Explosive Financing? Bank Share Price Reactions to Carbon Bomb Exposure

Abstract

On 31 October 2023, a collaboration of international media houses and French non-profit organizations published a report on bank financing of fossil fuel extraction projects representing more than 1 gigaton of CO_2 emissions ("carbon bombs"). Despite the fact that the impending carbon bomb emissions significantly exceed the remaining carbon budget to limit global warming to 1.5°C, the report shows that major US, European and Asian banks continue to finance these projects. In this paper, we examine the value relevance of this information. We test the competing hypotheses that (1) the market reaction is naively negative; (2) the market reacts to the incremental information about carbon bomb financing that is not yet included in the banks' ESG scores (from LSEG Datastream); and (3) the market focuses on the ESG ratings themselves when incorporating the carbon bomb information. We find that the market reaction was primarily influenced by the banks' ESG scores: the lower the pre-release ESG score, the more negative the market reaction, suggesting that a strong environmental reputation mitigates the negative reaction to the carbon bomb disclosure.

Keywords: Carbon bombs, fossil fuel financing, CO_2 emissions, banking sector, sustainable finance.

JEL Classification Codes: G14, G32, Q51

1. Introduction

On 31 October 2023, the newspapers *The Guardian* in the UK, *Le Monde* in France and *Der Spiegel* in Germany published exclusive reports exposing the bank financing of so-called "carbon bombs". On the same day, the CarbonBombs.org website went online, making available the data collected by the collaboration of these newspapers and non-profit organizations. The term carbon bomb had been introduced a year earlier by Kühne et al. (2022), who defined it as "a proposed or existing fossil fuel extraction project (a coal mine, oil or gas project) that would result in more than 1 gigaton of CO_2 emissions if its reserves were completely extracted and burnt" (p. 1). Kühne et al. (2022) identified 425 such projects and described their location and emissions potential. In 2020, 294 (69%) of the projects were ongoing, while 131 (31%) were still in the planning stage. The regional distribution shows a focus on Asia (264 projects), followed by Europe (52), North America (44), Oceania (23), Africa (22) and South America (20).

The new information about the financing structures seemed explosive, as major US, European and Asian banks continued to finance the projects with billions of US dollars. This is despite the fact that the impending carbon bomb emissions significantly exceed the remaining carbon budget to limit global warming to 1.5°C (Kühne et al., 2022; DGE, 2023). Financing carbon bombs therefore does not seem to be in line with the green policies of most major banks and the requirements of sustainable finance (UNEP, 2024; BOCC, 2024b; IPCC, 2023; Bernardelli et al., 2022).

Our first research question is whether carbon bomb financing is related to the ESG score (from LSEG Datastream) a bank had prior to the publication of CarbonBombs.org. Since carbon bomb projects are part of the broader class of fossil fuel projects, which are important for ESG scores, we hypothesize that some of the carbon bomb information is already included in the scores. Our second research question is whether the incremental information about carbon bomb financing, which is not yet included in the banks' ESG scores, is value relevant. We test the competing hypotheses that (1) the market reaction is naively negative; (2) the market reacts to the incremental information about carbon bomb financing; and (3) the market focuses on the ESG scores themselves when incorporating the carbon bomb information.

Our findings indicate a negative association between pre-release ESG scores and carbon bomb involvement, particularly for projects that have not yet become operational. The market reaction was neither naive nor driven solely by the incremental information about carbon bombs. Instead, it was primarily influenced by the banks' ESG scores: the lower the pre-release ESG score, the more negative the market reaction.

Our study contributes to the growing literature on the valuation implications of fossil fuel finance. Previous research has found that market participants generally reward positive environmental news and penalize negative disclosures (see, e.g. Flammer, 2013; Griffin et al., 2017; Pham et al., 2019; Alsaifi et al., 2020; Jung et al., 2021; Alessi et al., 2024), and that climate-related news leads to a stronger stock price reaction for firms with higher exposure to carbon-intensive assets (Ilhan et al., 2021). Banks involved in fossil fuel finance face reputational risks (Jung et al., 2021) and tend to have lower ESG ratings (Kotsantonis and Bufalari, 2019; Bernardelli et al., 2022; BOCC, 2024a). Conversely, fossil fuel divestment campaigns by financial institutions tend to improve their environmental reputation and market value (Bassen et al., 2021; Zori et al., 2022; Monaco, 2023). Nevertheless, the banking sector continues to finance the fossil fuel industry (BOCC, 2024a), suggesting that this lending is still considered profitable compared to green investments (see, e.g., Minetti (2011) and Beyene et al. (2022)).

Our contribution to this literature is to focus on the financing of carbon bombs, which by their nature are particularly important for global CO_2 emissions. These projects provide an opportunity to test how serious banks are about reducing their carbon footprint, even at the cost of significant short-term profits, and how the market reacts to adverse information. We are not aware that the financing of carbon bombs has been analyzed as a test case for banks' green policies in previous literature.

2. Data and variables measuring bank involvement

The collaboration that analyzed the financing of carbon bombs was led by the French nonprofit organizations *Data for Good* and *Éclaircies* and included major European media outlets. The researchers linked the carbon bombs database created by Kühne et al. (2022) to the companies that own or operate the projects using the Global Energy Monitor (GEM) database, which consists of two parts, the Global Oil and Gas Extraction Tracker and the Global Coal Mine Tracker. The researchers then matched these operating fossil fuel companies with the world's 60 largest banks using the Banking on Climate Chaos database (BOCC, 2024b), which covers lending, debt underwriting and equity issuance to companies in the fossil fuel industry. The final sample consists of 58 banks for which the relevant data were available.

For the example of the three French banks Société Générale, Crédit Agricole and BNP Paribas, Figure 1 shows the network graphs of the connections between the banks (on the left), the operating companies (in the middle) and the carbon bomb projects (on the right). The top network includes all carbon bombs, while the bottom network includes only those projects that are not yet operational. The width of the lines on the left is proportional to the volume of financing provided by the bank to the operating company.

– Insert Figure 1 here –

The networks contain many connections and are difficult to evaluate intuitively. To gain a better overview and make the banks comparable, we construct the following variables to measure bank involvement:

$Nb.C$:	Number of fossil fuel companies financed
$FinVol$:	Total financing volume from 2016 to 2022 in billion USD
ΔFin:	Relative change of the financing volume in 2022 compared to the average financing volume from 2016 to 2021
$Nb.P$:	Number of carbon bombs financed
$Rank$:	Average rank according to the previous four indicators

Our main focus is on the $Rank$ variable, which is a combined score that is defined as the mean value of the ranks that the bank achieves in a univariate ranking (in ascending order) by $Nb.C$, $FinVol$, ΔFin, and $Nb.P$. All five variables are designed in such a way that a higher value indicates a greater involvement in carbon bomb financing.

– Insert Table 1 here –

Table 1 shows the bank-specific values of the five variables based on all carbon bomb projects and based only on the projects that are not yet operational. The differences in bank involvement are large, ranging from a number of projects financed of 1 (Danske Bank) to 174 (Bank of China). There are 24 banks that are involved in more than 100 carbon bombs, and 28 banks that are involved in more than 50 planned projects. Most banks have reduced their financing volume from 2016 to 2022, as indicated by the mostly negative ΔFin values. Several banks have stopped their financing altogether, with ΔFin equal to -100% (Lloyds, DZ Bank, Nordea Bank, Danske Bank, Rabobank).

– Insert Table 2 here –

The Pearson and Spearman correlation coefficients in Table 2 show that $Nb.C$, $FinVol$ and $Nb.P$ are highly correlated with each other, while they are not significantly correlated with ΔFin. This suggests that banks with high and low involvement make similar efforts to reduce their financing volumes. These observations are similar for ongoing and planned projects. The banks that are generally heavily involved in carbon bombs are also heavily involved in planned projects, and a stronger reduction in the financing volume of all projects is also associated with a stronger reduction in the financing volume of planned projects.

In addition to the carbon bomb data, we use stock return data and the ESG score from LSEG Datastream. This score ranges from 1 to 100. The ESG methodology is described in LSEG (2024).

3. Pre-release ESG scores and carbon bomb financing

Our first research question is about the relationship between pre-release ESG scores and carbon bomb financing. Our hypotheses are as follows:

H1a: The extent to which a bank is involved in the financing of carbon bombs is negatively related to its ESG score.

H1b: The extent to which a bank is involved in the financing of planned (not yet operational) carbon bombs is negatively related to its ESG score.

H1c: The relation to the ESG score is stronger for planned carbon bombs than for carbon bombs that are already operational.

To examine hypotheses H1a-H1c, we regress the banks' ESG score on the variables of bank involvement in carbon bombs in univariate cross-sectional regressions:

$$ESG_i = a + bVar_i + \epsilon_i, \tag{1}$$

where ESG_i is the ESG score, $i \in \{1, \cdots, 58\}$ is the bank identifier, $Var \in \{Nb.C, FinVol, \Delta Fin, Nb.P, Rank\}$, a and b are the regression coefficients, and ϵ is the error term.

We repeat estimation (1) for the components of the ESG score, i.e. the E, S and G scores. Panel A of Table 3 shows the results when the Var variables are based on all carbon bomb projects, Panel B when they are based on only the operational projects, and Panel C when they are based on only those projects that are still in the planning stage.

– Insert Table 3 here –

The $Rank$ variable has significantly negative coefficients in all panels, confirming hypotheses H1a and H1b. With R^2 coefficients of 8.1% (Panel A), 7.1% (Panel B) and 18.2% (Panel C), $Rank$ explains an important part of the variation in ESG. The number of projects financed, measured by $Nb.P$, also has a significantly negative relationship with ESG in all panels. Looking at the ongoing carbon bombs, the change in the volume of financing (ΔFin) is more important for ESG than its level ($FinVol$), suggesting that efforts to reduce carbon footprints are rewarded. For projects in the planning stage, on the other hand, a reduction in exposure does not seem sufficient and the volume of financing becomes significant (with a negative coefficient). The results are similar for the E and S scores, while the G score is less well explained by banks' involvement in carbon bombs.

Consistent with hypothesis H1c, the *Rank* variable has lower *ESG* coefficients for new projects (-0.516) than for ongoing projects (-0.298). However, the Z-test shows that the difference is not significant ($Z = 1.017$). This could be due to low test power – given the small sample size of 58 banks, the difference would have to be very large to be significant.

4. Market reaction to carbon bomb financing

For the second research question about the value relevance of carbon bomb financing, our hypotheses are as follows:

H2: (Naive reaction hypothesis) The average market reaction is negative.

H3: (Incremental information hypothesis) The market reacts more negatively if a bank is more involved in financing carbon bombs than its pre-release ESG score would suggest.

H4: (ESG channel hypothesis) The market reacts more negatively if a bank has a lower pre-release ESG score.

Following common practice in event studies, we measure the market reaction to the carbon bomb information by the Cumulative Abnormal Return (CAR) over the event window. We choose a short event window $[-1,1]$ from the day before to the day after the publication, because there is no uncertainty about the announcement date (31 October 2023), and the collaborating media houses ensured wide distribution on day 0. The abnormal performance on day t is defined as the market-adjusted stock return $AR_{it} = r_{it} - \beta_i r_{mt}$, where AR_i is the abnormal return of bank i, r_i is its stock return, r_m is the return of the market proxy and β_i is the slope of the characteristic line in the estimation window $[-252, -2]$. We use the most common country index in the country where a bank is headquartered as the market proxy. Our results are robust to using the MSCI ACWI index or the MSCI ACWI Banks index instead. Due to missing stock price data or confounding events in the event window, 13 banks have to be excluded, leaving 45 banks for this part of the study.[1]

– Insert Table 4 here –

According to the naive reaction hypothesis H2, the market reaction should be negative on average. To test this hypothesis, we calculate the Cumulative Average Abnormal Return (CAAR) and apply the BMP t-test developed by Boehmer et al. (1991) and later adjusted by Kolari and Pynnönen (2010) to account for event-related return volatility and cross-sectional return correlation. This adjustment is important in our case as the event date is the same for all banks (see also Antoniuk and Leirvik, 2024). With a CAAR of -0.624% and a t-value of -0.637, there is clearly no support for this hypothesis (see Table 4).

The incremental information hypothesis H3 states that the market reacts to the part of a banks' involvement that is not yet captured by its ESG score. This could be implemented as a two-stage regression. The first-stage regression would be $Var_i = b_{10} + b_{11} ESG_i + \epsilon_i$, where b_{10} and b_{11} are the regression coefficients (with b_{11} expected to be negative). The residuals would be used as the explanatory variable in the second regression: $CAR_i = b_{20} + b_{21}\epsilon_i + \varepsilon_i$ with the expectation $b_{21} < 0$ (negative market reaction to higher bank involvement not explained by

[1] The specific reasons for the exclusion of 13 banks are: quarterly earnings announcements in the event window (5); ex-dividend date in the event window (2); delisted bank shares (4); Chinese A-shares due to trading restrictions for international investors (2).

ESG). We integrate the two steps by inserting $\epsilon_i = Var_i - b_{10} - b_{11}ESG_i$ from the first stage into the second-stage equation, which gives $CAR_i = (b_{20} - b_{21}b_{10}) - b_{11}b_{21}ESG + b_{21}Var_i + \varepsilon_i$. We adopt the general structure of the equation in our regression model:

$$CAR_i = \alpha + \beta ESG_i + \gamma Var_i + \varepsilon_i. \tag{2}$$

Under the incremental information hypothesis, we expect γ to be significantly negative (since it is theoretically equal to b_{21}) and β to be negative but small. The ESG channel hypothesis H4 can be tested using the same regression model (2). According to H4, β should be significantly positive while γ is insignificant.

The regression results in Table 5 clearly reject the incremental information hypothesis and confirm the ESG channel hypothesis. The coefficient of ESG is significantly positive in all specifications while the Var coefficients are close to zero. Between 12.8% and 21.1% of the variation of CAR can be explained by ESG. The ESG coefficients are about 5.5, which means that an increase of ESG of 10 points (on a scale from 1 to 100) would result in a 0.55 percentage points increase in CAR.

– Insert Table 5 here –

5. Discussion

Our finding of a negative relationship between banks' involvement in carbon bombs and pre-release ESG scores from LSEG Datastream confirms that the ESG scores are informative about fossil fuel financing. Possible interpretations are that the carbon bombs were already explicitly taken into account when the scores were created, or that the financing of carbon bombs correlates with the financing of oil and gas extraction projects in general. For ongoing projects, a decrease in funding volume is rewarded, while for projects in the planning stage, the funding volume itself is more strongly related to the ESG score.

We also find that the market reaction to the disclosure of the carbon bomb financing was based on the pre-release ESG score rather than the incremental information about the carbon bombs. The underlying assumption may have been that banks with high ESG scores can be more trusted to reduce their involvement in large fossil fuel projects in the future. This is consistent with the findings of Xu et al. (2012) and Xu and Zhang (2024) that a strong environmental reputation mitigates the negative reaction to the disclosure of environmental fines (see similarly for a strong Corporate Social Responsibility (CSR) reputation Godfrey, 2005).

While significant, the ESG-related market reaction remains relatively small given the crucial role of carbon bomb projects in reducing CO_2 emissions. One possible explanation is that the financing of such projects is largely indirect, with banks financing the fossil fuel companies that operate these projects rather than the projects themselves. In contrast, direct project financing is largely restricted by bank policies that prohibit direct investment in new fossil fuel projects. This indirect financing structure obscures the relationship between banks and carbon bomb projects, allowing banks to remain involved (Cojoianu et al., 2021; Beyene et al., 2022; Rickman et al., 2024). As fossil fuel projects continue to be perceived as profitable (Kreibiehl et al., 2022), this dynamic creates strong incentives for continued investment. Consequently, it may be prudent to consider binding restrictions on indirect financing as well.

References

Alessi, L., Battiston, S., Kvedaras, V., 2024. Over with carbon? Investors' reaction to the Paris Agreement and the US withdrawal. Journal of Financial Stability 71, 101232.

Alsaifi, K., Elnahass, M., Salama, A., 2020. Market responses to firms' voluntary carbon disclosure: Empirical evidence from the United Kingdom. Journal of Cleaner Production 262, 121377.

Antoniuk, Y., Leirvik, T., 2024. Climate change events and stock market returns. Journal of Sustainable Finance & Investment 14, 42–67.

Bassen, A., Kaspereit, T., Buchholz, D., 2021. The capital market impact of Blackrock's thermal coal divestment announcement. Finance Research Letters 41, 101874.

Bernardelli, M., Korzeb, Z., Niedziółka, P., 2022. Does fossil fuel financing affect banks' ESG ratings? Energies 15, 1495.

Beyene, W., Delis, M., Ondega, S., 2022. Financial Institutions' Exposures to Fossil Fuel Activities: Financial Stability, Risks, and Policy Responses. Report. European Parliament.

BOCC, 2024a. Fossil Fuels Finance Report 2024. Report. Banking on Climate Chaos.

BOCC, 2024b. Fossil Fuels Financing Data for JPMorgan Chase. Report. Banking on Climate Chaos.

Boehmer, E., Masumeci, J., Poulsen, A.B., 1991. Event-study methodology under conditions of event-induced variance. Journal of Financial Economics 30, 253–272.

Cojoianu, T.F., Ascui, F., Clark, G.L., Hoepner, A.G., Wójcik, D., 2021. Does the fossil fuel divestment movement impact new oil and gas fundraising? Journal of Economic Geography 21, 141–164.

DGE, 2023. Carbon bombs under the spotlight. Report. Data for Good and Eclaircies.

Flammer, C., 2013. Corporate Social Responsibility and shareholder reaction: The environmental awareness of investors. Academy of Management Journal 56, 758–781.

Godfrey, P.C., 2005. The relationship between corporate philanthropy and shareholder wealth: A risk management perspective. Academy of Management Review 30, 777–798.

Griffin, P.A., Lont, D.H., Sun, E.Y., 2017. The relevance to investors of greenhouse gas emission disclosures. Contemporary Accounting Research 34, 1265–1297.

Ilhan, E., Sautner, Z., Vilkov, G., 2021. Carbon tail risk. Review of Financial Studies 34, 1540–1571.

IPCC, 2023. Climate Change 2023. Synthesis Report, Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.

Jung, H., Engle, R.F., Berner, R., 2021. CRISK: Measuring the climate risk exposure of the financial system. Staff report No. 977. Federal Reserve Board of New York.

Kolari, J.W., Pynnönen, S., 2010. Event study testing with cross-sectional correlation of abnormal returns. Review of Financial Studies 23, 3996–4025.

Kotsantonis, S., Bufalari, V., 2019. Do sustainable banks outperform? Driving value creation through ESG practices. Report. Global Alliance for Banking on Values (GABV).

Kreibiehl, S., Yong Jung, T., Battiston, S., Carvajal, P.E., Clapp, C., Dasgupta, D., Dube, N., Jachnik, R., Morita, K., Samargandi, N., Williams, M., 2022. Investment and Finance. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. IPCC. Cambridge, UK and New York, NY, USA.

Kühne, K., Bartsch, N., Tate, R.D., Higson, J., Habet, A., 2022. "Carbon Bombs" – Mapping key fossil fuel projects. Energy Policy 166, 112950.

LSEG, 2024. Environmental, Social and Governance scores from LSEG. LSEG Data & Analytics.

Minetti, R., 2011. Informed finance and technological conservatism. Review of Finance 15, 633–692.

Monaco, A., 2023. Divestment and greenhouse gas emissions: An event-study analysis of university fossil fuel divestment announcements. Journal of Sustainable Finance & Investment 13, 1451–1479.

Pham, H., Nguyen, V., Ramiah, V., Saleem, K., Moosa, N., 2019. The effects of the Paris climate agreement on stock markets: Evidence from the German stock market. Applied Economics 51, 6068–6075.

Rickman, J., Falkenberg, M., Kothari, S., Larosa, F., Grubb, M., Ameli, N., 2024. The challenge of phasing-out fossil fuel finance in the banking sector. Nature Communications 15, 7881.

UNEP, 2024. Net-Zero Banking Alliance. Report. United Nations Environment Programme.

Xu, X., Zeng, S., Tam, C.M., 2012. Stock market's reaction to disclosure of environmental violations: Evidence from China. Journal of Business Ethics 107, 227–237.

Xu, X., Zhang, C., 2024. How does stock market react to environmental penalty announcements? Environmental Science and Pollution Research 31, 1–20.

Zori, S.G., Bakker, M.H., Tuokuu, F.X.D., Pare, J., 2022. Market reaction to fossil fuel divestment announcements: Evidence from the United States. Business and Society Review 127, 939–960.

Table 1: **Descriptive statistics.**

Variables measuring bank involvement in carbon bombs for the sample banks. The variables are defined in Section 2. Sorting by *Rank* based on all carbon bomb projects.

			All carbon bomb projects ($N = 425$)					**Projects not yet operational** ($N = 131$)				
#	**Bank**	**Country**	$Nb.C$	$FinVol$	ΔFin	$Nb.P$	$Rank$	$Nb.C$	$FinVol$	ΔFin	$Nb.P$	$Rank$
1	Bank of China	China	42	65.7	−35.2	174	49.1	15	32.8	−49.1	104	45.8
2	Citi	United States	83	119.2	−56.4	144	49	23	37.4	−71.0	88	44.8
3	ICBC	China	30	92.2	14.4	131	48.6	11	49.5	28.2	87	46.8
4	MUFG	Japan	49	48.8	−30.5	139	48.1	18	10.8	−8.3	94	43.8
5	Mizuho	Japan	51	49.4	−27.1	113	46.5	22	16.1	−14.6	74	41
6	JPMorgan Chase	United States	78	141.8	−72.9	131	45.9	21	46.3	−70.0	81	43
7	Bank of America	United States	58	93.5	−69.5	108	43.2	16	32.1	−70.3	62	39.5
8	China Construction Bank	China	31	47.6	−39.5	140	43	14	30.1	−52.9	92	43.4
9	BNP Paribas	France	34	71.9	−30.9	88	42.4	10	12.7	85.9	50	37
10	Bank of Communications	China	25	28.5	30.9	133	41.9	10	18.8	64.4	82	42.1
11	Crédit Agricole	France	31	39.8	14.4	93	41.8	13	15.0	30.4	53	39.9
12	Goldman Sachs	United States	49	46.8	−78.8	146	41.8	19	13.8	−75.1	100	40.5
13	Industrial Bank	China	26	51.5	−37.3	118	41.5	12	31.6	−22.2	87	42.1
14	Morgan Stanley	United States	42	51.5	−81.5	146	41.5	17	21.9	−87.1	107	40.9
15	SMBC Group	Japan	36	36.3	8.4	93	41.1	10	7.1	102.0	44	35.2
16	Shanghai Pudong Dev. Bank	China	26	38.3	−16.5	118	41	14	18.1	−31.1	91	42.1
17	Agricultural Bank of China	China	25	49.4	6.9	102	40.6	10	26.7	15.0	78	40.8
18	China CITIC Bank	China	24	35.3	76.1	114	40.5	12	23.1	7.4	84	42.9
19	HSBC	UK	46	62.1	−72.7	105	40.1	15	16.6	−53.4	59	37.2
20	China Merchants Bank	China	26	34.6	−8.3	116	39.4	11	16.5	−20.4	83	38.5
21	Société Générale	France	34	36.8	−32.7	92	38.1	11	15.6	25.1	52	38
22	China Everbright Bank	China	21	34.9	−2.9	112	37	10	23.9	6.6	82	40.1
23	Deutsche Bank	Germany	46	28.2	−83.7	143	36.6	17	10.8	−75.4	89	37.6
24	Credit Suisse	Switzerland	43	24.5	−54.1	104	35.9	13	5.8	3.9	57	34.4
25	RBC	Canada	31	41.2	−42.1	61	35.5	8	7.6	17.7	35	30.9
26	Wells Fargo	United States	33	62.4	−44.3	34	35.2	6	9.8	5.4	14	25.4
27	Barclays	UK	36	54.4	−87.5	69	33.9	15	25.5	−87.9	54	34.5
28	Postal Savings Bank	China	20	9.4	−0.7	104	32.4	8	4.2	45.1	76	34
29	Standard Chartered	UK	26	10.7	−66.1	128	32.2	10	2.5	−88.8	90	27.8
30	Scotiabank	Canada	24	36.8	−37.7	59	31.8	7	5.3	6.4	21	25.6

Table 1 continues on the next page.

Table 1: Continuation.

			All carbon bomb projects ($N = 425$)					Projects not yet operational ($N = 131$)				
#	**Bank**	**Country**	$Nb.C$	$FinVol$	ΔFin	$Nb.P$	$Rank$	$Nb.C$	$FinVol$	ΔFin	$Nb.P$	$Rank$
31	Ping An Insurance Group	China	19	30.1	−53.9	109	31.1	8	9.4	−79.0	77	28.2
32	TD	Canada	19	39.8	−32.4	36	30.1	6	6.3	145.9	16	28.4
33	ANZ	Australia	14	7.2	81.4	57	28.4	6	1.9	−85.3	47	19.1
34	UBS	Switzerland	24	11.9	−91.1	128	27.1	9	4.9	−91.1	87	26.5
35	Santander	Spain	19	23.6	−55.5	66	26.6	6	2.9	−73.8	34	20.2
36	China Minsheng Bank	China	23	23.6	−77.2	93	26	10	7.6	−45.0	51	30.2
37	Intesa Sanpaolo	Italy	10	6.9	124.9	42	25.8	5	2.1	−8.6	32	20.8
38	PNC	United States	15	7.1	151.3	18	25.6	3	0.5	1,356.1	7	19.4
39	CIBC	Canada	19	23.2	−42.2	31	23.9	6	1.2	18.2	23	22.9
40	Bank of Montreal	Canada	28	14.6	−82.6	32	22.5	5	4.0	−93.0	19	14.1
41	US Bancorp	United States	11	3.1	157.2	10	21.6	1	0.1	100	3	14.2
42	BPCE/Natixis	France	13	5.9	−71.2	64	19.8	5	1.6	−67.4	35	18.5
43	BBVA	Spain	17	9.0	−75.6	47	19.5	5	2.4	−88.0	34	15.8
44	UniCredit	Italy	10	13.0	−69.3	41	19.5	5	6.6	−100	32	15.8
45	ING	Netherlands	16	7.7	−77.8	57	19.1	7	2.8	−89.7	42	19.4
46	NAB	Australia	5	1.1	10.9	14	17.2	3	0.7	−55.6	12	13.2
47	Commerzbank	Germany	11	4.4	−93.7	49	14.1	6	2.0	−85.9	38	18.4
48	State Bank of India	India	6	9.8	−74.4	14	14.1	2	1.3	147.3	10	20
49	KB Financial	South Korea	3	1.2	−43.1	21	13.2	1	0.4	7.0	1	12.2
50	NatWest	UK	10	4.2	−93.3	45	13	5	1.8	−83.7	33	15.6
51	Westpac	None	6	2.2	−65.2	12	12	2	0.3	27.3	7	14.9
52	CaixaBank	Spain	3	0.4	−33.5	8	11.6	1	0.4	−100	4	3
53	Commonwealth Bank	Australia	6	2.8	−89.8	18	9.4	3	1.1	−72.7	13	12.5
54	Lloyds	UK	5	3.5	−100	17	7.4					
55	DZ Bank	Germany	4	0.9	−100	20	6	2	0.7	−100	17	7.5
56	Nordea Bank	Finland	3	3.7	−100	8	5.1	2	0.4	−100	8	5
57	Danske Bank	Denmark	1	1.7	−100	1	2.8					
58	Rabobank	Netherlands	2	0.1	−100	11	2.8	2	0.1	−100	11	4.8

Table 2: **Correlation matrix.**

The top right triangle of the matrix in each panel shows pairwise Pearson correlations, and the bottom left triangle shows Spearman correlations between variables measuring bank involvement. In Panel A, the bank involvement variables are calculated on the basis of all carbon bomb projects, in Panel B on the basis of ongoing projects and in Panel C on the basis of planned projects. The variables are defined in Section 2. Each correlation is based on 58 cross-sectional bank observations.

	Nb.C	*FinVol*	ΔFin	*Nb.P*	*Rank*
Panel A: All carbon bomb projects ($N = 425$)					
Nb.C	1	0.874***	−0.066	0.753***	0.824***
FinVol	0.890***	1	−0.030	0.643***	0.786***
ΔFin	0.177	0.244	1	0.008	0.276
Nb.P	0.802***	0.734***	0.190	1	0.867***
Rank	0.899***	0.906***	0.461***	0.864***	1
Panel B: Ongoing projects ($N = 294$)					
Nb.C	1	0.875***	−0.054	0.737***	0.82***
FinVol	0.889***	1	−0.022	0.633***	0.777***
ΔFin	0.202	0.268	1	0.034	0.292
Nb.P	0.79***	0.732***	0.229	1	0.87***
Rank	0.898***	0.906***	0.476***	0.867***	1
Panel C: Projects not yet operational ($N = 131$)					
Nb.C	1	0.733***	−0.166	0.827***	0.867***
FinVol	0.878***	1	−0.108	0.695***	0.801***
ΔFin	0.069	0.154	1	−0.215	−0.006
Nb.P	0.881***	0.806***	−0.051	1	0.857***
Rank	0.908***	0.924***	0.342**	0.862***	1

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

Table 3: **ESG score and carbon bomb financing.**
Regression results of univariate cross-sectional regressions of Y on Var, where $Y \in \{ESG, E, S, G\}$ and $Var \in \{Nb.C, FinVol, \Delta Fin, Nb.P, Rank\}$. The variables are defined in Section 2. Each regression is based on 58 bank observations. In Panel A, the bank involvement variables are calculated on the basis of all carbon bomb projects, in Panel B on the basis of ongoing projects and in Panel C on the basis of planned projects.

Var	**ESG** Slope (p-value)	**ESG** R^2	**E** Slope (p-value)	**E** R^2	**S** Slope (p-value)	**S** R^2	**G** Slope (p-value)	**G** R^2
Panel A: All carbon bomb projects ($N = 425$)								
$Nb.C$	0.017	0	0.033	0.003	−0.019	0	0.028	0.001
	(0.88)		(0.681)		(0.877)		(0.858)	
$FinVol$	−0.039	0.007	−0.019	0.003	−0.04	0.007	−0.048	0.005
	(0.557)		(0.679)		(0.562)		(0.6)	
ΔFin	−0.053	0.05	-0.053^{**}	0.102	−0.053	0.044	−0.037	0.013
	(0.104)		(0.019)		(0.127)		(0.414)	
$Nb.P$	-0.093^{**}	0.097	-0.072^{**}	0.118	-0.119^{***}	0.143	−0.061	0.022
	(0.022)		(0.011)		(0.005)		(0.284)	
$Rank$	-0.32^{**}	0.081	-0.209^{*}	0.071	-0.353^{**}	0.089	−0.296	0.036
	(0.037)		(0.051)		(0.028)		(0.168)	
Panel B: Ongoing projects ($N = 294$)								
$Nb.C$	0.029	0.001	0.041	0.005	0.001	0	0.03	0.001
	(0.804)		(0.614)		(0.995)		(0.853)	
$FinVol$	−0.034	0.005	−0.017	0.003	−0.033	0.004	−0.045	0.005
	(0.611)		(0.719)		(0.633)		(0.626)	
ΔFin	-0.055^{*}	0.055	-0.054^{**}	0.107	-0.056^{*}	0.052	−0.037	0.013
	(0.087)		(0.016)		(0.096)		(0.406)	
$Nb.P$	-0.095^{**}	0.098	-0.073^{**}	0.119	-0.12^{***}	0.144	−0.063	0.023
	(0.021)		(0.011)		(0.005)		(0.275)	
$Rank$	-0.298^{*}	0.071	-0.198^{*}	0.065	-0.333^{**}	0.080	−0.27	0.031
	(0.051)		(0.063)		(0.038)		(0.206)	
Panel C: Projects not yet operational ($N = 131$)								
$Nb.C$	−0.305	0.014	−0.086	0.002	−0.606	0.05	−0.034	0
	(0.403)		(0.735)		(0.109)		(0.947)	
$FinVol$	-0.358^{**}	0.096	-0.237^{**}	0.088	-0.432^{***}	0.127	−0.265	0.027
	(0.025)		(0.033)		(0.01)		(0.241)	
ΔFin	−0.01	0.018	−0.006	0.017	−0.007	0.01	−0.012	0.016
	(0.337)		(0.36)		(0.491)		(0.378)	
$Nb.P$	-0.159^{***}	0.126	-0.118^{***}	0.146	-0.212^{***}	0.203	−0.09	0.021
	(0.01)		(0.005)		(0.001)		(0.305)	
$Rank$	-0.516^{***}	0.182	-0.269^{**}	0.103	-0.591^{***}	0.217	-0.471^{**}	0.079
	(0.002)		(0.02)		(0.001)		(0.043)	
Note:								*p<0.1; **p<0.05; ***p<0.01

Table 4: **Cumulative Average Abnormal Returns.**
Cumulative Average Abnormal Returns (CAAR) in the event window [−1,1]. Abnormal returns are based on the market model with an estimation window of 250 trading days prior to the event window and the most common country index in the country where a bank is headquartered as the market proxy. The sample consists of 45 banks. The $CAAR$ is expressed as a percentage return and tested using the BMP t-test developed by Boehmer et al. (1991), later adjusted by Kolari and Pynnönen (2010) to account for event-related return volatility and cross-sectional return correlation. The reported test results in the table are expressed using *p-values*.

Day	$CAAR$	*p-value*
−1	−0.646	0.551
0	−0.311	0.788
1	−0.624	0.524

Table 5: **Market reaction.**

Regression results of cross-sectional regressions $CAR_i = \alpha + \beta ESG_i + \gamma Var_i + \varepsilon_i$, where CAR is the Cumulative Abnormal Return in the event window $[-1,1]$ and $Var \in \{Nb.C, FinVol, \Delta Fin, Nb.P, Rank\}$. The variables are defined in Section 2. Each regression is based on 45 bank observations. In Panel A, the bank involvement variables are calculated on the basis of all carbon bomb projects, in Panel B on the basis of ongoing projects and in Panel C on the basis of planned projects. The slope coefficients are multiplied by 10^4. The p-values are given in parentheses.

	ESG	Var	R^2
Panel A: All carbon bomb projects ($N = 425$)			
$Nb.C$	5.196^{**}	2.348	0.173
	(0.02)	(0.14)	
$FinVol$	5.488^{**}	0.855	0.146
	(0.016)	(0.357)	
ΔFin	5.333^{**}	−0.114	0.13
	(0.025)	(0.813)	
$Nb.P$	5.48^{**}	−0.008	0.128
	(0.019)	(0.99)	
$Rank$	5.757^{**}	1.433	0.136
	(0.014)	(0.539)	
Panel B: Ongoing projects ($N = 294$)			
$Nb.C$	5.183^{**}	2.424	0.173
	(0.021)	(0.142)	
$FinVol$	5.481^{**}	0.846	0.146
	(0.016)	(0.364)	
ΔFin	5.347^{**}	−0.1	0.129
	(0.025)	(0.833)	
$Nb.P$	5.473^{**}	−0.02	0.128
	(0.019)	(0.976)	
$Rank$	5.722^{**}	1.326	0.135
	(0.014)	(0.564)	
Panel C: Projects not yet operational ($N = 131$)			
$Nb.C$	5.618^{**}	9.166^{*}	0.211
	(0.011)	(0.072)	
$FinVol$	5.987^{**}	1.643	0.153
	(0.011)	(0.508)	
ΔFin	5.743^{**}	0.019	0.144
	(0.014)	(0.893)	
$Nb.P$	5.814^{**}	0.24	0.145
	(0.014)	(0.807)	
$Rank$	6.631^{***}	3.34	0.178
	(0.006)	(0.205)	
Note:	*p<0.1; **p<0.05; ***p<0.01		

Figure 1: **Network graphs.**
Connections between Société Générale, Crédit Agricole and BNP Paribas (on the left), the operating companies of carbon bombs (in the middle) and the carbon bomb projects (on the right). The top network includes all carbon bombs, the bottom network includes only the planned projects. The width of the lines on the left is proportional to the volume of financing provided by the bank to the operating company.