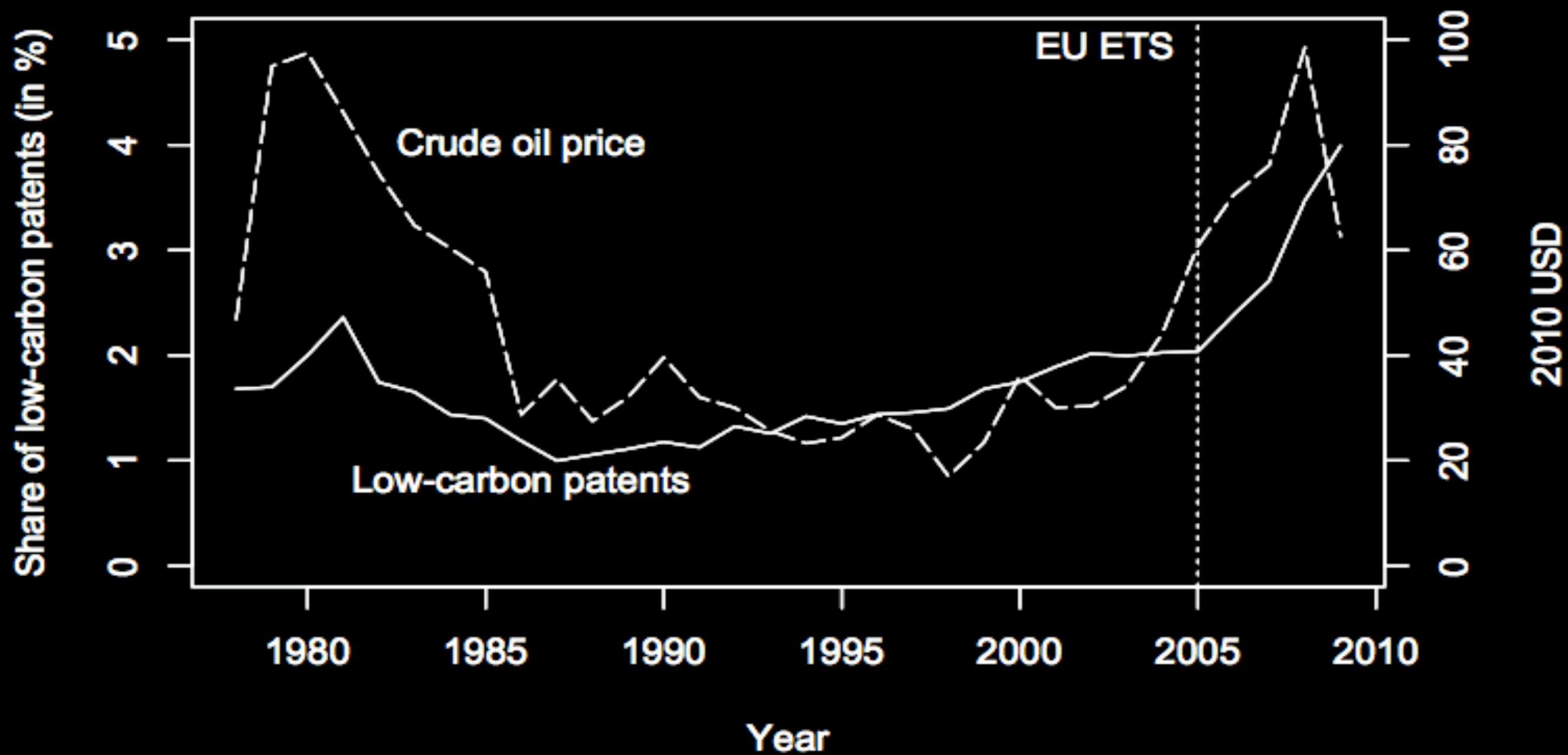
analysis of how the EU ETS has impacted innovation and whether it

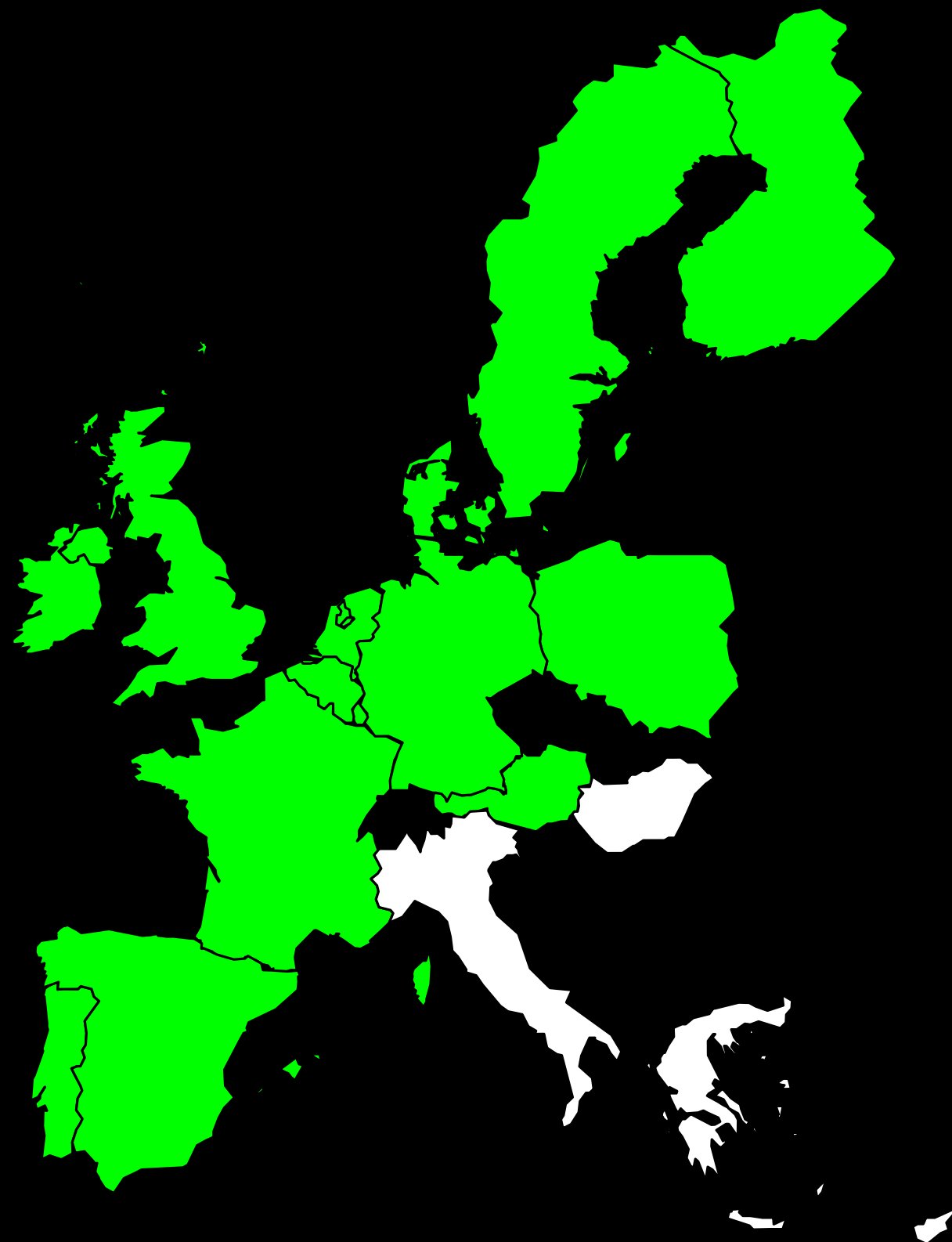
does so at a level adequate to reach the long-term political targets

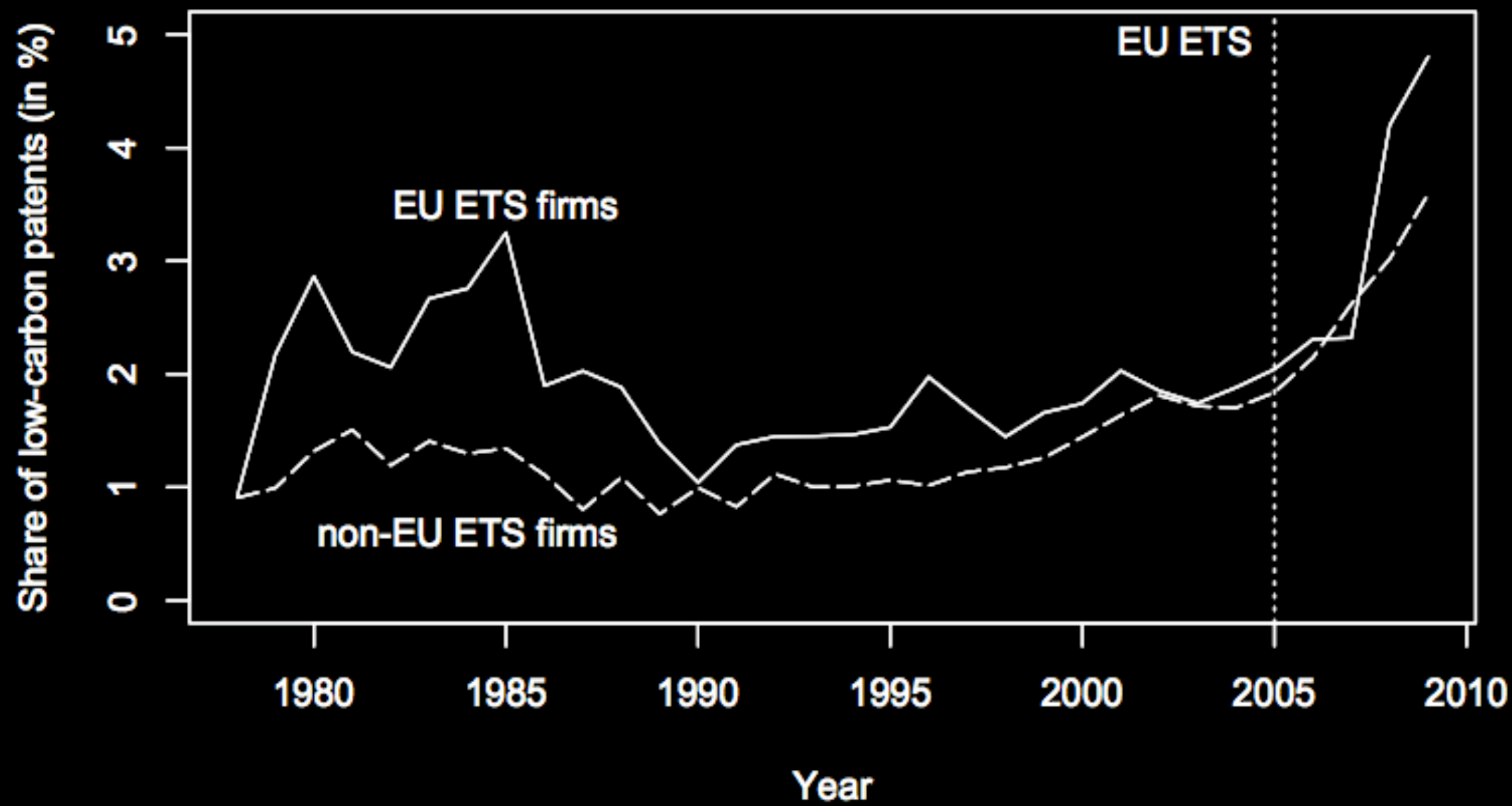
required for a decarbonization of the economy. In doing so, we

address several of the research recommendations made for studying

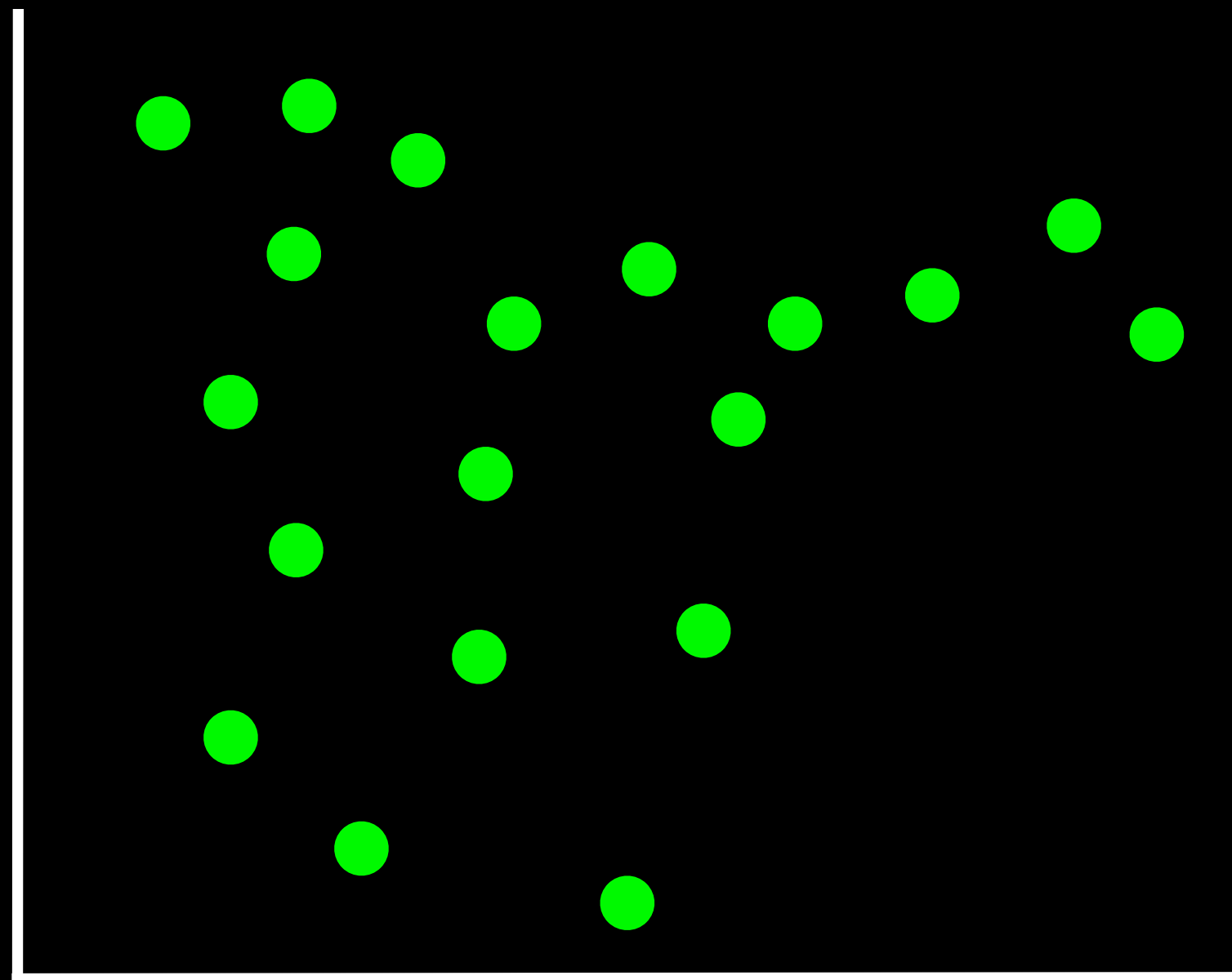








Attribute 2



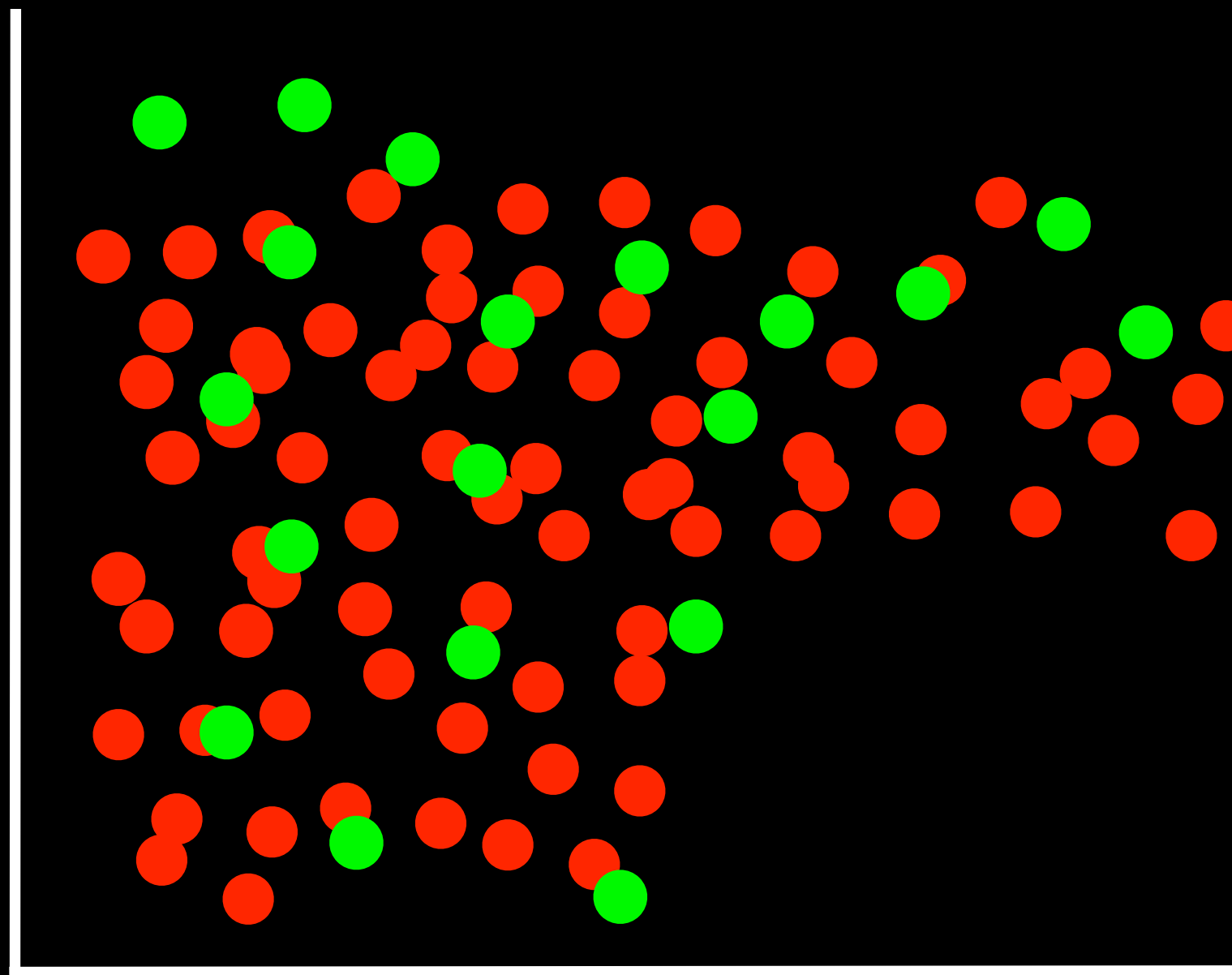
Attribute 1

EU ETS



Not EU ETS

Attribute 2



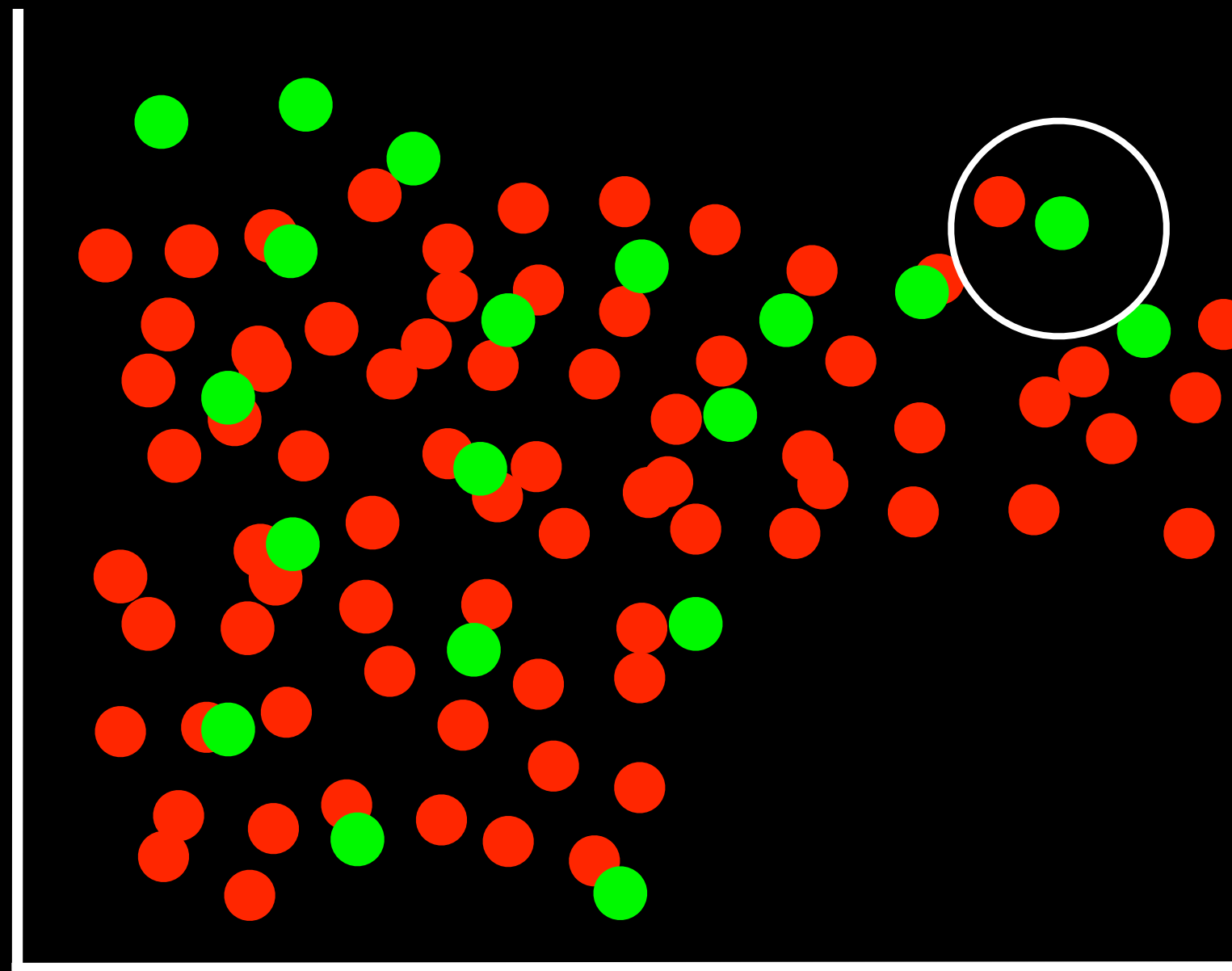
Attribute 1

EU ETS



Not EU ETS

Attribute 2

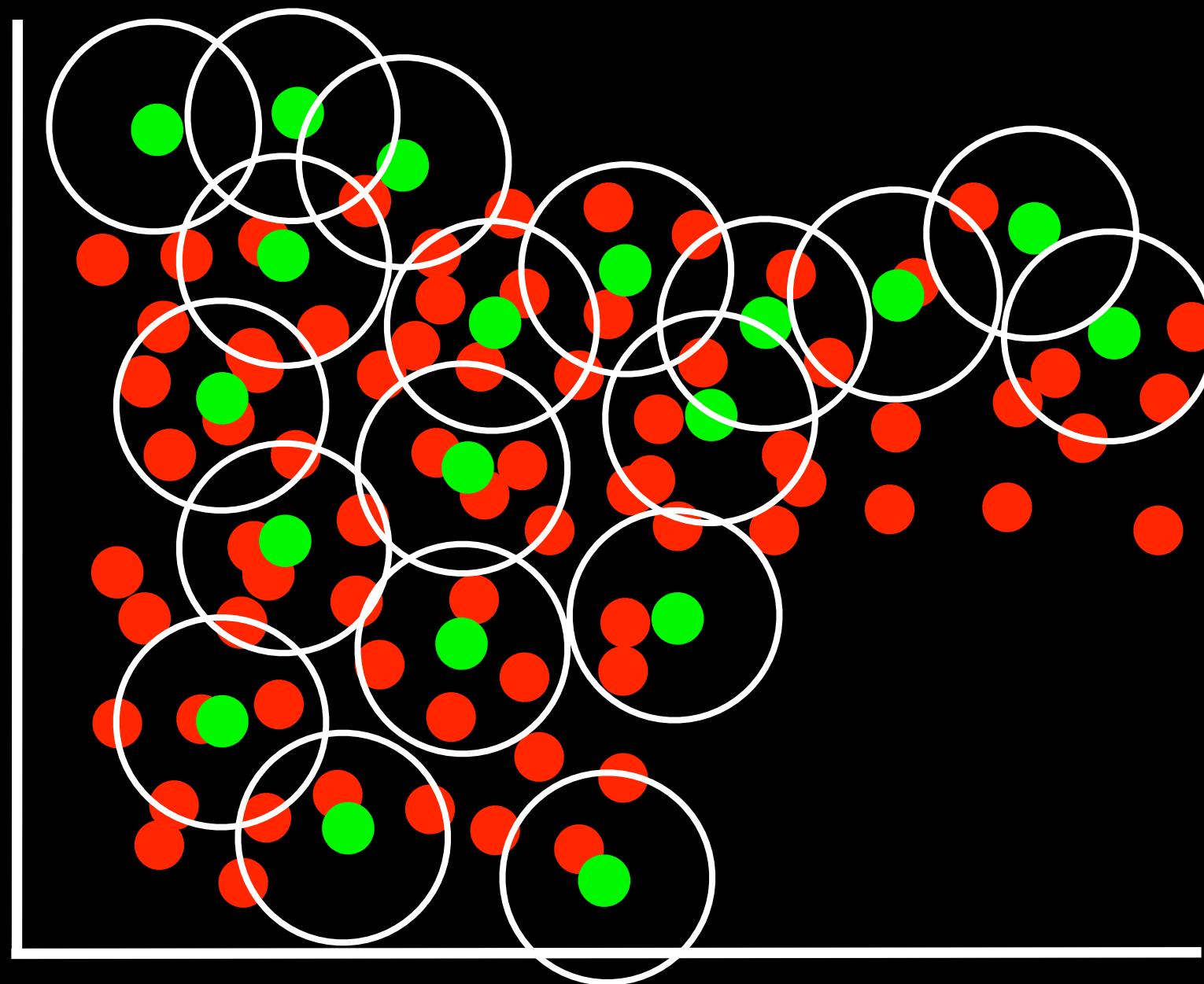


Attribute 1

EU ETS ●

● **Not EU ETS**

Attribute 2



Attribute 1

EU ETS ●

● **Not EU ETS**

Matching on:

Country

Sector

Total and low-carbon patents

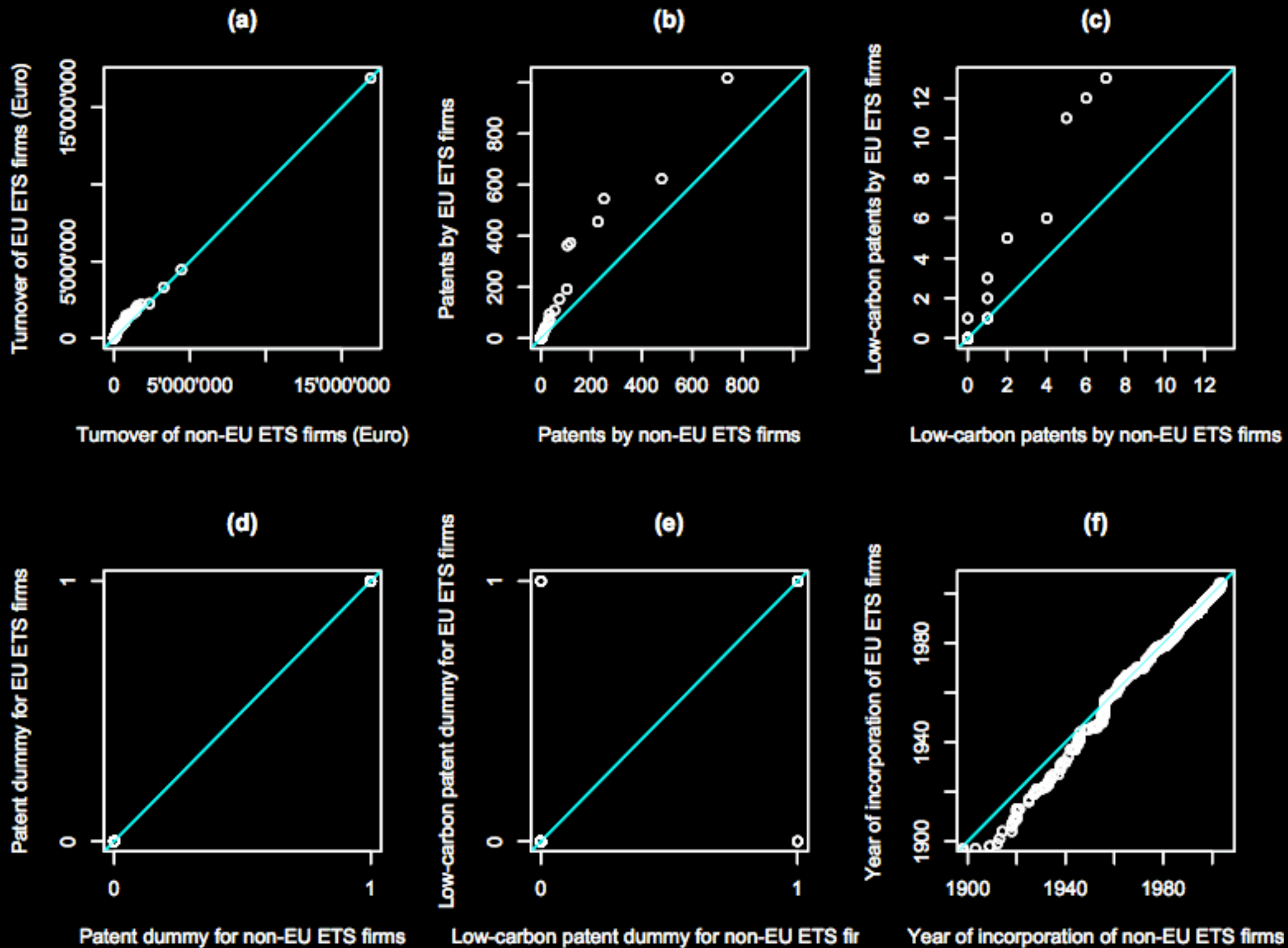
Turnover

Year of incorporation

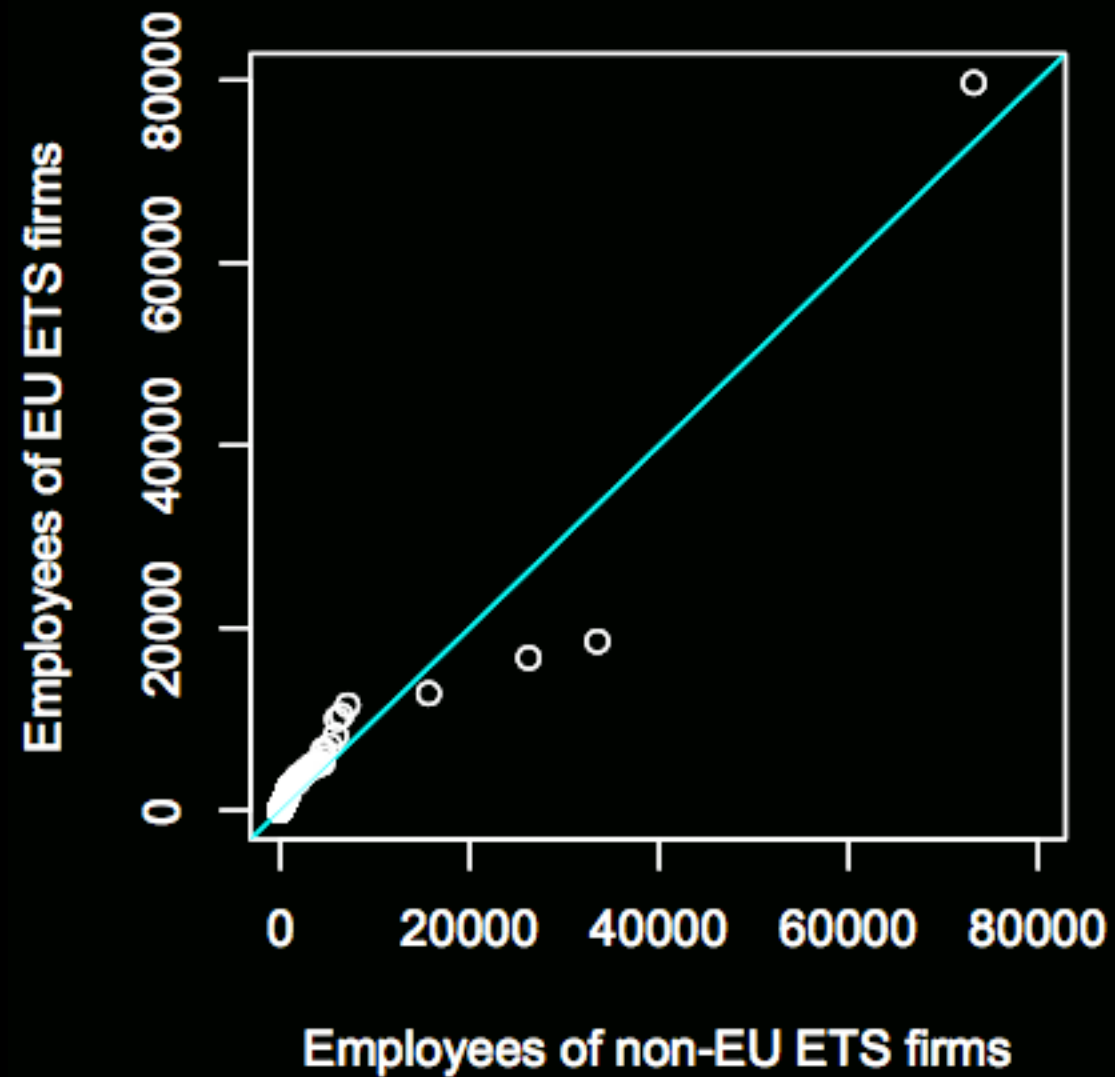
Outcome measured:

Difference in low-carbon patenting 2000-2004 to 2005-2009

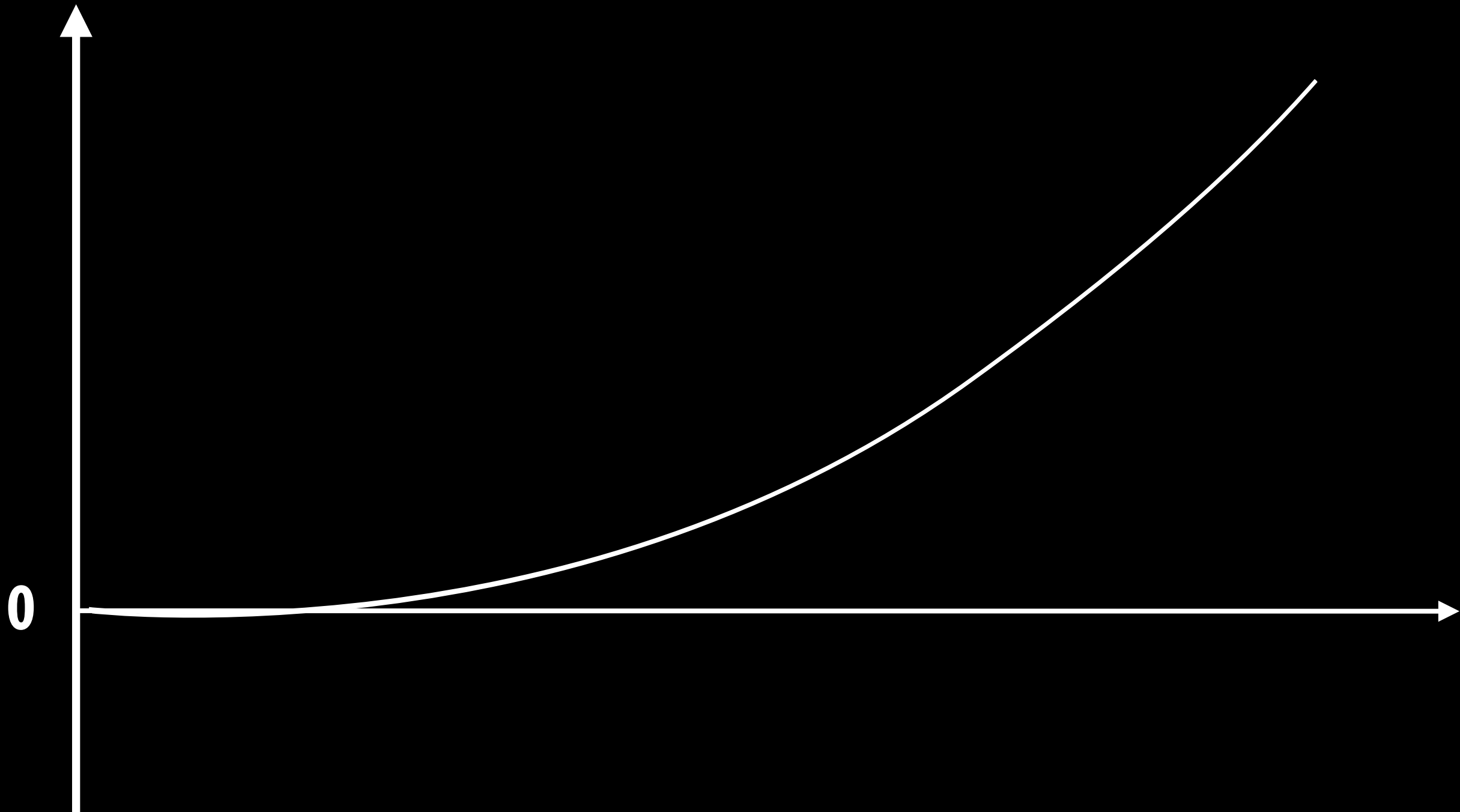
Does matching work?



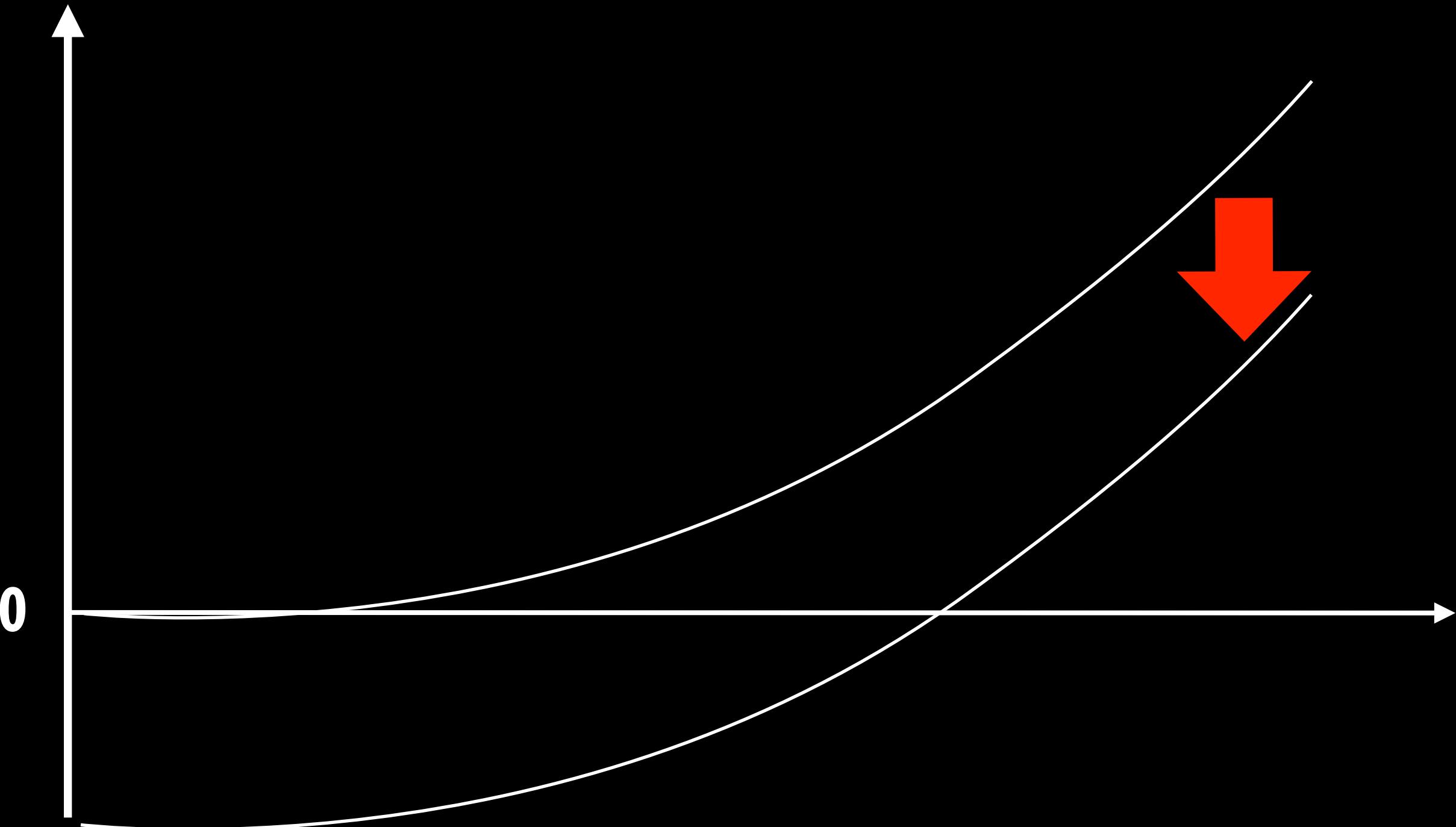
Does matching work?



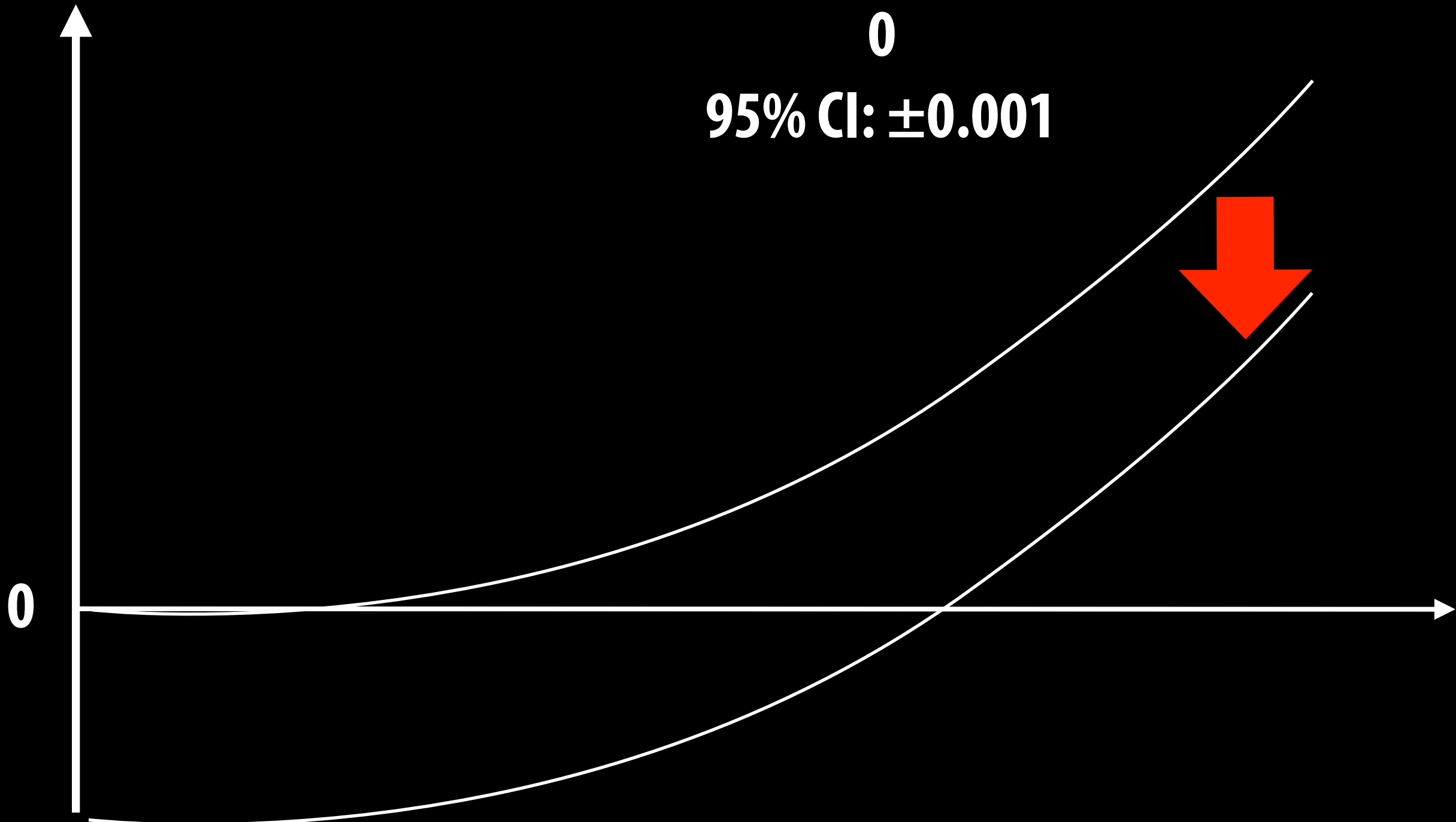
Diff in Patents



Diff in Patents



Diff in Patents



0

95% CI: ± 0.001

Competing explanation 1:

Artifact of how we measure technological change

Too narrow?

- Extended “low-carbon” definition
- Patents filed with national patent offices

Too coarse?

- Citation-weighted
- Family size-weighted

Competing explanation 2:

Hidden bias in study design

Estimating “known effects”:

- Non-greenhouse gas pollution control technologies

Competing explanation 3:

Non-EU ETS firms responding to EU ETS

Response because of “peer effects” or “market effect”

Re-match with Bulgaria, Norway, Romania, and Switzerland

Competing explanation 4:

Estimate valid for sub-sample, not EU ETS

Use 2005 turnover figures

Over 3'000 matched groups

Distribution of firm characteristics much the same

Competing explanation 5:

Omitted variable bias

$\text{Corr}(\text{EU ETS}, \text{Omitted variable}) > 0$

$\text{Corr}(\text{More patents}, \text{Omitted variable}) > 0$

$\text{Corr}(\text{EU ETS}, \text{Omitted variable}) < 0$

$\text{Corr}(\text{More patents}, \text{Omitted variable}) < 0$

} +

$\text{Corr}(\text{EU ETS}, \text{Omitted variable}) > 0$

$\text{Corr}(\text{More patents}, \text{Omitted variable}) < 0$

$\text{Corr}(\text{EU ETS}, \text{Omitted variable}) < 0$

$\text{Corr}(\text{More patents}, \text{Omitted variable}) > 0$

} -

“Competing” explanation 6:

Technologies developed further up the technology supply chain

Firms in sample filed over 25'000 patents

2% of patents protecting low-carbon technologies



EU ETS appears insufficient

Complementary policies?



Centre for
Climate Change
Economics and Policy



Grantham Research Institute on
Climate Change and
the Environment

Thank you

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