How does going green affect firms' financial performance? Evidence from a global firm level dataset.

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Research Institute
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LSE THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE

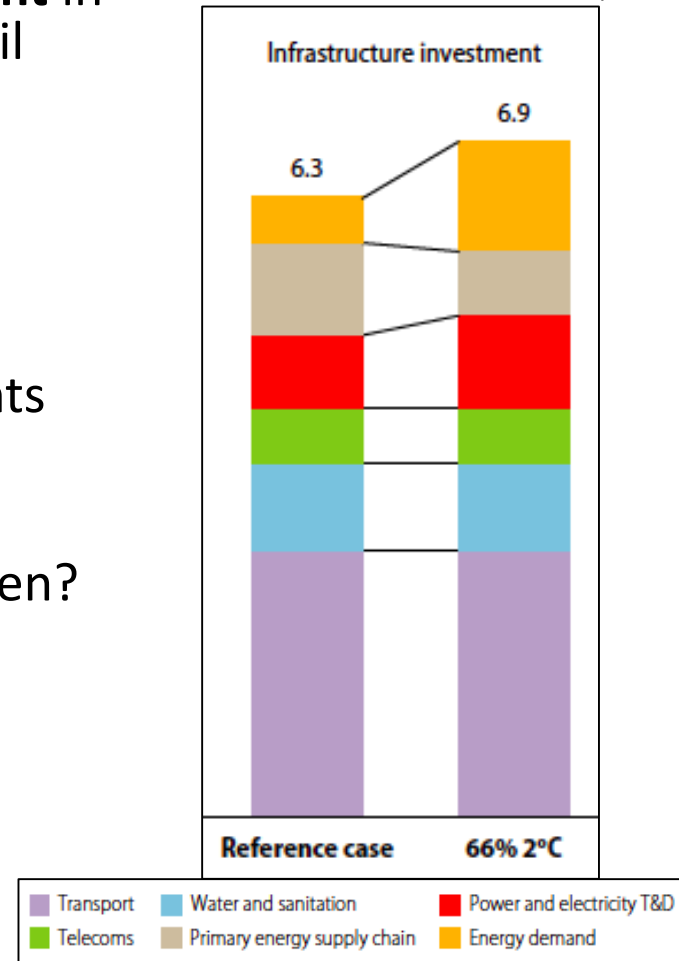# Large scale private and public investments must be mobilized to meet climate goals.

➢ Estimated **US$ 6.9 trillion of annual investment** in climate-compatible infrastructure needed until 2030 (OECD, 2017).

  ➢ Equal to approx. 10% of global GVA in 2016.

➢ **US$ 3.5 trillion** annually in **energy-sector investments** are needed until 2050 to remain below 2°C – **twice current levels** of investments (IEA, 2017).

Currently, are firms being rewarded for going green?

Our research question:

➢ How does going green affect firms' financial performance?

Global Estimates (annual average for 2016-2030, USD 2015 trillion).

Infrastructure investment

6.3   6.9

Reference case   66% 2°C

| Transport | Water and sanitation | Power and electricity T&D |
| Telecoms | Primary energy supply chain | Energy demand |

Source: Adapted from OECD (2017).

Contributions

➢ New Measure of firms' 'greenness': We use a novel measure of firm-level green activities: **Green Revenue share (%)**.

➢ Comprehensive Coverage: Capture green activities of publicly listed firms representing **95% of global market capitalization**, across **60 sectors**, and **8 years**.

➢ Financial Performance Variables: Comprehensive analysis of different measures of **current** and **expected profitability** of firms.

➢ Econometric Model: Building upon **financial accounting** and **environmental economics literature**

How does going green affect the financial performance of firms?

Current profitability

Ability to earn income ✔	Ability to use assets ✘

Expected profitability

Market value (share price) ✘

Ability to earn income ✔	Ability to use assets

Tobin's Q (Market Capitalization / Assets) ✘

Ability to earn income ✔	Ability to use assets

FTSE Russell Green Revenues Database

Coverage:

➢ Overall FTSE universe of publicly listed firms: **16,000** (approx. 95% of global market capitalization),

  ➢ of which **3,500** engage in **green activities**.

➢ Time Period: 2009 - 2016

➢ Coverage across 47 countries and 60 FTSE industry-subsectors.

What does Green Revenue capture?
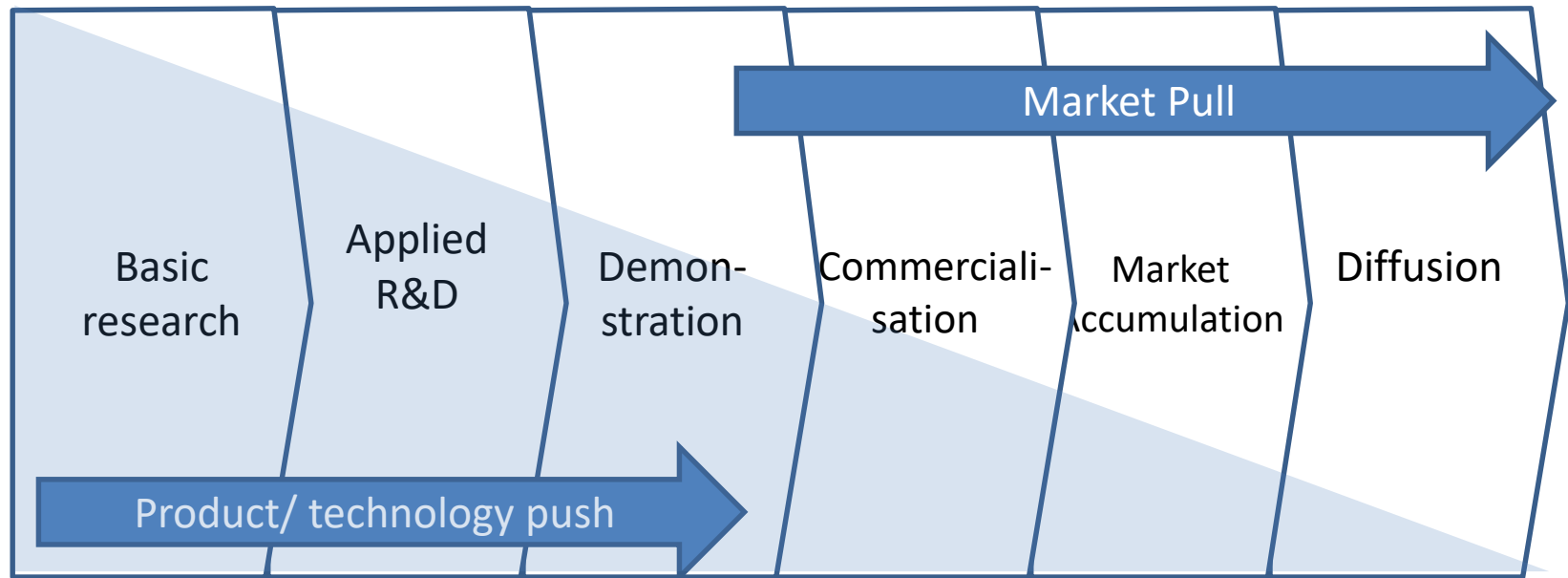
Green Revenue Data Example

Automobile Company

Segment - Name	Segment – Revenue (%)	Sub-Segment Name	Sub-Segment Revenue (%)
Road vehicles	60%	Non-green conventional car.	95%
		Manufacture and Sale of hybrid and electric vehicles.	5%
Energy Storage Solutions	5%	Sale of energy storage solutions for PV energy.	100%
Industrial Processes	35%	Non-green industrial process products.	30%
		Sale of energy-efficiency improving technologies.	5%
Overall Green Revenue Share (%)			**9.75%**

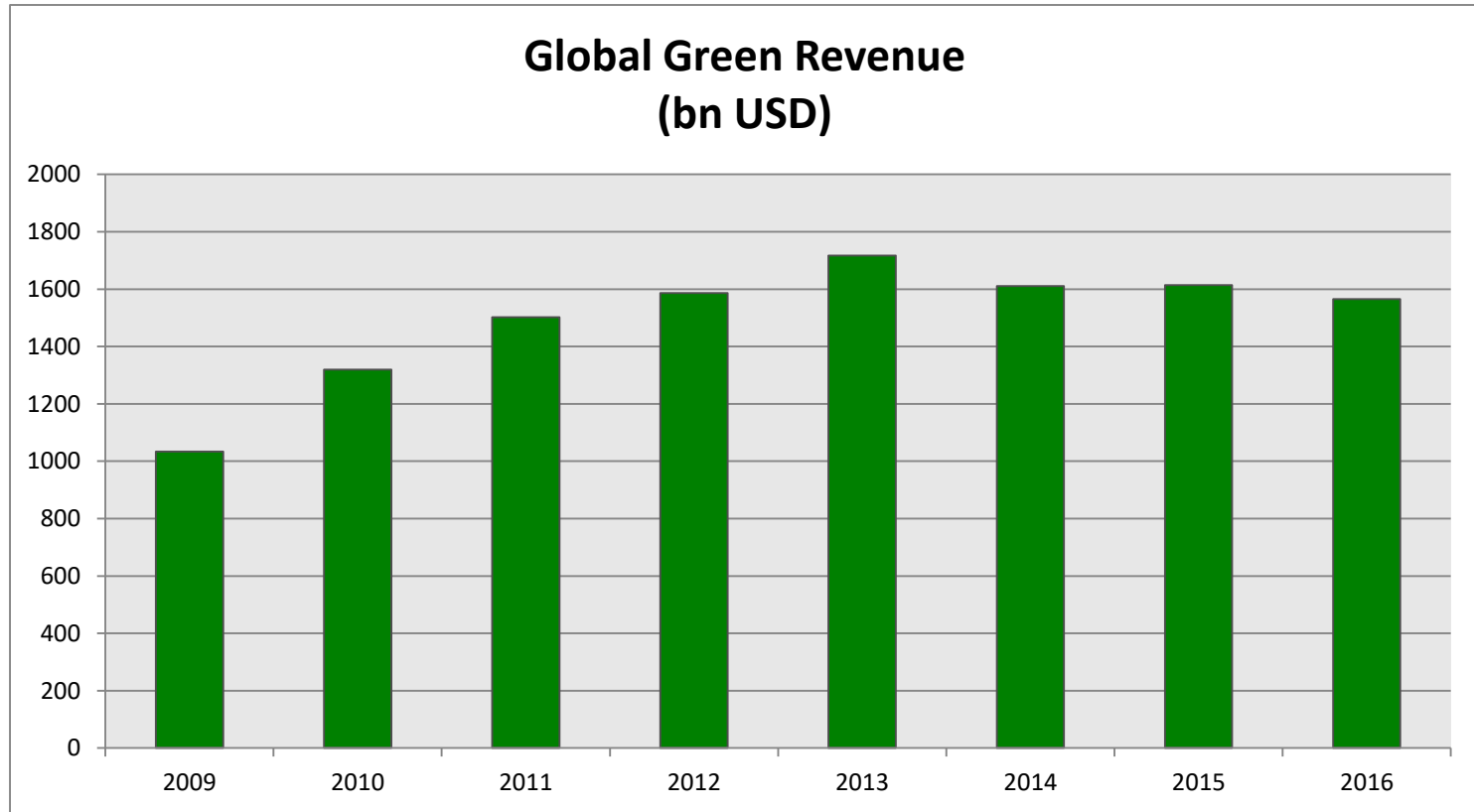# Most green firms generate **up to 20%** of their revenue from **green activities**

Estimated GR Share
(based on 2-digit NACE industry average and green candidate sample)
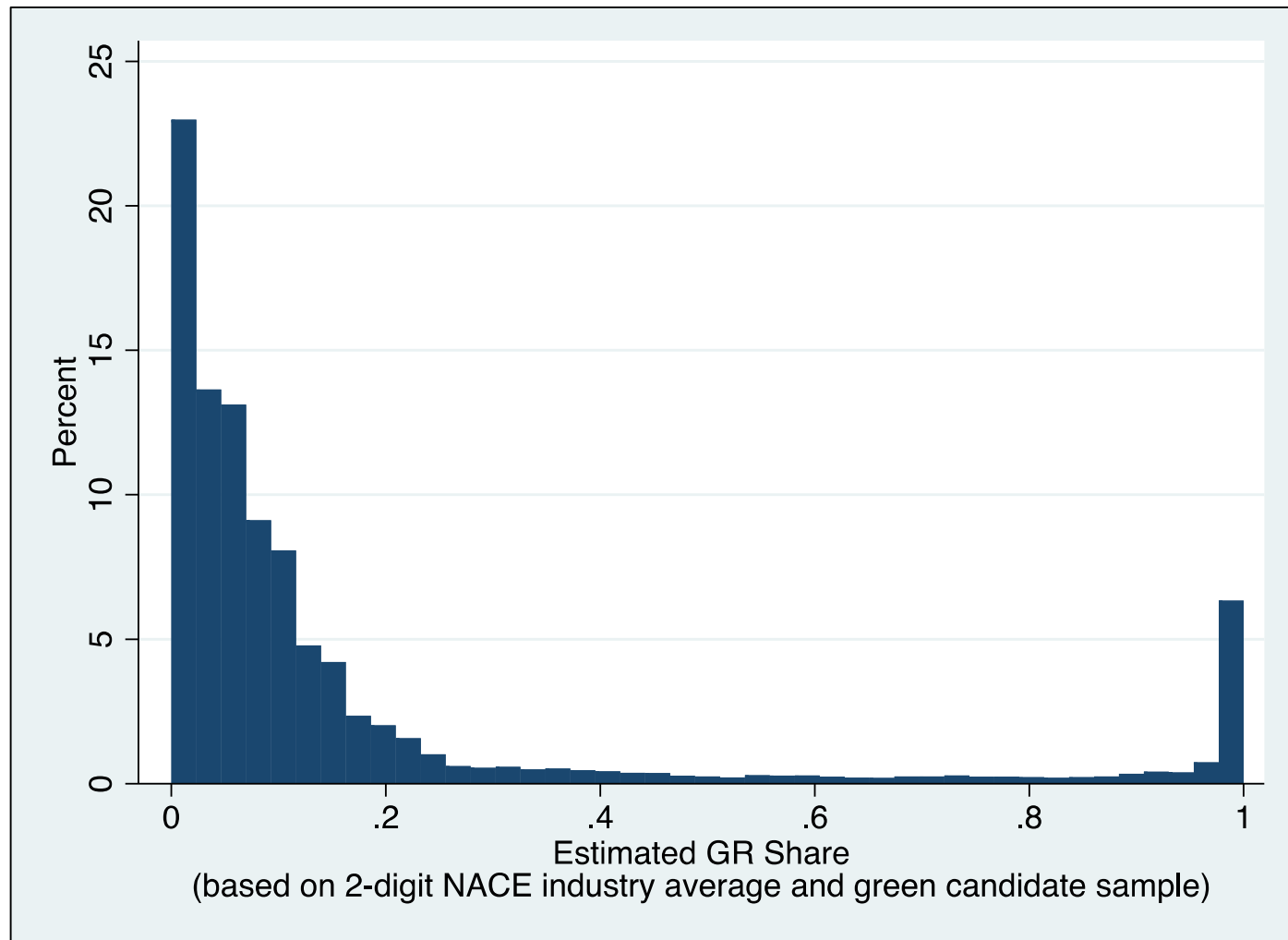
WHAT IS THE SIZE OF THE GLOBAL GREEN ECONOMY?

Global Green Revenues of listed firms account for **1.6 US$ trillion:**

Global Green Revenue (bn USD)

Year	Revenue (bn USD)
2009	~1030
2010	~1320
2011	~1500
2012	~1585
2013	~1715
2014	~1610
2015	~1615
2016	~1565

Globally the largest 2000 publicly listed firms account for **US$39 trillion** in revenue (Forbes, 2018).

➢ Green Revenue accounts for **4% of global turnover** among publicly listed firms.

Most Green Revenue is generated in **Manufacturing** and **Electricity Generation** (2)

Global Green Turnover by 2-digit NACE code (2016 bn USD)
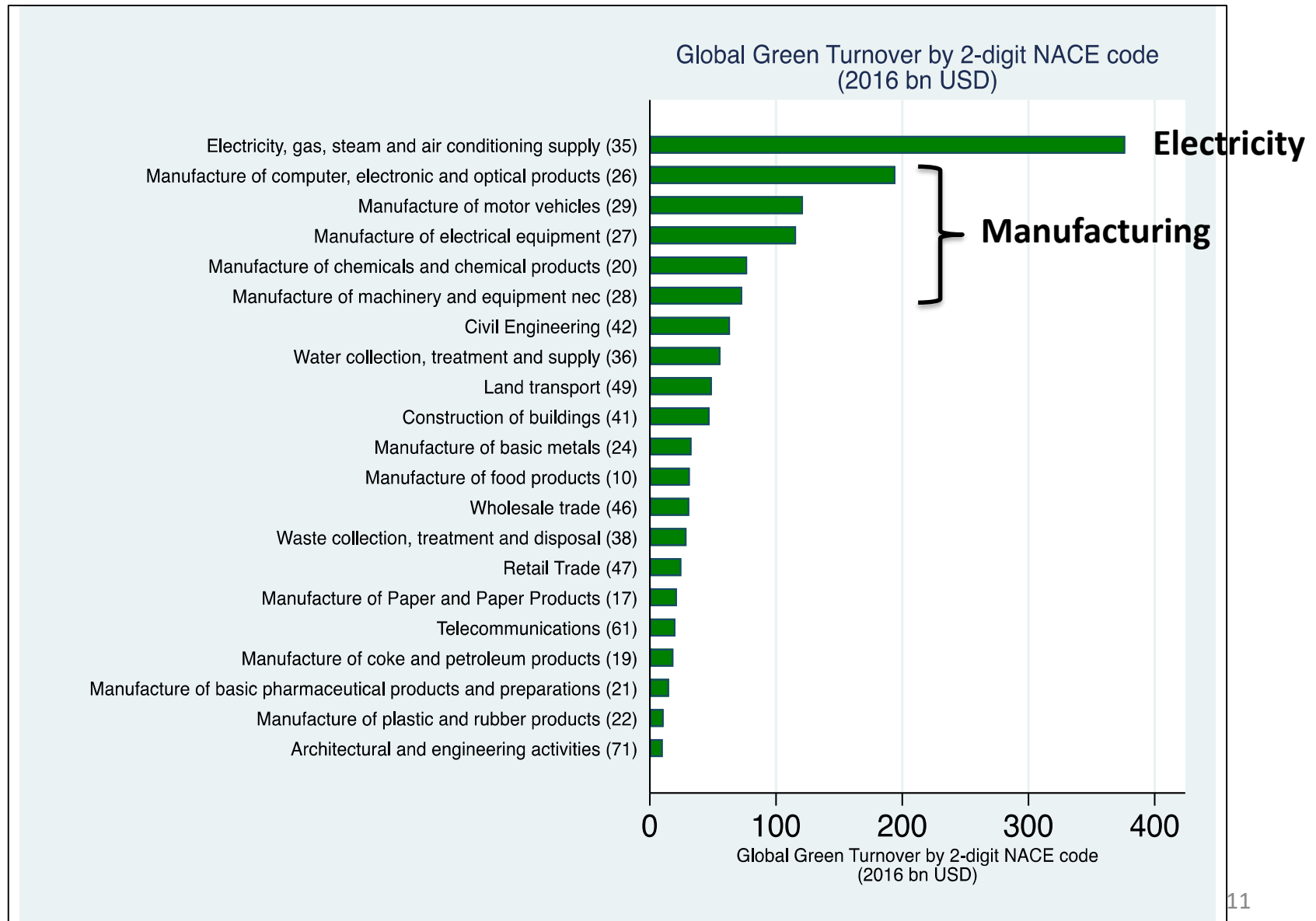
Green Revenue and Average Green Revenue Share
by Industry (2016)

12
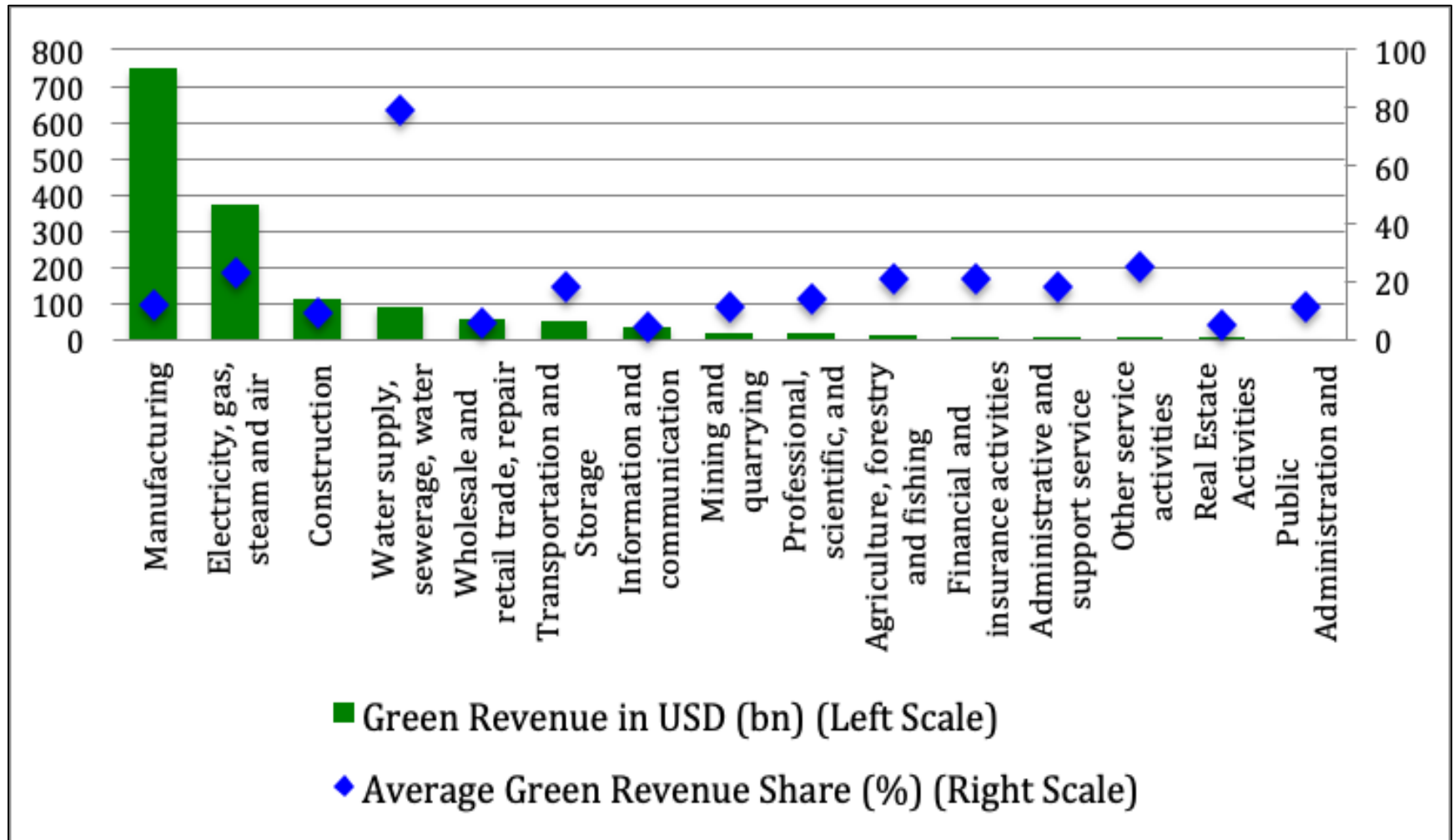
EXISTING LITERATURE & THEORIES

Positive Links between Environmental & Economic Performance (Source: Ambec and Lanoie, 2008)

Literature
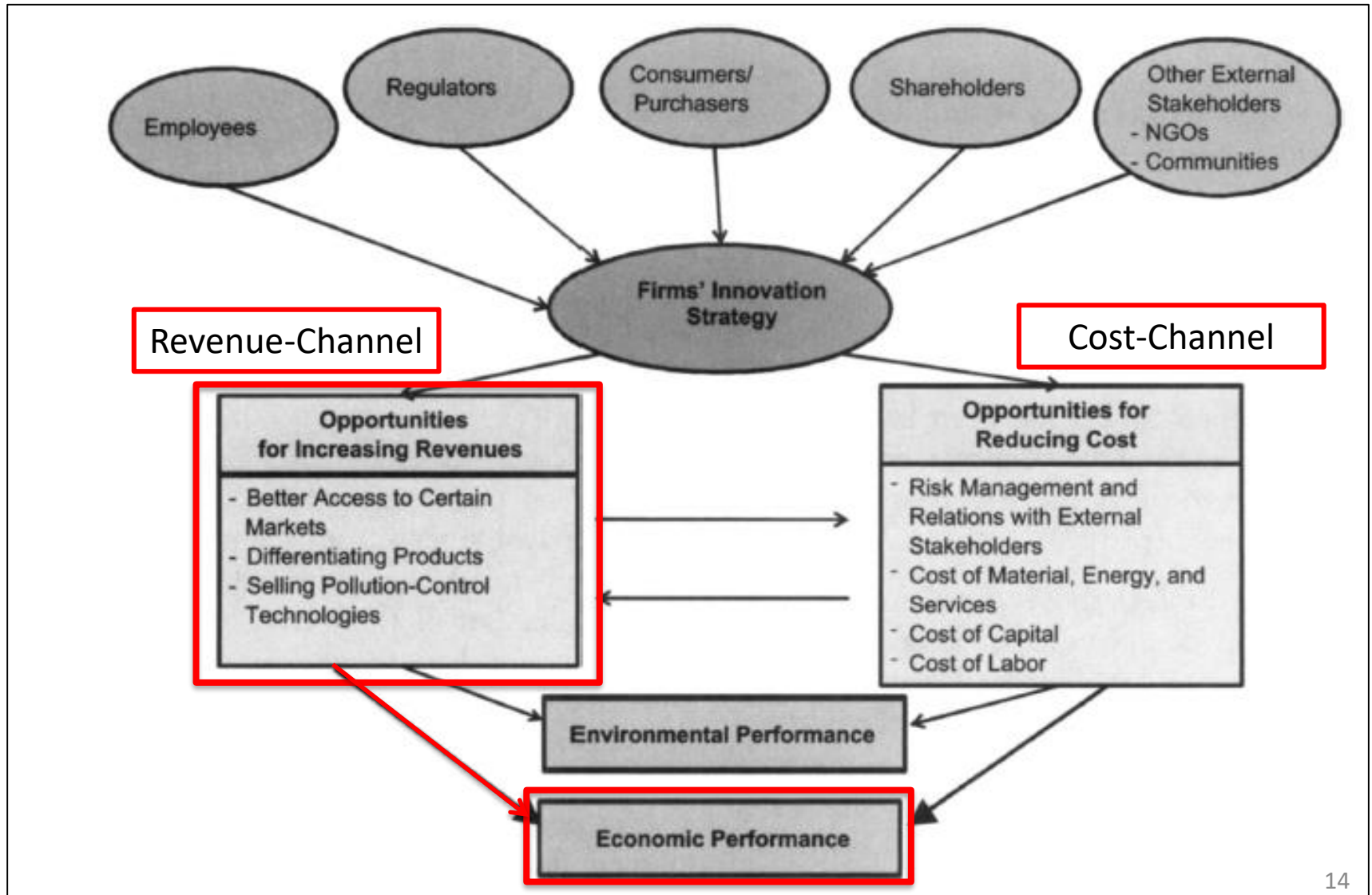
Most studies find a **positive** correlation between **environmental** and **economic performance** at the firm level (Blanco et al., 2010; Horváthová, 2010; Albertini, 2013; Dechezlepretre et al., 2018):

Most conclusive evidence on **cost-channel**:

➢ **Reducing input costs** through cleaner production processes innovations improves profitability (Van Leeuwen and Mohnen, 2017).

➢ Positive correlation between reduction in **toxic-release emissions** and **profitability**, and (less conclusive) **investors' valuation** (e.g. Konar & Cohen, 2001; Rassier and Earnhart, 2015).

Limited Evidence on **revenue-channel:**

➢ Positive effect between **green new product innovation** and profitability for 80 global firms (Palmer and Truong, 2017).

➢ Positive effect of **green product innovation** on employment (cross-section: Rennings and Zwick, 2002; Rennings et al., 2004; panel: Horbach, 2010)

EMPIRICAL SPECIFICATION

Model 1:
Short-term Profitability

$$\underset{it}{Y} = \beta_1 D_{i,t-l}^{GR} + \beta_4 V_{it}' + \beta_5 X_{it}' + \alpha_i + \varepsilon_{it}$$

Y_{it}:   **Financial performance variables:**
  ➢ Ability to earn income**: Ebit-, Ebitda-margin, Return-on-Sales (ROS).**
  ➢ Ability to use assets**: Return-on-Assets (ROA), Return-on-Equity (ROE).**

D^{GR}:   Green Revenue variable (continuous or factor variable) (1-year lag).
V':   Vector of firm-specific controls: number of employees (log),
          Assets/Sales (log), R&D-dummy, Leverage (Debt/Assets).
X':   2-digit NACE industry-by-year dummies that take account for
          unobserved year-specific effects.
α_i: Firm fixed effects.
ε_{it}:   idiosyncratic error term.

RESULTS

Positive Effect of Green Revenue on Earnings-per-Sale Ratios (1)

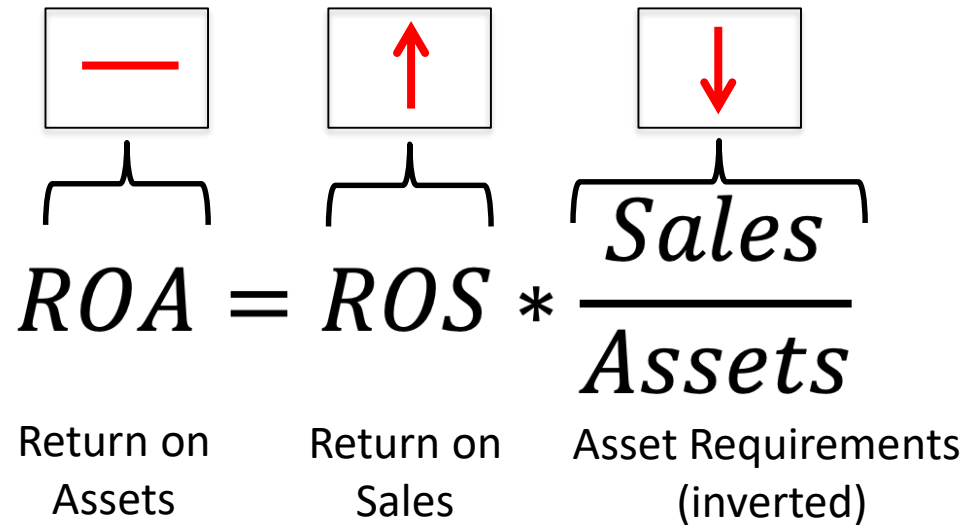|	EBIT margin	EBITDA margin	ROS	ROA	ROE
Estimated GR Share (1-year lag)	4.15** (1.98)	4.68** (1.85)	0.46** (0.22)	1.82 (1.75)	1.24 (3.88)
Employees (log)	0.79*** (0.26)	0.87*** (0.25)	0.12*** (0.03)	0.16 (0.18)	1.25*** (0.48)
Assets/Sales (log)	-7.25*** (0.52)	-5.84*** (0.50)	-2.00*** (0.08)	-3.89*** (0.29)	-5.37*** (0.63)
R&D (dummy: yes=1)	-0.56 (0.35)	-0.41 (0.34)	0.07* (0.04)	-0.88*** (0.25)	-1.98*** (0.67)
Leverage (Debt/Assets) (log)	-5.44*** (0.41)	-3.79*** (0.42)	-0.41*** (0.06)	-5.98*** (0.34)	-14.00*** (0.83)
Constant	2.20 (2.13)	9.53*** (1.98)	-0.33 (0.28)	-0.44 (1.46)	-11.99*** (4.05)
R^2	0.107	0.069	0.348	0.108	0.078
N	57948	58108	60661	59998	58877

Robust Standard errors clustered at the firm-level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All regressions are estimated using firm fixed effects and 2-digit NACE industry-by-year dummies.

Positive Effect of Green Revenue on Earnings-per-Sale Ratios (2).

	EBIT margin	EBITDA margin	ROS	ROA	ROE
FTSE Min GR Share (1-year lag)	3.32[*] (1.94)	4.11[**] (1.81)	0.43[**] (0.21)	1.59 (1.68)	-0.10 (3.79)
Employees (log)	0.79[***] (0.26)	0.87[***] (0.25)	0.12[***] (0.03)	0.16 (0.18)	1.26[***] (0.48)
Assets/Sales (log)	-7.25[***] (0.52)	-5.84[***] (0.50)	-2.00[***] (0.08)	-3.89[***] (0.29)	-5.37[***] (0.63)
R&D expenditure (dummy: 1=yes)	-0.56 (0.35)	-0.41 (0.34)	0.07[*] (0.04)	-0.88[***] (0.25)	-1.97[***] (0.67)
Leverage (Debt/Assets) (log)	-5.44[***] (0.41)	-3.80[***] (0.42)	-0.41[***] (0.06)	-5.98[***] (0.34)	-14.00[***] (0.83)
Constant	2.28 (2.13)	9.61[***] (1.98)	-0.33 (0.27)	-0.41 (1.45)	-11.96[***] (4.05)
R^2	0.107	0.069	0.348	0.108	0.078
N	57948	58108	60661	59998	58877

Robust Standard errors clustered at the firm-level. [*] $p < 0.10$, [**] $p < 0.05$, [***] $p < 0.01$. All regressions are estimated using firm fixed effects and 2-digit NACE industry-by-year dummies.

Effect Decomposition

$$ROA = ROS * \frac{Sales}{Assets}$$

Return on Assets   Return on Sales   Asset Requirements (inverted)

Green Revenue is:

➤ **Positively** associated with **sales income.**

➤ **Negatively** associated with **Sales/Assets.**

➤ **No significant** relationship with **ROA**.

Model 2: Investors' Expectations of *Future Profitability*

$$MV_{it} = \beta_1 D_{i,t}^{GR} + \beta_2 V'_{it} + \boxed{\beta_3 ROA_{it} + \beta_4 Div_{it}} + \beta_5 + X'_{it} + \alpha_i + \varepsilon_{it}$$

MV_{it}: **Market Valuation (Tobin's Q = Market Capitalization / Assets)**

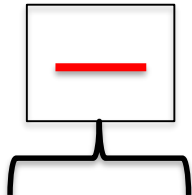D^{GR}: Green Revenue variable (continuous or factor variable) (no lag).

Controls: Same as before **+ ROA, Dividends per share**

No Effect on Investors' Expectations
of *Future Profitability*

	Tobin's q (log)	Tobin's q (log)	Tobin's q (log)	Tobin's q (log)
Estimated GR Share (%)	0.11 (0.08)			
Estimated GR (dummy)		0.05[*] (0.03)		
FTSE Min GR Share (%)			0.10 (0.08)	
FTSE Min GR-dummy				0.04[*] (0.02)
Employees (log)	-0.13[***] (0.01)	-0.13[***] (0.01)	-0.13[***] (0.01)	-0.13[***] (0.01)
Assets/Sales (log)	-0.13[***] (0.01)	-0.13[***] (0.01)	-0.13[***] (0.01)	-0.13[***] (0.01)
R&D-dummy	-0.01 (0.02)	-0.01 (0.02)	-0.01 (0.02)	-0.01 (0.02)
Leverage (log)	-0.19[***] (0.02)	-0.19[***] (0.02)	-0.19[***] (0.02)	-0.19[***] (0.02)
ROA	0.01[***] (0.00)	0.01[***] (0.00)	0.01[***] (0.00)	0.01[***] (0.00)
Dividends per Share	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Constant	0.77[***] (0.10)	0.76[***] (0.10)	0.77[***] (0.10)	0.77[***] (0.10)
R^2	0.181	0.181	0.181	0.181
N	58061	58061	58061	58061

Robust Standard errors clustered at the firm-level. [*] $p < 0.10$, [**] $p < 0.05$, [***] $p < 0.01$. All regressions are estimated using firm fixed effects and 2-digit NACE industry-by-year dummies.

Results

$$ExptProfit_{it} = \beta_1 GR_{it} + \beta_2 V'_{it}$$

Tobin's Q   Green   Control
Revenue   Variables

➢ No Effect from being green on expectations of future profitability *per se.*

Model 3:
Asset-Pricing Model

$$MV_{it} = \beta_1 NI_{it} + \beta_2 BV_{it} + \beta_3 GR_{it} + \boxed{\beta_4 NI_{it} * GR_{it} + \beta_5 BV_{it} * GR_{it}}$$
$$+ \beta_6 X'_{it} + \beta_7 V'_{it} + \alpha_i + \varepsilon_{it}$$

MV: **Market Value per share (= Share price).**

NI: Net Income per share.

BV: Book Value per share.

GR: Green Revenue indicator (dummy).

X': Vector of firm-level controls: ROE, Leverage, Total Assets, Dividends per share.

V': industry-by-year dummies.

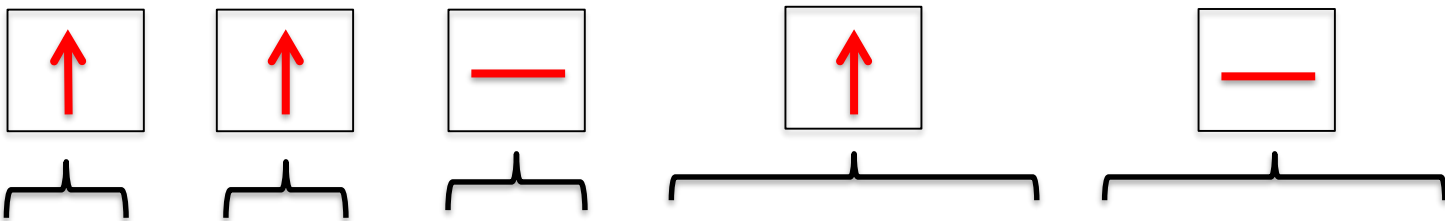α_i: Firm fixed effects

ε: idiosyncratic error term

	Market Cap per share	Market Cap per share	Market Cap per share
NI	1.23*** (0.15)	1.26*** (0.15)	1.28*** (0.15)
BV	1.16*** (0.05)	1.17*** (0.05)	1.15*** (0.05)
Green Revenue (dummy)	-0.21 (0.82)		
Green Revenue (dummy) * NI	0.67*** (0.26)		
Green Revenue (dummy) * BV	-0.13* (0.07)		
Green Revenue (dummy Vs2)		0.12 (0.80)	
Green Revenue (dummy Vs2) * NI		0.60** (0.26)	
Green Revenue (dummy Vs2) * BV		-0.16*** (0.06)	
At least 1 Green Subsegment			-1.17 (1.11)
At least 1 green Subsegment * NI			0.46* (0.26)
At least 1 green Subsegment * BV			-0.09 (0.09)
ROE	-0.02*** (0.01)	-0.02*** (0.01)	-0.02*** (0.01)
Leverage	4.40*** (1.17)	4.42*** (1.17)	4.38*** (1.18)
Assets	0.27 (0.25)	0.26 (0.25)	0.30 (0.26)
Dividends per Share	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Constant	2.63 (3.36)	2.69 (3.36)	2.48 (3.39)
R^2	0.331	0.331	0.329
N	90393	90393	89387

Robust Standard errors clustered at the firm-level. $p < 0.10$, $p < 0.05$, $p < 0.01$. All regressions are estimated using firm fixed effects and 2-digit NACE industry-by-year dummies.

Results

$$MV_{it} = \beta_1 NI_{it} + \beta_2 BV_{it} + \beta_3 GR_{it} + \beta_4 (NI_{it} * GR_{it}) + \beta_5 (BV_{it} * GR_{it})$$

➢ The market values **profitability** among **green firms** more than among non-green counterparts by **paying** a **premium** on the **share price.**

➢ No premium from being green *per se.*

CONCLUSION

Summary of Results

Current profitability	
Ability to earn income ✔	Ability to use assets ✖

Expected profitability	

Market value (share price) ✖

Ability to earn income ✔	Ability to use assets

Tobin's Q (Market Capitalization / Assets) ✖

Ability to earn income ✔	Ability to use assets

Headline Results

➢ Engaging in *Green Activities* and generating ***Green Revenues*** is **positively associated** with firms' ability to generate a higher return per unit of sales.

  ➢ No effect on profitability after accounting for increased asset and equity requirements (ROA, ROE).

➢ No relationship between *Green Revenues* and firms' market valuation *per se*.

  ➢ **No market penalty** for engaging in green activities.

➢ However, the market values **profitability** among **green firms** more than among non-green counterparts by **paying** a **premium** on the **share price**.

Policy Messages

Demand side:

- Create markets for green goods and services through for example:
    - Labelling or additional information.
    - Regulation and standards.
    - Green (public) procurement.
    - Downstream carbon consumption charge.

Supply Side:

- Boost green investment through for example:
    - Cheaper access to 'green' capital.
    - Public-private partnerships.
    - Targeted R&D subsidies.

Thank you!

Further Questions:

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ADDITIONAL SLIDES

FTSE Green Revenues Classification System

A comprehensive structure for green revenues classification

FTSE Russell

8 Sectors

Energy Generation	Energy Equipment	Energy Management	Energy Efficiency
EG Bio Fuels	EQ Bio Fuels	EM Combined Heat/Power	EE Advanced Materials
EG Clean Fossil Fuels	EQ Clean Fossil Fuels	EM Controls	EE Buildings and Property
EG Geothermal	EQ Geothermal	EM Fuel Cells	EE Industrial Processes
EG Hydro	EQ Hydro	EM Integrated Energy Management	EE Integrated Energy Efficiency
EG Integrated Energy Generation	EQ Integrated Energy Equipment	EM Logistics and Support	EE IT Processes
EG Nuclear	EQ Nuclear	EM Power Storage	EE Lighting
EG Ocean and Tidal	EQ Ocean and Tidal	EM Smart Grids	EE Video Conferencing
EG Solar	EQ Solar		
EG Waste to Energy	EQ Waste to Energy		
EG Wind	EQ Wind		
Environmental Infrastructure	**Environmental Resources**	**Modal Shift**	**Operational Shift**
EI Carbon Capture and Storage	ER Agriculture	MS Aviation	OS Finance/Investment
EI Desalination	ER Aquaculture	MS Integrated Modal Shift	OS Integrated Operational Shift
EI Flood Control & Land Erosion	ER Integrated Environmental Resources	MS Railways	OS Retail/Wholesale
EI Integrated Environmental Infrastructure	ER Mining	MS Road Vehicles	OS Property
EI Logistics and Support	ER Minerals and Metals	MS Shipping	
EI Pollution Management	ER Source Water		
EI Recyclable Products	ER Sustainable Forestry		
EI Recycling Services			
EI Waste Management			
EI Water Management			

60 Sub-sectors

Green Revenue Data (Missing values)

Segment - Name	Segment – Revenue (%)	Sub-Segment Name	Sub-Segment Revenue (%)
Road vehicles	60%	Non-green conventional car.	95%
		Manufacture and Sale of hybrid and electric vehicles.	5%
Energy Storage Solutions	5%	Sale of energy storage solutions for PV energy.	100%
Industrial Processes	35%	Non-green industrial process products.	**N.A.**
		Sale of energy-efficiency improving technologies.	**N.A.**
Overall Green Revenue Share (%)			**8.00 – 35.00%**

Firms with the highest Green Revenue Share operate in Water- and Waste-management
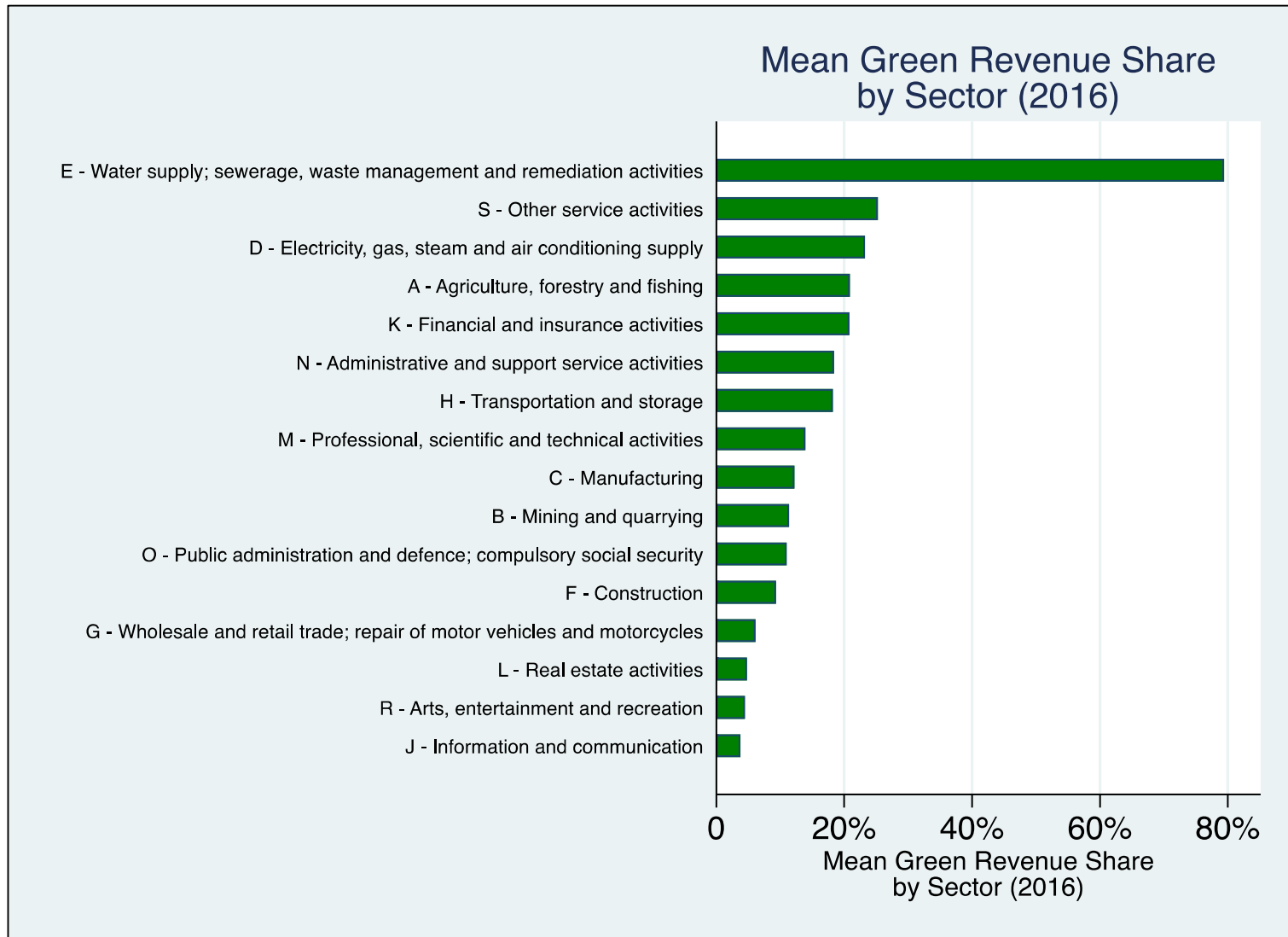
Mean Green Revenue Share by Sector (2016)

Most Green Revenue is generated in **Manufacturing** and **Electricity Generation** (1)

Global Green Revenue by NACE Main Section (1-digit) 2016 (bn USD)

2016 Global Green Revenue by 1-digit NACE (Main Section) bn USD
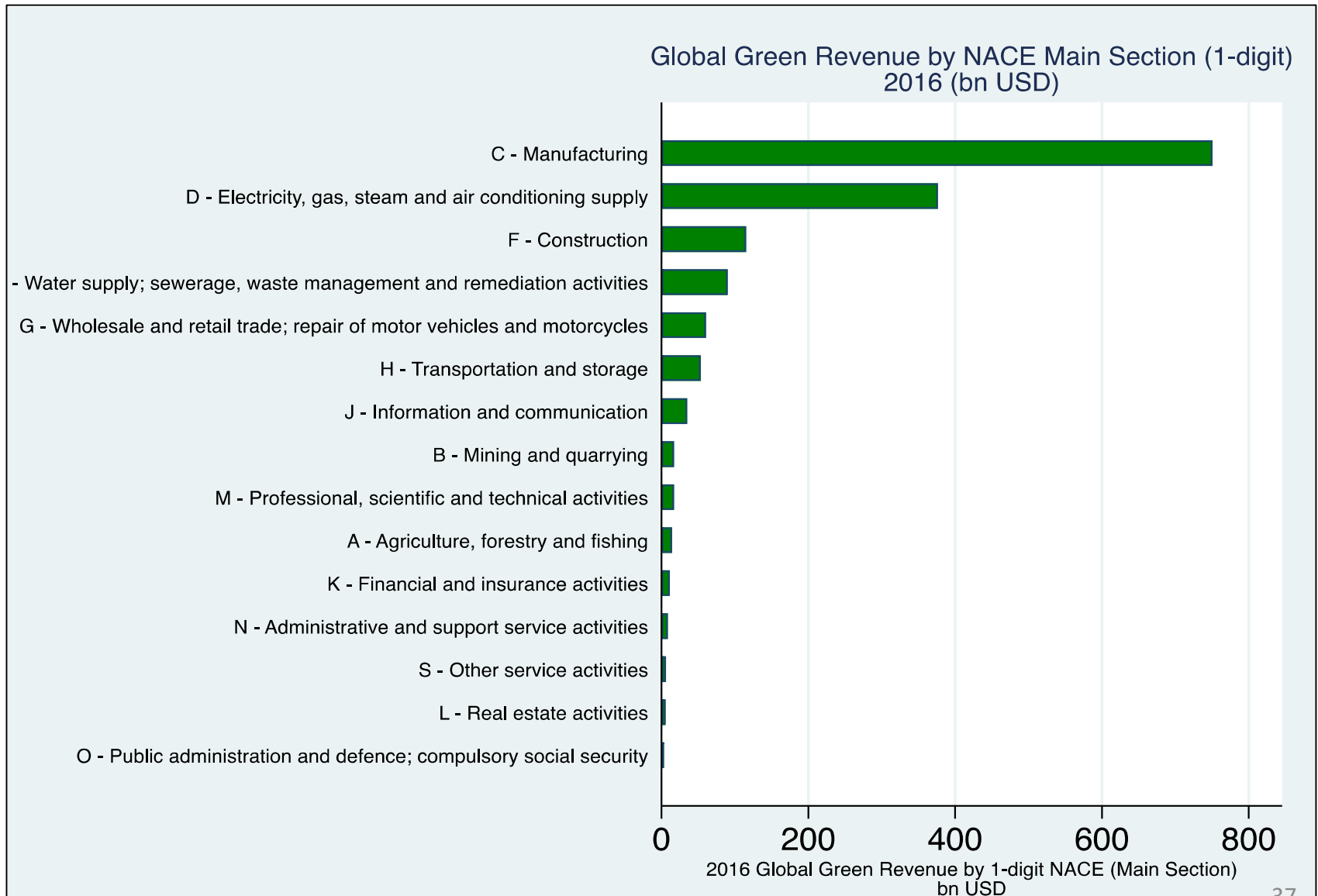
SECTOR-BY-SECTOR EFFECTS

Manufacturing is the strongest driver of the results

NACE 1-digit Main Section	EBIT margin	EBITDA margin	ROS	ROA	ROE
Manufacturing (C)	6.19** (2.88)	5.05* (2.81)	0.69** (0.32)	2.70 (2.41)	6.91 (5.73)
Electricitry, gas, steam and air conditioning supply (D)	4.12 (5.16)	8.77* (4.74)	0.59* (0.31)	-2.40 (1.52)	-20.61** (7.96)
Construction (F)	2.64 (1.68)	1.60 (1.48)	1.44 (1.39)	1.36 (4.43)	0.03 (0.02)
Water Supply, sewerage, waste management, and remediation activities (E)	3.82 (2.69)	4.29* (2.17)	-0.94 (3.04)	-25.67 (18.07)	0.19 (0.47)

What is *Green Revenue*?