sustainability

MDPI

Article

Carbon Emissions by South American Companies: Driving Factors for Reporting Decisions and Emissions Reduction

Carmen Córdova [1,*], Ana Zorio-Grima [2] and Paloma Merello [2]

[1] Department of Business Sciences, Universidad Técnica Particular de Loja, San Cayetano alto s/n, Loja 11-01-608, Ecuador
[2] Department of Accounting, Universitat de València, Av. Tarongers, s/n, 46071 Valencia, Spain; Ana.zorio@uv.es (A.Z.-G.); Paloma.merello@uv.es (P.M.)
* Correspondence: crcordova2@utpl.edu.ec; Tel.: +593-07-959-531986

Received: 25 May 2018; Accepted: 3 July 2018; Published: 11 July 2018

Abstract: In the last decade, companies have started to disclose information on carbon emissions. To our knowledge, this is the first paper to look into this phenomenon in South America, which is a very important geographical area regarding climate change because of the local nature and developing economies. This paper explores the relationships between some corporate variables and two important decisions: (i) whether to report carbon emissions, and (ii) the impact on the evolution of carbon emissions. Logit and linear panel data models are used to determine the driving factors for decisions (i) and (ii). Our results show that regarding the carbon reporting decision, a company's size, sustainability reporting, existence of a sustainability committee, and whether it belongs to a certain sector (telecom, utilities, and consumer discretionary) are significant positive factors, whereas the country is a negatively significant factor if the company is based in either Chile or Peru. Regarding the factors that lead to more sustainable behavior, our results reveal that a company's size, the existence of a corporate social responsibility (CSR) committee, and the disclosure of a sustainability report lead to a decrease in emissions levels.

Keywords: GHG; CO_2 emissions; disclosure; South America

1. Introduction

In the last decade, companies have started to disclose information on greenhouse gas (GHG) emissions. In fact, the GHG Protocol has issued globally followed standards for accounting and reporting GHG emissions both for the private and public sector, taking into account value chains and mitigation actions. Although reporting occurs on a voluntary basis most of the time, these standards are followed all around the world, and are probably the most important action for climate policy-making so far. More specifically, the Corporate Accounting and Reporting Standard issued by the GHG Protocol sets the accounting platform for nearly all of the corporate reporting programs in the world, covering seven GHGs included in the Kyoto Protocol: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3). The standard was updated in 2015 with the Scope 2 Guidance, which allows companies to credibly measure and report emissions from purchased or acquired electricity, steam, heat, and cooling. Note that fossil fuel-based energy is one of the most important sources of emissions in Latin America [1], and that 92% of the Fortune 500 companies responding to the CDP (Carbon Disclosure Project) used this standard from the GHG Protocol (according to the GHG Protocol webpage).

CDP runs a global disclosure system allowing companies, cities, states, and regions to measure and manage their environmental impacts. CDP produces the most comprehensive database of self-reported environmental data in the world, which is used by policy-makers as well as a wide network of investors and purchasers, representing over $95 trillion [2]. Note that investors may be interested in carbon emissions as a signal of their investment risk, and purchasing managers are concerned about the carbon footprint of their inputs, as the consumers are beginning to be able to find carbon-labeled products in the marketplace [3]. In fact, as CDP [4] reports, a Norwegian pension fund worth $260 billion was divested from companies that did not meet the standards on climate change risk mitigation. In Latin America, no similar initiative on sustainable investment has been reported in the literature, yet through funding from the government of Norway, a sustainable returns project is about to be extended to some African and Latin American counties by the International Finance Corporation, which is a member of the World Bank Group [5]. Therefore, the CDP initiative has achieved great levels of environmental disclosure, which has consequently allowed researchers to analyze the existence and completeness of GHG disclosures, the levels of emissions, and their evolution through time.

In fact, recent research has begun to look into this trend in developed countries. Nonetheless, to our knowledge, this is the first paper to analyze this phenomenon in companies located in South America, which is a very important geographical area regarding climate change because of its natural resources and developing economies.

Some authors have explored the concept of social responsibility in this geographical context [6], as well as the trend of disclosing sustainability reports and even submitting them to external assurance. Sierra-Garcia et al. [7] analyzed the corporate social responsibility (CSR) reports from 12 countries in Latin America during the period 2006–2010; they concluded that this is a region committed to sustainability (especially in Brazil, Mexico, and Chile) and identified the factors leading to the external assurance of this report. Zorio-Grima et al. [8] went a step further and did a content analysis of the CSR assurance report. However, no academic research to date has analyzed the disclosure of GHG emissions and its implications in this part of the world.

Hickman [9] concluded that private companies will invest in the accurate measurement and management of their GHGs only as long as they perceive that stringent mandatory GHG emission controls and a global market-based instrument are likely to be adopted in a coherent international regulatory setting. However, some companies strive for pre-compliance with a view of getting first-mover advantages over their competitors. This is the case of the companies that we analyze in this study, since only the governments from Chile, Brazil, and Colombia are considering introducing a market-based instrument as a climate-policy action. This local approach, which takes into consideration the possibility of implementing an Emissions Trading System (ETS), explains the composition of our sample. Even though our initial research design planned to cover all South American countries, the data-gathering process revealed that CO_2 data was only available for some companies from Chile, Brazil, and Colombia, and just one company from Argentina and two companies from Peru.

In fact, the purpose of this study is to explore the relationships between some corporate variables (e.g., sustainability reporting, the existence of a sustainability committee, and financial reporting variables) and two important decisions, which are: (i) whether to report carbon emissions and (ii) the impact on the yearly variation of carbon emissions.

Regarding GHGs, this study focuses on the disclosure of carbon emissions measured in tCO_2eq (or ton of CO_2 equivalent), since in addition to CO_2 emissions, there are several emissions of CH_4, N_2O, NO_X, CO, SO_2, and non-methane volatile organic compounds (NMVOC) from industries such as cement, minerals, or even utilities, which are all converted to tCO_2eq. We gather the information on total emissions, Scope 1 emissions, and Scope 2 emissions. Scope 1 emissions include all of the direct emissions that are under the control of the reporting entity, such as emissions from the entity's own vehicles or factories, whereas Scope 2 emissions include all of the indirect emissions from consumption of purchased electricity, heat, or steam. We do not take Scope 3 emissions into account.

This study makes a valuable contribution to existing research, as it fills a gap on CO_2 disclosures and the yearly variation of CO_2 emissions in this geographical area, which is important regarding climate change. The evidence obtained confirms the expectation that sustainability reporting and sustainability concern at the corporate governance structure is translated into better sustainability reporting and performance regarding CO_2 emissions. This evidence suggests interesting implications for policy-makers and citizens in general, as the final aim is to increase awareness of the risks of climate change and corporate action in this field in order to promote sustainable development.

The remainder of this paper is structured as follows. The next section provides some background to understand the legal framework on climate change in South American countries. A brief literature review on GHG emissions is then presented in order to introduce the hypotheses development for the study. The data and methodological issues are considered in the next section. The results are then presented and discussed. The final section closes with a summary of the findings obtained, and some concluding remarks.

2. Legal Frameworks on Climate Change in South American Countries

Even though Latin America represents approximately only 11.7% of GHG emissions in the world [10], the countries in the region are making important adaptation and mitigation efforts. Indeed, urgent action is required as some of its areas are highly vulnerable to the impacts of climate change. As we analyze next, some countries in South America are leading the way forward toward sustainability.

Brazil's National Climate Change Policy (PNMC) was enacted in December 2009, with the aim of developing a domestic market for emissions reductions. The Brazilian government is currently considering the introduction of several carbon-pricing instruments such as an ETS and a carbon tax. In fact, the Ministry of Finance has launched a campaign on carbon pricing instruments addressed to stakeholders by means of higher engagement, communication, and consultation about this process. Brazil has established mandatory goals for the reduction of GHG emissions (Federal Law 13576 of 26 December 2017), setting a trading mechanism for emissions reduction units obtained from switching from fossil fuels to biofuels. In addition, leading companies in Brazil have been participating in a voluntary ETS simulation since 2013, managed by the Rio de Janeiro Green Stock Exchange (BVRio) and coordinated by the Centro de Estudos em Sustentabilidade da Fundação Getúlio Vargas, with up to 23 companies from several industries in 2015 [11].

In 2017, the Colombian government issued the National Policy on Climate Change, setting the vision, instruments, and action plan for climate change policy in Colombia in order to influence public and private decisions. In the medium-term, Colombia is also considering introducing an ETS. In fact, the Colombian Stock Exchange is currently developing a platform for the registry and operation of verified emissions reductions. In 2016, Colombia approved the implementation of a carbon tax on the carbon content of fossil fuels that will be devoted to funding environmental and rural development projects.

According to the International Carbon Action Partnership [11], in 2014, Chile approved a carbon tax for fixed emission sources consisting of turbines or boilers beginning on 1 January 2017, and a tax on local pollutants, such as SO_2 and NOx. The purchase of new lightweight vehicles is levied with a tax on NOx since 2015, depending on the NOx emissions/km, fuel efficiency, and purchase price. Chile is also considering implementing an Emissions Trading System (ETS) in the long term [12].

Argentina and Peru are the other two countries in the region where very recent developments have taken place in this field.

In Argentina, Decree 891/2016 created a National Cabinet for Climate Change (NCCC), which is chaired by the chief of the Argentinian Cabinet, with representatives from the Ministries of Energy, Transport, Environment, Economic Development, Agriculture, Education, Social Development, Science, Interior, and Culture, as well as Foreign Affairs. Its main goal is to articulate climate change policies across national departments and agencies at the national and local levels, drafting a National Plan for

Response to Climate Change and putting forward action plans for mitigation and adaptation in the most vulnerable and key sectors.

In 2013, Peru drafted a Law on Climate Change. In 2018, the Peruvian Congress approved the regulation (Law No. 30754), establishing obligations regarding GHG reduction for the different State sectors at the national, subnational, and local levels. The law aims at reducing the vulnerability of the country to climate change, taking advantage of the opportunities of low carbon growth and fulfilling the commitments assumed by Peru in the United Nations Framework Convention on Climate Change. The Ministry of Environment has to present an annual report to the Parliament that includes information on the progress regarding their Nationally Determined Contribution (NDC). The Ministry should also receive reports on the progress of sectoral NDCs from other ministries and public entities, and ensure compliance with the NDC targets for Peru. Indeed, Peru's NDCs are described by the law itself as one of the country's instruments for climate management, with binding effects on the competent authorities and their institutional budgets. The law also lists the principles for climate change mitigation and adaptation (i.e., integration, subsidiarity, accountability, transparency, participation, climate governance, and prevention), and gives details on how to pursue mitigation efforts.

United Nations Environment Programme (PNUMA) [10] describes in further detail the legal framework in all of the Latin American countries regarding climate change, as well the national commitments regarding reductions of GHG (NDC) that these countries filed with the United Nations Framework Convention on Climate Change (UNFCCC) in 2015.

As governments are increasingly concerned about sustainability and climate change, citizens and companies also develop higher degrees of sensitivity toward GHG emissions, especially if governmental action is expected to implement an Emissions Trading System (ETS) in the near future [4]. In fact, this reason is key to understanding the composition of the sample in our study, as well as interpreting the results obtained regarding the country variable for the first set of models.

3. Literature Review and Hypotheses Development

In the Latin American region, very scarce research has been published regarding carbon emissions; for instance, in 2015 Vasquez et al. analyzed the case study of a university campus in Chile. To our knowledge, no one yet has analyzed carbon reporting by companies from South American countries, even though sustainability reporting and assurance have been looked into in this region by prior studies [7,8,13].

However, burgeoning research from the last decade identifies the factors that determine the companies' level of environmental reporting. For instance, Andrikopoulus and Kriklani [14] conclude, using a sample from the Copenhagen Stock Exchange, that firm size, financial leverage, the market-to-book ratio, and profitability are significantly associated with levels of environmental disclosure. These disclosures quite often follow the Global Reporting Initiative (GRI) guidelines. The GRI is an independent organization that supports sustainability reporting by providing a reporting framework to participating organizations [7,8].

There is an increasing demand of information by the capital markets and pressures from stakeholders who care for climate change—e.g., Zuraida et al. [15] found the value relevance of environmental, social, and governance (ESG) reporting by companies from 38 countries. As a result, the stakeholder theory and the legitimacy theory are often cited to frame research not only about general social corporate responsibility reporting, but also on GHG emissions [16–18]. Indeed, Liesen et al. [16] explored whether external stakeholder pressure influences the existence and the completeness of voluntary GHG emissions disclosures by 431 European companies. Their findings are consistent with stakeholder theory as companies respond to external stakeholder pressure by reporting GHG emissions, as well as with legitimacy theory in the sense that firms can use carbon reporting, even if information is incomplete, to address legitimacy exposures. A study on a sample from the US S&P 500 index [19] found that carbon-related disclosures increased from 2006 to 2008; it concluded that

many firms answered the CDP questionnaire, but did not disclose the emission amounts, or their emissions-accounting methods were consistent with the legitimacy theory literature, in the sense that firms sometimes disclose the minimum level of information in order to avoid scrutiny. Some studies provided evidence of a positive relationship between environmental performance and climate change disclosure, which is consistent with voluntary disclosure theory [20,21]. If there is an increase of direct GHG emissions, corporate managers tend to disseminate less information in order to attract less attention from investors, governmental authorities, and other stakeholders, giving the impression of an 'average' performance firm.

In the field of CO_2 reporting and usefulness for a wide variety of stakeholders (from investors to consumers and the general public), Jackson and Belkhir [22] used CO_2 data from the automotive industry to provide a ranking of the individual car companies relative to their sector's GHG emissions, design a framework to identify the sector's leader, and assess actual sustainability performance against current and future performance targets. They proposed standardizing voluntary reporting in such a way that emissions intensity used the entities' revenue as the denominator as a means for facilitating the comparability and accountability of carbon emissions.

Focusing the stakeholders under analysis to only shareholders, the results of Mae Matsumura et al. [23] provided evidence that the markets penalize companies for their carbon emissions, but the penalty is even higher if the firms do not report on emissions. This finding reinforces the idea that capital markets are sensitive to emissions, and voluntary disclosure can help decision makers regarding firm valuations. Along the same lines, other results [24] indicate that for an S&P 500 index firm, GHG emissions impose an average equity discount of $79 per ton, which is about 0.5% of market capitalization. On the other hand, Krishnamurtia and Velayuthamn [25] found that Australian firms that voluntarily disclose higher-quality information on GHG emissions experience reduced stock price volatility and improved stock market liquidity.

Research is also conclusive regarding the positive links between corporate governance and carbon reporting. Looking into the effect of the United Kingdom (UK) 2009 guidance on GHG disclosure, a study with a sample of 215 companies from the FTSE 350 index for the period between 2008–2011 [26] developed a GHG disclosure index and concluded that corporate governance variables (such as director ownership, board size, and ownership concentration) affect the extent of GHG disclosure. Their results also indicate that companies increased their disclosures in anticipation of the publication of the UK 2009 Department for Environment, Food and Rural Affairs (DEFRA) guidelines. Also, with a sample of the largest UK companies [27], the results provided evidence that board gender diversity and the percentage of independent directors on the board increase the likelihood of GHG disclosure in terms of propensity and completeness. In addition, the presence and independence of an environmental committee have a significant impact on GHG reporting, which is consistent with the idea that the environment committee is connected with environmental strengths and concerns [28]. In the case of New Zealand [29], a study of companies including firms both with and without ETS compliance obligations found that economic and regulatory environmental pressures, the level of proactiveness within the emissions management strategy, the level of integration of carbon issues in strategic and operational processes, and the perceived importance of carbon issues are the significant drivers of tight carbon-focused budgetary control. Therefore, carbon control depends on top management's strategic perception and responsiveness to carbon issues. However, Krishnamurtia and Velayuthamn [25] concluded that Australian firms with combined audit and risk committees tend to disclose less information on carbon emissions.

The relationship between GRI reporting and the level of GHG emissions has just started to receive the attention of academics. Belkhir et al. [30] pioneered investigating whether GRI reporting really helped improve sustainability performance regarding GHG. These authors looked into CO_2 emissions data from 40 United States (US) A-level GRI-reporting companies and a control group of 24 non-reporting companies, covering the period 2007–2012. Their results are rather disappointing, as they found that the mean of the CO_2 five-year cumulative change for the GRI reporting group

was an actual increase of about 6% in absolute emissions, while non-GRI entities showed a decrease of about 3%. These results suggest that GRI reporting, by itself, has no direct impact on companies' sustainability performance, proposing that the drivers are the use of natural gas, business strategy, government laws and regulations, or public opinion, which seem equally shared by both GRI and non-GRI entities. The largest companies listed in the London Stock Exchange, according to Broadstock et al. [31], show a non-linear relationship of carbon emissions that initially increases with firm performance, and then decreases. Also, these authors conclude that the decision to report emissions is not directly affected by the social/governance disclosure attitudes of the company; this suggests that firms disassociate environmental responsibility from social responsibility, which is in line with [30].

In light of the above previous research, we posit the following hypotheses regarding the decision to report on carbon emissions:

Hypothesis 1a. *Firms' decision to report carbon emissions is driven by the sustainability profile of the company proxied by the publication of a CSR report.*

Even though in Anglo-saxon settings, evidence has been obtained that there is no direct association between CSR reporting and the level of emissions [30,31], it can be expected that in a very different region such as South America, if a company is committed to sustainability reporting, it will be more prone to disclose carbon emissions.

Hypothesis 2a. *Firms' decision to report carbon emissions is driven by the sustainability profile of the corporate governance structure of the company, proxied by the existence of a CSR committee.*

According to extant research, even though a combined audit and risk committee may imply lower carbon reporting [25], an environmental committee has been found to have a positive significant impact on GHG reporting [27].

Hypothesis 3a. *Firms' decision to report carbon emissions is dependent on corporate characteristics such as size, increases in assets and revenues, leverage or firm return, country, and sector.*

These factors are normally taken into account as control variables in research exploring sustainability reporting behavior [7,8], or even the decision to inform on carbon emissions. In fact, size and return on equity (ROE) have been positively and significantly associated with the carbon reporting decision [16]. One might expect that companies from countries where the government is considering the idea to implement a market system for emissions trading might be more prone to anticipate carbon accounting and disclosure [9].

As regards the sustainable performance of companies in terms of yearly variation of carbon emissions, we posit the following hypotheses:

Hypothesis 1b. *Firms' yearly variation of carbon emissions is influenced by the sustainability profile of the company, proxied by the publication of a CSR report.*

One may expect that a South American company that is committed to sustainability reporting should be more prone to monitor their levels and reduce carbon emissions. However, the only existing research on this link is based on a very different setting such as the US, and the authors find that GRI reporting is not associated with carbon emissions reductions, but rather with an increase [31].

Hypothesis 2b. *Firms' yearly variation of carbon emissions is influenced by the sustainability profile of the corporate governance structure of the company, proxied by the existence of a CSR committee.*

Our analysis goes one step further than extant research, and we posit that similarly to an environmental committee making GHG reporting more likely [27], the existence of such a committee should imply a higher monitoring of pollution levels and efforts to reduce carbon emissions.

Hypothesis 3b. *Firms' decision to report carbon emissions is dependent on corporate characteristics such as size, increases in assets and revenues, leverage, or firm return.*

Again, we consider these factors as control variables following extant research. For instance, ref. [31] takes into account return on equity (ROE) and assets in order to assess the levels of emissions.

4. Sample and Methods

Our sample includes listed companies from South American countries with a minimum market capitalization of 2500 million US dollars (USD). Data were downloaded from the Eikon database (Thomson Reuters) for all of the companies from South American countries. However, the country of the headquarters where the CO_2 reporting companies are located takes the following values: Argentina, Brazil, Chile, Colombia, and Peru. No CO_2 complete information was available for companies located in Bolivia, Ecuador, Uruguay, and Venezuela, so we had to delete the observations from these South American countries with no carbon reporting companies in order to be able to keep the country variable as an explanatory factor for the carbon-reporting decision.

This is consistent with the information published by CDP [4] on GHG emissions, where no companies from any of these five countries are reported to have sent their data to CDP, as opposed to the other countries with reporting companies; this is coherent with the specific national regulatory approaches to climate change that were explained in section two above.

This study considers a four-year period, covering from 2013 to 2016. However, the panel data is unbalanced, as some companies do not have complete information for the whole period under analysis.

All of the financial data are in US dollars (USD), and consolidated data from the financial statements.

The dependent variables considered are as follows. In the reporting decision models, we look into three dichotomous variables (*report_tco2*, *report_scope1* and *report_scope2*), which are equal to 1 when the company reports the total value, Scope 1, or Scope 2 of its CO_2 emissions for that year, respectively. Note that the missing information for the CO_2 emissions has been categorized as zero, as we assume that it is not easily available for the public because of a non-transparent corporate reporting policy in this field. The sample for this model includes 496 observations.

In addition, we also look into the evolution of emissions. As a result, the three dependent variables analyzed by the CO_2 emissions evolution models are: the annual variation of emissions (in tons) for the total CO_2 emissions, emissions according to Scope 1, and emissions according to Scope 2 (*var_tco*$_2$, *var_scope1* and *var_scope2*). The annual variations are calculated as the difference between the emissions in year t minus the emissions in year $t-1$. The total CO_2 and CO_2 equivalent emissions in tons is the sum of Scope 1 and Scope 2 emissions; however, note that some companies report total CO_2 emissions, but avoid the disclosure of the scopes (Scope 1 emissions are direct emissions, and Scope 2 emissions are indirect emissions from energy consumption).

The following independent variables are considered. As a proxy of size, we consider the logarithm of total assets (*logassets*) and the variable *employees*, which is obtained as the average of the number of employees at the beginning and at the end of the fiscal year.

We consider five variables capturing the economic and financial position of the company every period: Return on Assets (*roa*), which is calculated as (Net income/Total Assets)*100; Return on Equity (*roe*), which is calculated as (Net income/Total Equity)*100; *leverage* as (Total Liabilities/Total Assets)*100; increase in assets (*incrassets*) obtained as ((Total_Assets$_{t+1}$ − Total_Assets$_t$)/Total_ Assets $_t$)*100; and increase in revenues (*incrrevenue*) obtained as ((Total_revenues$_{t+1}$ − Total_revenues$_t$)/Total_revenues$_t$)*100, where Total_revenues$_t$ represents

the revenue from all of a company's operating activities after deducting any sales adjustments and their equivalents in the fiscal year *t*.

The sample is composed by a wide variety of companies in terms of their economic and financial position, as well as in terms of CO_2 emissions (Table 1). Some independent variables are significantly correlated. However, the Pearson correlation coefficient is always lower than 0.6 (Pearson-r = 0.47, for the pair of variables *logassets* and *employees*).

Table 1. Descriptive statistics. CSR: corporate social responsibility; ROA: return on assets; ROE: return on equity; USD: United States dollars.

Variable	Expected Sign	Mean	Std. Dev.	Min	Max
Independent variables					
Total assets	+	2560.00	15,300.00	0.47	320,000.00
Employees	+	24,863.86	39,962.33	77.00	237,541.00
incrassets	+	−0.24	35.72	−91.60	531.61
incrrevenue	+	23.54	441.95	−99.93	9746.41
ROE	+	7.81	45.04	−463.30	268.80
ROA	+	3.62	15.61	−123.96	221.73
Leverage	−	60.97	25.97	7.46	354.28
CSR report	+	0.66	0.47	0	1
CSR committee	+	0.47	0.49	0	1
Argentina		0.05	0.21	0	1
Brazil		0.65	0.48	0	1
Chile		0.16	0.37	0	1
Colombia		0.08	0.27	0	1
Peru		0.06	0.25	0	1
Consumer Discretionary		0.14	0.34	0	1
Consumer Staples		0.13	0.34	0	1
Energy	+	0.06	0.24	0	1
Financials		0.07	0.26	0	1
Health Care		0.03	0.18	0	1
Industrials	+	0.10	0.30	0	1
Information Technology		0.02	0.15	0	1
Materials	+	0.17	0.37	0	1
Real Estate		0.03	0.18	0	1
Telecommunication Services		0.04	0.19	0	1
Utilities	+	0.21	0.41	0	1
DEPENDENT VARIABLES					
CO_2 total		3,746,797	10,300,000	278	81,000,000
CO_2 Scope1		3,442,709	10,400,000	65	80,000,000
CO_2 Scope2		285,954	510,994	33	3,100,000
var_tco_2		230,482	1,797,002	−12,000,000	10,000,000
var_scope1		161,322	1,589,802	−11,000,000	9,300,000
var_scope2		−5771	301,067	−2,304,290	1,911,993

Financial data in millions (USD), ratios in percentage (%), and carbon emissions data in tons equivalent (tCO_2eq). Column expected sign indicates the a priori hypothesis about the direction of the association of variables in the probability of disclose CO_2 information, where "+" indicates a positive relation and "−" a negative relation.

As regards the sustainability profile of the company, two variables are considered. Regarding CSR reporting, *CSR_report* takes the value 1 when the company publishes a separate CSR report or publishes a section on its annual report on CSR. Regarding corporate governance and sustainability concern, the variable *CSR_committee* is equal to 1 when the company has a CSR committee or a team in that period. As can be seen in Table 1, 66% of the observations have a CSR report, and 47% have a CSR committee.

As regards the composition of the sample, the representation of the years in the sample (Table 2, panel A) is quite proportional (34% of data corresponds to year 2016, 23% corresponds to 2015, 22% corresponds to 2014, and 21% corresponds to 2013). However, for the cases of Peru and Argentina, the data mainly correspond to 2016, but also in those countries, the companies reporting CO_2 data are almost negligible (Table 2, panel B).

As regards the headquarters' country, 321 observations out of N = 496 (65%) are from Brazil, 16% are from Chile, 8% are from Colombia, 6% are from Peru, and 5% are from Argentina (Table 2, panel A).

As can be seen in Table 2, panel B, the Colombian companies in the sample are the ones that report most often on CO_2 emissions (82% of the observations from that country), followed by Brazil (53% of the observations from that country report on CO_2—i.e., 169 observations, which is the highest in absolute values), Chile (40% of the country observations), Peru (6%), and Argentina (with just one observation with information on CO_2 emissions—i.e., 4%). Note that companies from Chile are the ones reporting higher total emissions on average (5.2 million tons), followed by Brazil and Colombia.

Table 2. Sample composition.

Panel A: Firms' Data per Year					
	2016	**2015**	**2014**	**2013**	**TOTAL**
Argentina	22	2	0	0	24
Brazil	78	82	82	79	321
Chile	28	18	18	17	81
Colombia	14	8	8	8	38
Peru	25	3	2	2	32
TOTAL	167	113	110	106	496

Panel B: Headquarters' Country								
		CO_2 Total			**CO_2 Scope 1**		**CO_2 Scope 2**	
	Total obs.	**RO**	**%**	**Average**	**RO**	**Average**	**RO**	**Average**
Argentina	24	1	4%	589,167	1	18,321.5	1	570,845
Brazil	321	169	53%	3,600,000	157	3,500,000	159	331,351
Chile	81	32	40%	5,200,000	25	3,400,000	25	85,606.3
Colombia	38	31	82%	3,500,000	31	3,300,000	31	205,495
Peru	32	2	6%	204,457	0		0	

Panel C: Industry Classification								
		CO_2 Total			**CO_2 Scope 1**		**CO_2 Scope 2**	
	Total obs.	**ROs**	**%**	**Average**	**RO**	**Average**	**RO**	**Average**
Consumer Discretionary	67	23	34%	84611.4	23	40,015.4	23	44,595.9
Consumer Staples	64	34	53%	1,100,000	28	877,528	28	354,916
Energy	30	15	50%	22,000,000	14	24,000,000	14	429,062
Financials	35	11	31%	2526.2	11	891.605	11	1634.59
Health Care	17	4	24%	25,056	0		0	
Industrials	51	25	49%	2,500,000	22	2,800,000	24	21,241.2
Information Technology	11	4	36%	2810.36	4	2389.49	4	420.878
Materials	82	38	46%	6,300,000	37	5,800,000	37	593,802
Real Estate	16	3	19%	34,311.7	3	5912.76	3	28,398.6
Telecommunication Services	18	14	78%	151,793	14	22,122.7	14	129,670
Utilities	105	64	61%	3,200,000	58	1,800,000	58	351,642

RO stands for number of observations reporting CO_2 data.

Regarding the industry variable, the Primary Global Industry Classification Standard (GICS) sector for the firm is considered. The categorical variable sector includes the following categories: energy, consumer staples, consumer discretionary, financial, health, industrials, technology, materials, real estate, telecommunication services, and utilities. The sector that is more represented is utilities, with 21% of the sample—i.e., 105 observations out of *N* = 496 (Table 2, panel C). As regards the sectors with a higher propensity to disclose CO_2 data, 78% of the observations from the telecommunication services inform about CO_2 emissions (note though that those companies only represent the 3.6% of the sample), and 61% of the observations from the utilities sector do so—which was 64 observations in absolute values. Real estate is the sector with the lowest percentage of observations reporting CO_2 emissions (19%). Note that the companies in the materials sector are the ones reporting the highest total emissions on average (6.3 million tons), whereas financial companies are the ones reporting the lowest values (2526 tons on average for total emissions).

Data have been disaggregated by sector and country, and it can be guaranteed that no bias is presented by countries with a greater representation of examples of sectors with low reporting.

As the sample comprises panel data, logit and linear panel data models are computed using Stata 12.

5. Results

5.1. Models on the CO_2 Reporting Decision

Firstly, we analyze through a logistic model whether the probability of reporting CO_2 emissions is influenced by the financial position, sector, country, and sustainable profile of the firm (proxied by CSR reporting and the existence of a sustainability committee in the corporate governance structure).

Models in Table 3 are estimated with random effects (RE), since the Hausman test is non-significant (p-value > 0.05). We use RE models, as some independent variables vary greatly across individuals, but have little variation over time for each individual, so fixed effects estimates would be imprecise with large standard errors.

The models are significant, and the standard error of the significant variables is smaller than their estimated coefficient, so no estimation problems are identified in the parameters caused by multicollinearity. In addition, note that the variable *employees* has been excluded from the final models (Table 3), since its inclusion causes the model to be non-significant.

The financial sector and Colombia are considered the benchmark in the models.

The models correctly classified more than 83% of the cases (cases correctly predicted/total cases), with a sensitivity that is always higher than 85% when identifying the firms reporting CO_2 emissions. The default limit point of the calculated probability is set to 50% (0.5). The odds ratio is a measure of how much higher/lower the probability that an event will happen is than the probability that it will not occur.

Note that the size of the company (log assets) significantly increases the probability of reporting information regarding CO_2 emissions (total, Scope 1 and Scope 2).

The sector and the country where the headquarters is located are also significantly related to the probability of reporting the emissions. As regards the sector, in the telecommunication services, utilities, and consumer discretionary, the probability of reporting the direct CO_2 emissions (Scope 1) is 98.98, 8.47, and 10.42 times the probability of not reporting, respectively, when the rest of the variables remain constant, compared with the financial sector. In the case of total emissions, only the telecommunication and the utilities sector are significantly increasing the probability of carbon reporting.

On the other hand, compared with the benchmark (Colombia), companies located in Chile have a significantly lower probability of reporting the CO_2 emissions. As regards the total emissions, the probability of not reporting that information in companies from Chile is 17.13 times more than the probability of reporting. Note that it has been obtained as the inverse of the odds ratio (0.058^{-1}). For the case of the two companies located in Peru, the probability of not reporting total emissions is 187.79 times the probability of reporting (0.005^{-1}). However, due to the lack of data, this effect cannot be assumed as generalized in the country.

In addition, having a CSR committee as well as publishing a CSR report positively increases the probability of reporting information of CO_2 emissions for the three measures (total emissions, Scope 1, and Scope 2).

Table 3. Logit panel data models for the probability of reporting the CO_2 emissions.

	Model 1 CO_2 Total					Model 2 CO_2 Scope 1					Model 3 CO_2 Scope 2				
	Coef.	**Odds Ratio**	**Std. Err.**	**z Statistic**	**P > |z|**	**Coef.**	**Odds Ratio**	**Std. Err.**	**z Statistic**	**P > |z|**	**Coef.**	**Odds Ratio**	**Std. Err.**	**z Statistic**	**P > |z|**
logassets	1.621	5.058	0.899	1.8	0.071 *	2.19	8.935	1.006	2.18	0.029 **	2.078	7.988	1.012	2.05	0.04 **
roa	0.003	1.003	0.052	0.05	0.956	−0.025	0.975	0.047	−0.53	0.599	−0.019	0.981	0.049	−0.38	0.702
roe	−0.009	0.991	0.01	−0.91	0.365	−0.008	0.992	0.01	−0.84	0.401	−0.009	0.991	0.01	−0.87	0.383
leverage	−0.004	0.996	0.02	−0.22	0.824	0.007	1.007	0.021	0.32	0.75	0.004	1.004	0.021	0.18	0.854
incrassets	−0.005	0.995	0.01	−0.5	0.62	−0.01	0.990	0.009	−1.16	0.247	−0.008	0.992	0.009	−0.94	0.346
incrrevenue	−0.001	0.999	0.01	−0.12	0.908	0	1.000	0.002	0	0.999	0	1.000	0.002	−0.01	0.989
csr_report	6.859	952.414	1.322	5.19	0.000 ***	6.969	1063.159	1.56	4.47	0.000 ***	7.02	1118.787	1.595	4.4	0.000 ***
csr_committee	2.547	12.769	0.711	3.58	0.000 ***	3.465	31.976	0.806	4.3	0.000 ***	3.003	20.146	0.786	3.82	0.000 ***
Country															
Brazil	−1.257	0.285	1.253	−1	0.316	−1.794	0.166	1.26	−1.42	0.154	−1.696	0.183	1.296	−1.31	0.191
Chile	−2.841	0.058	1.487	−1.91	0.056 *	−4.57	0.010	1.575	−2.9	0.004 ***	−4.61	0.010	1.619	−2.85	0.004 ***
Argentina	−3.895	0.020	2.754	−1.41	0.157	−3.795	0.022	2.763	−1.37	0.17	−3.815	0.022	2.824	−1.35	0.177
Peru	−5.235	0.005	2.024	−2.59	0.01 ***	−28.691	0.000	24,114.09	0	0.999	−27.07	0.000	9200.286	0	0.998
Sector															
energy	−0.088	0.916	1.653	−0.05	0.957	−0.438	0.645	1.664	−0.26	0.793	−0.3	0.741	1.718	−0.17	0.861
consumer_staples	−0.336	0.715	1.19	−0.28	0.778	0.026	1.026	1.239	0.02	0.983	0.037	1.038	1.275	0.03	0.977
consumer_discret	1.216	3.374	1.028	1.18	0.237	2.344	10.423	1.147	2.04	0.041 **	2.245	9.440	1.172	1.92	0.055 *
health	2.653	14.197	2.481	1.07	0.285	−23.742	0.000	37,385.96	0	0.999	−22.515	0.000	14,075.09	0	0.999
industrials	1.145	3.142	1.266	0.9	0.366	0.734	2.083	1.303	0.56	0.573	1.17	3.222	1.363	0.86	0.391
technology	3.067	21.477	3.363	0.91	0.362	4.274	71.808	3.873	1.1	0.27	4.071	58.616	3.777	1.08	0.281
materials	0.376	1.456	1.087	0.35	0.73	0.705	2.024	1.161	0.61	0.544	0.675	1.964	1.202	0.56	0.574
telecom	3.428	30.815	2.048	1.67	0.094 *	4.595	98.988	2.187	2.1	0.036 **	4.506	90.559	2.249	2	0.045 **
utilities	2.295	9.924	1.02	2.25	0.024 **	2.137	8.474	1.024	2.09	0.037 **	2.124	8.365	1.046	2.03	0.042 **
Number of observations	496					496					496				
Number of groups	176					176					176				
Specificity	78.16%					85.82%					84.64%				
Sensitivity	89.36%					87.38%					85.65%				
Wald Chi^2	45					40.48					39.75				
$P > Chi^2$	0.002					0.007					0.008				

The dependent variable of models 1, 2, and 3 is the dichotomous variable reporting the total CO_2 emissions, and reporting emissions according to Scope 1 and Scope 2, respectively. ***, **, and * are statistically significant at 1%, 5%, and 10%, respectively. The variables Bolivia, Ecuador, Uruguay, Venezuela, and real estate have been omitted due to perfect collinearity. Specificity and sensitivity are calculated for the default limit point of the calculated probability set to 50% (0.5).

Specifically, companies reporting CSR information have a probability of reporting the total, direct (Scope 1), and indirect (Scope 2) CO_2 emissions that is 952.41, 1063.16, and 1118.79 times higher the probability of not reporting, respectively, when the rest of the variables remain constant. In the case of companies with a CSR committee, the probability of reporting is 12.77, 31.98, and 20.15 times the probability of not reporting for the total, direct (Scope 1), and indirect (Scope 2) CO_2 emissions, respectively.

5.2. Models on the Yearly Variation of CO_2 Emissions

Linear panel data models have been run in order to look into the effects of the financial characteristics and sustainable profile of the firm on the variations of CO_2 emissions (proxied by CSR reporting and the existence of a sustainability committee in the corporate governance structure).

All the models in Table 4 are random effects, since the Hausman test is non-significant (p-value > 0.05). The residuals of the models have been estimated under conditions of robustness. Note also that all of the models are significant, and that the standard error of the significant variables is smaller than the estimated coefficient; thus, no traits of estimation problems are identified in the parameters caused by multicollinearity.

These models consider only those companies reporting CO_2 emissions. As a consequence, the variables sector and country have been omitted in the models due to perfect collinearity.

The size variable (log assets) is negatively significant for the three CO_2 emissions for the three measures (total emissions, Scope 1, and Scope 2). No other financial variable is found to be significantly related with CO_2 emissions except for leverage, which has a negative impact at the 10% level in the Scope 1 model.

Our results reveal that the disclosure of a sustainability report leads to more sustainable behavior in the sense of a decrease in the level of total and direct emissions (models 1 and 2, Table 4). In addition, the existence of a CSR committee significantly decreases the total CO_2 emissions.

As regards Scope 1, the number of employees is positively significant, whereas its interaction with the sustainability reporting is negatively significant. This interesting finding suggests that companies disclosing a sustainability report increase their emissions by 4.07 tons per employee, but if they do not have such a report, the increase is much higher (6.28 tons per employee).

Table 4. Panel data models for the variations of CO_2 emissions.

	Model 1 Variations in CO_2 Total				**Model 2 Variations in CO_2 Scope 1**				**Model 3 Variations in CO_2 Scope 2**			
	Coef.	**Std. Err.**	**z Statistic**	**P > |z|**	**Coef.**	**Std. Err.**	**z Statistic**	**P > |z|**	**Coef.**	**Std. Err.**	**z Statistic**	**P > |z|**
logassets	−836,185.900	371,481.200	−2.250	0.024 **	−721,673.300	308,795.400	−2.340	0.019 **	−138,355.000	83,163.660	−1.660	0.096 *
employees	5.637	3.180	1.770	0.076 *	6.282	2.261	2.780	0.005 ***	0.560	0.402	1.390	0.163
roe	−813.924	1129.588	−0.720	0.471	−351.347	865.406	−0.410	0.685	312.375	196.690	1.590	0.112
roa	−28,002.440	21,029.490	−1.330	0.183	−18,602.710	18,313.460	−1.020	0.310	2206.072	2394.389	0.920	0.357
leverage	−9291.897	5879.786	−1.580	0.114	−12,126.320	7082.677	−1.710	0.087 *	138.095	770.943	0.180	0.858
incr_assets	4193.671	6913.772	0.610	0.544	−1306.987	7333.057	−0.180	0.859	1727.841	1608.802	1.070	0.283
incr_revenue	1564.007	4582.273	0.340	0.733	1569.772	4849.724	0.320	0.746	−154.864	1381.383	−0.110	0.911
csr_report	−4,708,460.000	2,423,138.000	−1.940	0.052 *	−1,284,242.000	96,807.770	−13.270	0.000 ***	−56,858.120	39,792.900	−1.430	0.153
csr_committee	−476,041.500	230,041.000	−2.070	0.039 **	−431,422.200	272,291.900	−1.580	0.113	−4259.495	34,900.190	−0.120	0.903
csr_report*employees	0.622	2.384	0.260	0.794	−2.211	1.291	−1.710	0.087 *	0.277	0.430	0.640	0.519
Number of observations	110				100				100			
Number of groups	51				46				46			
R^2 within	0.101				0.010				0.014			
R^2 between	0.441				0.205				0.311			
R^2 overall	0.186				0.052				0.135			
Wald Chi^2	25.94				94265				20.92			
$p > Chi^2$	0.004				0.000				0.022			

The dependent variable of models 1, 2, and 3 is the annual variation of the total CO_2 emissions (units), the annual variation of the emissions according to Scope 1, and the annual variation of the emissions according to Scope 2, respectively. ***, **, and * are statistically significant at 1%, 5%, and 10%, respectively. The interaction variable csr_committee*employees has been omitted due to perfect collinearity.

6. Concluding Remarks

The measurement of carbon emissions, transparency, and accountability are important drivers for sustainable development in businesses under pressures from investors and capital markets, as well as the civil society. According to the CDP [2], Latin American companies have improved performance across a number of GHG metrics, reducing the level of emissions as a whole—i.e., more specifically, the five companies that participated in CDP's program in 2010 and 2015 had substantial Scope 1 and Scope 2 emissions reductions (a 59% and 32% reduction, respectively).

However, no research to date has carried out a thorough analysis on carbon reporting by the listed companies in this region. This article makes a valuable contribution in the sense that it examines the driving factors not only for the carbon reporting decision, but also for emissions reductions, as suggested by the CDP itself [2]. According to Hickmann [9], corporations tend to strive for pre-compliance in order to gain an advantage over their competitors if their countries are active regarding climate change initiatives. We find that the variable country follows that pattern as regards the carbon reporting decision. Regarding the sustainable profile of the company, our findings provide evidence of a positive relationship both with the existence of a CSR committee and a CSR report, for both the reporting decision and more sustainable behavior in terms of the variation of emissions. The size of the company is also found to be a significant factor in both sets of models.

However, according to our results for the period from 2013 to 2016, the yearly variation for the more than 100 carbon reporting observations is a mean increase except for Scope 2, where there is a decrease in the level of emissions.

One limitation of this paper is the rather reduced sample size, yet it includes all of the companies with data available in the region; this is most likely a consequence of the lack of interest at the regulatory level. For all of the models, we use total emissions, Scope 1, and 2. Scope 3 indicates all the indirect emissions not covered under Scope 2, such as those associated with the transport of goods and waste disposal; however, we do not take Scope 3 into account, since it is more difficult to monitor and control (as Hickmann [9]).

Our results have important implications for governments, suggesting that non-mandatory guidance or the consideration of a likely introduction of a requirement may lead to higher levels of GHG reporting and subsequent sustainable action. The measurement and subsequent disclosure of GHG emissions is a tool that can make management aware of the need to improve on terms of sustainable development and against climate change [9,26]. National registries of carbon footprints are powerful tools to that end, so that any company listed or not can disclose this information to the public and inform the authorities [32]. Also, these reporting initiatives can help reduce the emissions, which according to the findings obtained are more likely if the company publishes a CSR report and has an environmental committee in its corporate governance structure. This evidence may suggest the convenience of promoting these kinds of initiatives amongst corporations at the regulatory level. Furthermore, we think that this type of study may increase awareness amongst academics about the importance of analyzing carbon reporting from a managerial perspective. In addition, and in line with Jackson and Belkhir [22], the idea of creating company benchmarks of carbon reductions could be used as an incentive for other players to adopt the best practices as in the quality movement from the 1970s and 1980s, in order to provide better and lower-cost products and services, but now including as well the characteristic of less polluting products or services.

It is of the utmost importance that the general public also increases its awareness about carbon emissions and climate change, and academics continue shedding some light on this emerging topic. According to the findings of our study, it is vital to do so in a region such as South America, which has so many natural resources and is so vulnerable to climate change. Note that even though the five companies analyzed by the CDP [2] decreased their emissions from 2010 to 2015, our more than 100 observations from 2013 to 2016 of carbon-reporting companies show an average yearly increase in the level of total and Scope 1 emissions; however, there is a decrease for Scope 2. Hence, this research reveals the need to disseminate how important it is to care for the environment and invest in corporate

actions to decrease pollution. The importance of South America for research is that it is a growing economy. Maybe right now the presence of the rain forest is not that relevant as GHGs spreads across the world. However, the presence of such a rich biological region so close to the companies may be a driver for a change in their attitude toward the environment, and may make the public more concerned in the years to come.

Author Contributions: This article was originally conceived and designed by C.C., A.Z.-G., and P.M. The three authors also wrote the paper and approved the final manuscript.

Acknowledgments: A.Z.-G. acknowledges financial support from the Generalitat Valenciana AICO/2017/092 and C.C. acknowledges financial support from Universidad Técnica Particular de Loja (Ecuador).

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Intergovernmental Panel on Climate Change (IPCC). Climate Change 2014, Synthesis Report. Available online: http://www.ipcc.ch/news_and_events/docs/ar5/ar5_syr_headlines_en.pdf (accessed on 21 May 2018).
2. CDP. Global Climate Change Report 2015 at the Tipping Point? Available online: https://www.marriott.com/MarriottInternational/CorporateResponsability/Performance_New_2016/SPG_PDFs/CDP_SP_500_Climate_Change_Report_2015.pdf (accessed on 21 May 2018).
3. Fantozzi, F.; Bartocci, P. Carbon Footprint as a Tool to Limit Greenhouse Gas Emissions. In *Greenhouse Gases*; Llamas, B., Pous, J., Eds.; IntechOpen: London, UK, 2016; ISBN 978-953-51-2273-9.
4. CDP. Competitive Business in a Low Carbon Economy Latin America 80 Climate Change Report. Available online: https://b8f65cb373b1b7b15feb-c70d8ead6ced550b4d987d7c03fcdd1d.ssl.cf3.rackcdn.com/cms/reports/documents/000/000/867/original/CDP-latin-america-climate-change-report-2014.pdf?1472044538 (accessed on 21 May 2018).
5. IFC. IFC Promotes Sustainable Investing in South Africa's $500 Billion Pension Fund Market and beyond. Available online: https://www.ifc.org/wps/wcm/connect/news_ext_content/ifc_external_corporate_site/news+and+events/news/za_ifc_as_pension_fund_soutafrica (accessed on 18 June 2018).
6. Vives, A.; Peinado-Vara, E. *La Responsabilidad Social de la Empresa en América Latina*, 1st ed.; Banco Interamericano de Desarrollo: New York, NY, USA; Washington, DC, USA, 2011; Available online: https://issuu.com/idb_publications/docs/technicalnotes_es_62218 (accessed on 21 May 2018).
7. Sierra-García, L.; García-Benau, M.; Zorio, A. Credibilidad en Latinoamérica del Informe de Responsabilidad Corporativa. *Rev. Adm. Empres.* **2014**, *54*, 28–38. [CrossRef]
8. Zorio-Grima, A.; García-Benau, M.A.; Sierra-García, L. Sustainability report assurance in Spain and Latin America. *Innovar* **2015**, *25*, 85–101.
9. Hickmann, T. Voluntary global business initiatives and the international climate negotiations: A case study of the Greenhouse Gas Protocol. *J. Clean. Prod.* **2017**, *169*, 94–104. [CrossRef]
10. United Nations Environment Programme (PNUMA). *Aportes Legislativos de América Latina y El Caribe en Materia de Cambio Climático*; PNUMA: Parlatino, Panamá, 2015.
11. International Carbon Action Partnership. ETS Map. Available online: https://icapcarbonaction.com/en/ets-map (accessed on 14 May 2018).
12. World Bank Group. State and Trends of Carbon Pricing. Available online: http://documents.worldbank.org/curated/en/636161467995665933/pdf/99533-REVISED-PUB-P153405-Box393205B.pdf (accessed on 22 May 2018).
13. Correa-Garcia, J.A.; Garcia-Benau, M.A.; Garcia-Meca, E. CSR Communication Strategies of Colombian Business Groups: An Analysis of Corporate Reports. *Sustainability* **2018**, *10*, 1602. [CrossRef]
14. Andrikopoulus, A.; Kriklani, N. Environmental Disclosure and Financial Characteristics of the Firm: The Case of Denmark. *Corp. Soc. Responsib. Environ. Manag.* **2013**, *20*, 55–64. [CrossRef]
15. Zuraida, Z.; Houque, N.; VanZijl, T. Value Relevance of Environmental, Social and Governance Disclosure. In *Handbook of Finance and Sustainability*; Edward Elgar Publishing: Cheltenham, UK, 2016; pp. 1–34.
16. Liesen, A.; Hoepner, A.G.; Patten, D.M.; Figge, F. Does stakeholder pressure influence corporate GHG emissions reporting? Empirical evidence from Europe. *Acc. Audit. Account. J.* **2015**, *287*, 1047–1074. [CrossRef]

17. Ieng Chu, C.; Chatterjee, B.; Brown, A. The current status of greenhouse gas reporting by Chinese companies: A test of legitimacy theory. *Manag. Audit. J.* **2012**, *28*, 114–139. [CrossRef]
18. Freedman, M.; Jaggi, B. Global warming, commitment to the Kyoto protocol, and accounting disclosures by the largest global public firms from polluting industries. *Int. J. Account.* **2005**, *40*, 215–232. [CrossRef]
19. Stanny, E. Voluntary Disclosures of Emissions by US Firms. *Bus. Strateg. Environ.* **2013**, *22*, 145–158. [CrossRef]
20. Giannarakis, G.; Zafeiriou, E.; Sariannidis, N. The impact of carbon performance on climate change disclosure. *Bus. Strateg. Environ.* **2017**, *26*, 1078–1094. [CrossRef]
21. Giannarakis, G.; Konteos, G.; Sariannidis, N.; Chaitidis, G. The relation between voluntary carbon disclosure and environmental performance: The case of S&P 500. *Int. J. Law Manag.* **2017**, *59*, 784–803.
22. Jackson, J.; Belkhir, L. Assigning firm-level GHGE reductions based on national goals-Mathematical model & empirical evidence. *J. Clean. Prod.* **2018**, *170*, 76–84.
23. Mae Matsumura, E.; Prakash, R.; Vera-Muñoz, S.C. Firm-Value Effects of Carbon Emissions and Carbon Disclosures. *Account. Rev.* **2014**, *89*, 695–724. [CrossRef]
24. Griffin, P.A.; Lont, D.H.; Sun, E.Y. The relevance to investors of greenhouse gas emission disclosures. *Contemp. Account. Res.* **2017**, *34*, 1265–1297. [CrossRef]
25. Krishnamurtia, C.; Velayuthamn, E. The influence of board committee structures on voluntary disclosure of greenhouse gas emissions: Australian evidence. *Pac.-Basin Financ. J.* **2017**, in press. [CrossRef]
26. Tauringana, V.; Chithambo, L. The effect of DEFRA guidance on greenhouse gas disclosure. *Br. Account. Rev.* **2015**, *47*, 425–444. [CrossRef]
27. Liao, L.; Luo, L.; Tang, Q. Gender diversity, board independence, environmental committee and greenhouse gas disclosure. *Br. Account. Rev.* **2015**, *47*, 409–424. [CrossRef]
28. Walls, J.L.; Berrone, P.; Phan, P.H. Corporate governance and environmental performance: Is there really a link? *Strateg. Manag. J.* **2012**, *33*, 885–913. [CrossRef]
29. Bui, B.; Chapple, L.; Truong, T.P. Drivers of tight carbon control in the context of climate change regulation. *Account. Financ.* **2017**. [CrossRef]
30. Belkhir, L.; Bernard, S.; Abdelgadir, S. Does GRI reporting impact environmental sustainability? A cross-industry analysis of CO_2 emissions performance between GRI-reporting and non-reporting companies. *Manag. Environ. Qual.* **2017**, *28*, 138–155.
31. Broadstock, D.C.; Collins, A.; Hunt, L.C.; Vergos, K. Voluntary disclosure, greenhouse gas emissions and business performance: Assessing the first decade of reporting. *Br. Account. Rev.* **2017**, *50*, 48–59. [CrossRef]
32. Cordova, C.; Zorio-Grima, A.; Garcia-Benau, M.A. Nuevas Formas de Reporting Corporativo: Información Sobre La Huella de Carbono en España. *Rev. Adm. Empres.* **2018**, *58*. in press.