

# What Drives Firm Participation in the Low-Carbon Economy? The Role of Peer Effect in the UK

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# Outline

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- Descriptive Statistics
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- Discussion
- Policy Implications

# Introduction

- Policy measures for the green transition that can contribute to more firms participating in the low-carbon
- Exciting evidence on firm's participation in the low-carbon economy leaves room for more to be discovered
- Several papers study internal factors of the firms such as ownership, management practises, whether they export or not etc. Siedschlag & Yan (2021 see Kalantzis et al., 2022; De Haas et al.,2023). Collins & Harris (2005)
- Less focus is on how other firms' decisions influence the given firm being active in the low-carbon economy

# Introduction

- Firm-level data from the UK from 2014-2021
- Econometrics study of firms' decision to be active in the low-carbon economy is affected by the decisions of their peer firm in the same industry or area
- The result shows that 0.44-1.0% increased probability of participating in the low-carbon economy by a one unit increase in the peer's participation in the same area
- For the industry division, the result is around 0.78-0.8% increased probability of participating in the low-carbon economy by a one unit increase in the peer's participation

# Dataset and Sample

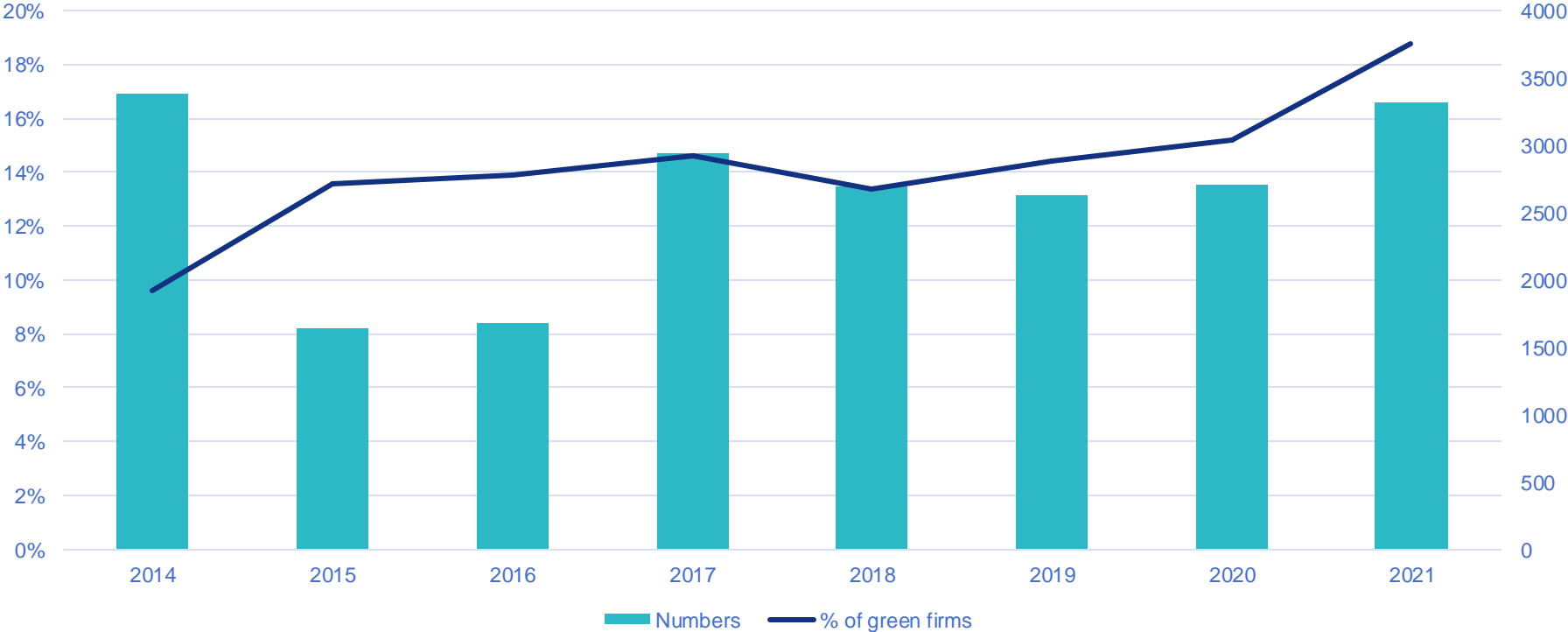
**Datasets:** Office for National Statistics (ONS) survey on the Low-carbon and renewable energy economy (LCREE) and the Annual Business Survey (ABS).

- LCREE contains microdata on turnover, import, export, employment, acquisitions, and disposables.
- The survey samples around 25,000 UK businesses. With a population of 2.4 million, the sample size is around 1% of the total population (ONS, 2023).

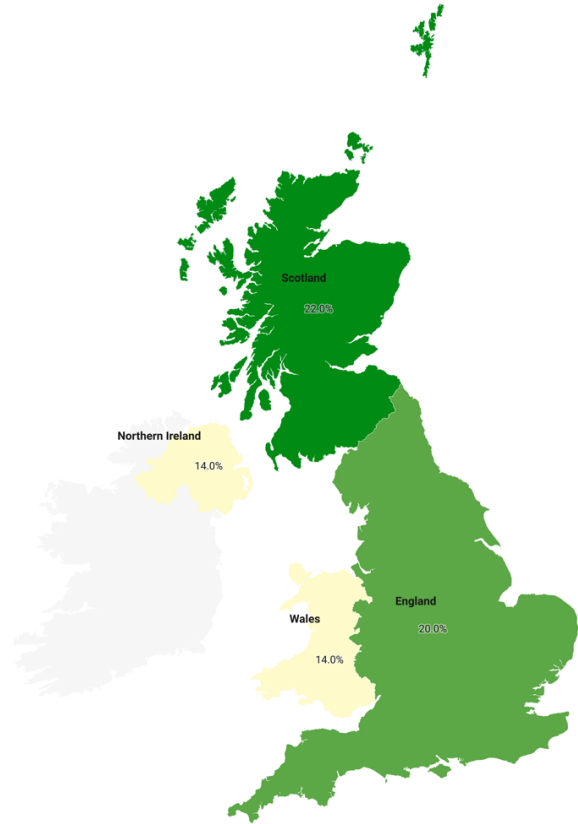
# Dataset and Sample

- Annual Business Survey collects data from 73,000 businesses with a response rate above 70% (ONS, 2024).
- The survey asks over 600 questions and covers the turnover, employment costs, industry, GVA, export/import, foreign ownership etc.
- The LCREE and ABS have been merged, giving us more than 6000 observations per year from 2014-2021 and approximately 51000 observations.

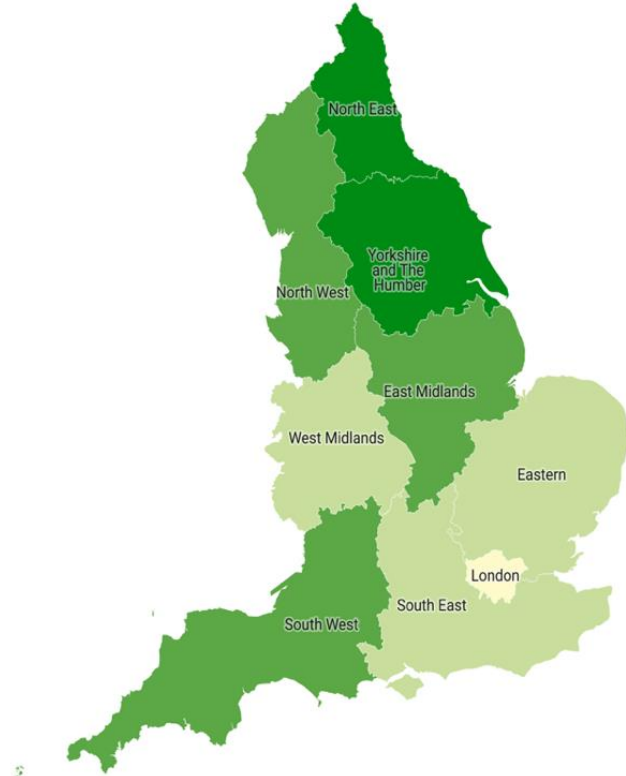
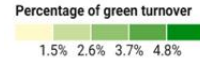
# Firms active in the low-carbon economy



### Percentage of Green firms by Countries

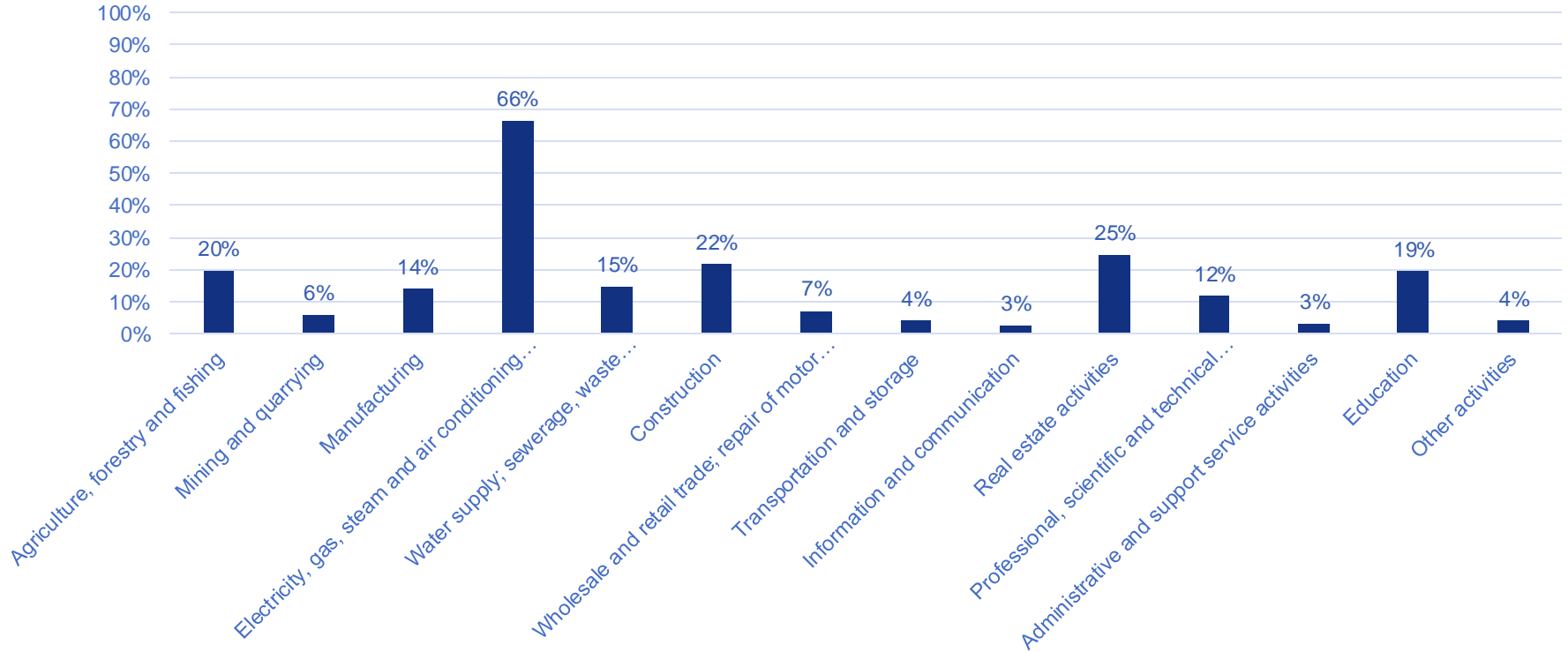


### Percentage of Green Turnover by Region





## Percentage of Green firms per industry



# Dependent variable

## Low-carbon economy active

- Binary variable taking the value 1 if the firm is active in a low-carbon economy

# Peer effect variables

- 3 peer effect variable for industry, division and area groups
- Calculated by taking the proportion of firms in the low-carbon economy in the same industry/region (\*100) minus the given firm. This is captured by the expected participation rate of the peer group.

$$\widehat{E}_{-i}(y|x)$$

- It shows the peer group denoted by  $x$  and the average participation  $y$ . The notation excludes firm  $i$ , which means the given firm's participation is excluded.

# Instrumental Variables

- 3 Instrumental variables using the proportion of UK-owned firms in the peer groups
- Proportion of firms that are from the UK the industry other than the given firm (\*100)
- The IV must 1) have a strong correlation with the endogenous variable 2) have a direct effect on the dependent variable only through the endogenous variable.
- The ownership variable has a positive coefficient and is significant when regressed against the dependent variable. This suggests that UK-owned firms are more likely to be in the low-carbon economy.
- A higher proportion of UK-owned firms in the peer group would correlate with higher participation rates. However, the ownership of other firms is not very likely to directly affect the decision of a given firm to be active in the low-carbon economy.
- Therefore, this variable is exogenous from the system and provides a good instrument.

# Independent control variables

<b>Log GVA</b>	Log of gross value added (£,000)
<b>Employment numbers</b>	Total employment
<b>Investment intensity</b>	Value of total capex acquisitions (£,000)
<b>Log of energy intensity</b>	Log of energy costs over GVA. 1 is added to the ratio before taking logs (£,000)
<b>Skills</b>	Labour cost per employee (£,000)
<b>Log productivity</b>	Log of GVA per employee
<b>Export</b>	Binary variable for if a firm is an exporter (1=exporter)
<b>Ownership</b>	Binary variable for if a firm is an exporter (1=exporter)

# Methods

- Peer effect model, IV probit using Maximum likelihood estimation

$$y_1^* = z_1\delta_1 + \alpha_1 y_2 + Y_t + u_1 \quad (1)$$

$$y_2 = z_1\delta_{21} + z_2\delta_{22} + v_2 = z\delta_2 + v_2 \quad (2)$$

$$y_1 = 1[y_1^* > 0] \quad (3)$$

$y_1^*$  = binary variable for if a firm is a part of the low-carbon economy

$y_2$  = endogenous continuous variable, peer effect variable

$z_1$  = exogenous variables

$z_2$  = instrumental variable

$Y_t$  = Year fixed effects

**Table 1: Peer effect models for area, division and industry**

	Probit model	Linear probability model (OLS)	Linear probability model, IV (2SLS)	Probit model, IV (MLE)
Model number	(1)	(2)	(3)	(4)
Dependent variable	Low-carbon economy active (binary)			
Instrumental Variable			Ownership	Ownership
<b>A) Peer effect by industry</b>				
Peer effect variable	2.72*** (0.15)	0.69*** (0.04)	0.96*** (0.09)	4.72*** (0.62)
R <sup>2</sup> / Pseudo R <sup>2</sup>	0.13	0.11	0.10	
Wald Test				203.02***
<b>B) Peer effect by division</b>				
Peer effect variable	3.84*** (0.24)	0.87*** (0.03)	0.89*** (0.15)	4.55*** (0.78)
R <sup>2</sup> / Pseudo R <sup>2</sup>	0.11	0.09	0.09	
Wald Test				147.71***
<b>C) Peer effect by area</b>				
Peer effect variable	3.02*** (0.57)	0.65*** (0.14)	0.88*** (0.17)	4.66*** (1.11)
R <sup>2</sup> / Pseudo R <sup>2</sup>	0.02	0.01	0.019	
Wald Test				59.95***
Observations	34374	34374	34374	34374

# Results Peer Effect Model

- Marginal effects of the probit models

	<b>Area</b>	<b>Industry</b>	<b>Division</b>
	<b>Peer effect</b>	<b>Peer effect</b>	<b>Peer effect</b>
<b>IV Probit, Ownership</b>	0.44	0.52	0.78
<b>Probit model no IV</b>	0.49	0.53	0.78



# Discussion

- There is an argument to be made that the correlation of behaviour identified in the peer groups might not be driven by the peer effect
  - 1) The firms in the same peer group likely share similar preferences
  - 2) There is an exogenous social effect

# Robustness check

- Using only the LCREE data:

Peer effect using only the LCREE data.

The merged LCREE and ABS dataset reduces the observations.

The LCREE does not have the data on the region but does contain the industry-level data.

- Doing a cross sub-peer group analysis:

The peer groups are often smaller than those at industry or regional levels.

For example, small firms in the same region might be more likely to influence each other.

These sub-groups within departments can be used to prove that the effects found in are peer effects.

	<b>Probit model</b>	<b>Linear probability model (OLS)</b>	<b>Probit model</b>	<b>Linear probability model (OLS)</b>
	<b>ABS + LCREE data</b>		<b>LCREE data</b>	
<b>Model number</b>	(1)	(2)	(3)	(4)
<b>Dependent variable</b>	Low carbon economy active			
<b>peer green industry</b>	2.82*** (0.049)	0.75*** (0.01)	3.39*** (0.021)	0.94*** (0.005)
<b>R<sup>2</sup> / Pseudo R<sup>2</sup></b>	0.14	0.25	0.24	0.25
<b>peer green division</b>	4.0*** (0.079)	0.95*** (0.02)	3.52*** (0.024)	0.99*** (0.007)
<b>R<sup>2</sup> / Pseudo R<sup>2</sup></b>	0.11	0.22	0.19	0.20
<b>Observations</b>	34810	34811	153236	153236

<b>Table 3: Peer effects on low-carbon economy participation in sub-groups</b>				
	<b>Group 1 (small firms)</b>		<b>Group 2 (big firms)</b>	
	OLS	2SLS	OLS	2SLS
	(1)	(2)	(3)	(4)
<b>Area Peer Group</b>				
<i>(A) Group 1: small firms (31,113.) and group 2 big firms (obs.)</i>				
<b>Average participation in group 1 (small firms)</b>	1.030*** (0.082)	1.097*** (0.138)	0.045 (0.115)	0.122 (0.163)
<b>Average participation in group 2 (big firms)</b>	0.016 (0.076)	-0.007 (0.086)	0.933*** (0.120)	0.725* (0.336)
<b>p-value coefficients equal</b>	0.000***	0.000***	0.000***	0.202
<b>Industry Division Peer Group</b>				
<i>(A) Group 1: small firms (30,845) and group 2 big firms (15,398)</i>				
<b>Average participation in group 1 (small firms)</b>	1.014*** (0.034)	1.006*** (0.253)	-0.018 (0.059)	-0.809* (0.354)
<b>Average participation in group 2 (big firms)</b>	-0.0008 (0.022)	0.003 (0.140)	0.073*** (0.038)	1.640*** (0.296)
<b>p-value coefficients equal</b>	0.000***	0.010*	0.000*	0.000***

# Policy Implications

- These findings have implications for how to structure policies to amplify this peer effect.
  - 1) The government should take into account the inter-firm influence on firms' decision on being active in the low-carbon economy which can lead to enhanced effects.
  - 2) Given the significant peer effect by area, the government should consider localising its efforts
  - 3) When the government conduct their cost-benefit analysis for new policies it should consider the amplified effect stemming from the indirect impact of firms influencing each other to participate in the low-carbon economy

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**Thank you**



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