Introduction
ooooooo

Theoretical Framework
oooooo

Methodology
ooooooo

Results
ooooo

Summary
oooo

References
ooo

Towards Green Companies: A Panel Data Study of The Environmental and Financial Performance Nexus

Pierrick KINIF

Supervised by Sophie BÉREAU and Jean-Yves GNABO

University of Namur

Faculty of Economics, Social Sciences and Business Administration

June 20, 2018

Introduction
○○○○○○○

Theoretical Framework
○○○○○○

Methodology
○○○○○○○

Results
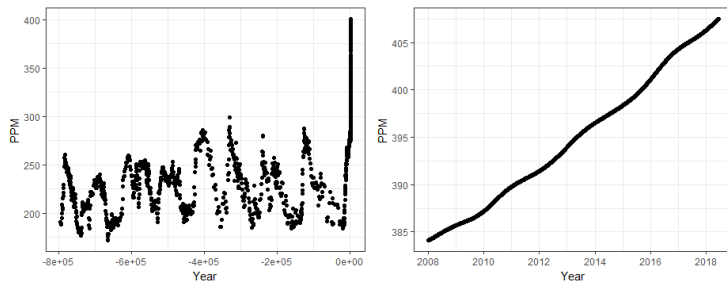○○○○○

Summary
○○○○

References
○○○

Introduction

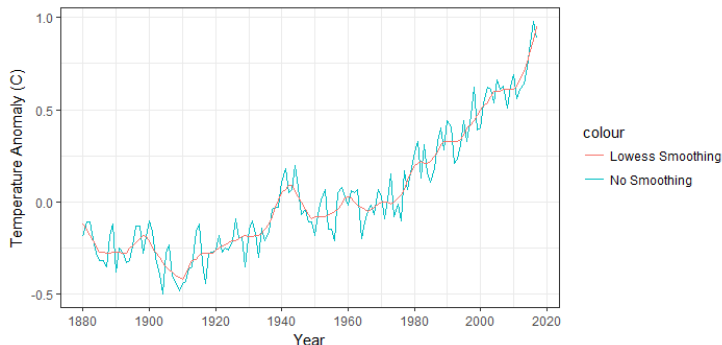# Global Warming Is Not a Myth and Is Growing Fast

Figure 1: Global Atmospheric Concentrations of Carbon Dioxide Over Time

Source: Data coming from US EPA (2016) and Pieter Tans et al. (2018)

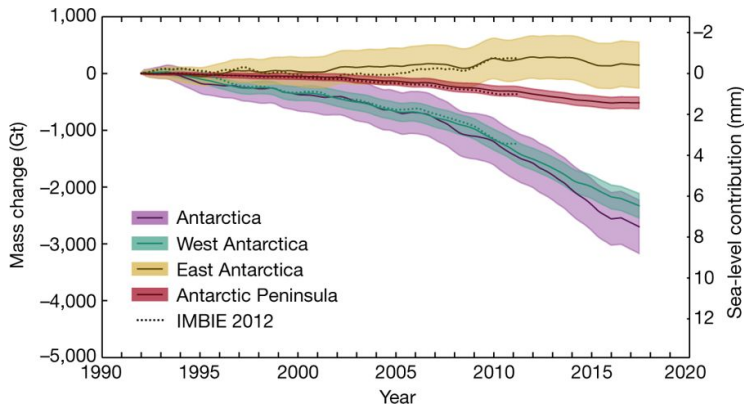# Global Warming Is Not a Myth and Is Growing Fast

Figure 2: Global Mean Estimates Based On Land and Ocean Data

Source: Data coming from Gistemp Team (2018)

Global Warming Is Not a Myth and Is Growing Fast

Figure 3: Cumulative Antarctic Ice Sheet Mass Change

Source: IMBIE team (2018)

Global Warming Represents a Threat for Companies

- Resource depletion, effect on geography, increase of incertainty, increase of natural disasters,...
- "The ice sheets of Antarctica hold enough water to raise global sea level by 58 meters" (FRETWELL ET AL., 2013)
- The BUSINESS AND SUSTAINABLE DEVELOPMENT COMMISSION (2017) (p12) report states:

  "... businesses need to pursue social and environmental sustainability as avidly as they pursue market share and shareholder value... If they don't, the costs and uncertainty of unsustainable development could swell until there is no viable world in which to do business."

Turn the Threat into an Opportunity

- Companies are important stakeholders of Global Warming. They are part of the **problem** but can be part of the **solution**
- The solution is **profitable**

Contribution of this thesis

This thesis **provides incentives** for companies to invest in environmental strategies and shows that **it does pay to be green**. Companies with better corporate environmental performance have better financal performance and the relation increases with a long-term perspective.

Introduction
0000000

Theoretical Framework
●00000

Methodology
0000000

Results
00000

Summary
0000

References
000

Theoretical Framework

Introduction
○○○○○○○

Theoretical Framework
○●○○○○○

Methodology
○○○○○○○

Results
○○○○○

Summary
○○○○
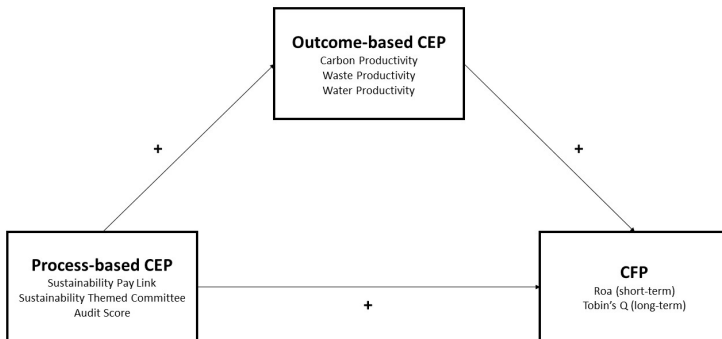
References
○○○

Corporate Environmental And Financial Performance Nexus

Figure 4: Research Framework

Corporate Financial Performance (i.e. CFP)

Focus on two of the three-group classification of Orlitzky et al. (2003):

1. **Market-based measures** (e.g. price-earning ratio or Tobin's Q) consider that returns should be measured from the perspective of shareholders (COCHRAN AND WOOD, 1984). They are considered as proxies for **long-term CFP** (ENDRIKAT ET AL., 2014).

2. **Accounting-based measures** require profitability and asset utilization indicators such as Return on Asset (i.e. ROA) or Return on Equity (i.e. ROE) (COCHRAN AND WOOD, 1984; WU, 2006). They are considered as proxies for **short-term CFP** (ENDRIKAT ET AL., 2014).

Corporate Environmental Performance (i.e. CEP)

Two-group classification of Endrikat et al. (2014):

1. **Process-based CEP** which refers to "a strategic level and focuses on managerial principles and processes such as environmental objectives, environmental policies, or environmental management structures".

2. **Outcome-based CEP** which reflects "the observable and quantifiable results of these efforts (DELMAS ET AL., 2011) and refers to measures such as the number of released pollutants or the ratio of recycled waste to total waste".

Hypotheses

- **Hypothesis 1.** Process-based CEP has a positive impact on Outcome-based CEP
- **Hypothesis 2.** Outcome-based CEP has a positive impact on short-term CFP
- **Hypothesis 3.** Outcome-based CEP has a positive impact on long-term CFP
- **Hypothesis 4.** Process-based CEP has a positive impact on short-term CFP
- **Hypothesis 5.** Process-based CEP has a positive impact on long-term CFP

Methodology

Introduction
0000000

Theoretical Framework
000000

Methodology
0●00000

Results
00000

Summary
0000

References
000

Econometric Model

The link between Process-Based CEP and Outcome-Based CEP

$$Y_{it} = \alpha + \beta_1 SPL_{it} + \beta_2 STC_{it} + \beta_3 AS_{it} + Controls_{it} + d_t + u_{it} \tag{1}$$

where Y_{it} is a proxy of outcome-based CEP measured as carbon productivity, water productivity and waste productivity, SPL_{it} is a proxy for a firm's sustainability pay link, STC_{it} is a proxy for a firm's sustainability themed commitment, AS_{it} is a proxy for a firm's audit score, $Controls_{it}$ is a vector of control variables that includes firm size, industry sector, financial leverage and growth, d_t represents the time effect and u_{it} is the error term.

The link between CEP and CFP

$$\begin{aligned} Y_{it+1} = \quad & \alpha + \beta_1 SPL_{it} + \beta_2 STC_{it} + \beta_3 AS_{it} + \beta_4 CaP_{it} \\ & + \beta_5 WatP_{it} + \beta_6 WastP_{it} + Controls_{it} + d_t + u_{it} \end{aligned} \tag{2}$$

where Y_{it+1} is a proxy of CFP measured as ROA or Tobin's Q, SPL_{it} is a proxy for a firm's sustainability pay link, STC_{it} is a proxy for a firm's sustainability themed commitment, AS_{it} is a proxy for a firm's audit score, CP_{it} is a proxy for a firm's carbon productivity, $WatP_{it}$ is a proxy for a firm's water productivity, $WasP_{it}$ is a proxy for a firm's waste productivity, $Controls_{it}$ is a vector of control variables that includes firm size, industry sector, financial leverage and growth, d_t represents the time effect and u_{it} is the error term.

Panel Data

General form:

$$Y_{it} = \alpha + \beta_k X_{itk} + u_{it} \tag{3}$$

- with $u_{it} = \mu_i + \epsilon_{it}$
- μ_i is the individual error component and is time-invariant. It can be considered as the unobserved effect model
- ϵ_{it}, is the idiosyncratic error which is assumed well-behaved and independent of X_{it} and μ_i

If $\rho(X_{itk}, \mu_i) \neq 0$ then μ_i is considered as the *Fixed Effect* (i.e. FE) and equation 3 becomes:

$$Y_{it} = (\alpha + \mu i) + \beta_k X_{itk} + \epsilon_{it} \tag{4}$$

else, μ_i is considered as the *Fixed Effect* (i.e. FE) and equation 3 becomes:

$$Y_{it} = \alpha + \beta_k X_{itk} + (\epsilon_{it} + \mu i) \tag{5}$$

- FE and RE models imply that OLS estimators of β_k are inconsistent

Panel Data

Testing for RE

- Breusch-Pagan Lagrange Multiplier (i.e. BPLM) test (BREUSCH AND PAGAN, 1980)
- Examines if time and/or individual specific variance components equal zero (PARK, 2011).
- If H0 is verified, there is no RE in the panel data.

Testing for FE

- The presence of FE is tested by an F test (i.e. the function pFtest in R).
- It tests the individual and/or time effects based on the comparison of the within and the pooling model (CROISSANT AND MILLO, 2008).
- If H0 is verified, there is no FE in the panel data.
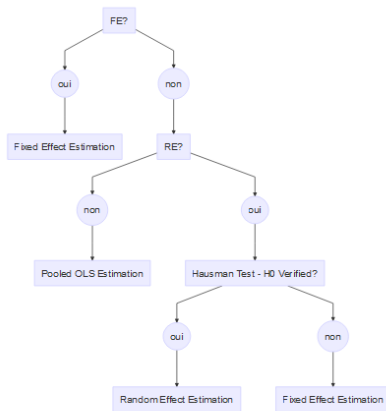
Panel Data

Figure 5: Process to Determine the Estimation Method

Endogeneity Concern

Omission variable bias

Inclusion of a vector of control variables $Controls_{it}$ that explain the relation between CEP and CFP

Simultaneity bias

There is a bidirectional causality between CEP and CFP (ENDRIKAT ET AL., 2014) that could cause simultaneous causality. I used a lagged instrument Y_{it+1} to increases the confidence of the direction of the relationship (MIROSHNYCHENKO ET AL., 2017)

Presence of FE in the model

Under FE, endogeneity is a concern. The Fixed Effect Estimation (i.e. equation 6) solves this as $(\mu_i - \frac{1}{T} \sum_{t=1}^{T} \mu_i) = 0$ (ROBERTS AND WHITED, 2013).

$$(Y_{it} - \frac{1}{T} \sum_{t=1}^{T} Y_{it}) = \beta_k (X_{itk} - \frac{1}{T} \sum_{t=1}^{T} X_{itk}) + (\epsilon_{it} - \frac{1}{T} \sum_{t=1}^{T} \epsilon_{it}) \tag{6}$$

Introduction
0000000

Theoretical Framework
000000

Methodology
0000000●

Results
00000

Summary
0000

References
000

Results

Introduction
0000000

Theoretical Framework
000000

Methodology
0000000

Results
0●0000

Summary
0000

References
000

Process-based CEP positively influences outcome-based CEP

Table 1: The Impact of Process-Based on Outcome-Based CEP

	Dependent variable:		
	CaP	WaP	WastP
	Model (1)	Model (2)	Model (3)
SPL	0.010 (0.011)	0.022* (0.012)	0.025** (0.011)
STC	0.058*** (0.010)	0.067*** (0.011)	0.046*** (0.011)
AS	0.057*** (0.010)	0.068*** (0.011)	0.071*** (0.011)
FirmSize	−0.005 (0.008)	−0.008 (0.008)	−0.010 (0.008)
Leverage	0.0003 (0.001)	0.001* (0.001)	0.001** (0.001)
Growth	0.028 (0.028)	0.001 (0.030)	0.003 (0.028)
Industry	0.002 (0.002)	−0.00001 (0.002)	0.004** (0.002)
BPLM test (pvalue)	0***	0***	0***
F test (pvalue)	0***	0***	0***
Observations	1,123	1,123	1,123
Adjusted R^2	0.109	0.138	0.132
F Statistic (df = 7; 1113)	20.888***	26.892***	25.632***

Note: $^*p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Both process and outcome-based CEP have a positive impact on CFP

Table 2: The Impact of Process and Outcome-Based CEP on CFP

	Dependent variable:	
	TobinsQ	ROA
	Model (4)	Model (5)
SPL	0.079^{*} (0.044)	0.008^{**} (0.004)
STC	0.063 (0.044)	0.012^{***} (0.004)
AS	0.158^{***} (0.044)	-0.004 (0.004)
CaP	-0.012 (0.135)	0.030^{**} (0.012)
WaP	0.337^{**} (0.155)	0.006 (0.012)
WastP	-0.199 (0.156)	0.010 (0.012)
FirmSize	-0.443^{***} (0.015)	-0.020^{***} (0.001)
Leverage	0.003 (0.003)	-0.00000 (0.0003)
Growth	0.465^{***} (0.152)	0.138^{***} (0.012)
Industry	-0.026^{***} (0.007)	-0.002^{***} (0.001)
Constant	10.701^{***} (0.345)	
BPLM test (pvalue)	0.508	0.024^{**}
F test (pvalue)	0.323	0.012^{**}
Observations	954	1,093
Adjusted R^2	0.500	0.282
F Statistic	96.388^{***} (df = 10; 943)	44.007^{***} (df = 10; 1080)
Note:		*p<0.1; **p<0.05; ***p<0.01

Sensitivity analyses

- Describe + confirms results

Introduction
0000000

Theoretical Framework
000000

Methodology
0000000

Results
00000

Summary
●000

References
000

Summary

Main findings and contributions

1. Contribution 1
2. Contribution 2
3. Contribution 3
4. Contribution 4

Limitations

1. Limitation 1
2. Limitation 2
3. Limitation 3
4. Limitation 4

Introduction
○○○○○○○

Theoretical Framework
○○○○○○

Methodology
○○○○○○○

Results
○○○○○

Summary
○○○○

References
●○○

References

References I

References II

Breusch, T.S., Pagan, A.R., 1980. The Lagrange multiplier test and its applications to model specification in econometrics. The Review of Economic Studies 47, 239–253. doi:10.2307/2297111

Business and Sustainable Development Commission, 2017. Better business, better world - The report of the Business & Sustainable Development Commission.

Cochran, P.L., Wood, R.A., 1984. Corporate social responsibility and financial performance. Academy of management Journal 27, 42–56. doi:10.2307/255956

Croissant, Y., Millo, G., 2008. Panel data econometrics in R: The plm package. Journal of Statistical Software 27, 1–43. doi:10.18637/jss.v027.i02

Delmas, M., Hoffmann, V.H., Kuss, M., 2011. Under the Tip of the Iceberg: Absorptive Capacity, Environmental Strategy, and Competitive Advantage. Business & Society 50, 116–154. doi:10.1177/0007650310394400

Endrikat, J., Guenther, E., Hoppe, H., 2014. Making sense of conflicting empirical findings: A meta-analytic review of the relationship between corporate environmental and financial performance. European Management Journal 32, 735–751. doi:10.1016/j.emj.2013.12.004

Fretwell, P., Pritchard, H.D., Vaughan, D.G., Bamber, J.L., Barrand, N.E., Bell, R., Bianchi, C., Bingham, R.G., Blankenship, D.D., Casassa, G., Catania, G., Callens, D., Conway, H., Cook, A.J., Corr, H.F.J., Damaske, D., Damm, V., Ferraccioli, F., Forsberg, R., Fujita, S., Gim, Y., Gogineni, P., Griggs, J.A., Hindmarsh, R.C.A., Holmlund, P., Holt, J.W., Jacobel, R.W., Jenkins, A., Jokat, W., Jordan, T., King, E.C., Kohler, J., Krabill, W., Riger-Kusk, M., Langley, K.A., Leitchenkov, G., Leuschen, C., Luyendyk, B.P., Matsuoka, K., Mouginot, J., Nitsche, F.O., Nogi, Y., Nost, O.A., Popov, S.V., Rignot, E., Rippin, D.M., Rivera, A., Roberts, J., Ross, N., Siegert, M.J., Smith, A.M., Steinhage, D., Studinger, M., Sun, B., Tinto, B.K., Welch, B.C., Wilson, D., Young, D.A., Xiangbin, C., Zirizzotti, A., 2013. Bedmap2: Improved ice bed, surface and thickness datasets for Antarctica. The Cryosphere 7, 375–393. doi:10.5194/tc-7-375-2013

Gistemp Team, 2018. GISS Surface Temperature Analysis (GISTEMP). NASA Goddard Institute for Space Studies. [WWW Document]. URL https://data.giss.nasa.gov/gistemp/. (accessed 4.15.18).