Results

The `R` script of this section is available in *"[Appendix B: Results - R Script]"*.

Descriptive Statistics

This section provides an overview of the database. Table 0.1 presents the main descriptive statistics of each variable. The sample size of ROA (i.e. N = 0) is superior to the sample size of Tobin's Q (i.e. N = 1038). Compared to ROA, *"calculating Tobin's Q requires a relatively high number of financial variables and is more susceptible to missing values"* [@Delmas2015]. This creates a disparity among the number of observations for each dependent variables. @Delmas2015 encountered the same issue and conducted an identical analysis to check whether this introduces a sample bias. I did the same and the *p-value* of the unpaired two-sample t-test equals 0.365 meaning that there is no significant difference between both samples.

Table 0.2 contains the matrix of correlation. There are highly significant correlations between outcome-based CEP variables (i.e. CaP, WatP and, WastP) and process-based CEP variables (i.e. SPL, STC and, AS) suggesting that the model could suffer from a high degree of multicollinearity. Multicollinearity inflates the standard errors of the coefficients making some variables statistically insignificant when they should be significant [@Akinwande2015]. One common practice in the literature to detect multicollinearity is the computation of the Variance Inflation Factor (i.e. VIF) [@Salmeron2018]. VIF indicates how much the estimated variance of the i_{th} regression coefficient is increased above what it would be if R_i^2 equaled zero [@Obrien2007]. Table 0.3 reports VIF of all variables. The maximum VIF is 2,477 meaning that there is no multicollinearity in the model [@Obrien2007].

Outliers Treatment

@Lyu2015 has defined outliers as observations in the dataset that appear to be unusual and discordant and which could lead to inconsistent results. @Osborne2004 showed that even a small proportion of outliers can significantly affect simple analyses (i.e. t-tests, correlations and ANOVAs). @Cousineau2010 claimed that outliers are an issue only and only if they are influential (i.e. any extreme observations whose removal causes a different conclusion in the analysis).

How to treat influential outliers has been a lively debate in the literature [@OrrJohn1991; @Cousineau2010]. @Tabachnick2007 argued that the imputation with the mean is the best method while @Cousineau2010 highlighted that it tends to reduce the spread of the population, making the observed distribution more leptokurtic, and possibly increase the likelihood of a type-I error. @Dang2009 advocated that a more elaborate technique involves replacing outliers with possible values (e.g. multiple imputations) while @Barnett1994 stressed that the best option is to remove or winsorize them. Alternatively, @Pollet2017 argued that inclusion or exclusion of outliers depend on the significativity of the results. According to them, if results are more significant without outliers, scholars should remove them.

Following the mindset of @Pollet2017, I removed outliers from the database. Influential outliers have been identified based on the Cook's distance [@Cook1977] which is a common statistical tool to assess the influence of outliers [@JPStevens1984; @Cousineau2010; @Zuurprotocoldataexploration2010]. Cook's Distance observes

the difference between the regression parameters of a given model, $\hat{\beta}$, and what they become if the i_{th} data point is deleted, let's say $\hat{\beta}_i$. See *"[Appendix C: Outliers Treatment]"* for further details on how I proceed.

The Impact of Process-Based CEP on Outcome-Based CEP

Table 0.4 reports the main results of the analysis of the impact of process-based CEP (i.e. SPL, STC and AS) on outcome-based CEP (i.e. CaP, WatP and WastP). Given the p-value of the F test, all models have FE making the *fixed effects estimation* the most efficient estimator.

Except for Model (1) which indicates no significant relation between SPL and CaP, all models show evidence of a positive and highly statistically significant effect of process-based CEP on outcome-based CEP. Indeed, results demonstrate that companies, which link the remuneration of any member of a company's senior executive team with the achievement of environmental performance targets, have a better WatP (+0.022%) and WastP (+0.025%). The fact of having a sustainability committee on the board of directors level increases the CaP (+0.058%), WatP (+0.067%) and, WastP (+0.046%). Finally, companies having their latest reported environmental metrics audited by a third party have a higher CaP (+0.057%), WatP (+0.068%) and, WastP (+0.071%). Hence, hypothesis 1 is verified.

The Impact of CEP on CFP

Table 0.5 reports the main results of the analysis of the impact of both process-based CEP (i.e. SPL, STC and AS) and outcome-based CEP (i.e. CaP, WatP and WastP) on short-term CFP (ROA) and long-term CFP (i.e. TobinsQ). Based on the pvalue of BPLM and F tests, model (4) has been estimated with the *pooled OLS estimation* while model (5) has been estimated with the *fixed effects estimation*.

Model (4) shows evidence of a positive and statistically significant effect of SPL, AS, and WaP on *long-term CFP*. Model (5) shows evidence of a positive and statistically significant effect of SPL, STC and CaP on *short-term CFP*.

More precisely, regarding process-based CEP variables, results stress that companies, which link the remuneration of any member of a company's senior executive team with the achievement of environmental performance targets, are characterized by both a higher Tobin's Q (+0.079) and ROA (+0.008). Then, the fact of having a sustainability committee on the board of directors level increases the ROA (+0.012). Finally, companies having their latest reported environmental metrics audited by a third party have a higher Tobin's Q (+0.158). Regarding outcome-based CEP variables, results demonstrate that a 1% increase of carbon productivity increases the ROA (+0.03) and a 1% increase of water productivity increases the Tobin's Q (+0.337). Hence, hypotheses 2, 3, 4 and 5 are verified.

Regarding control variables, firm size and industry sector negatively and significantly influence CFP in both models while growth has a positive impact, with an effect more pronounced in Model (4). These results support previous research [@EndrikatMakingsenseconflicting2014; @MiroshnychenkoGreenpracticesfinancial2017]. Against all odds, leverage does not have any significant impact.

Table 0.1: Descriptive Statistics

Statistic	N	Mean	St. Dev.	Min	Max
ROA	1,176	0.06	0.07	−0.62	0.42
TobinsQ	1,038	0.10	0.38	−1.30	1.08
Leverage	1,130	1.51	8.02	0.00	157.90
Growth	1,174	0.12	0.24	−2.04	5.96
FirmSize	1,172	10.35	0.60	8.45	12.51
Industry	1,177	4.59	2.65	1	11
CaP	1,177	0.12	0.18	0.00	0.97
WaP	1,177	0.09	0.18	0.00	0.99
WastP	1,177	0.07	0.17	0.00	0.97
SPL	1,177	0.49	0.50	0	1
STC	1,177	0.48	0.50	0	1
AS	1,177	0.47	0.50	0	1

Table 0.2: Correlation Matrix

	1	2	3	4	5	6	7	8	9	10	11
1. ROA											
2. TobinsQ	0.40***										
3. Leverage	-0.02	0.03									
4. Growth	0.19***	-0.02	-0.07**								
5. FirmSize	-0.27***	-0.66***	-0.02	0.09***							
6. Industry	-0.10***	-0.09***	-0.05*	0.00	0.06**						
7. CaP	0.09***	0.02	0.03	0.00	0.07**	0.04					
8. WaP	0.08***	0.03	0.06**	-0.02	0.08***	0.02	0.67***				
9. WastP	0.07**	0.01	0.08***	-0.01	0.07**	0.08***	0.56***	0.69***			
10. SPL	-0.05*	-0.11***	-0.02	-0.02	0.29***	0.09***	0.06**	0.14***	0.15***		
11. STC	0.00	-0.10***	-0.01	-0.04	0.29***	0.06**	0.21***	0.26***	0.24***	0.48***	
12. AS	-0.04	-0.08**	0.01	0.05*	0.26***	0.04	0.21***	0.26***	0.28***	0.50***	0.46***

Note : * p<0.1; ** p<0.05; *** p<0.01

Table 0.3: Variance Inflation Factor

	ROA	TobinsQ
SPL	1.543	1.487
STC	1.507	1.475
AS	1.527	1.514
CaP	1.862	1.846
WaP	2.477	2.425
WastP	1.966	2.008
Leverage	1.021	1.027
Growth	1.029	1.026
FirmSize	1.155	1.134
Industry	1.025	1.020

Table 0.4: 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
R^2	0.116	0.145	0.139
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

Table 0.5: The Impact of Process and Outcome-Based CEP on CFP (Lag = 1)

	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
R^2	0.505	0.290
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