



# Corporate Carbon and Financial Performance: A Meta-analysis

IEA workshop on Industry/business use of 'complementary measures' for decarbonisation

22 June 2015, Paris

Prof. Dr. Timo Busch

University of Hamburg  
Faculty of Business, Economics and Social Sciences  
Von-Melle-Park 9; 20146 Hamburg; Germany

Chair of Management and Sustainability  
[www.wiso.uni-hamburg.de/sustainability](http://www.wiso.uni-hamburg.de/sustainability)



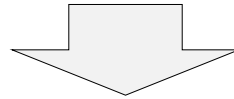
## Question: Are a firm's carbon emissions related to its financial performance?

| <i>Author(s)<br/>(Year)</i>   | <i>Data</i>   | <i>Sample</i>                      | <i>CEP variable(s)</i>                      | <i>Scope</i> | <i>CFP variable(s)</i>          | <i>Evidence ...</i>        |
|-------------------------------|---------------|------------------------------------|---|--------------|---------------------------------|----------------------------|
| Pogutz and Russo (2009)       | Own survey... | ~117 firms (worldwide) (2002-2005) | <i>GHG emission ratio</i> (measured as ...) | unspecified  | ROA, ROS, ROE, Tobin's <i>q</i> | Increases all variables    |
| Delmas and Nairn-Birch (2010) | Trucost       | ~1,100 US firms, (2004-2008)       | Total CO <sub>2</sub> e emissions           | 1, 2, 3      | ROA, Tobin's <i>q</i>           | Increases Tobin's <i>q</i> |
| Busch and Hoffmann (2011)     | Own survey... | 174 firms (worldwide) (2007)       | <i>Carbon intensity</i> (measured as ...)   | 1, 2         | ROA, ROE, Tobin's <i>q</i>      | Mixed results              |
| ...                           | ...           | ...                                | ...   | ...          | ...                             | ...                        |
| Wang et al. (2013)            | CDP           | 69 Australian firms (2010)         | Total carbon emissions                      | 1, 2         | Tobin's <i>q</i>                | Decreases Tobin's <i>q</i> |



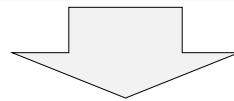
## Research case

Motivation: Conflicting results across studies (typical for this research field)



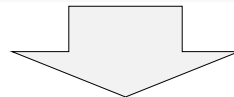
Method: A meta-analytical review is useful as it...

1. synthesizes empirical findings across a variety of studies
2. allows paying attention to how environmental data (specifically CO<sub>2</sub> emissions) is operationalized across studies
3. can show which measurements of financial performance matter most



Questions:

- What is the overall effect?
- What matters: Emission ratios vs. absolute emissions?
- How does it matter: Accounting vs. market-based CFP?



Sample: 21 studies with 25,552 firm year observations

## The over all effect

| <i>CFP</i>     | <i>k</i> | <i>N</i> | <i>r</i> | <i>95% CI</i> |       | <i>Q</i>   |
|----------------|----------|----------|----------|---------------|-------|------------|
| All indicators | 43       | 25,552   | -.047**  | -.079         | -.015 | 219.444*** |

*Note:* k = number of effect sizes; N = total sample size; r = summary effect; CI = confidence interval;  
 Q = Q statistic for homogeneity; \* p < 0.05; \*\* p < .01; \*\*\* p < .001.

## Emission ratios vs. absolute emissions

| <i>Emission measurement</i> | <i>k</i> | <i>N</i> | <i>r</i> | <i>95% CI</i> |       | <i>Q</i>   | <i>Q<sub>B</sub></i> |
|-----------------------------|----------|----------|----------|---------------|-------|------------|----------------------|
| Absolute emissions          | 13       | 8,387    | -.017    | -.077         | .042  | 49.949***  |                      |
| Emission ratios             | 30       | 17,165   | -.058**  | -.097         | -.019 | 164.826*** | 4.669*               |

*Note:* k = number of effect sizes; N = total sample size; r = summary effect; CI = confidence interval;  
 Q = Q statistic for homogeneity; \* p < 0.05; \*\* p < .01; \*\*\* p < .001.

## Accounting vs. market-based CFP (I/II)

| CFP measurement    | <i>k</i> | <i>N</i> | <i>r</i> | 95% CI |       | <i>Q</i>   | <i>Q<sub>B</sub></i> |
|--------------------|----------|----------|----------|--------|-------|------------|----------------------|
| Accounting         | 25       | 13,415   | −.060*   | −.106  | −.014 | 138.294*** |                      |
| Absolute emissions | 5        | 3,653    | .040*    | .007   | .072  |            |                      |
| Emission ratios    | 20       | 9,762    | −.081**  | −.132  | −.028 |            | 20.744***            |
| ROA                | 10       | 6,072    | −.066*   | −.129  | −.003 | 30.859***  |                      |
| Absolute emissions | 2        | 3,405    | .036*    | .003   | .070  |            |                      |
| Emission ratios    | 8        | 2,667    | −.086*** | −.133  | −.038 |            | 21.656***            |
| ROE                | 5        | 1,608    | −.043    | −.092  | .006  | 1.553      |                      |
| Absolute emissions | 2        | 98       | .014     | −.188  | .215  |            |                      |
| Emission ratios    | 3        | 1,510    | −.047    | −.097  | .004  |            | .317                 |

Note: *k* = number of effect sizes; *N* = total sample sizes; *r* = partial correlation (effect size); LL-CI = lower-level confidence interval; UL-IC = upper-level confidence interval; *Q* = *Q* statistic for homogeneity; \* *p* < 0.05; \*\* *p* < .01; \*\*\* *p* < .001.

## Accounting vs. market-based CFP (II/II)

| CFP measurement    | <i>k</i> | <i>N</i> | <i>r</i> | 95% CI |       | <i>Q</i>  | <i>Q<sub>B</sub></i> |
|--------------------|----------|----------|----------|--------|-------|-----------|----------------------|
| Market             | 18       | 12,137   | −.032    | −.077  | .014  | 80.963*** |                      |
| Absolute emissions | 8        | 4,734    | −.055    | −.140  | .031  |           |                      |
| Emission ratios    | 10       | 7,403    | −.020    | −.076  | .037  |           | 2.037                |
| Share Price        | 4        | 4,485    | −.010    | −.074  | .054  | 11.768**  |                      |
| Absolute emissions | 2        | 1,156    | −.067    | −.189  | .057  |           |                      |
| Emission ratios    | 2        | 3,329    | .031     | −.023  | .086  |           | 5.762*               |
| Tobin's <i>q</i>   | 7        | 6,307    | −.068**  | −.113  | −.023 | 13.323*   |                      |
| Absolute emissions | 2        | 2,747    | .010     | −.139  | .159  |           |                      |
| Emission ratios    | 5        | 3,560    | −.092**  | −.149  | −.034 |           | 3.054                |

*Note:* *k* = number of effect sizes; *N* = total sample sizes; *r* = partial correlation (effect size); LL-CI = lower-level confidence interval; UL-IC = upper-level confidence interval; *Q* = *Q* statistic for homogeneity; \* *p* < 0.05; \*\* *p* < .01; \*\*\* *p* < .001.



## Messages to take home

- ❑ Across a variety of studies, corporate carbon performance is on average positively related to financial performance.
- ❑ This effect is most prominent for carbon emission ratios.
- ❑ When considering carbon emission ratios, corporate carbon performance has the most pronounced effect on RoA (accounting-based CFP) as well as on Tobin's q (market-based CFP).