Do French firms follow a transparent or climate-friendly path?

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This version: July 2021

Abstract

Corporate disclosures related to climate risks are one of the ways to fight climate change by improving financial transparency for investors. An initial assessment, five years after the COP 21, of the climate disclosure practices of French companies (CAC 40) 2015–2019 will be presented by putting into perspective, on the one hand, the level of climate disclosure in relation to the recommendations of the Task Force on Climate-related Financial Disclosures, and on the other hand, the performance of these firms in terms of their climate commitment. To do so, we use two indicators: the Climate Risks and Opportunities Index (CRORI) and the CDP climate score. Our results reveal a parallel improvement of these indices with different sectoral disparities over the whole of the period. A dynamic analysis of these two indicators shows that the firms adopted different paths: 70 percent of the firms followed a path oriented towards both transparency and a positive climate commitment marked by a more or less strong improvement of both the CRORI and the CDP score. While these results are encouraging, they need to be put into perspective because these firms are still far from being carbon neutral.

JEL classification: G38 ; M41 ; Q51 ; Q56 ; F39 ; G3

Keywords: Climate disclosures; CSR reporting; Climate performance; TCFD recommendations.

Funding: This work was financed by the Agency for Ecological Transition and by the Chair Energy and Prosperity under the aegis of the *Fondation du Risque*.

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1 Introduction

Over the past twenty years or so, there has been a gradual increase in the awareness of the danger that global warming represents for our societies. According to the scientific experts of the Intergovernmental Panel on Climate Change (IPCC) the increase in temperature has been on the order of 1°C between the last decade and the pre-industrial years, with the last five years being the warmest. This is due to the increase in greenhouse gas (GHG) emissions, mainly caused by human activities related to the use of fossil fuels (especially for transportation and the production of electricity), deforestation, agriculture, livestock ... Insofar as there is a link between the acceleration of climate change and GHG production processes (IPCC, 2015) [1], the continuation of high growth based on fossil fuels would lead economies to a catastrophic scenario: the trend of the trajectory brings the planet's increase to 4°C by 2100, with consequences that are difficult to predict.

This global warming implies more and more risks that can have a considerable financial impact on economic actors. There are two main risks: on the one hand, the physical risks resulting from the damage caused directly by meteorological conditions (increase in the frequency and intensity of extreme weather events, rise in sea level with the consequences of a significant migration of coastal populations, increased episodes of heat waves, droughts, hurricanes, and the accelerated loss of biodiversity ...); and on the other hand, transition risks, stemming from adjustments, most often regulatory, to put our economies on a low carbon trajectory (stricter environmental regulations, introduction of a carbon tax, information disclosure requirements. ...) when these are poorly anticipated or occur suddenly. The result is a necessary energy transition involving a substantial and sustainable reduction of GHGs, which involves greater energy efficiency, a reduction in the carbon intensity of production systems, and the development of renewable energy. All of our economies, with their carbon-based methods of production and consumption, are therefore being called into question.

Companies have a role to play in this GHG mitigation process. They are directly (e.g. those that produce fossil fuels and electricity) or indirectly (e.g. those that consume fossil fuels and electricity) responsible for GHG emission. Indeed, the GHG emissions of individual companies can match or even exceed those of a small countries: those of the mining group Rio Tinto rival New Zealand, and ExxonMobil's emissions are higher than those of Belgium (Patenaude 2011). In addition, the direct and indirect impact of climate change on a company may be related to regulation, market changes, or climate-induced physical changes affecting the environment in which the company operates. This last regulatory aspect could be quite new for companies, given the recent Paris international agreement on climate change (December 2015), which recognizes the need for adaptation while reaffirming the need for mitigation, which has been recognized since the Kyoto Protocol in 1997.

In this context, COP 21 (2015) marks a major turning point. During this event, more than 175 countries committed themselves to the Paris agreement, in other words, to keep the increase in global temperature below 2°C by 2100. Similarly, the Financial Stability Board (FSB) launched an international initiative, the Task Force on Climate-related Financial Disclosures (TCFD), to improve financial transparency regarding the impact of climate risks on companies. If the FSB emphasizes the strategic role of finance in the fight against climate change, it is because the financial sector is involved in it in two ways: not only does it provide the massive financing required by the energy transition, but it also faces the financial risks associated with climate change through its securities portfolios.

According to former FSB Chairman Mark Carney, financial investors are not sufficiently aware of these risks. These risks stem from radical uncertainty and can affect the investments of financial and non-financial companies, particularly through the potential devaluation of carbon-intensive financial assets (stranded assets) resulting from transition risks. In a famous speech addressed to institutional investors in 2015 on the consequences of the climate crisis, Mark Carney denounced the tragedy of the horizons of finance. Considering that the negative effects of climate change

[1] https://www.ipcc.ch/2015/

will be felt in the distant future, investors are led to neglect the financial risks that result from it. The long-term horizon that applies to most investments for sustainable development is then incompatible with a financial system dominated by short-term criteria.

This results in information asymetries that limit the understanding of the financial consequences of climate risks. Reducing these information asymmetries therefore requires an improvement in financial transparency through information disclosures by companies. In other words, companies should be encouraged to include in their annual reports information not only on the environmental impact of their activities but also on how they integrate climate risks into their strategy. This information is necessary for companies to get an idea of the vulnerability of their activities to climate change. It is also crucial to better inform their stakeholders so that they can reallocate their portfolios[2] or change their consumption habits accordingly. Without the right information on how climate risks affect a company, investors risk pricing or valuing assets incorrectly, leading to misallocation of capital and financial instability. From this perspective, financial transparency is one way to combat climate change.

For these firms to provide such information, which is seen as one of the means of improving financial transparency, is in line with the theory of efficient markets through the market discipline mechanism. The latter reflects the influence that investors and other stakeholders can have on a firm's behavior and risk profile. According to this theoretical framework, capital markets need quality and reliable data to function effectively and foster trust. This is precisely the objective of TCFD, which is to establish recommendations for specifying the elements of environmental/climatic information expected in the annual reports of listed companies.

The present paper seeks to draw up an initial assessment five years after COP 21 on the climate disclosure practices of the largest French stock market capitalizations (CAC 40) over the period 2015–2019, by evaluating both the level of their disclosures and their quality in terms of their climate commitment. Through a TCFD compliance disclosure index based on a content analysis of the annual report, it aims in particular to answer the following questions: Do companies disclose information on climate-related risks and their impacts in their reference documents? Is a company's climate commitment consistent with its climate-related disclosures? Indeed, while some firms may disclose abundant environmental and climate information, they may at the same time have practices that are not in line with their climate related disclosures. This article is an original contribution to the academic work on climate reporting, which is still very limited. To our knowledge, there has been little empirical study of climate information disclosures, neither for the case of France, nor for the application of the TCFD's recommendations.

Our results reveal a parallel improvement of these indices with different sectoral disparities over the whole period. The dynamic analysis of these two indicators shows that the firms adopted different paths: 70 percent of the firms followed a path oriented towards both transparency and positive commitment, marked by a more or less strong improvement of the Climate Risks and Opportunities Reporting Index (CRORI) and the climate disclosure practices (CDP) score.

This paper is organized as follows. Section 2 presents the recommendations of the TCFD, which are becoming the global standard for climate reporting. Section 3 surveys the relevant literature on environmental climate disclosures. Section 4 presents the data. Section 5 presents the results of the dynamical anaysis. Lastly, Section 6 presents our conclusions.

[2]Especially for investors who are eager to reach the decarbonation objectives of their portfolios.

2 The TCFD recommendations: The new global standard for climate reporting

The initiative of the TCFD is part of the framework of private non-binding non-financial reporting initiatives. Indeed, over the last two decades, we have witnessed a strong development of non-financial reporting due to national regulations and/or non-binding legislation. For example, in France, there are a number of national laws, namely the law on new economic regulations (NRE law, 2001), as well as the subsequent introduction of the Grenelle II bill (2010) and the law on energy transition and green growth (2015). At the European level, there is Directive 2014/95/EU, also known as the Non-Financial Reporting Directive. At the international level, two main sustainability reporting frameworks dominate: the Global Reporting Initiative (GRI) and the International Integrated Reporting Council (IIRC). The latter helps companies, governments and other organizations understand and communicate their impacts on environmental, social and governance (ESG) and other sustainability issues by publishing a Corporate Social Responsibility (CSR) report or an ESG report. In addition, they are designed for a wide range of stakeholders.

More recently, the TCFD, in its final report (TCFD 2017), established recommendations to specify the environmental/climate information expected in the annual reports of all types of companies in terms of governance, strategy, risk management and environmental indicators (metrics). They aim to improve the non-financial information provided by companies on how they integrate climate risks and opportunities (CRO) in these four areas (see Table 1). They also take into account sectoral characteristics. According to the TCFD, high-stake sectors are not only those that are considered polluting, but also those whose practices may be affected by climate change (food sector) or those that may influence environmental change (financial sector). Finally, the TCFD has identified investors, lenders and insurance underwriters as the preferred recipients. The demand for useful market information is broad, ranging from depositors, policyholders, shareholders, and creditors, to rating agencies, credit and market analysts, and the financial media.

Table 1: Areas and sub-areas of TCFD recommendations. Source: TCFD (CRO: Climate risks and opportunities)

Areas	Governance	Strategy	Risk management	Metrics and objectives
Sub-areas	Vision of the Board of Directors on climate issues	Identification of the CRO in the short, medium and long term	Description of the process to identify and evaluate the CRO	Dissemination of information on the metrics used to evaluate the CRO
	Role of management in the assessment of the climatic risks and opportunities	Description of the impacts of the CRO on business, strategy, and financial planning	Description of the CRO management process	Dissemination of information on the Scopes 1, 2 and if relevant of scope 3
		Description of the potential impacts of different scenarios, including 2°, on the business of Organization, strategy, and financial planning	Description of how the process of identification and evaluation of the CRO are integrated into the overall risk management	Description of the objectives used to manage the CRO and the performance in relation to these objectives

Source: Demaria and Rigot 2021

The recommendations of the TCFD have several advantages over GRI or IR frameworks:

- The TCFD adopts an innovative approach by not focusing on a company's impact on climate change, but rather on the impact of climate change on the company;
- It focuses in particular on CROs rather than CSR; and it focuses on the financial sector, which is considered an important environmental issue as it plays a crucial role in financing the economy through its investment and financing policies;
- It attempts to link financial and non-financial information by asking companies to present the financial impact of CROs on their business and financing plans in financial documents.

However, while the TCFD's stated objective is to ask companies to quantify the financial impact of CROs, much of the reporting recommendations relate to non-financial information (such as in the areas of governance and strategy). All these reasons explain why the TCFD's recommendations have received growing support since 2015 and are becoming the global benchmark for climate reporting. After receiving support from the French government and the European Union HLEG 2018, the European Commission has published 'Guidelines on Non-Financial Reporting: Supplement on Climate Disclosure', which implements the TCFD's recommendations in the Non-Financial Reporting Directive (European Commission, 2019). Large companies have followed this movement: while in 2017, 282 companies adopted these recommendations, by December 2020, there were about 1,600.

3 A review of the literature on climate disclosures and climate performance

Since the early 1980s, there has been a growing academic literature on environmental disclosures. Much of this has aimed to study the compliance of company disclosures with regulatory requirements or non-financial reporting frameworks on different samples and their evolution over time. For example, since the introduction of the NER Act (2001), it has been sought to identify French companies' level of compliance and investigate the reliability of the information (Ben Rhouma and Cormier 2007, Delbard 2008, Damak-Ayadi 2010). This research generally shows that in the first few years of application of a law, the level of compliance is relatively low, regardless of the sector of activity. These French studies echo research conducted in Spain in 1997 by Larrinaga et al. 2002, who show that firms do not comply with accounting standards imposing environmental reporting requirements. Regarding voluntary guidelines such as the GRI, some studies show that the level of environmental disclosure is not sufficient and leaves much room for improvement in different European countries (Beck et al. 2010, Lock and Seele 2015, Pistoni et al. 2018). However, we observe an improvement over time. In France, ten years after the introduction of the NER Act, some studies highlight an indisputable increase in environmental disclosures for listed companies (Albertini 2014, Chelli et al. 2014, Chauvey et al. 2015). It is also the case of Russo-Spena et al. 2018 that confirm this trend from a sample of international automotive firms between 2009 to 2014. Despite this improvement, disclosures are often descriptive, rarely quantitative and negative. Firms tend to favour optimistic information on environmental practices while negative impacts are largely ignored. This is observed on a French sample (Albertini 2014, Chauvey et al. 2015, Depoers and Jérôme 2017) and on British and German samples (Beck et al. 2010) as well as Indian firms (Sen et al. 2011).

More recently, there has been a surge in attention to climate disclosures from investors and regulators around the world. Such studies rely on a wide variety of indicators, such as the choice to answer the CDP survey (Ben-Amar and McIlkenny 2015, Sullivan and Gouldson 2016), the presence of the amount of GHG emissions in the annual/CSR reports (Kouloukoui et al. 2019), or the disclosure about climate risks and opportunities according international climate reporting framework like TCFD (Demaria and Rigot 2021). For example, Sullivan and Gouldson 2016 compare retailer'firms practices in the United Kingdom and the United States based on a content analysis of CDP survey responses. They show that companies in the UK are some way ahead of their US counterparts in terms of the actions they are taking (in particular in relation to their willingness to focus on their supply-chain-related emissions), the ambition of the emission reduction targets that they are setting for themselves, and (while acknowledging the difficulties in making direct performance comparisons) the rates of improvement in their energy consumption and GHG emissions. In this way, Kouloukoui et al. 2019 show, with a sample of Brazilian firms, that the level of disclosure of climate risks increased from 2009 to 2014, although it is still considered too low. In the same perspective, Demaria and Rigot 2021 observe, on a sample of French firms between 2015 and 2018, a significant improvement in the level of disclosure of information related to climate risks

and opportunities in accordance with the recommendations of the TCFD. For their part, Amar et al. 2020 propose a measure to assess the level of climate disclosure by a company based on the recommendations of the TCFD.

Among these research papers on corporate disclosures, some have focused on the relationship between the level of disclosure and the environmental performance, and to a lesser extent climate performance. It is interesting to note that there is no consensus on the results about environmental performance. While some authors believe that the least environmentally efficient firms tend to disclose more information(O'Donovan 2002, Deegan and Blomquist 2006, Cho and Patten 2007, Hassan 2018), other authors find the opposite (Clarkson et al. 2008, Hummel and Schlick 2016, Hora and Subramanian 2019). This variety of results may have its origin in the multiplicity of environmental performance measures/proxies: toxic releases (Patten 2002), the ratio of toxic waste recycled to total toxic waste generated or amount of toxic release and toxic waste (Al-Tuwaijri et al. 2004, Clarkson et al. 2008) or environmental scores from databases like KDL or TRI Database (Cho et al. 2006, Hora and Subramanian 2019).

In more recent years, there has been a line of research into the specific relation between climate performance and climate disclosure. Climate performance is generally measured by the emission of carbon scope 1, 2 and 3, or via other indicators like the CDP climate score. For instance, with a sample of European firms in 2014, Giannarakis et al. 2017 find that better environmental performance positively affects the level of climate change disclosure. The literature review carried out by Velte et al. 2020 shows that climate-carbon disclosure and climate performance are related to each other. They estimate that if a firm has achieved a high level of carbon-related performance, it is expected that this firm will be more willing to report these practices on a voluntary basis, either in a CSR report or in an integrated report. In the end, we observe that authors interested in the study of climate information or performance often work with CDP data. From a sample of international firms from 2009 to 2017, Guo et al. 2020 show that the CDP climate performance index is a good proxy for assessing the climate (carbon) performance.

Our paper is in line with previous work in studying the disclosure of climate information through the score developed by Amar et al. 2020 and using the CDP climate score to assess climate performance.

4 Data description

4.1 The sample

Our sample includes the 39 companies on the Euronext Paris with the largest market capitalisation (the CAC 40 index) from 2015 to 2019.[3] The choice to study French companies is explained by the fact that:

- France is regarded as a country with a considerable number of regulations concerning mandatory environmental disclosures,
- the French government supports the implementation of TCFD's recommendations at the EU and G20 levels,
- the existing French reporting regulation is not far from that of the TCFD. Indeed, French firms are subject to the most stringent environmental legislation: the NER Act (2001), the

[3]Technip was removed from the sample because in 2016 it merged with the British company FMC and no longer published an annual report in the French format. The company Unibail, which left the index in 2019, was retained in the sample.

Grenelle II Bill (2010), and the Energy Transition and Green Growth Act (2015).

Moreover, these companies sometimes go further than the regulations require by disclosing voluntary information because they may be subject to pressure from stakeholders (NGOs, analysts, the general public, etc.) regarding the disclosure of environmental information. This is particularly important in the context of our study for two reasons. First, for the period 2015–2017, the TCFD recommendations had not yet been issued, so only the firms reporting significant disclosure can be studied. Second, for the period 2018–2019, the TCFD's recommendations were not binding, so only large companies could be expected to change their disclosure policies (due to the aforementioned external stakeholder pressure). The choice of this study period aims to observe the evolution of such practices in order to identify if a change occurs after the publication of the TCFD's recommendations.

Lastly, to identify sector reporting differences, we retain here the TCFD's industry classification: high impact industries (energy, transport, food & agriculture, materials & building, and finance) and low impact industries (e.g. all other sectors).[4] According to the TCFD, high-stakes industries are not only those considered polluting, but also those whose practices may be affected by climate change (food sector) or those that may influence environmental change (financial sector).

4.2 Data

To assess French firms' climate transparency and compliance with the TCFD's guidelines, we use a new composite index, the Climate Risks and Opportunities Reporting Index (CRORI), developed by Amar et al. 2020, which assesses the level of a firm's compliance with TCFD recommendations on a 0 to 1 scale. The CRORI is broken down into 4 sub-indices (ranging from 0 to 0.25) which indicate the level of the firm's compliance with each area of the TCFD recommendations (see Amar et al. 2020 for more details about the methodology).

As a proxy of climate performance, we use the CDP climate performance score, computed by CDP (formerly known as Carbon Disclosure Project), a UK-based non-for-profit organization, that runs a global disclosure system for investors, companies, cities, states and regions to manage their environmental impact. CDP is considered the benchmark for environmental reporting, with the richest and most comprehensive set of data on the actions of companies. By means of its questionnaire, sent to listed companies, CDP awards points for companies that highlight "positive" climate change actions that they are undertaking, or have undertaken. As a result, the Climate Performance Leadership Index of the CDP (henceforth called the CDP score) reflects the level of a company's commitment to climate change mitigation, adaptation, and transparency. It is important to note that the CDP does not check the materiality of the reported actions and it takes into account only information from a company's response to the annual climate change questionnaire. The resulting rating then, by construction, only reflects a company's self-reported commitments to greening their business. However, since CDP's main clients are investors who want to have more transparency on the part of firms with regard to climate risk, they are better able to verify this information. It is therefore not in the interest of a firm to not respond to this questionnaire or to withhold information or disclose false information.

Responses to the CDP questionnaire are compiled to derive an overall score (ranging from 0 to 1). The companies are then grouped into categories indicated by the letters A/A-, B, C, D, and E:

- A/A- correspond to a score higher than 0.85
- B corresponds to a score between 0.6 and 0.85
- C corresponds to a score between 0.4 and 0.6

[4] In our sample, firms belonging to high impact industries represent around two-thirds of the firms (based on market capitalisation).

- D corresponds to a score between 0.2 and 0.4
- E corresponds to a score between 0 and 0.2

As the numerical CDP scores were not available, in this paper we use the median of each category.

5 Results

5.1 Descriptive statistics

Table 2 displays the descriptive statistics of the CRORI over the period 2015–2019. We observe that the average CRORI is 0.38 (respectively 0.72) in 2015 (resp. in 2019) with a minimum of 0.05 (resp. 0.15) and a maximum of 0.68 (resp. 0.99), the standard deviation is about the same, around 0.19. The relatively good levels in 2015 and 2016 can be explained by the fact that France has required CSR disclosures since 2001: first the NER Act laid the foundations for improving environmental reporting, and then the Energy Transition Act (2015) consolidated it by imposing more specific environmental requirements. Efforts initiated in early 2016 as a result of the Energy Transition Act have been continued with the commitment of companies to comply with the TCFD's international initiative.

Table 2: Descriptive statistics of the CRORI
Annual descriptive statistics of the Climate Risks and Opportunities Reporting Index (CRORI) of CAC 40 companies 2015–2019. The CRORI assesses a firm's compliance with TCFD recommendations and ranges from 0 to 1. The higher the index, the higher the climate performance.

Year	Obs	Mean	Std. Dev.	Min	Max
2015	39	.3825677	.1769168	.0509259	.6759259
2016	39	.5160553	.2135246	.125	.8194444
2017	39	.5834817	.1982696	.1550926	.9803241
2018	39	.6415895	.2077165	.1238426	.9814815
2019	39	.720495	.1901209	.150463	.9861111

Figure 1: Evolution of the sub-components of the CRORI 2015–2019
Annual evolution of four sub-components of the Climate Risks and Opportunities Reporting Index (CRORI) of CAC 40 companies 2015–2019: governance, risk management, strategy, and metrics and objectives. Each sub-index ranges from 0 to 1. The higher the index, the higher the climate performance.

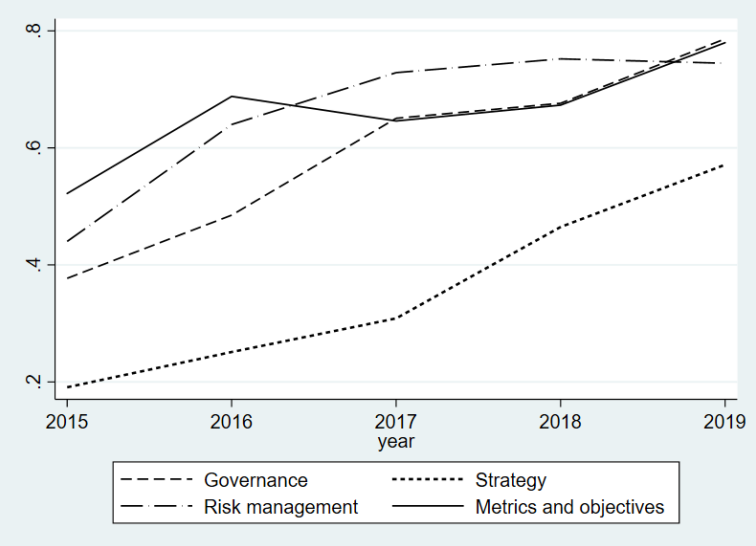


Figure 1 presents the evolution of the four sub-components of the CRORI. It reveals a higher

score of the CRORI over the period in the areas of strategy, metrics & objectives, risk management and governance, despite continuous improvement in each area. By way of illustration, in 2019, CAC 40 companies reported the most in the areas of risk management (0.74), metrics & objectives (0.78) and governance (0.79) and far ahead of strategy (0.57) against respectively 0.44, 0.52, 0.38 and 0.52 in 2015. The low level of compliance for this last area may be related to the tactical nature of the information in highly competitive sectors.
The high level of compliance with the recommendations in terms of risk management, metrics and governance can be explained by French regulations, which for several years have required non financial information in line with the development of corporate social responsibility (CSR). The AMF 2014-14 Act requires companies to present their risk factors; climate risks therefore seem to fit well into the overall risk management. The NER Act (2001), the Grenelle II Bill (2010) and the Energy Transition and Green Growth Act (2015) required listed companies to publish a sustainability report including environmental indicators and information about how the governance manages environmental and climate issues.

Table 3: Descriptive statistics of the CDP score
Annual descriptive statistics of the CDP score of CAC 40 companies 2015–2019. The CDP score assesses firms' climate performance and has been transformed here into an index ranging from 0 to 1. The higher the index, the higher the climate performance.

CDP	Obs.	Mean	Std. Dev.	Min	Max
2015	33	.680303	.2009506	.1	.9625
2016	36	.7888889	.1432336	.5	.9625
2017	34	.8345588	.1467146	.3	.9625
2018	38	.8131579	.1827425	.3	.9625
2019	38	.8118421	.196892	.3	.9625

Table 3 displays the descriptive statistics of the CDP scores of CAC 40 companies (when available). We observe that the average CDP score is 0.6803 in 2015 (respectively 0.8118 in 2019) with a minimum of 0.1 (resp. 0.3 in 2019) and a maximum of 0.9625 (resp. 0.9625 in 2019). The standard deviation is quite high in 2015 (0.20), which indicates a strong heterogeneity among firms. It decreases in 2016 and 2017, but this trend reverses in 2018 and 2019.

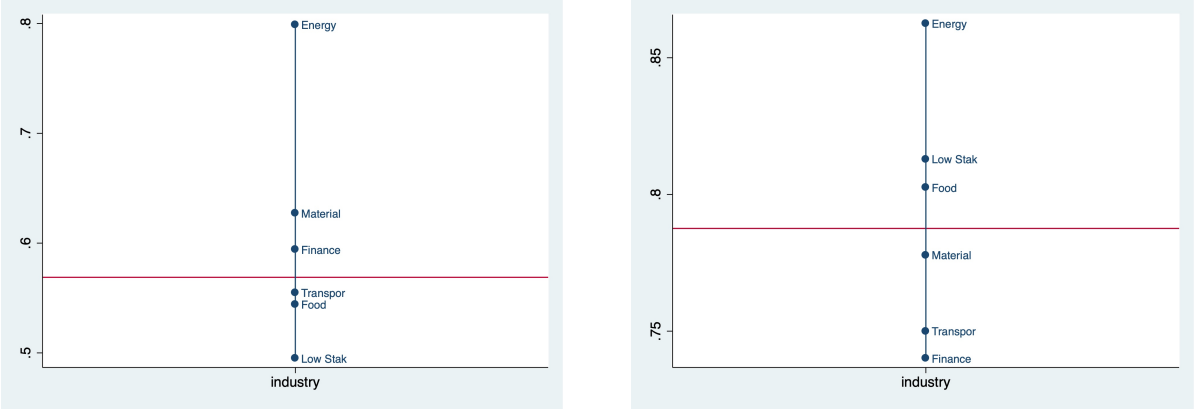
5.2 Evolution of CRORI and the CDP score 2015–2019

5.2.1 CRORI and CDP score by industry

Figure 2 shows the average values of the CRORI and the CDP score by industry.
Regarding the CRORI by industry, we observe that energy and material & building sectors have relatively good CRORI levels (0.80 and 0.63 respectively) over the period in comparison with the CRORI average over the period (0.57). The latter would have been better if it had not been driven down by the low rates of two companies (ArcelorMittal and Lafarge). The restrictive French regulatory context, which requires companies to use more environmentally friendly alternative solutions, can explain the relatively good scores of this sector.

Far ahead we note that the level of the finance sector is also higher than the sample average over the period (0.53) which may reflect a relatively recent awareness which can be related to Article 173 of the Energy Transition Act (2015), which compels banks and investors to report on how they are addressing climate change. The TCFD considers that the financial sphere has a huge role to play as a catalyst and has a significant capacity to move the economy towards a low-carbon trajectory. The transport and food sectors are lagging behind, with an index below the CRORI average (0.55 and 0.54 respectively). The distinction between the two sub-sectors (automotive and aerospace) is relevant: while the scores of Airbus and Safran improved over the period, they remain very low.

Figure 2: Average CRORI and CDP score by industry 2015–2019
Average CRORI (subfigure (a)) and CDP score (subfigure (b)) of CAC 40 companies by industry 2015–2019.



(a) CRORI **(b) CDP**

With regard to the sectoral distribution of the CDP score over the period 2015–2019, we observe that the energy sector is once again the best placed, with a high level of 0.86. It is followed by the low stake sector and then by the food sector with a score higher than 0.80 (grade B). According to the methodology of the CDP, these high scores mean that these sectors have taken actions to manage their climate issues. They have a better carbon governance, proactivity and commitment to environmental stewardship. On the other hand, for the other sectors, there is still room for improvement of environmental commitment. If the materials & building is close to the average (0.79), the transport and finance sectors are a bit far behind, with scores of 0.75 and 0.74 respectively.

5.2.2 CRORI and CDP score: A dynamical analysis

Table 4 displays the descriptive statistics of the CRORI and the CDP score before and after the TCFD recommendations (respectively over the periods 2015–2017 and 2018–2019).[5] These results show that there is a parallel improvement in the CRORI and CDP score between the period prior to the publication of the TCFD recommendations and the following period.
In addition, we can see that even the lowest-performing companies improved their scores, since the

Table 4: Summary Statistics of the CRORI and CDP score before and after the TCFD recommendations

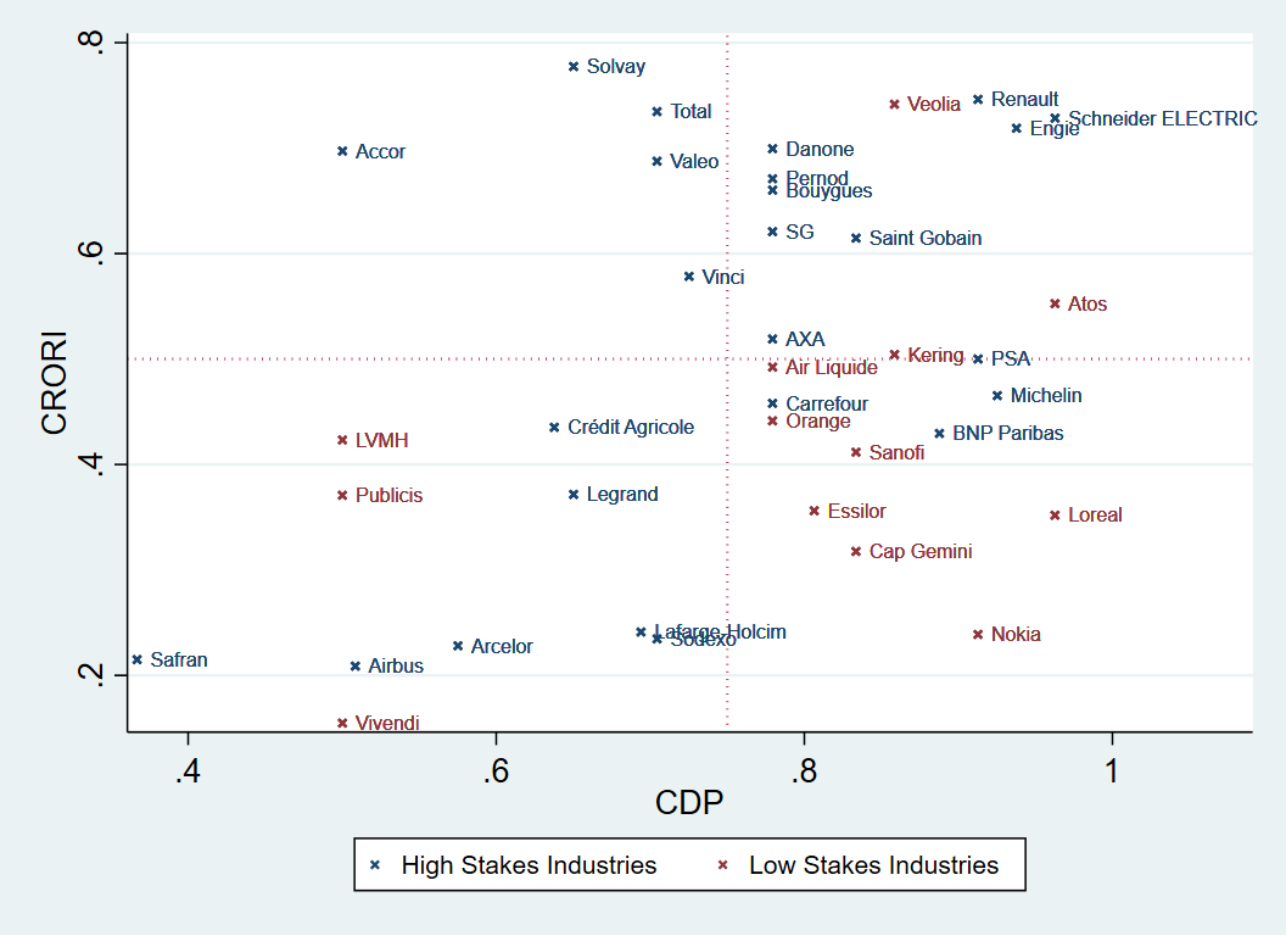
Variable	Obs	Mean	Std. Dev.	Min	Max
2015-2017					
CRORI	117	.4940349	.2123601	.0509259	.9803241
CDP	103	.7691748	.1754704	.1	.9625
2018-2019					
CRORI	78	.6810423	.201762	.1238426	.9861111
CDP	76	.8125	.1886796	.3	.9625

minimum CRORI (respectively CDP) was 0.05 (resp. 0.1) over 2015–2017 and 0.12 (resp. 0.3) over 2018–2019. Nevertheless, the dispersion has not been significantly reduced, since the standard deviations remains comparable over the two periods.

[5]The evolution of the CDP and CRORI by firm over the period is provided in Appendix A.

In Figures 3 and 4, we have coupled the level of transparency (CRORI) with the CDP score by distinguishing two sub-periods: the first one before the TCFD recommendations (2015–2017) and the second one after the TCFD (2018–2019) in order to see whether this initiative had a positive or negative effect.
These figures should read as follows: all companies above the horizontal red line can be considered transparent, as their CRORI is higher than 0.5; similarly, all companies to the right of the vertical red line have a high CDP climate score, i.e. greater than or equal to grade B.

Figure 3: Average CRORI and CDP score of CAC 40 companies before the TCFD recommendations (2015–2017)
Average CRORI and average CDP score for CAC 40 companies 2015–2017, considering, on the one hand, high stakes industries, and on the other hand, low stakes industries. The vertical red line corresponds to a CDP score of 0.725 (the median of category B). The vertical red line corresponds to a CRORI of 0.5.



Two key insights emerge from these figures. First, there is an overall improvement of both firm transparency and climate performance (CRORI and CDP) over the period. Second, there is still a strong heterogeneity among companies, which may be explained by the fact that they have followed different paths over the period.

Regarding the improvement of the pair (CRORI, CDP) over the period, we can see that the number of firms with both a high CRORI and a high CDP (upper right quadrant) increased from 12 to 26 between the two periods. In contrast, the number of firms with both a low CRORI and a low CDP (lower left quadrant) decreased from 10 to 3. On the other hand, the number of firms with a high CRORI and a low CDP (upper left quadrant) remained relatively stable from sub-period 1 to sub-period 2.

Since the composition of the quadrants is not the same from one sub-period to another, it is

Figure 4: Average CRORI and CDP score of CAC 40 companies after the TCFD recommendations (2018–2019)
Average CRORI and average CDP score for CAC 40 companies 2018–2019, considering, on the one hand, high stakes industries, and on the other hand, low stakes industries. The vertical red line corresponds to a CDP score of 0.725 (the median of category B). The vertical red line corresponds to a CRORI of 0.5.

necessary to perform a dynamic analysis of the level of the pair (CRORI, CDP score) for each company by distinguishing the two sub-periods. The idea is to follow the evolution of these indices for each firm, which are, respectively, proxies of the transparency of the firm with regard to climate risks and its commitment or its efforts in climate matters. Indeed, it is not because a company is polluting that it cannot green its activities.
Our analysis allows us to identify 8 paths likely to be taken by CAC 40 companies, depending on their original position.

1. A path oriented toward both transparency and a positive commitment marked by a more or less strong improvement of the CRORI level and the CDP score.

2. A transparent oriented path (which translates into an increase in CRORI and a stable CDP score).

3. A path oriented toward a stable level of both transparency and commitment, which translates into a relative stability of both the CRORI level and the CDP score.

4. A path oriented toward both less transparency and a negative engagement, marked by a decrease of the CRORI levels and the CDP score.

5. A non-transparent oriented path, corresponding to a decrease in the CRORI and a stable CDP.

6. A path oriented toward more to transparence than to engagement, which results in an increase in the CRORI level and a decrease in the CDP score.

7. A transparency oriented path, marked by a decrease in the CRORI and an increase in the CDP score.

8. A commitment oriented path (with a stable CRORI and an increase in the CDP score).

Table 5 provides a breakdown of companies following each of these 8 paths by industry.

It can be observed that only 6 paths have been followed by French firms and 70 percent of them have followed the first path (i.e. oriented toward both transparency and positive commitment marked by an improvement of both the CRORI and the CDP score). The remaining 30% are distributed among the others. It should be noted that two trajectories were not adopted: non-transparency oriented corresponding to a decrease in CRORI and a stable CDP (path 5) and the one consisting of more commitment than transparency, marked by a decrease in CRORI and an increase in CDP score (path 7).

Several key insights emerge from this analysis. First, we observe that only the first 6 paths have been followed by French firms, with a large majority adopting the path oriented toward both transparency and a positive commitment (path 1). This is the case for 19 companies out of 26 in sectors with high environmental stakes, a large proportion of which already had a high level of CRORI and CDP score. Despite their good initial positioning, they continued to improve their level of compliance with the TCFD recommendations and their climate performance, which makes them leaders in their sector. These include : i) Accor, Schneider Electric and Legrand in the building sector; ii) PSA, Renault and Valeo in the transport sector; iii) Total and Engie in the energy sector; and iv) Danone and Pernod in the food sector.

This strategy can be explained by the nature of the activities of these companies, which are mainly business-to-consumer (BtoC) companies and/or brand-name companies. Indeed, these kinds of companies are highly likely to adopt a strategy oriented toward climate commitment and transparency, as they are subject to direct consumer pressure. We observe that two firms are exceptions, and therefore cannot be considered as leaders in the transport sector. By way of illustration, despite the increase in their CRORI and CDP levels, Airbus remains in the lower left-hand quadrant, which groups together firms with a CRORI level below 0.5, but also a CDP score below grade B, and Safran moved to the upper left hand quadrant which groups together firms with a CRORI level up to 0.5, but also a CDP score below grade B. This specific trajectory certainly reflects an awareness of the interest in following the trend, but there is still substantial room for improvement. This can be explained by the fact that, as a Business-to-Business firm, Airbus seems less subject to direct pressure from the media and clients.

In low stakes industries, 9 out of 13 companies have taken this path, like Kering and Atos. For most of them, the improvement has focused more on the level of transparency in response to pressure from the markets and investors in particular.

Second, we observe that some companies have chosen to prioritize transparency over commitment by following path 2 or path 6, which are oriented toward higher transparency with a stable or decreasing commitment. Four companies followed path 2: BNP Paribas, Crédit Agricole, Nokia and Publicis. The two banks stand out: while Crédit Agricole moved from the bottom to the top left quadrant favoring transparency, BNP Paribas remained in the top right quadrant with a CDP score higher than grade B and improving its transparency on climate issues. The increase in CRORI is explained by a tracking effect, the wish to do like other firms in the sector. Publicis, in spite of its efforts in terms of disclosure, remains to the left of the vertical line, indicating a still insufficient CDP score. This can be seen as a certain passivity or even indifference to these issues, as the company operates in a low-stakes industry. Nokia is in the opposite position since its CDP score is satisfactory while its CRORI remains well below 0.5.

Four companies followed path 6. This includes the bank Société Générale and the construction

Table 5: Overview of companies' paths regarding transparency and climate commitment
The number and share of companies adopting each of the 8 identified paths. Path (1): Positive transparent and commitment oriented; Path (2): Transparent oriented; Path (3): Stable transparent and commitment oriented; Path (4): Negative transparent and commitment oriented; Path (5): Non transparent oriented; Path (6): More transparent than commitment oriented; Path (7): More commitment than transparent oriented; Path (8): Commitment oriented.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	CRORI ↗ CDP ↗	CRORI ↗ CDP =	CRORI = CDP =	CRORI ↘ CDP ↘	CRORI ↘ CDP =	CRORI ↗ CDP ↘	CRORI ↘ CDP ↗	CRORI = CDP ↗
High stakes industries	19	2	1	1	0	2	0	1
(percent.)	*48.72%*	*5.13%*	*2.56%*	*2.56%*	*0%*	*5.13%*	*0%*	*2.56%*
Finance	1	2				1		
Materials	7		1		0	1		1
Transport	6							
Energy	2							
Food	3			1				
Low stakes industries	9	2				2		
(percent.)	*23.08%*	*5.13%*	*0%*	*0%*	*0%*	*5.13%*	*0%*	*0%*

company Solvay in sectors considered to have high environmental stakes. However, their situation is different, insofar as Société Générale moves from the upper right to the upper left quadrant and Solvay remains in the upper left quadrant. For Société Generale, this is all the more remarkable, as the decrease in the score dates from 2018 and 2019 after having been quite good in previous years, following article 173 of the Climate Law. This bank makes an effort to be transparent with regard to the expectations of the financial markets and its competitors, but this has not been followed with a sufficient improvement with regard to the expectations of CDP. It can be assumed that investments and financing granted to the high carbon sector are still too high compared to those of the low carbon sector (OXFAM 2018, Mesonnier and Nguyen 2020).

Finally, some companies have followed singular strategies. Arcelor displays a stable CRORI and a higher CDP (path 8), which allows it to switch from the lower left to the lower right quadrant. The situation of Bouygues remains unchanged between the two periods, which can be explained by the fact that it already belongs to the group of leaders (upper right quadrant). More surprisingly, Sodexho's CRORI and CDP scores have declined (path 4). This reflects a passive or even indifferent behavior due to the fact it is a BtoB firm.

Overall, these results reflect a general desire on the part of major French companies to improve their climate performance and their transparency with regard to climate risks and opportunities.

6 Conclusion

The issue of environmental and climate disclosure has become a major challenge in the fight against climate change. Eager to allocate their portfolios and savings as efficiently as possible, investors expect companies to become more transparent about how they integrate climate risks. We have reviewed, five years after COP 21, the climate disclosure practices of those French firms with the largest stock market capitalizations (CAC 40) over the period 2015–2019, putting into perspective both the evolution of the level of their disclosures, measured by the Climate Risks and Opportunities Index (CRORI), and the level of their climate commitment, measured by the climate disclosures practices (CDP score which is considered as a climate performance index).

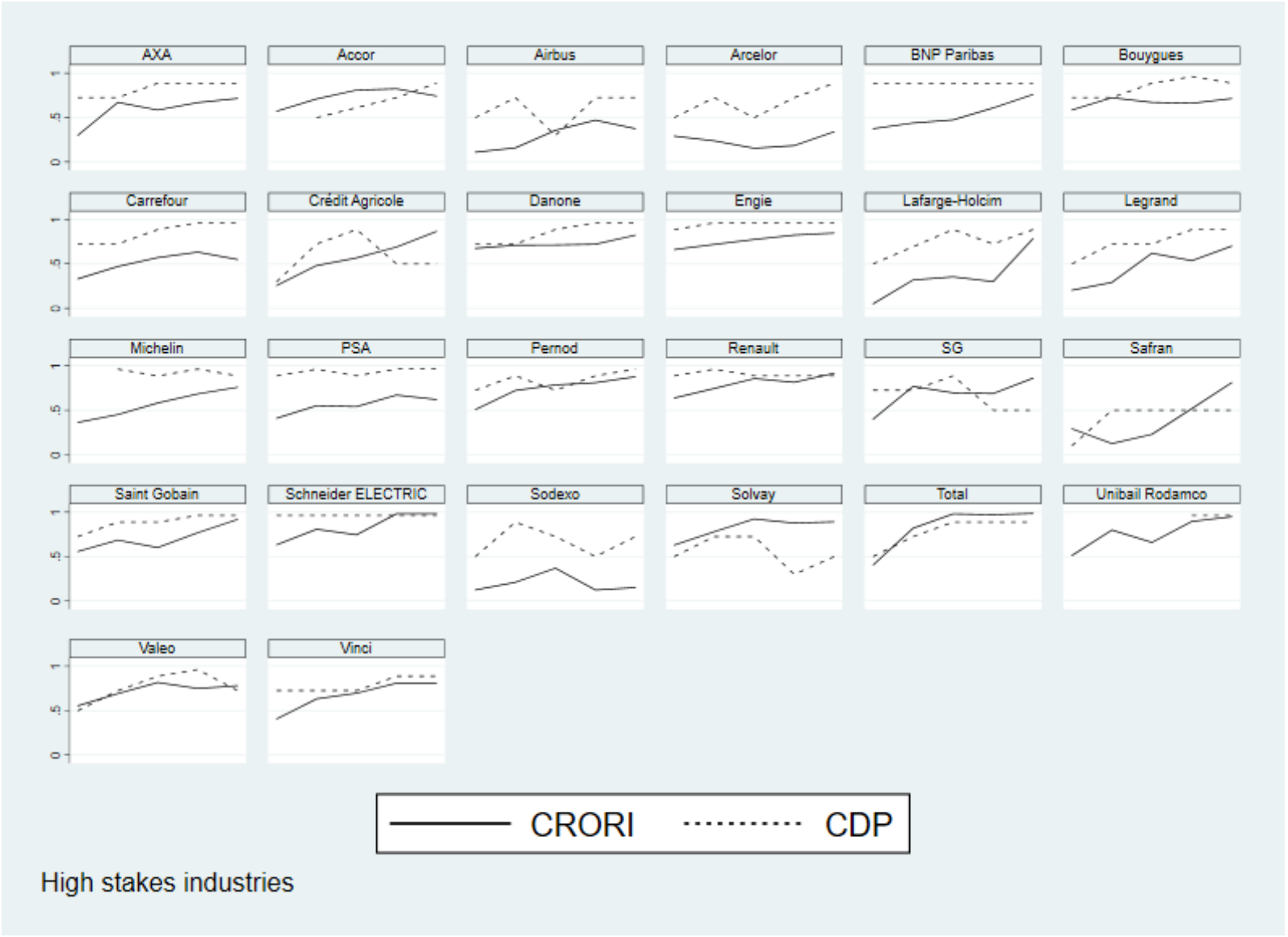
While the Financial Stability Board has been working since 2015 to improve corporate climate reporting, our results show that France's largest listed companies are disclosing more and more information on climate risk. On average, companies in the energy sector are far ahead, followed by those in the construction and finance sectors, with CRORI levels above the sample average. The transport and food sectors are below, and with a very low level for the low stakes sector. These results are in line with previous work demonstrating that following the appearance of a new environmental recommendation, firms tend to improve their level of compliance over time (Albertini 2014, Chauvey et al. 2015, Russo-Spena et al. 2018). This improvement in the CRORI is explained by the growing interest of disclosure on their consideration of climate change management by investors and financial markets (Ben-Amar and McIlkenny 2015, Velte et al. 2020)

While the evolution of the CDP score follows the same upward trend, the sectoral breakdown is different, with the exception of the energy sector, which scores very well in both the CDP score and the CRORI. It is followed by the low stakes and food sector, with levels above a grade of B. The other sectors that are considered the most polluting, such as construction and transportation, are below and finance is in last place. This last observation fuels Mark Carney's fears, which he expressed in his speech in 2015. If finance seems to have taken the measure of the importance of financial transparency with an increase in the CRORI, the same cannot be said for the CDP score. With regard to the scores of this sector, its true commitment is lagging behind. A dynamic analysis of the pair (CRORI, CDP score) allowed us to identify 8 trajectories likely to be taken by CAC 40 companies according to their sector. 70 percent of them have followed the same trajectory, which can be considered a trajectory oriented towards both transparency and positive commitment marked by a more or less strong improvement of the CRORI level and the CDP score.

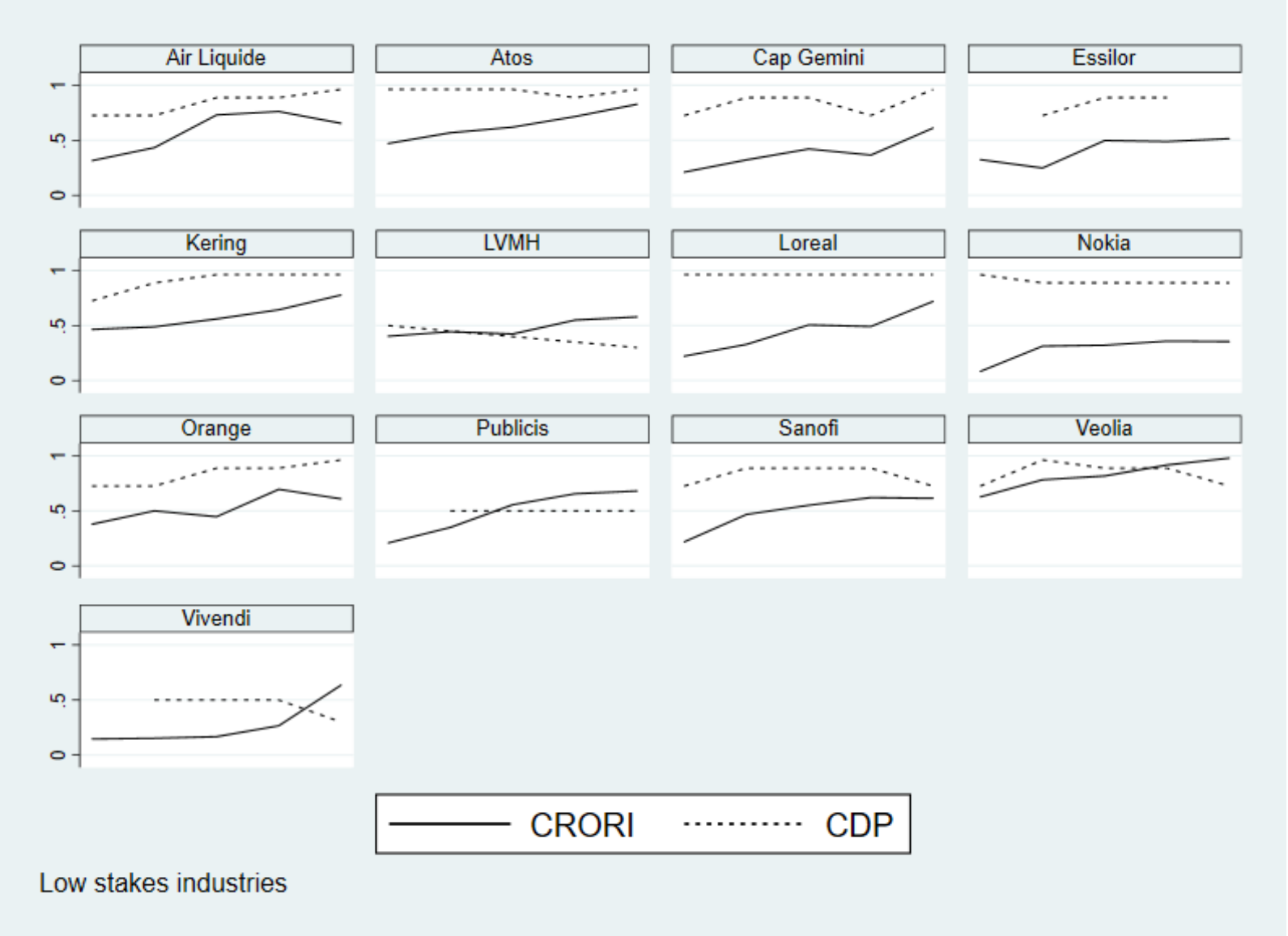
This observation is rather encouraging: over the last five years, firms have really accelerated their efforts in non-financial communication and climate risk management. Despite these encouraging results, they should be put into perspective if we consider the alignment of CAC 40 index portfolios. In 2018, it was 5.2°C while the objectives to be reached are less than 2°C (Stephens 2018). Substantial progress remains to be made. If we can hope that companies that are on a transparent and commitment oriented path are more likely to achieve them, we can assume that this will not be the case for companies that are on the opposite trajectory, such as negative transparent and commitment oriented path or more transparent than commitment oriented path.

This paper is of interest to regulators in order to make recommendations on how to improve the level and quality of disclosures related to climate risks, as this study reveals gaps between the two and especially the efforts to be made between now and 2050 are enormous given that these firms are far from being carbon neutral. Thus the comparison of the compliance index with a climate performance indicator of firms fuels fears linked to the temptation to make the fight against climate change rely mainly on transparency. This must remain one of several avenues to be explored. As for its effectiveness, that depends on its mandatory nature and the standardization of non-financial disinformation, in particular to avoid greenwashing practices.

Appendix A: Evolution 2015–2019 of the CRORI and CDP score by firm



Evolution of the CDP score and the CRORI, Low stakes industries



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