# Do COPs really help sustainability? An asset pricing perspective.

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This draft: February 11, 2025

**Abstract**

Do COP summits[1] pressure investors to divest from brown firms and invest in green firms? This paper addresses this question using an event study that examines the impact of COP summits on the returns of brown and green firms during both Pre-COP[2], Intra-COP and Post-COP periods. The findings reveal that COP meetings do not directly and significantly affect returns: while some years exhibit an increase in green returns following COP summits, these effects are inconsistent and not uniformly attributable to the meetings, suggesting that they do not drive investors divestment from brown firms in favor of green alternatives. However, I observe market reactions, particularly in the Pre-COP and Post-COP periods, but depending on the time-period selected, where green firms experienced an increase in their returns. This might suggest that while COP meetings do not exert strong short-term influence, they may still contribute indirectly to investors behavior by shaping long-term expectations about sustainability.

*Keywords:* Asset pricing, Climate summits, Climate policy regulation, Sustainable investing.

*JEL classification:* G12, G18, G40

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[1] In this paper I characterize Conference of Parties (COP), which is a decision-making body of the United Nations Framework Convention on Climate Change (UNFCCC), as an event/summit/meeting which is held typically once a year just to conform myself to the common knowledge related to this kind of conferences. Moreover here I only study events connected to this Convention, and I do not consider other events in which the COP could possibly meet.

[2] With the term Pre-COP here I am not referring to formal meetings that take place some months before the COP (like for example the Pre-COP27 held in October 2022 in Kinshasa, DRC, previous to the COP27 held in November 2022 in Sharm el-Sheikh), but rather the period of time that anticipate the summit itself (this does not exclude that the information arising from the aforementioned meetings could reflected into prices). Also in the analysis in this paper the term Pre-COP refers to a period of time of at least 1 month, whereas those formal meetings are approximately held over few days.

# 1 Introduction

The global emphasis on climate change has led to significant regulatory changes aimed at curb firms' carbon emissions, with the Conferences of the Parties (COP) being one of the major events in which these policies are discussed. The United Nations Framework Convention on Climate Change (UNFCCC) has established COP summits with the scope of shaping global climate policy, with as objective to influence both national regulations and international agreements. Beyond environmental policy, the influence of these summits potentially extends to financial markets as well. This paper investigates this second aspect, so whether COP meetings contribute to a reduction in the return differential, where the portfolio of high carbon-intensity firms underperforms relative to the low carbon-intensity portfolio, potentially resulting in negative excess returns. The scope is to study whether COPs promote sustainability from an asset pricing perspective by influencing investors behavior, particularly in terms of rewarding green firms and penalizing brown ones around the time of COP summits.

While COP summits are among the most globally recognized events for climate policy negotiation, their direct impact on financial markets is still not fully understood. Consequently, the research question addressed in this paper is whether COP summits impact the sustainable investing, which has been constantly growing in the recent years[3], by incentivizing investors to divest from brown firms and invest in green firms. This question is of critical importance given the growing role of sustainability in financial markets, as well the increasing emphasis on environmental (also ESG) factors in asset allocation decisions both in theoretical (Pedersen et al. (2021); Berk and van Binsbergen (2021); Pástor et al. (2021); Avramov et al. (2022, 2024) among others) and empirical (Görgen et al. (2020); Engle et al. (2020); Faccini et al. (2023); Bolton and Kacperczyk (2021); Pástor et al. (2022); Zhang (2023); Aswani et al. (2024) among others) literature. Analyzing how COP meetings impact financial markets could be relevant for policymakers in order to design climate policies which align with expected reactions in investors behaviors and market dynamics. In particular, the hope is that COP meetings would have a significantly influence investment patterns, this would provide strong evidence that climate agreements are affecting the flow of capital, potentially accelerating

[3]See "Principles for Responsible Investment (PRI) Annual Report, 2020" available at this link and "Global Sustainable Investment Alliance (GSIA) Report 2020" available at this link

the transition to a sustainable economy. However, if these events do not prompt a direct response in financial markets, it could suggest the need for additional mechanisms or clearer signals to induce market reactions aligned with long-term environmental goals. This second alternative seems more plausible from the findings contained in this paper.

Through an event study methodology, in this paper I examine the impact of COP summits on the returns of brown and green firms during two key periods: pre-COP, intra-COP and post-COP. This kind of approach allows me to isolate the specific effects of these summits on stocks returns by focusing on short-term investors reactions around COP events. Specifically, I analyze whether the spread between high and low carbon-intensive firms changes during and after the COPs, reflecting potential shifts in investor preferences (possibly influencing the demand for green assets coherently with large sustainable literature). The goal is to determine whether COP summits trigger immediate divestment from carbon-intensive firms in favor of greener alternatives. The findings of this paper indicate that COP meetings do not directly and significantly influence the returns of brown and green firms. While certain years exhibit an increase in green firm returns following COP summits (Figure 4 in the Appendix), these effects are not consistent and I show not uniformly attributable to the summits themselves. Regarding the returns of high and low carbon-intensity firms (same results hold for the high-minus-low portfolio), there is no significant difference before (Pre-COP), around (Intra-COP) and ex-post (Post-COP) these events. Other risk factors (mainly traditional ones) and the additional compensation (*alpha*) offered by low carbon-intensity companies — which is consistently higher than that of high carbon-intensity companies — are attributed as the main sources of variation in returns. This implies that green firms are viewed as safer assets, which leads to a greater capital supply and a reduced capital cost. On the other hand, because of investor apprehension regarding their sustainability and related hazards, brown firms have a comparatively higher cost of financing. These dynamics highlight how implementing sustainable practices can save money and how ESG considerations are becoming more and more significant when making investment decisions. To summarize, the results suggest that, on average, COP meetings do not systematically drive divestment from brown firms or promote investment in green firms in the short term. However, I observe some market reactions, particularly in the pre-COP and post-COP period, but depending on the time-period considered, where green firms

experience a modest increase in their returns. This may indicate that while COP summits do not exert strong short-term effects, they might contribute indirectly to shaping long-term investor expectations regarding sustainability and future regulatory environments. Lastly, I notice that the results are highly dependent on the emission measure considered (as shown in the Appendix).

As anticipated before, the results of this analysis are relevant for policymakers and investors alike. Particularly for the first ones, who seek to promote sustainable investments through international climate negotiations, they might need to consider additional measures to drive more immediate market responses. For instance, stronger regulatory signals or incentives could be required to shift investor behavior in favor of green firms. For investors, particularly those focused on ESG criteria, these findings suggest that while COP meetings are important for setting long-term agendas, short-term portfolio adjustments are not significantly influenced by the outcomes of these summits. The remainder of this paper is structured as follows: Section 2 provides a review of the relevant literature on the intersection of climate policy and financial markets, including previous studies on COP events and their potential impact on asset prices. Section 3 describes the data used in this analysis and characterizes the brown and green firm portfolios. Section 4 outlines the event study methodology used to assess the impact of COP events on firm returns. Section 5 presents the empirical results, and Section 6 concludes with implications for policymakers and investors, as well as directions for future research. The most important tables are within the text, while figures and additional tables are contained in the Appendix.

## 2 Literature Review

Recent years have seen a proliferation of studies on carbon emissions, climate policies, and asset prices. In fact, there is a growing body of literature that examines the return spread between high and low carbon-intensity firms, unfortunately with mixed results (see Eskildsen et al. (2024) for a discussion on the topic); therefore, it becomes difficult to assess a possible impact of policy events such as the COPs. Bolton and Kacperczyk (2021) find that high-emission firms are increasingly being financially penalized as carbon risk becomes priced into stock returns in a systematic manner, especially since the Paris Agreement (however only for Scope 1 emissions and limited to up 2 years after the treaty). As they estimate it, investor concern over stranded assets and the regulatory

tightening of high-carbon firms increasingly dominates investor behavior [4]. Similarly Monasterolo and De Angelis (2020) find an increase in systematic risk for brown indices. In a sequel, Bolton and Kacperczyk (2023) extend this into an international study of the global pricing of carbon-transition risk. They find that while domestic climate policies indeed have a sharp economic impact on firm valuations, the international agreements have a much more modest direct effect. This difference is indicative of the difficulties in political coordination in international climate agreements, and even though the COP summits may affect long-term expectations (like the aforementioned Paris Agreement which is a milestone in climate regulation), their short-term financial consequences are minor compared with national policy actions.

On the other hand, it is said that a low-carbon company benefits from growing awareness of climate risks among investors. Using this as an example, Krueger et al. (2020) report that institutional investors are increasingly considering climate risks in their investment decisions, arguably seeing low-carbon firms better positioned to meet future regulatory challenges and long-term performance. This evidence also supports literature on sustainable investment strategies, which indicates in general that integration of climate factors into investment decisions is associated with better financial performance. For example, Pástor et al. (2021) present a theoretical model of how investor preferences for sustainability determine asset prices, while Pedersen et al. (2021) go a step further by adding the ESG-efficient frontier that balances risk and return with an optimization of environmental factors; the idea behind this concept is to bring forth, via sustainability integration, gains within investment portfolios. Specifically, Avramov et al. (2022) and Avramov et al. (2024) present issues and a changing landscape with respect to sustainable investing in the presence of uncertainty about ESG ratings and regulatory change. Generally, this body of work indicates that ESG-themed portfolios, such as those focused on environmental practices, outperform brown portfolios, though the drivers differ across the two studies. Finally, Pástor et al. (2022) and Pástor et al. (2023) investigate the connection between sustainability and financial performance, focusing on the perspective of those two issues which have been most discussed in the literature so far, namely investor demand for green assets and the pricing of climate risk. From the results, they conclude that much of the outperformance by green assets could relate to rising investor appetite for sustainability rather

[4] although this result is mainly driven by an increase of the number of firms (particularly small ones) adopted by S&P Trucost in 2016.

than to firms' low-carbon strategies directly. These studies put into perspective how fluctuations in investor demand shake the returns of green assets in the market. On this line, Avramov et al. (2024) emphasize that this evolving dynamic ESG investing both opens up new opportunities for low-carbon firms and amplifies risks of carbon-intensive companies. Generally, such a shift can be explained by investor environmental concerns (also expectations of future regulation) and higher returns of greener firms.

Also the consistency and drivers of the return spread between high and low carbon-intensity firms remain controversial. Ardia et al. (2022), Pástor et al. (2022), Berg et al. (2023) and Zhang (2023) present empirical evidence that climate policies might favor low-carbon firms, resulting in superior returns for these companies. Conversely, other studies such as Bolton and Kacperczyk (2021), Bolton and Kacperczyk (2023), and Eskildsen et al. (2024) present opposite results. This difference in the literature might indicate that the impact of climate policies on firm returns is not yet unclear; indeed, it depends significantly on factors such as strength of policy measures (also coherency and consistency as discussed in some of these works), industry sector, firms characteristics, and even measures used[5]. This divergence underlines the difficulty in precisely pinpointing the impact of climate policy events on the aggregate economy. One clear area of consensus, however, is that changes in regulatory conditions - such as through climate deals and announcements of policy - are likely to provide very propitious market conditions for low carbon-intensity firms (those less exposed to uncertainty in the regulation). Görgen et al. (2020) construct a measure of carbon risk factor with the aim of identifying to what extent carbon intensity affects the returns from stocks. They find that high carbon-intensity firms are always penalized by the market since carbon risk is priced, and that investors are concerned about future regulatory costs and transition risks. The authors' findings indicate that, as carbon risk becomes a more important factor in determining asset prices, firms with higher carbon emissions have lower returns. Similarly, Ilhan et al. (2021) find evidence that firms with higher carbon risk are facing higher costs on account of regulatory uncertainty and yield lower returns.

[5]Zhang (2023) and Aswani et al. (2024) provide detailed discussions on the complexities surrounding the measurement of carbon emissions (also which measures are more suited for financial research) and their relation to stock returns. These studies underscore the importance of considering the accuracy of emissions data, differences between vendor-estimated and firm-disclosed figures, and the methodological approaches used to assess the financial impact of carbon intensity.

Meanwhile, methodologically, the exact measurement of climate-related risk and its consequence on firm performance remains an open challenge. Specifically, by investigating the connection between carbon management and financial performance, Busch et al. (2018) report evidence showing that firms with better carbon management practices tend to exhibit superior financial performance, since such firms enjoy higher returns and face lower risks. Their findings suggest that a firm that actively mitigates regulatory risks by increasing carbon efficiency improves its general financial position. Besides, financial penalties for poor environmental performance are well-documented. Chava (2014) present evidence that firms exposed to high environmental risk bear higher capital costs as investors demand a premium for greater exposure to climate risks. This finding reflects investor concern about the regulatory (and consequently also financial) risks associated with carbon-intensive firms. Another related direction is pursued by Hsu et al. (2023) with their "pollution premium" when they find that highly polluting firms offer higher stock returns when regulation strengthen. That means regulations should be tightened in compensation for the additional risks of their environmental impact. This premium reflects investors' concerns about regulatory, reputational, and financial risks faced by firms with significant pollution exposure.

From a review of the literature, few works have investigated the immediate consequences of specific events related to climate policy, such as COP summits. While much of this literature focuses on long-term trends and structural shifts-particularly with respect to carbon risk pricing, ESG integration into investment decisions, and broader dynamics of sustainable investing, still little is currently known regarding the immediate financial consequences of relevant policy events. My contribution to this literature is twofold. First, I attempt to study the short-run market reactions of COP summits with dedicated focus on how such events alter investments towards green and brown firms. Second, I examine whether COP summits lead to capital reallocation between high (brown) and low (green) carbon-intensive firms in days and weeks following the event. By focusing on the short-term dynamics, this study contributes to an understanding of how these high-profile global events affect investor sentiment and capital flows, hence filling an important gap in the literature, which predominantly addresses long-term implications of climate policies.

# 3 Data

I collect firm-level stock market daily data from CRSP, restricting my sample to common stocks and considering only securities listed on primary exchange markets (NYSE, NASDAQ, and AMEX). I gather firm-level annual carbon intensities, which are calculated as annual emissions in tons of carbon dioxide (tCO2e) divided by annual revenues in millions of euros, from S&P Trucost. Subsequently, I extract the US-listed companies and match the CRSP data with S&P Trucost based on Compustat. identifiers by following the procedure reported in Zhang, 2023. Different from her work, I keep a constant rebalancing annual period starting from the first available date of July, when accounting values are was also issued, allowing for possible delays in reporting emissions and providing some leeway over the forward-looking intrinsic bias in the emissions data. I construct annual portfolios, as COPs can span a period across two subsequent months. Specifically, I account for the fact that information concerning emissions of year $t$ is only fully available with a six-month lag; S&P Trucost provides the exact date when such information becomes available. For each year, I construct value-weighted excess returns.

I use Carbon Intensity (Scope 1) as a proxy for emissions (following Zhang (2023)[6]) since it represents direct greenhouse gas emissions from owned or controlled sources scaled by a firm's sales. Scope 1 emissions are chosen due to their direct relevance to a firm's operations and susceptibility to policy regulations influenced by COP decisions, such as cap-and-trade systems and carbon taxes. The analysis accounts for the differential impact of carbon emissions on firms, recognizing that regulatory measures based on total emissions may affect firms differently depending on their size, even if their total emissions are similar. I construct two portfolios for empirical analysis: a high carbon-intensity portfolio, comprising the top 30 percent most polluting companies, and a low carbon-intensity portfolio, comprising the bottom 30 percent least polluting companies.

Then I introduce the high-minus-low portfolio, which is the spread between high and low carbon-intensity returns. The time span of this study is from 2006 to 2022 and includes 16 COP events. Figure 1 illustrates the downward trend in returns of the portfolio HmL. This provides some evidence that high carbon-intensity companies underperform compared with the low carbon-intensity over

[6]Using carbon intensity accounts for the scale of a firm's operations by measuring emissions relative to output (e.g., per unit of revenue), providing a more accurate assessment of a firm's efficiency and environmental impact compared to absolute emissions alone.

time. This gives, besides other reasons such as actively rebalancing run by investors, To regulatory pressure, shifting market perceptions, and differences in operational efficiency between high and low-intensity firms, Figure 2 further depicts the cumulative excess value-weighted returns for high and low carbon-intensity portfolios separately showing a more substantial growth over time for a portfolio with low carbon intensity compared to that with high carbon intensity, which again asserts the better performance of companies with lower carbon footprint.

[Figure 1 and Figure 2 around here]

Figure 3 presents the spreads of the 12-month rolling return between the high and low carbon intensity portfolios. Periods of high volatility in the rolling spreads can fall at major COP decisions or major regulatory announcements, which needs further investigation. Despite whereas short-run fluctuations, there is a long-term shift toward the low-intensity firms in line with It also chimes with the broader trend of increasing investor focus on sustainability and ESG factors. The data reveal a consistent underperformance of high carbon intensity firms, a discrepancy that could be due to several factors, including changing market preferences, regulatory pressures, and the practical benefits of low carbon practices (the cost for companies of a green transition). The results show how financial markets penalize brown firms and reward green firms as climate regulations evolve; however, this result may not be strictly due to policy-induced reactions but also changes in firms' operational efficiency or strategic choices. I report the summary statistics of portfolio returns in Table 1.

[Table 1 around here]

Table 2 displays average yearly carbon intensities for the two portfolios (High and Low). As pointed out in previous literature, S&P Trucost has significantly increased the number of firms under coverage in 2016. I also take into account this fact into further analysis, especially since it coincides with the year following the adoption of the Paris Agreement (during COP 21), which is considered a milestone in the contrasting on a global scale climate change, marking the first time a binding accord unites all nations (194 plus the EU) in the fight against climate change and in adapting to its impacts[7]. As shown in Figure 5, in that year S&P Trucost has ultimately included

[7]Source UNFCCC website available at this link

mostly small companies, which if we consider carbon intensity as proxy for emissions, are also the most polluting ones; this is further supported by data in Table 3 in which we observe a significant decrease in market capitalization especially within High carbon-intensity firms.

To assess relevance of Conference of Parties summits, I consider both the Pre-COP, before the start date, the Intra-COP effect, within the start date and end date, and the Post-COP effect, the following day after the COP has concluded. Pre-COP dummy equals 1 in the dates prior to the COP events take place and 0 elsewhere. Intra-COP dummy equals 1 in the dates COP events take place and 0 elsewhere. Post-COP dummy equals 1 in the dates following the end date of COP events (and up to the end of rebalancing period) and 0 elsewhere.

Finally, as shown is Table 2 in 2016 S&P Trucost significantly increased the number of firms under coverage (mostly small firms following Figure 5) which coincides also with the Post Paris Agreement period; therefore, for some analysis, I report also results for the sub-sample after 2016.

# 4 The background

## 4.1 COP events

The Conference of the Parties (COP) is the supreme decision-making body of the United Nations Framework Convention on Climate Change (UNFCCC). The first COP meeting (COP1) was held in Berlin, Germany, in 1995. The COP is an annual meeting usually held in November or December) that brings together the 197 parties (countries and the European Union) that are signatories to the UNFCCC. Its primary purpose is to assess progress in dealing with climate change negative externalities, negotiate agreements to mitigate (or contrast) them, and set binding obligations for developed countries to reduce greenhouse gas emissions. The decisions made at COP meetings results of an extreme importance for setting a common background to global climate policy, for example by international climate goals.

Additionally, COP can produce technical advice on calculating and reporting emissions and have a impact on the financing channels as well, which it will discussed in the next section. Overall, agreements resulting from COP events are non-binding and encourage voluntary initiatives to support sustainable practices and technology transfer, while other decisions are legally obligatory and

impose particular responsibilities under the international law. The purpose is making countries pledged to find common, tangible and concrete solutions to mitigate climate change negative externalities and at the same time reducing emissions. Among the legally biding treaties, there are the Kyoto Protocol, which forced developed countries to decrease emissions, and the Paris Agreement, which requires governments to submit and revise climate commitments.

However, a lot of the decisions made at the COP serve as voluntary guides for sustainability. Even though legally enforceable agreements place particular requirements on parties, there are few ways to ensure compliance, making enforcement difficult. COP meetings face a lot of criticism and difficulties. Furthermore, there are limited means of forcing compliance, making it challenging to enforce legally enforceable agreements. Critics also point out that it may be challenging to take meaningful action as a result of slow negotiations and often times unclear agreements. These challenges underscore the need for more robust systems and enhanced international cooperation to effectively tackle climate change.

### 4.2 COP events and Asset Prices

As anticipated earlier in this paper, COPs agreements claim to have an impact on financial markets and asset prices as well. The fostering of a strengthen in the current climate regulation which can be reflect both on market participants and companies as these two actors try to anticipate the possible effects. Concerning market sentiment and investor behavior, COP agreements may cause changes in investor attitude and behavior, which consequently impacts the returns of both high and low carbon-intensity firms; but that pattern does not emerge in our results. Announcements of stricter climate legislation may still impact market sentiment to turn negative and cause stock prices of high carbon intensity corporations to decrease. On the other hand, firms that emit less carbon dioxide generally gain from regulatory changes since they may have to pay less for compliance and may even be eligible for subsidies or incentives. Businesses in the renewable energy, energy efficiency, and other sustainable industries may notice a boost in demand for their goods and services as rules propel the shift to a low-carbon economy, but the empirical research has shown that the size of this market is still limited.

The purpose of COP outcomes is to incentivize the transition to a more sustainable economy, which

is translated into long-term survival and growth prospects. In particular, long-term demand for high carbon-intensity firms may decline as the world economy moves towards cleaner energy sources. Firms can exposed to a range of transition risks, all of which have the potential to negatively impact returns (Bolton and Kacperczyk (2021)). Generally speaking, the returns of enterprises with high vs low carbon emissions are affected differently by COP agreements. Companies with high carbon emissions typically have lower returns due to higher expenses, regulatory issues, and unfavorable investor opinion. On the other hand, firms that produce less carbon dioxide typically experience higher profits due to greater investment, favorable market sentiment, and regulatory backing. This phenomenon emphasizes how sustainability is becoming more and more important when making investments and setting asset prices. If desired results from COP events would be true, that would imply the conclusions pointed out in Berk and van Binsbergen (2021): a switch from brown firms to green one that has as a consequence, a decrease in the High-minus-Low returns implies a decrease (increase) in the price of high (low) intensity firms, which then increase (decrease) the cost of capital.

# 5 Results

## 5.1 High-minus-Low vs COP period

There was also prior expectations that the COP events would manifest market signals throughout signed treaties, as they aim to promote transition to a more sustainable economy by curbing emissions. One would expect to see a consistent decrease in the returns of high intensity compared to low intensity firms after such events. However, as I can see from Figure 4 empirical evidence suggests that there is no clear influence on emissions of this behavior. In this figure, I plot the cumulative returns (value-weighted) of a High-minus-Low intensity portfolio around the COP period (20 business days before the start and 60 business days after the end date). It appears there is no consistent pattern: i.e. if the COP event as a real effect on fostering a reduction of emissions, which it would happen if the High-minus-Low intensity portfolio return were to decrease after the end of the COP. Furthermore, the outcome validates the concerns raised regarding the COP conferences' capacity to bring about meaningful modifications to plans for reducing emissions. It also makes further research necessary to determine how pollution reductions can affect businesses'

cost of capital. COP conferences have the potential to impact the cost of capital through multiple channels.

[Figure 4 around here]

### 5.2 Industry Portfolios vs COP

At first I conduct an analysis studying whether COP summits have an effect on major Industry Portfolios (for simplicity I consider the some from Kenneth French data library); I control also for the Fama-French three factors (Market, Size, and Value), several intriguing findings emerge.

$$R_{ip,t} - R_{f,t} = +\beta_1 \cdot PrCOP_t + \beta_2 \cdot ICOP_t + \beta_3 \cdot PoCOP_t$$
$$+ \beta_4 \cdot (Mkt_t - R_{f,t}) + \beta_5 \cdot SMB_t + \beta_6 \cdot HML_t + \epsilon_{ip,t} \quad (1)$$

[Table 4 around here]

Table 4 presents the results after controlling for the Fama and French (1992) three-factor model. The coefficients associated with the COP event dummies, $Pre-COP$, $Intra-COP$ and $Post-COP$, capture the effects during and after the COP summits, respectively. The $PrCOP$ coefficients represent an anticipation of the possible impact investor are expecting from COP summits; here the results are strongly significant for Manufacturing (positive) and Business Equipment (negative). The $ICOP$ coefficients measure the immediate impact of COP events on industry returns; unfortunately, I do not find any significant effect during these periods. Similar conclusion holds for the $PoCOP$ coefficients, which capture the impact on returns post COP summits. The regression also provides information on the sensitivity of industry portfolios to main factors, whose coefficients are overall all strongly significant. I observe only a positive and strongly significant $\alpha$ in Business Equipment, symptom that this industry probably enjoys some special frictions in the economy that give it an edge in returns over and above the expected. Market, Size and Value coefficients are on average strongly significant across all industry (but with different signs), indicating some strict peculiarities associated with specific industries. In all, the findings indicate that the COP summits do not influence industry portfolios at all, complementing the lower importance of international

climate policy debate for industry performance and investor behavior.

$$R_{ip,t} - R_{f,t} = +\beta_1 \cdot PrCOP_t + \beta_2 \cdot ICOP_t + \beta_3 \cdot PoCOP_t$$
$$+ (\iota_0 + \iota_1 \cdot PrCOP_t + \iota_2 \cdot ICOP_t + \iota_3 \cdot PoCOP_t) \cdot (Mkt_t - R_{f,t}) + \epsilon_{ip,t} \quad (2)$$

[Table 5 around here]

Table 5 presents the results controlling for the interactions between COP periods and the market portfolio to observe how the latter reacts to these summits. The table includes interaction terms between the market factor ($MKT$) and the COP event periods ($Pre-COP$, $Intra-COP$, and $Post-COP$), along with the direct effects of these periods on industry portfolio returns. The $Pre-COP$ coefficient remains significant for Manufacturing and Business Equipment, reflecting anticipation effects similar to those observed in Table 4. However, the interaction between $MKT$ and $Pre-COP$ shows a significant positive effect for Telecommunications, suggesting that this sector exhibits heightened sensitivity to market movements before COP summits, amplifying returns in this period. While the $Intra-COP$ and $Post-COP$ coefficients remain largely insignificant across industries, the $MKT * Post-COP$ interaction is significant in Business Equipment, Telecommunications, Utilities, and Healthcare. This implies that these sectors experience increased market sensitivity following COP events, even though the events themselves do not directly influence returns. The alpha ($\alpha$) values show a positive and significant abnormal return for Business Equipment, indicating that this sector continues to outperform beyond what the model predicts. The comprehensive results for the main factors are consistent with the previous table, with the market factor remaining highly significant across industries and the size and value factors showing varying levels of importance depending on the sector. Overall the results contained in these preliminary analysis show that while direct effects of COP events on industry portfolios are minimal, the interaction terms suggest that specific industries may experience heightened sensitivity to market movements during and after COP summits, highlighting indirect effects on investor behavior and market dynamics during these periods.

### 5.3 Preliminary analysis

In the initial analysis, I am regressing excess returns of the high-, low-, and high-minus-low carbon-intensity portfolios on the Fama-French three factors (Market, Size, and Value), few intriguing findings emerge.

$$R_{i,t} - R_{f,t} = \alpha + \beta_3 \cdot (Mkt_t - R_{f,t}) + \beta_4 \cdot SMB_t + \beta_5 \cdot HML_t + \epsilon_{BmG,t} \tag{3}$$

[Table 6 around here]

From Table 6 we can observe that the high carbon-intensity and low carbon-intensity portfolios consistently show a positive and statistically significant loading on almost all the Fama and French (1992) three factors which sounds plausible. The positive alpha on high carbon-intensity and low carbon-intensity portfolios across all specifications moreover, shows that there may be significant effects on the cost of capital and investor supply. Comparably, the positive alpha for low carbon-intensity implies that investors are rewarding companies with smaller carbon footprints, which may be a reflection of investors' increasing inclination towards environmentally friendly investments (Pástor et al., 2022; Avramov et al., 2022). On the other hand, the negative but statistically negligible alpha of the high-minus-low carbon-intensity portfolio does not allow me to assess a prevalence of the green portfolio over the brown one. The absence of statistical significance might suggest that there is uncertainty in assessing a clear overperformance, even if the negative alpha suggests that the green economy is growing at a faster rate than the brown ones. Moreover, the high-minus-low carbon-intensity portfolio's negative loadings on all parameters point to a continuous performance pattern that deviates from market norms. This may be a reflection of how the market is changing its perception of carbon-intensity firms, with investors maybe taking environmental risks into account more and more but not yet consistently rewarding or penalizing these companies in a clear-cut way (Pedersen et al., 2021). The findings are consistent with research on sustainable investment in equilibrium by Pástor et al. (2021), which indicates that including ESG considerations can improve portfolio performance. The high-minus-low carbon-intensity portfolio's unclear findings, however, point to a more nuanced connection between financial performance and carbon intensity.

### 5.4 Pre-COP, Intra-COP and Post-COP

Given all the considerations made in the previous paragraph, in this section I let enter in the analysis COP events. In particular, I consider both the $Pre - COP$, until the starting date of summits, $Intra - COP$ effect, within the start and end date, and the $Post - COP$ effect, the following day after the COP has concluded. In the first regression, I control only for the market excess return. The results for Low-carbon intensity portfolios, High-carbon intensity portfolios, and a High-minus-Low-carbon intensity portfolio are displayed below.

$$R_{i,t} - R_{f,t} = \alpha + \beta_1 \cdot PrCOP_t + \beta_2 \cdot ICOP_t + \beta_3 \cdot PoCOP_t + \beta_4 \cdot (Mkt_t - R_{f,t}) + \epsilon_{BmG,t} \quad (4)$$

[Table 7 around here]

The results presented in Table 7 show no statistical significance for the $Pre - COP$, $Intra - COP$ and $Post - COPperiods$. This suggests that COP events, both before ($Pre - COP$) during ($Intra - COP$) and after ($Post - COP$), do not play a significant role in the excess returns of green (low-carbon) and brown (high-carbon) portfolios. Despite growing global public attention, these international meetings do not seem to affect market returns for companies based on their carbon intensity in the short or medium term. This may suggest that investors do not anticipate that these events will have an immediate impact on company valuations in terms of, for example dramatic changes in strategic management decisions which may ultimately affect firms' prices. Similarly, the lack of relevance in the time after COP events implies that any agreements or treaties reached do not immediately result in changes in investor behavior, business performance, or divestment from the brown sector in favor of the green sector. The main source of variation is explained by the market factors, whose coefficients are highly significant and positive across all regressions, with values around 1.103 for green and 0.961 for brown portfolios.

Consistent with the section above, I can draw similar conclusions on the $\alpha$ differences. I observe a slight outperformance of low carbon-intensity companies compared to high carbon-intensity ones, irrespective of COP events. Moreover, the higher $\alpha$ for green companies (0.032% versus 0.017% in column 4) suggests that they are generally viewed more favorably by investors; this could be due to a potential number of reasons: for example, long-term sustainability trends and investor

preferences for environmentally responsible investments. On the other hand, brown companies do not appear to have the same degree of investor enthusiasm. This is likely because investors are increasingly concerned about potential future regulatory pressure on this industry, linked to the planned shift to a low-carbon economy. This performance from low carbon-intensity firms confirms previous findings in the literature, reflecting investors' perception of green companies as having superior growth prospects, higher operational efficiency, or positive sentiment due to sustainable practices. Consequently, investors might view green companies as more attractive investments, contributing to increased demand for these assets, which leads to an increases in their prices. As green firms are perceived as over-performing or being more sustainable, investors are more inclined to invest in these assets, thereby increasing the supply of capital available to these companies and lowering their cost of capital.

In a second regression, I perform the same exercise controlling for all Fama and French (1992) factors. I regress excess returns on Intra-COP dates, Post-COP periods, the Market, Size, and Value (Fama and French, 1992) contemporaneous returns. The results for Low-carbon intensity portfolios, High-carbon intensity portfolios, and a High-minus-Low-carbon intensity portfolio are displayed below.

In Table 8, I examine the regression results of excess returns on Intra-COP dates, Post-COP periods, and the combination of both, while controlling for all three Fama and French (1992) factors (Market, Size, and Value). The regressions display results for low-carbon intensity portfolios (green), high-carbon intensity portfolios (brown), and a high-minus-low-carbon intensity portfolio (brown minus green). By including the three additional factors, I still obtain similar results, although predictability decreases, particularly regarding the $\alpha$ of high carbon-intensity firms. Concerning green firms, the previous conclusions remain consistent.

$$R_{i,t} - R_{f,t} = \alpha + \beta_1 \cdot PrCOP_t + \beta_2 \cdot ICOP_t + \beta_3 \cdot PoCOP_t$$
$$+ \beta_4 \cdot (Mkt_t - R_{f,t}) + \beta_5 \cdot SMB_t + \beta_6 \cdot HML_t + \epsilon_{BmG,t} \quad (5)$$

[Table 8 around here]

COP events, both before (Pre-COP), during (Intra-COP) and after (Post-COP), still do not play

a significant role in the excess returns of green (low-carbon) and brown (high-carbon) portfolios. Again, I confirm that the excess returns for both green and brown companies are not significantly impacted by the timing of COP events. Investors do not appear to react strongly to COP events in terms of altering their returns expectations for either type of company.

Once again the coefficients for the market factor are highly significant and positive across all regressions, with values around 1.103 for green and 0.946 for brown portfolios, suggesting that the market factor holds a strong explanatory power. This indicates that both low and high carbon-intensity portfolios are influenced by overall market performance, but green portfolios have a slightly higher sensitivity to market excess returns. To properly account for this result, I control for market movements in the next analysis in order to establish a possible influence of COP events in this regard. The coefficients for the Size factor are negative and statistically significant for low portfolios ($-0.129$), indicating that green companies are typically larger in size. The coefficients for the Value factor are positive and statistically significant for both green (0.086) and brown (0.135) portfolios. This indicates that both types of companies tend to have characteristics of value stocks, but the effect is slightly stronger for brown companies.

The results of this section suggest that COP events do not significantly affect returns, and investors may focus more on broader market conditions and individual company fundamentals when making investment decisions in green and brown portfolios. The general outperformance of low carbon-intensity firms suggests a preference for investments aligned with long-term sustainability trends, also compared to findings in Table 6. The insignificance of Pre-COP, Intra-COP and Post-COP indicates that these events do not play a direct role in influencing short-term market returns for green and brown companies. However, the consistent positive and significant alpha for green companies highlights the market's general favorability towards sustainable investments. For policymakers, the lack of significant impact from COP events on stock returns indicates that while these events are crucial for setting long-term agendas, they do not immediately influence market behavior. Policymakers might need to consider additional (tighter and more directed) measures or clearer signals to the market to drive immediate investment responses. For companies, particularly brown firms, the results suggest that ongoing sustainable practices and clear communication of long-term strategies are essential for attracting investment, rather than relying on the outcomes of COP events. Results

do not change if I consider only the sub-sample after 2016.

In Table 9, I control for the market effect before ($Mkt \cdot PrCOP$), during ($Mkt \cdot ICOP$) and after the COP periods ($Mkt \cdot PoCOP$). The results still show a positive and significant $\alpha$, especially for the low carbon-intensity portfolio, with values ranging from 0.028% to 0.033%, while for high intensity firms, values range from 0.017% to 0.021% (for the full sample case, and slight higher in the post 2016 sample). This further strengthens previous results, suggesting that there is a baseline level of return that is not directly influenced by COP events nor traditional factors (in this case, the Fama and French (1992) 3 factors). However, these returns can still be subject to systemic risk factors, especially in how they respond to broader market conditions post-COP.

$$R_{i,t} - R_{f,t} = \alpha + \beta_1 \cdot PrCOP_t + \beta_2 \cdot ICOP_t + \beta_3 \cdot PoCOP_t$$
$$+ (\gamma_0 + \gamma_1 \cdot PrCOP_t + \gamma_2 \cdot ICOP_t + \gamma_3 \cdot PoCOP_t) \cdot (Mkt_t - R_{f,t}) + \epsilon_{BmG,t} \quad (6)$$

[Table 9 around here]

From the interactions terms we can extrapolate some more interesting findings: post Paris Agreement (and also post 2016, greater, sample) we can observe the positive (negative) market interaction with Pre-COP period on the low (high) corbon-intensity portfolio, which unfortunately vanish once the COP start. Secondly, it appears that during COP events (Intra-COP), the returns of carbon-intensity firms are not heavily influenced by market movements (in both samples). This could imply that COP events, which are highly anticipated (as the previous finding justify) and globally significant, do not introduce additional systematic risk in terms of market interactions during the event itself. Companies might be able to hedge or manage risks associated with the anticipation of these events (Garcia et al., 2019).

In contrast, the significant interaction loadings between market returns and post-COP periods highlight an important aspect of systemic risk. For instance, in model (4) for the H-L portfolio, the significant negative interaction term ($-0.081$) suggests that high carbon-intensity are more adversely affected by broader market movements after COP events. Similarly, for low intensity firms, the coefficient of 0.068 in model (3) suggests a positive interaction between market returns and

post-COP returns. This aligns with Albuquerque et al. (2019)'s discussion on how systematic risk can manifest more prominently in response to policy changes and market reactions. Following COP events, firms might face increased uncertainty and risk related to new regulations, public perception, and market adjustments, which can exacerbate their systematic risk profile. Specifically, their work emphasizes that climate change itself is a systemic risk, affecting all sectors and economies. The differential impacts observed in the post-COP period reflect how environmental policies and global agreements can influence the risk profiles of different firms. High carbon-intensity, being more exposed to regulatory changes and shifting market dynamics, exhibit higher systematic risk post-COP, aligning with the findings from the aforementioned paper. The study by Albuquerque et al. (2019) highlights that systematic risk is not just about market-wide shocks but also about how individual firms or sectors respond to these shocks; to this extent, one could use the results highlighted in this paper and try to replicate them in the cross-section of firms. The significant negative interactions for high intensity companies in the post-COP periods suggest that these firms are more sensitive to market-wide factors, potentially due to increased regulatory scrutiny and investor concerns about future profitability in a low-carbon economy. This underscores the systemic nature of climate-related risks as they permeate through market and firm-specific dynamics (Bolton and Kacperczyk, 2021). Unfortunately, this finding vanishes in the post Paris Agreement sample, differently from what argue Monasterolo and De Angelis (2020), who find a negative coefficients on the same term on major indices for the EU, US and global stock markets, suggesting then a reduction in systematic risk for green stocks; however this result may be driven (as in the discussed case of Bolton and Kacperczyk (2021)) by the specific choice with make about emission data, so the lag consider in constructing portfolio, which those indices may not apply.

The analysis of COP events on carbon-emitter returns shows that while intra-COP periods may not introduce significant systematic risk through market interactions (probably due to the short time-frame in which they take place), the pre-COP and post-COP periods reveal notable systematic risk, particularly for high carbon-intensity. However the results depend on the sample (time-frame) and emission measure selected. The observed interactions highlight the importance of considering both market-wide factors and firm-specific responses in managing and understanding systematic risk in the context of environmental policies and climate change (Dietz et al., 2016).

### 5.5 Lagged predictors

$$R_{i,t} - R_{f,t} = \alpha_0 + \alpha_1 \cdot \Delta VIX_{t-1} + \alpha_2 \cdot \Delta Ardia_{t-1} + \alpha_3 \cdot \Delta Faccini_{t-1}$$
$$+ \beta_1 \cdot PrCOP_t + \beta_2 \cdot ICOP_t + \beta_3 \cdot PoCOP_t$$
$$+ (\gamma_0 + \gamma_1 \cdot PrCOP_t + \gamma_2 \cdot ICOP_t + \gamma_3 \cdot PoCOP_t) \cdot (Mkt_t - R_{f,t}) + \epsilon_{BmG,t} \quad (7)$$

[Table 10 around here]

Table 10 presents the results of regressions that include lagged predictors: the lagged VIX growth, the lagged MCCC (Climate Summits) growth measure from Ardia et al. (2022), and the lagged US climate policy growth measure from Faccini et al. (2023). These regressions analyze the returns on low-carbon intensity (L), high-carbon intensity (H), and high-minus-low carbon-intensity (H-L) portfolios in the context of COP events. At the dawn of this analysis, I also included additional measures that seemed to me could predict or somehow explain the variables at play, but without finding any more significant ones.[8]

The intercept values ($\alpha_0$) remain also in this scenario consistently positive and significant across all models. For low intensity firms, the intercept ranges from 0.029% to 0.032%, while for high intensity firms, it ranges from 0.018% to 0.020%. These significant values suggest that both low and high carbon-intensity portfolios generate positive excess returns (higher for the green portfolio), indicating a robust baseline performance independent of COP events. The coefficient for lagged VIX growth is significant for the high-minus-low carbon-intensity portfolio, with values such as $-0.036\%$ when I consider only alone and $-0.034\%$ when incorporating all predictors (although the significance comes from the low carbon intensity portfolio). This suggests that increased market volatility in the prior period negatively impacts the differential returns between high and low carbon-intensity, implying that high carbon-intensity firms are more adversely affected by previous market uncertainty. Conversely, I cannot draw the same conclusions for the other two predictors. The loading for lagged MCCC is not significant across most models, indicating that past climate summit activities do not significantly influence the returns of the carbon-intensity portfolios. Sim-

[8] Additionally, I also use both the Akaike and the Bayesian Information Criteria to evaluate the optimal number of lags for the lagged predictors, finding in 1 day lag value.

ilarly, the coefficient for lagged Faccini is also generally not significant, suggesting that prior US climate policy changes do not have a substantial impact on the portfolio returns. This result is somehow surprising, since these indexes are constructed using public available news, and hence, they should a priori be able to interpret and predict climate summits output (the first) and US climate policy evolution (the second).

Across all different model's specifications, I retrieve negative coefficients on the HmL portfolio, indicating that market returns negatively (positively) interact with Intra-COP (Pre-COP) returns for high relative to low carbon-intensity. This suggests that during (before) COP events, market movements have a more pronounced negative (positive) impact on high carbon-intensity. Post-COP interactions with market returns ($Mkt \cdot PCOP$) show more significant patterns. For example, the high-minus-low coefficients have always negative and significant values, which indicate that market returns negatively interact with Post-COP returns for high intensity firms. Overall, our results underscore the strong influence of market returns on portfolio performance, reaffirming the critical role of overall market conditions in driving returns for carbon-related assets. The high-minus-low portfolio's significant negative interaction term of $-0.176\%$ (in the last model specification) further highlights that high carbon-intensity are more negatively impacted by market conditions compared to low intensity firms.

In this section I have tried to capture the return dynamics of low and high carbon-intensity portfolios in relation to COP events and market movements. In conclusion, this analysis highlights that COP events do not significantly impact returns before and during the event itself nor post-event, with the only exception on low carbon-intensity portfolios. The significant interaction terms between market returns and both pre-COP, intra-COP and post-COP returns suggest heightened systemic risk for high carbon-intensity in these periods. These findings have important implications for financial markets, emphasizing the need for investors to consider both market conditions and environmental policy impacts when assessing the risk and return profiles of carbon-related assets.

### 5.6 Yearly variation

Here I regress excess returns on (1) Intra-Cop dates and Market contemporaneous returns, (2) Post-COP periods and Market contemporaneous returns and (3) all together. I display results

for Low-carbon intensity portfolio, High- carbon intensity portfolios and a High-minus-Low-carbon intensity portfolio.

$$R_{i,k,t} - R_{f,k,t} = \alpha_k + \beta_{1,k} \cdot PrCOP_{k,t} + \beta_{2,k} \cdot ICOP_{k,t} + \beta_{3,k} \cdot PoCOP_{k,t} + \beta_{4,k} \cdot (Mkt_{k,t} - R_{f,t}) + \epsilon_{k,t} \tag{8}$$

With

$$k = \text{ is the rebalancing period (emission year)} = 2006, ..., 2022$$

[Table 11 around here]

The analysis presented in the Table 11 investigates the excess returns on portfolios of low, high and high-minus-low carbon-intensity firms in relation to COP events over different rebalancing periods from 2006 to 2022. The intercept values are consistently positive and significant across all model's specifications, indicating that both low and high carbon-intensity portfolios generate positive excess returns. For low intensity firms, the intercept ranges from 0.030% to 0.035%, and for high intensity firms, it ranges from 0.016% to 0.021%. These significant values suggest a robust baseline performance for these portfolios, independent of COP events.

Pre-COP coefficients show a weak significance (particularly in model (4) when I consider the three periods together): investors each year form expectations before these events, but probably due to the vague outputs (treaties or agreements perceived as not really effective) this anticipation is not as strong as we would expect. As I have already highlighted in this paper, for Intra-COP coefficients are generally not significant, suggesting that what happens during these events does not materially influence the returns of either portfolio type. This implies that both high and low carbon-intensity portfolios do not react strongly to COP events during their occurrence, likely because expectations are already formed, hence priced in prior to the events. Same conclusion we can retrieve for Post-COP coefficient, with a notable difference when we use as emission measure, Carbon Intensity - Scope 2 as highlighted in the Appendix in Table 23 and Table 24 (where the coefficient of the Post-COP period is significant for the green portfolio). This is relevant to further stress the discussion on the relevance of the type of emission measure considered in this kind of analysis.

As before, the market coefficients are highly significant across all model's specifications for both high and low carbon-intensity portfolios, with coefficients around 1.021 and 0.967, confirming a strong correlation between market returns and carbon-intensity portfolio returns, which aligns with expectations. For the high-minus-low portfolio, the market coefficient is significantly negative ($-0.054$), indicating that the differential return between high and low carbon-intensity portfolios negatively correlates with market returns; this result is in line with the decreasing pattern of the high-minus-low portfolio (while the market one is constantly increasing). To sum up, even when I regress year-by-year, the results reveal that low carbon-intensity portfolios tend to outperform high carbon-intensity portfolios around COP events. The negative alphas for high-minus-low portfolios and significant market coefficients highlight the importance of considering both market-wide factors and event-specific impacts in portfolio performance evaluation. These findings are crucial for investors incorporating sustainable investment strategies, emphasizing the nuanced effects of environmental policy events on portfolio returns. Finally, in the Appendix in Table 12 I also report the detail of the regressions coefficients for the single years; here differently from Monasterolo and De Angelis (2020) and Bolton and Kacperczyk (2021) I do not observe any particular pattern.

[Table 12 around here]

### 5.7 Cumulative Abnormal Returns - Portfolio Level

In this section I use a multi-factor model, e.g., Fama and French (1992), to distinguish the anomalous excess returns given by the COP. I therefore use the single-factor CAPM to measure abnormal returns at:

$$(R_{p,t} - R_{f,t}) = \alpha + \beta \cdot (Mkt_t - R_{f,t}) + \epsilon_{k,t} \tag{9}$$

For a given COP $h$ and portfolio $p$ (Green, Brown and Brown-minus-Green), I compute abnormal returns for day $m$ during the event window as the difference between the actual excess returns and the expected excess returns estimated from the model, i.e.:

$$AR_{p,h,m} = (R_{p,h,m} - R_{f,h,m}) - \left[\hat{\alpha}_{p,h} - \hat{\beta}_{p,h}(Mkt_{h,m} - R_{f,h,m})\right] \tag{10}$$

The average cumulative abnormal return (ACAR) over the event window is then[9]:

$$ACAR_{h,p} = \frac{1}{m_2 - m_1 + 1} \sum_{m=m_1}^{m_2} AR_{p,h,m} \tag{11}$$

For a particular portfolio p, and in the equal-weighted case each COP has the same relevance, the portfolio average cumulative abnormal returns (PACAR) across all COP events is defined as:

$$PACAR_p = \frac{1}{H} \sum_{h=1}^{H} ACAR_{h,p} \tag{12}$$

Table 13 reports results for the portfolio absolute cumulative abnormal returns. For each COP event $h$ and carbon-intensity portfolio $p$ (low, high and high-minus-low), abnormal returns for day $m$ during the event window are calculated as the difference between actual excess returns and the expected excess returns estimated from the CAPM model. The average cumulative abnormal return (ACAR) over the event window is then derived, and the portfolio average cumulative abnormal returns (PACAR) across all COP events are computed following the equations reported above.

[Table 13 around here]

The only significant result is 30 prior to COP summits, a negative average cumulative abnormal returns for high carbon-intensity portfolios and consequently negative value for the HmL portfolio as well (effect that disappears when instead I consider as emission measure, Carbon Intensity - Scope 2 as highlighted in the Appendix in Table 25). This suggests that investors may forecast expected regulatory and policy changes penalizing high carbon-intensity firms, leading to negative price adjustments. The relative underperformance of high-carbon intensity portfolios, as reflected in the high-minus-low portfolio results, indicates a perceived increased risk or cost associated with high-intensity firms in the wake of COP events. Over shorter horizons however, this effect vanishes suggesting a potential market reassessment or adjustment period following the initial reaction. Overall, these findings highlight the importance of considering COP events in investment strategies, particularly in assessing the differential impacts on low versus high carbon-intensity firms.

[9]specifically I test the CAPM until $m_1$ dates before the COP, I then use the CAPM coefficients to compute expected returns which are subtracted from realized returns to obtains Abnormal returns

# 6 Conclusions

Overall the findings indicate that COP events do not play a significant role in driving the transition to a more sustainable economy in the short term. before (Pre-COP), around (Intra-COP) and ex-post (Post-COP) these events, there is no dramatic change in the returns of high versus low carbon-intensity firms. The primary source of variation in returns is attributed to other risk factors and an extra compensation (the *alpha*) provided by low carbon-intensity companies, which is consistently higher than that of high carbon-intensity companies. This indicates that green companies are seen as better investments which consequently results in a higher supply of capital and a lower cost of capital for green companies. Conversely, brown companies face a relatively higher cost of capital due to investor concerns about their sustainability and associated risks. These dynamics underscore the financial benefits of adopting sustainable practices and the growing importance of ESG factors in investment decisions. Nevertheless I find that the market is slightly reacting, mostly in the Pre-COP and Post-COP (less during Intra-COP) period raising up more significantly the returns of Low carbon-intensity firms, however these results largely depend on the selected time-series. In the last section I show an anticipation effect, which however diminishes as we approach the event itself. These results are crucial for policy maker as well for the international community for understanding that investors are not paying much attention to these kind of events, which in turns inspire the policy measures we are seeing implemented at country-level. Specifically, while COP events do not have an immediate and significant impact on stock returns, they are crucial for setting long-term agendas. Policymakers might need to consider additional measures or clearer signals to the market to drive immediate investment responses. For companies, particularly those with high carbon intensity, ongoing sustainable practices and clear communication of long-term strategies are essential for attracting investment, rather than relying on the outcomes of COP events. For future research, it would be valuable to investigate the long-term impacts of COP events and other policy-related events on the financial performance of companies. Understanding how these events influence investor behavior and market dynamics over extended periods can provide deeper insights into the financial implications of environmental policies and sustainability initiatives.

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# Appendix

## Additional Figures




Figure 1 Cumulative excess value-weighted return spreads between high and low carbon intensity portfolio

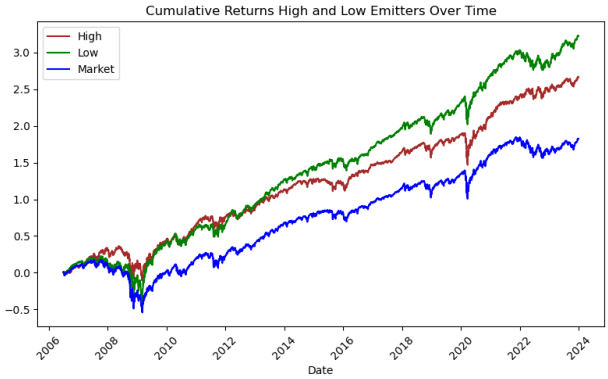



Figure 2 Cumulative excess value-weighted returns of high and low carbon intensity portfolio

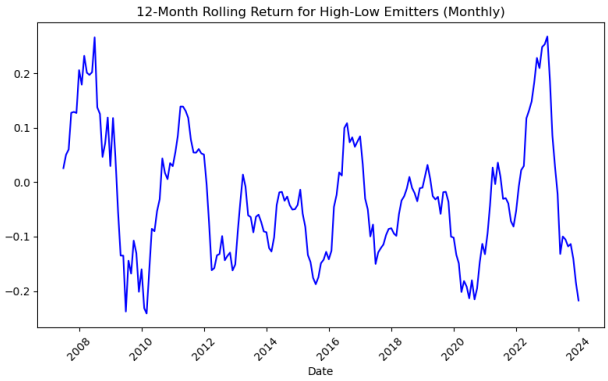



Figure 3 12-month rolling return spreads between high and low carbon intensity portfolio

High-minus-Low carbon-intensity portfolio and COP window.

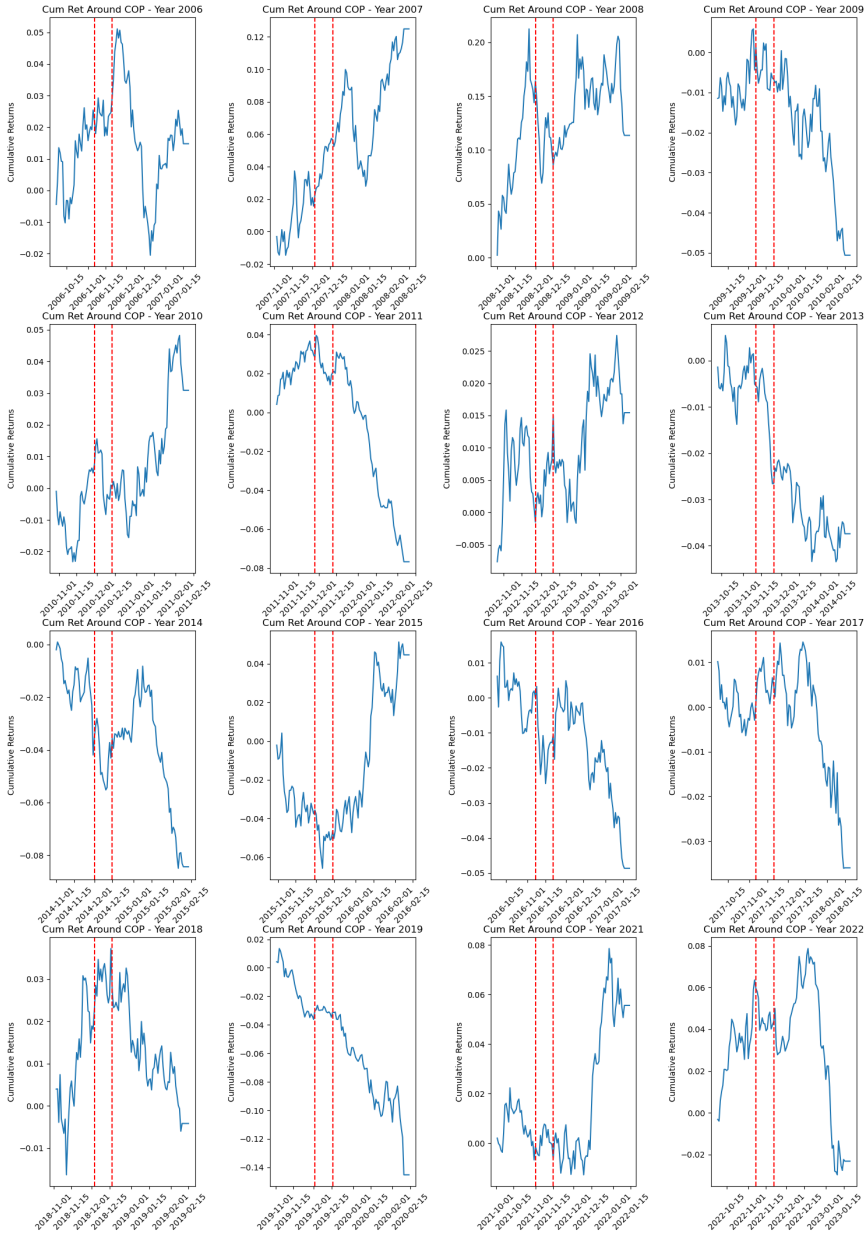
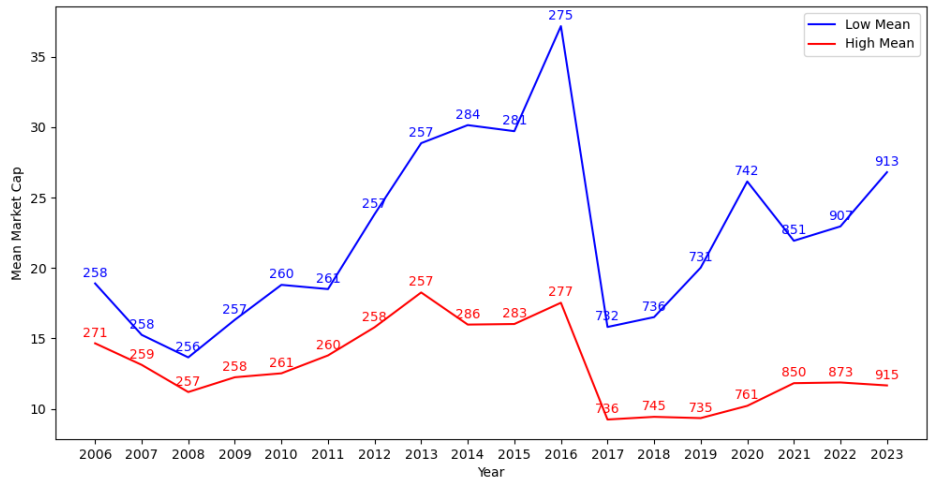
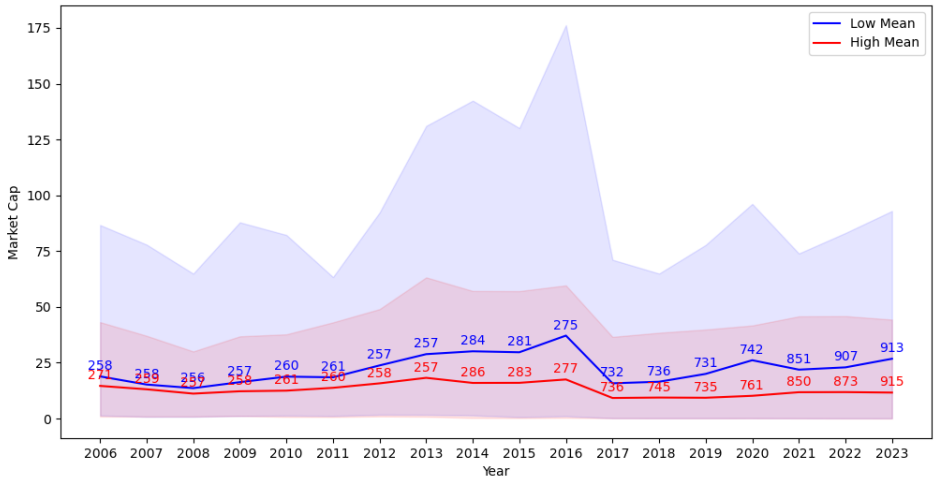



Figure 4 Cumulative excess value-weighted return 20 days before and 60 days after to COP




(a). Average Mkt Cap for the Low and High carbon-intensity portfolios




(b). Average Mkt Cap for the Low and High carbon-intensity portfolios with the respective confidence intervals.

Figure 5 Evolution of the Mkt Cap for the Low and High carbon-intensity portfolios trough time.

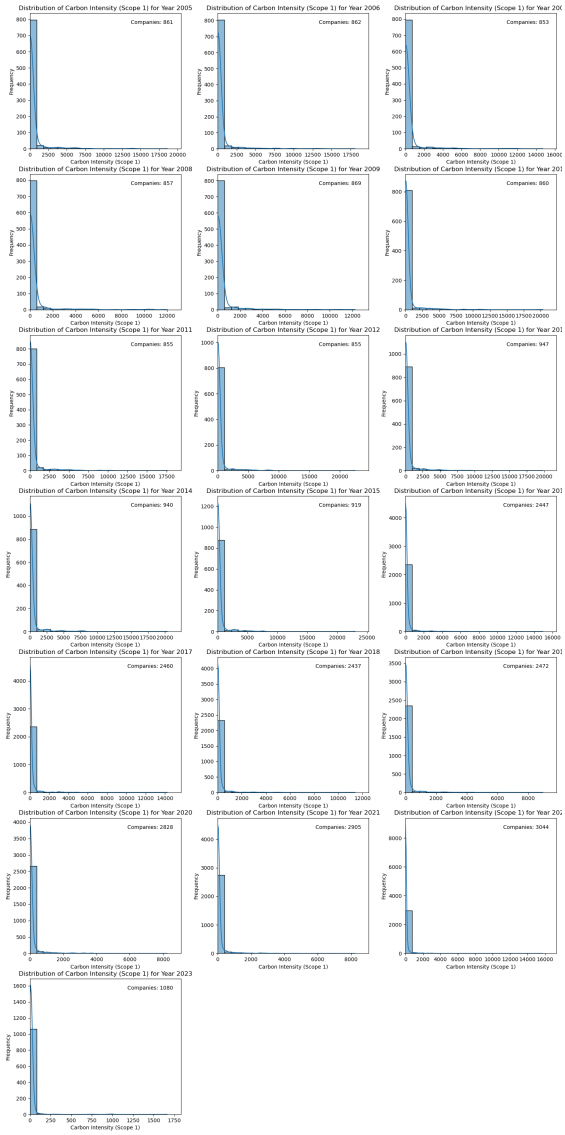



Figure 6 Distribution of Carbon Intensity (Scope 1) by year. I also display the number of companies for each year. The number of emissions per year is increasing since more and more companies are added.

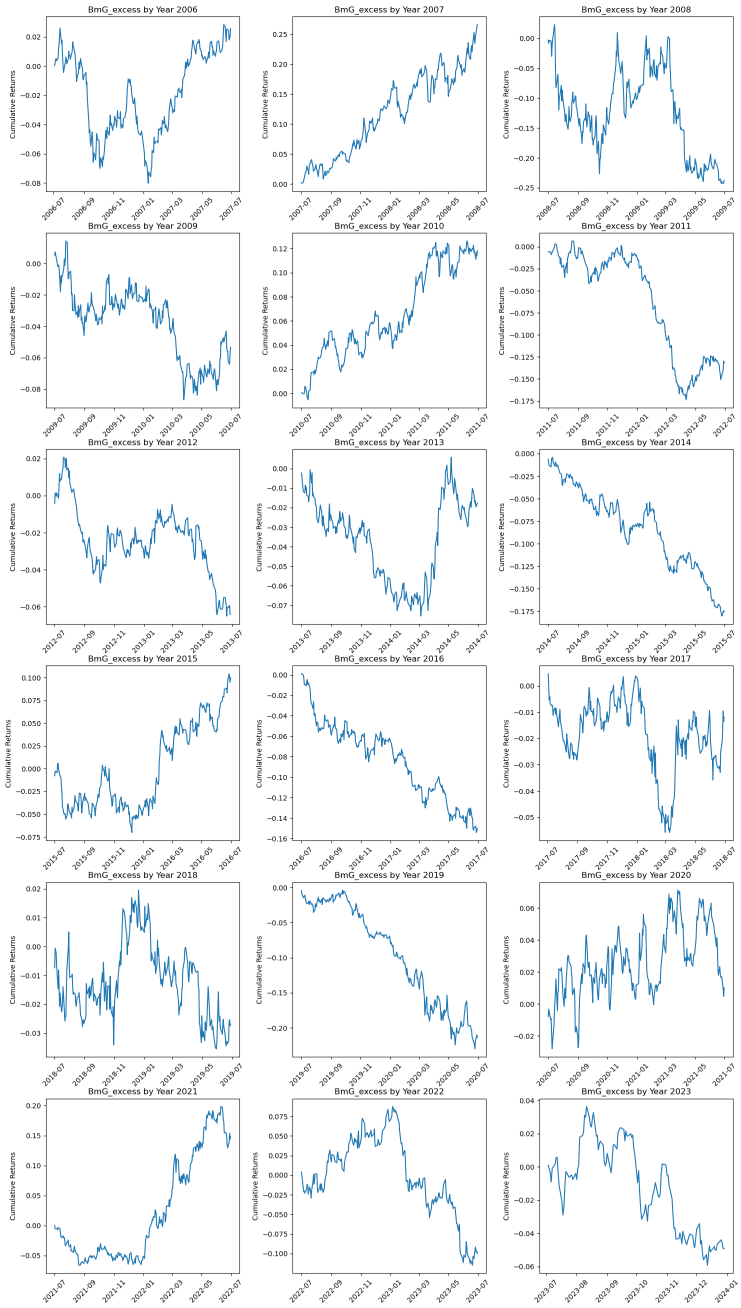
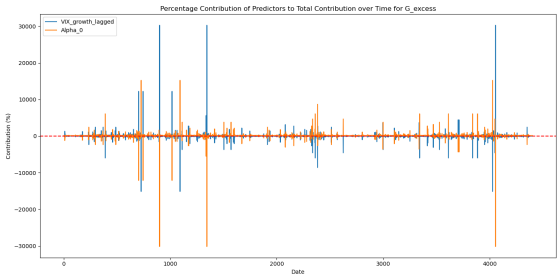
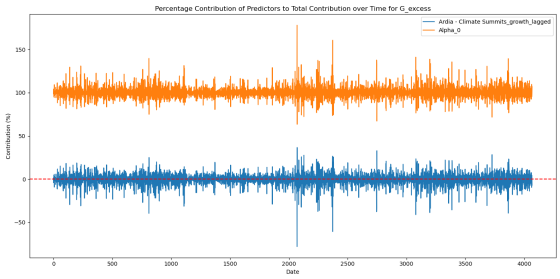


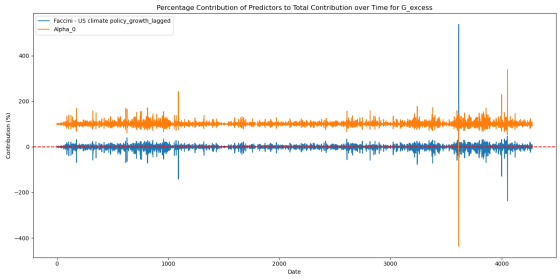

Figure 7 Cumulative excess returns of the High-minus-Low-carbon-intensity portfolio year per year.



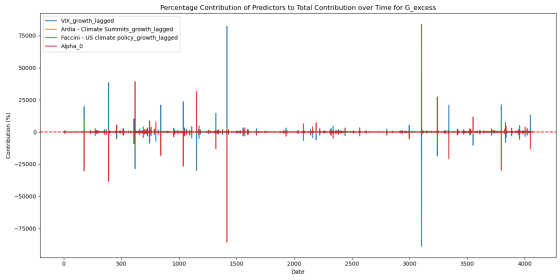

(a). Contribution of the VIX growth measure




(b). Contribution of the Ardia growth measure




(c). Contribution of the Faccini growth measure




(d). Contribution of the all growth measures

Figure 8 Lagged predictor contributions to the Alpha ($\alpha_0$) to the Low portfolio.

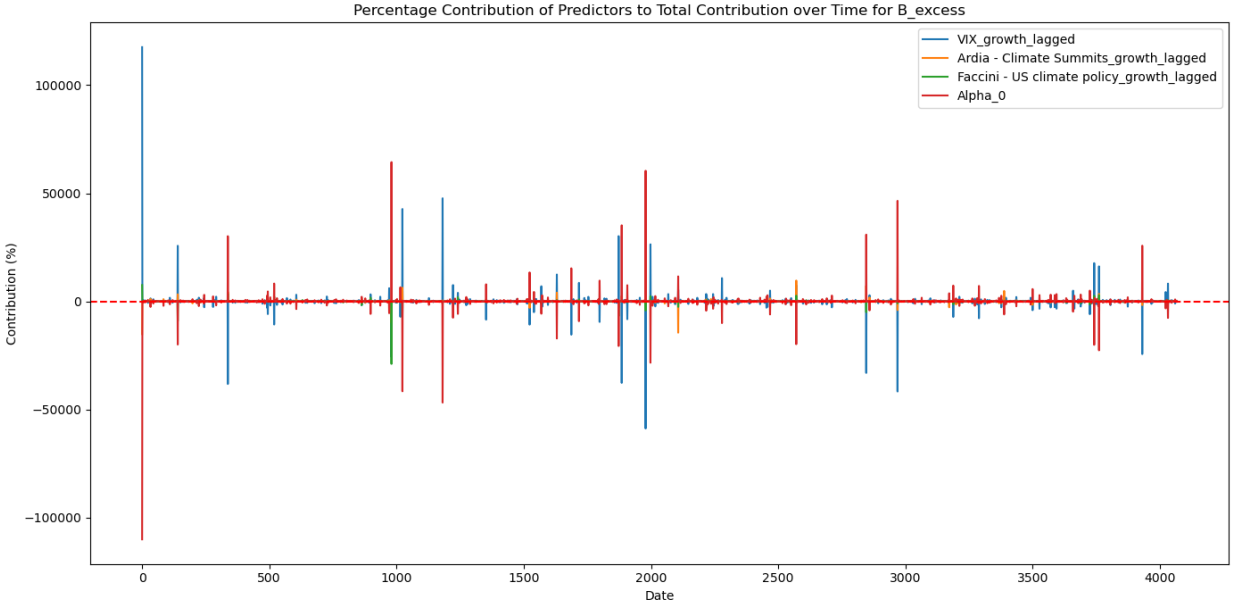
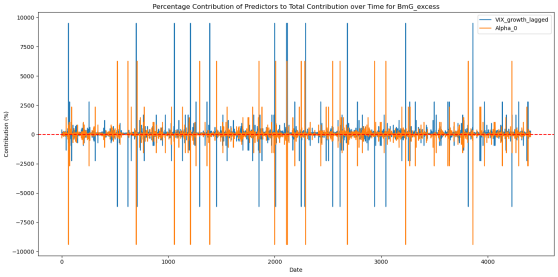
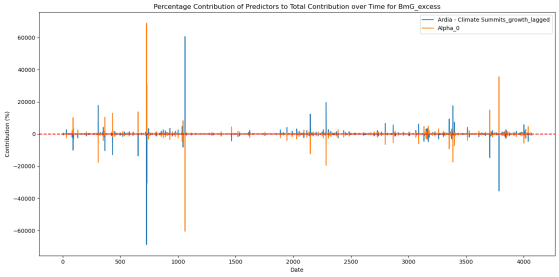


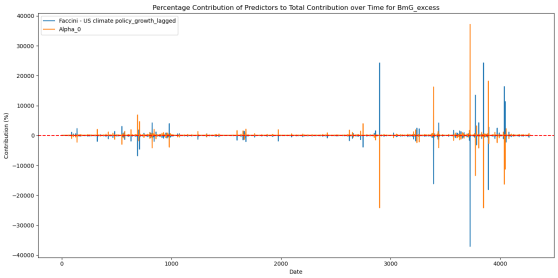

Figure 9 Lagged predictor contributions to the Alpha ($\alpha_0$) to the High portfolio



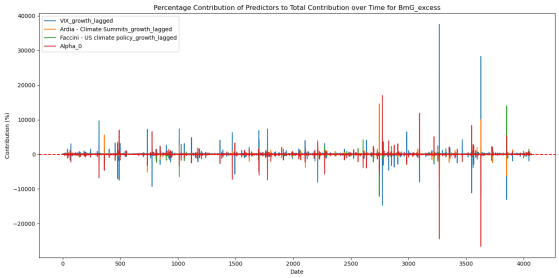

(a). Contribution of the VIX growth measure




(b). Contribution of the Ardia growth measure




(c). Contribution of the Faccini growth measure




(d). Contribution of the all growth measures

Figure 10 Lagged predictor contributions to the Alpha ($\alpha_0$) to the High-minus-Low portfolio

## Additional Tables

| Summary Statistics - returns | | | | | |
|---|---|---|---|---|---|
| | L | H | H-L | $\widehat{Mkt}_{VW}$ | $\widehat{Mkt}_{EW}$ |
| mean($r_t$) (%) | 0.0733 | 0.0605 | -0.0128 | 0.0759 | 0.0625 |
| std($r_t$) (%) | 1.443 | 1.3007 | 0.6892 | 1.2803 | 1.4889 |
| skew($r_t$) | -0.0254 | -0.0936 | -0.4679 | -0.1857 | -0.3446 |
| kurt($r_t$) | 11.397 | 14.291 | 6.777 | 11.5284 | 7.4362 |

Table 1 Summary statistics of the two portfolios, namely Low carbon-intensity and High carbon-intensity. I also report the values for a Market portfolio investing in the universe of CRSP stocks (whose firms are reported in S&P Trucost). I display the mean, standard deviation, skewness and kurtosis of the excess returns at daily frequency.

| Summary Statistics - CI1 | | | | |
|---|---|---|---|---|
| | Low | | High | |
| Year | Mean(CI1) | N. Firms | Mean(CI1) | N. Firms |
| 2005 | 3.97 | 258 | 1285.41 | 271 |
| 2006 | 3.72 | 258 | 1188.66 | 259 |
| 2007 | 3.17 | 256 | 1113.17 | 257 |
| 2008 | 2.96 | 257 | 997.01 | 258 |
| 2009 | 2.69 | 260 | 1084.21 | 261 |
| 2010 | 2.55 | 261 | 1119.52 | 260 |
| 2011 | 2.10 | 257 | 997.99 | 258 |
| 2012 | 1.89 | 257 | 1015.02 | 257 |
| 2013 | 1.92 | 284 | 943.21 | 286 |
| 2014 | 1.82 | 281 | 965.08 | 283 |
| 2015 | 1.80 | 275 | 927.94 | 277 |
| 2016 | 1.83 | 732 | 474.00 | 736 |
| 2017 | 1.67 | 736 | 451.23 | 745 |
| 2018 | 1.58 | 731 | 408.78 | 735 |
| 2019 | 1.52 | 742 | 397.78 | 761 |
| 2020 | 1.53 | 851 | 396.06 | 850 |
| 2021 | 1.46 | 907 | 353.12 | 873 |
| 2022 | 1.22 | 913 | 295.22 | 915 |
| 2023 | 1.44 | 346 | 40.03 | 398 |

Table 2 Summary statistics of the two portfolios, namely Low carbon-intensity and High carbon-intensity. I display for each year the average emission as well as number of firms per year in the portfolios.

| Summary Mkt Cap - CI1 | | | | | | |
|---|---|---|---|---|---|---|
| | Low | | | High | | |
| Year | 5% | Mean | 95% | 5% | Mean | 95% |
| 2006 | 1.40 | 18.90 | 86.69 | 0.93 | 14.65 | 43.20 |
| 2007 | 0.82 | 15.25 | 77.91 | 0.90 | 13.12 | 37.07 |
| 2008 | 0.83 | 13.65 | 64.93 | 0.92 | 11.19 | 30.08 |
| 2009 | 1.16 | 16.32 | 87.90 | 1.16 | 12.24 | 36.84 |
| 2010 | 1.35 | 18.80 | 82.23 | 0.81 | 12.52 | 37.74 |
| 2011 | 1.21 | 18.50 | 63.38 | 0.77 | 13.79 | 43.10 |
| 2012 | 1.75 | 23.82 | 92.31 | 1.00 | 15.79 | 49.04 |
| 2013 | 1.72 | 28.86 | 131.06 | 0.85 | 18.26 | 63.24 |
| 2014 | 1.44 | 30.14 | 142.39 | 0.31 | 15.98 | 57.15 |
| 2015 | 0.71 | 29.71 | 130.12 | 0.24 | 16.02 | 57.09 |
| 2016 | 1.08 | 37.17 | 176.22 | 0.39 | 17.53 | 59.65 |
| 2017 | 0.19 | 15.81 | 71.13 | 0.14 | 9.24 | 36.60 |
| 2018 | 0.17 | 16.51 | 64.95 | 0.12 | 9.43 | 38.44 |
| 2019 | 0.17 | 20.02 | 77.78 | 0.12 | 9.34 | 39.89 |
| 2020 | 0.18 | 26.14 | 96.16 | 0.13 | 10.21 | 41.71 |
| 2021 | 0.13 | 21.93 | 73.95 | 0.11 | 11.82 | 45.78 |
| 2022 | 0.12 | 22.95 | 83.13 | 0.06 | 11.87 | 45.88 |
| 2023 | 0.12 | 26.80 | 92.98 | 0.04 | 11.66 | 44.33 |

Table 3 Summary Mat Cap of the two portfolios, namely Low carbon-intensity and High carbon-intensity, expressed in billions of dollars. I display also the percentile at 5% and 95% confidence interval.

| | NoDur | Durbl | Manuf | Enrgy | Chems | BusEq | Telcm | Utils | Shops | Hlth | Money | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\alpha(\%)$ | 0.011 | 0.007 | -0.003 | 0.003 | 0.003 | 0.024*** | 0.000 | 0.009 | 0.015* | 0.013 | -0.001 | -0.005 |
| | (0.009) | (0.021) | (0.008) | (0.021) | (0.009) | (0.007) | (0.011) | (0.014) | (0.008) | (0.010) | (0.009) | (0.006) |
| $PrCOP(\%)$ | 0.050* | 0.044 | 0.060** | 0.021 | 0.021 | -0.055** | -0.032 | 0.011 | 0.010 | -0.007 | -0.004 | 0.025 |
| | (0.027) | (0.062) | (0.025) | (0.071) | (0.029) | (0.027) | (0.038) | (0.048) | (0.030) | (0.033) | (0.028) | (0.022) |
| $ICOP(\%)$ | -0.051 | -0.157 | 0.013 | -0.088 | 0.008 | 0.033 | -0.021 | -0.022 | 0.029 | -0.008 | 0.007 | -0.018 |
| | (0.043) | (0.100) | (0.034) | (0.098) | (0.038) | (0.033) | (0.051) | (0.065) | (0.046) | (0.052) | (0.039) | (0.031) |
| $PoCOP(\%)$ | -0.004 | -0.003 | 0.034* | 0.001 | 0.017 | -0.023 | 0.011 | 0.001 | -0.007 | 0.005 | -0.022 | 0.032* |
| | (0.022) | (0.053) | (0.019) | (0.046) | (0.021) | (0.018) | (0.027) | (0.032) | (0.022) | (0.024) | (0.023) | (0.017) |
| $MKT$ | 0.673*** | 1.271*** | 1.054*** | 1.044*** | 0.828*** | 1.112*** | 0.857*** | 0.712*** | 0.879*** | 0.769*** | 1.172*** | 0.986*** |
| | (0.012) | (0.023) | (0.010) | (0.031) | (0.010) | (0.009) | (0.016) | (0.023) | (0.011) | (0.010) | (0.011) | (0.012) |
| $SMB$ | -0.106*** | 0.545*** | 0.233*** | 0.017 | -0.076*** | -0.012 | -0.111*** | -0.219*** | 0.054*** | 0.002 | -0.051** | 0.193*** |
| | (0.019) | (0.037) | (0.017) | (0.050) | (0.018) | (0.014) | (0.025) | (0.034) | (0.018) | (0.019) | (0.021) | (0.018) |
| $HML$ | 0.044*** | -0.041 | 0.216*** | 0.573*** | 0.066*** | -0.380*** | 0.156*** | 0.096*** | -0.167*** | -0.213*** | 0.782*** | 0.200*** |
| | (0.016) | (0.034) | (0.015) | (0.048) | (0.015) | (0.011) | (0.017) | (0.025) | (0.014) | (0.015) | (0.020) | (0.012) |
| $N$ | 4509 | 4509 | 4509 | 4509 | 4509 | 4509 | 4509 | 4509 | 4509 | 4509 | 4509 | 4509 |
| $R^2(\%)$ | 72.93 | 66.23 | 0.90.40 | 60.18 | 80.70 | 92.12 | 75.89 | 55.57 | 83.46 | 74.58 | 91.95 | 92.65 |

Table 4 Standard errors (in parentheses) are computed under $t$ of contemporaneous cross-sectional correlation between panel portfolio residuals. *, **, ***, denote statistical significance at the 10%, 5%, and 1%. N is the number of days.

| | NoDur | Durbl | Manuf | Enrgy | Chems | BusEq | Telcm | Utils | Shops | Hlth | Money | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\alpha(\%)$ | 0.010 | 0.007 | -0.003 | 0.003 | 0.003 | 0.024*** | 0.000 | 0.009 | 0.015* | 0.013 | -0.000 | -0.004 |
| | (0.009) | (0.021) | (0.008) | (0.021) | (0.009) | (0.007) | (0.011) | (0.014) | (0.008) | (0.010) | (0.009) | (0.006) |
| $PrCOP(\%)$ | 0.050* | 0.045 | 0.061** | 0.020 | 0.00021 | -0.055** | -0.033 | 0.012 | 0.010 | -0.006 | -0.005 | 0.024 |
| | (0.027) | (0.062) | (0.025) | (0.071) | (0.029) | (0.027) | (0.038) | (0.048) | (0.030) | (0.033) | (0.028) | (0.022) |
| $MKT * PrCOP$ | -0.014 | -0.031 | 0.002 | 0.095 | 0.001 | -0.025 | 0.081** | -0.008 | -0.023 | -0.036 | 0.014 | 0.034 |
| | (0.028) | (0.063) | (0.036) | (0.104) | (0.037) | (0.033) | (0.040) | (0.073) | (0.032) | (0.035) | (0.046) | (0.040) |
| $ICOP(\%)$ | -0.047 | -0.156 | 0.019 | -0.077 | 0.010 | 0.034 | -0.016 | -0.015 | 0.031 | -0.010 | -0.006 | -0.021 |
| | (0.042) | (0.100) | (0.033) | (0.100) | (0.038) | (0.033) | (0.050) | (0.066) | (0.047) | (0.051) | (0.037) | (0.032) |
| $MKT * ICOP$ | -0.041 | -0.013 | -0.054 | -0.098 | -0.019 | -0.002 | -0.043 | -0.068 | -0.027 | 0.016 | 0.128*** | 0.032 |
| | (0.034) | (0.084) | (0.036) | (0.102) | (0.032) | (0.033) | (0.044) | (0.071) | (0.058) | (0.056) | (0.032) | (0.051) |
| $PoCOP(\%)$ | -0.001 | -0.003 | 0.035* | 0.001 | 0.017 | -0.026 | 0.012 | 0.007 | -0.006 | 0.008 | -0.026 | 0.032* |
| | (0.022) | (0.053) | (0.019) | (0.046) | (0.022) | (0.018) | (0.027) | (0.032) | (0.022) | (0.024) | (0.023) | (0.017) |
| $MKT * PoCOP$ | -0.054* | -0.006 | -0.030 | 0.008 | -0.015 | 0.072*** | -0.010 | -0.105** | -0.027 | -0.056** | 0.075* | 0.003 |
| | (0.029) | (0.054) | (0.023) | (0.065) | (0.027) | (0.021) | (0.031) | (0.041) | (0.027) | (0.025) | (0.043) | (0.023) |
| $MKT$ | 0.681*** | 1.274*** | 1.059*** | 1.039*** | 0.830*** | 1.107*** | 0.852*** | 0.726*** | 0.885*** | 0.777*** | 1.158*** | 0.982*** |
| | (0.014) | (0.028) | (0.011) | (0.037) | (0.012) | (0.011) | (0.020) | (0.027) | (0.013) | (0.011) | (0.012) | (0.014) |
| $SMB$ | -0.106*** | 0.544*** | 0.234*** | 0.021 | -0.075*** | -0.013 | -0.108*** | -0.219*** | 0.054*** | 0.001 | -0.053** | 0.194*** |
| | (0.019) | (0.037) | (0.017) | (0.050) | (0.018) | (0.014) | (0.025) | (0.034) | (0.018) | (0.019) | (0.021) | (0.018) |
| $HML$ | 0.044*** | -0.041 | 0.216*** | 0.57341*** | 0.06584*** | -0.380*** | 0.156*** | 0.096*** | -0.167*** | -0.213*** | 0.782*** | 0.200*** |
| | (0.016) | (0.034) | (0.015) | (0.048) | (0.015) | (0.011) | (0.017) | (0.025) | (0.014) | (0.015) | (0.020) | (0.012) |
| $N$ | 4509 | 4509 | 4509 | 4509 | 4509 | 4509 | 4509 | 4509 | 4509 | 4509 | 4509 | 4509 |
| $R^2(\%)$ | 72.98 | 66.23 | 90.42 | 60.24 | 80.70 | 92.17 | 75.96 | 55.69 | 83.48 | 74.63 | 92.01 | 92.66 |

Table 5 Standard errors (in parentheses) are computed under $t$ of contemporaneous cross-sectional correlation between panel portfolio residuals. *, **, ***, denote statistical significance at the 10%, 5%, and 1%. N is the number of days.

| | (1) | | | (2) | | | (3) | | | (4) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L | H | H-L | L | H | H-L | L | H | H-L | L | H | H-L |
| $\alpha(\%)$ | 0.028*** | 0.021*** | -0.007 | 0.073*** | 0.060*** | -0.013 | 0.076*** | 0.063*** | -0.013 | 0.028*** | 0.022*** | -0.006 |
| | (0.005) | (0.007) | (0.010) | (0.022) | (0.019) | (0.010) | (0.021) | (0.019) | (0.010) | (0.005) | (0.006) | (0.010) |
| $MKT$ | 1.103*** | 0.961*** | -0.143*** | | | | | | | 1.105*** | 0.947*** | -0.158*** |
| | (0.008) | (0.011) | (0.017) | | | | | | | (0.007) | (0.013) | (0.018) |
| $SMB$ | | | | 0.267*** | 0.304*** | 0.0363 | | | | -0.125*** | -0.029 | 0.097*** |
| | | | | (0.065) | (0.061) | (0.027) | | | | (0.013) | (0.022) | (0.031) |
| $HML$ | | | | | | | 0.395*** | 0.400*** | 0.005 | 0.080*** | 0.132*** | 0.053* |
| | | | | | | | (0.053) | (0.040) | (0.030) | (0.012) | (0.017) | (0.027) |
| $N$ | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 |
| $R^2(\%)$ | 95.15 | 88.81 | 6.99 | 1.35 | 2.15 | 0.11 | 5.28 | 6.65 | 0.00 | 95.68 | 89.55 | 8.04 |

Table 6 Standard errors (in parentheses) are computed under $t$ of contemporaneous cross-sectional correlation between panel portfolio residuals. *, **, ***, denote statistical significance at the 10%, 5%, and 1%. N is the number of companies times the number of COP. L = Low carbon-intensity portfolio returns, H = High carbon-intensity portfolio returns and H-L = spread between the two portfolio returns.

| | (1) | | | (2) | | | (3) | | | (4) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L | H | H-L | L | H | H-L | L | H | H-L | L | H | H-L |
| $\alpha(\%)$ | 0.029*** | 0.018*** | -0.011 | 0.028*** | 0.021*** | -0.007 | 0.030*** | 0.020*** | -0.010 | 0.032*** | 0.017** | -0.015 |
| | (0.005) | (0.007) | (0.010) | (0.005) | (0.007) | (0.010) | (0.005) | (0.007) | (0.11) | (0.005) | (0.008) | (0.012) |
| $PrCOP(\%)$ | -0.017 | 0.037 | 0.054 | | | | | | | -0.020 | 0.038 | 0.058 |
| | (0.018) | (0.025) | (0.040) | | | | | | | (0.019) | (0.025) | (0.040) |
| $ICOP(\%)$ | | | | -0.003 | -0.013 | -0.010 | | | | -0.008 | -0.009 | -0.001 |
| | | | | (0.023) | (0.033) | (0.051) | | | | (0.023) | (0.033) | (0.051) |
| $PoCOP(\%)$ | | | | | | | -0.019 | 0.006 | 0.025 | -0.021 | 0.008 | 0.030 |
| | | | | | | | (0.014) | (0.016) | (0.027) | (0.015) | (0.017) | (0.027) |
| $MKT$ | 1.103*** | 0.961*** | -0.143*** | 1.103*** | 0.961*** | -0.143*** | 1.104*** | 0.961*** | -0.143*** | 1.103*** | 0.961*** | -0.143*** |
| | (0.008) | (0.011) | (0.017) | (0.008) | (0.011) | (0.017) | (0.008) | (0.011) | (0.017) | (0.008) | (0.011) | (0.017) |
| $N$ | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 |
| $R^2(\%)$ | 95.15 | 88.82 | 7.03 | 95.15 | 88.81 | 6.99 | 95.15 | 88.81 | 7.00 | 95.15 | 88.82 | 7.05 |

Table 7 Standard errors (in parentheses) are computed under $t$ of contemporaneous cross-sectional correlation between panel portfolio residuals. *, **, ***, denote statistical significance at the 10%, 5%, and 1% levels. Regressions are: (1) = PreCOP, (2) = IntraCOP, (3)= PostCOP, and (3) = PrCOP + ICOP + PoCOP. N is the number of companies times the number of COPs. L = Low carbon-intensity portfolio returns, H = High carbon-intensity portfolio returns and H-L = spread between the two portfolio returns.

| | (1) | | | (2) | | | (3) | | | (4) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L | H | H-L | L | H | H-L | L | H | H-L | L | H | H-L |
| Full Sample | | | | | | | | | | | | |
| $\alpha(\%)$ | 0.030*** | 0.020*** | -0.010 | 0.028*** | 0.022*** | -0.005 | 0.031*** | 0.022*** | -0.009 | 0.033*** | 0.019** | -0.014 |
| | (0.005) | (0.007) | (0.010) | (0.005) | (0.006) | (0.010) | (0.005) | (0.007) | (0.011) | (0.005) | (0.007) | (0.012) |
| $PrCOP(\%)$ | -0.025 | 0.034 | 0.059 | | | | | | | -0.029 | 0.035 | 0.063 |
| | (0.017) | (0.025) | (0.040) | | | | | | | (0.017) | (0.026) | (0.040) |
| $ICOP(\%)$ | | | | 0.007 | -0.012 | -0.019 | | | | 0.001 | -0.009 | -0.010 |
| | | | | (0.022) | (0.034) | (0.052) | | | | (0.022) | (0.035) | (0.052) |
| $PoCOP(\%)$ | | | | | | | -0.022 | 0.003 | 0.025 | -0.024* | 0.005 | 0.029 |
| | | | | | | | (0.014) | (0.016) | (0.027) | (0.014) | (0.016) | (0.027) |
| $MKT$ | 1.105*** | 0.947*** | -0.158*** | 1.1047*** | 0.947*** | -0.158*** | 1.105*** | 0.947*** | -0.158*** | 1.105*** | 0.947*** | -0.158*** |
| | (0.007) | (0.013) | (0.018) | (0.007) | (0.013) | (0.018) | (0.007) | (0.013) | (0.018) | (0.007) | (0.013) | (0.018) |
| $SMB$ | -0.125*** | -0.028 | 0.097*** | -0.125*** | -0.029 | 0.097*** | -0.125*** | -0.029 | 0.097*** | -0.126*** | -0.028 | 0.097*** |
| | (0.013) | (0.022) | (0.031) | (0.013) | (0.022) | (0.031) | (0.013) | (0.022) | (0.031) | (0.013) | (0.022) | (0.031) |
| $HML$ | 0.080*** | 0.132*** | 0.053* | 0.080*** | 0.132*** | 0.053* | 0.080*** | 0.132*** | 0.053* | 0.080*** | 0.132*** | 0.053* |
| | (0.012) | (0.017) | (0.027) | (0.012) | (0.017) | (0.027) | (0.012) | (0.017) | (0.027) | (0.012) | (0.017) | (0.027) |
| $N$ | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 |
| $R^2(\%)$ | 95.68 | 89.56 | 8.09 | 95.68 | 89.55 | 8.04 | 95.68 | 89.55 | 8.06 | 95.69 | 89.56 | 8.11 |
| Post 2016 | | | | | | | | | | | | |
| $\alpha(\%)$ | 0.034*** | 0.028*** | -0.005 | 0.032*** | 0.026*** | -0.006 | 0.032*** | 0.029*** | -0.003 | 0.035*** | 0.028*** | -0.007 |
| | (0.006) | (0.008) | (0.012) | (0.006) | (0.008) | (0.012) | (0.006) | (0.008) | (0.013) | (0.007) | (0.009) | (0.014) |
| $PrCOP(\%)$ | -0.035 | -0.009 | 0.026 | | | | | | | -0.037 | -0.009 | 0.028 |
| | (0.022) | (0.029) | (0.044) | | | | | | | (0.023) | (0.029) | (0.044) |
| $ICOP(\%)$ | | | | -0.010 | 0.053 | 0.064 | | | | -0.014 | 0.051 | 0.065 |
| | | | | (0.024) | (0.043) | (0.053) | | | | (0.024) | (0.043) | (0.053) |
| $PoCOP(\%)$ | | | | | | | -0.006 | -0.011 | -0.006 | -0.009 | -0.010 | -0.001 |
| | | | | | | | (0.016) | (0.020) | (0.031) | (0.017) | (0.021) | (0.031) |
| $MKT$ | 1.104*** | 0.950*** | -0.155*** | 1.104*** | 0.950*** | -0.155*** | 1.104*** | 0.950*** | -0.155*** | 1.104*** | 0.950*** | -0.155*** |
| | (0.007) | (0.012) | (0.017) | (0.007) | (0.012) | (0.017) | (0.007) | (0.012) | (0.017) | (0.007) | (0.012) | (0.017) |
| $SMB$ | -0.085*** | 0.069*** | 0.154*** | -0.085*** | 0.069*** | 0.154*** | -0.085*** | 0.069*** | 0.154*** | -0.085*** | 0.069*** | 0.154*** |
| | (0.016) | (0.017) | (0.023) | (0.016) | (0.017) | (0.023) | (0.016) | (0.017) | (0.023) | (0.016) | (0.017) | (0.023) |
| $HML$ | -0.049*** | 0.306*** | 0.355*** | -0.050*** | 0.306*** | 0.356*** | -0.050*** | 0.306*** | 0.356*** | -0.049*** | 0.306*** | 0.356*** |
| | (0.008) | (0.011) | (0.015) | (0.008) | (0.011) | (0.015) | (0.008) | (0.011) | (0.015) | (0.008) | (0.011) | (0.015) |
| $N$ | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 |
| $R^2(\%)$ | 97.29 | 94.07 | 45.65 | 97.29 | 94.08 | 45.67 | 97.29 | 94.08 | 45.64 | 97.29 | 94.08 | 45.68 |

Table 8 Standard errors (in parentheses) are computed under $t$ of contemporaneous cross-sectional correlation between panel portfolio residuals. *, **, ***, denote statistical significance at the 10%, 5%, and 1% levels. Regressions are: (1) = PreCOP, (2) = IntraCOP, (3)= PostCOP, and (3) = PrCOP + ICOP + PoCOP. N is the number of companies times the number of COPs. L = Low carbon-intensity portfolio returns, H = High carbon-intensity portfolio returns and H-L = spread between the two portfolio returns.

| | (1) | | | (2) | | | (3) | | | (4) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L | H | H-L | L | H | H-L | L | H | H-L | L | H | H-L |
| Full Sample | | | | | | | | | | | | |
| $\alpha(\%)$ | 0.029*** | 0.018*** | -0.011 | 0.028*** | 0.021*** | -0.007 | 0.031*** | 0.020*** | -0.011 | 0.033*** | 0.017** | -0.016 |
| | (0.005) | (0.007) | (0.010) | (0.005) | (0.007) | (0.010) | (0.005) | (0.007) | (0.011) | (0.005) | (0.008) | (0.012) |
| $PrCOP(\%)$ | -0.017 | 0.036 | 0.053 | | | | | | | -0.021 | 0.038 | 0.058 |
| | (0.018) | (0.025) | (0.040) | | | | | | | (0.019) | (0.025) | (0.040) |
| $MKT \cdot PrCOP$ | -0.005 | 0.044 | 0.049 | | | | | | | 0.004 | 0.040 | 0.036 |
| | (0.038) | (0.042) | (0.075) | | | | | | | (0.038) | (0.042) | (0.075) |
| $ICOP(\%)$ | | | | -0.005 | -0.008 | -0.002 | | | | -0.010 | -0.004 | 0.007 |
| | | | | (0.022) | (0.032) | (0.050) | | | | (0.022) | (0.033) | (0.050) |
| $MKT \cdot ICOP$ | | | | 0.021 | -0.051* | -0.072 | | | | 0.029 | -0.048 | -0.077 |
| | | | | (0.025) | (0.031) | (0.050) | | | | (0.025) | (0.031) | (0.051) |
| $PoCOP(\%)$ | | | | | | | -0.023 | 0.006 | 0.029 | -0.025* | 0.009 | 0.034 |
| | | | | | | | (0.014) | (0.017) | (0.027) | (0.014) | (0.017) | (0.027) |
| $MKT \cdot PoCOP$ | | | | | | | 0.068** | -0.013 | -0.080* | 0.070** | -0.011 | -0.081* |
| | | | | | | | (0.030) | (0.021) | (0.044) | (0.030) | (0.021) | (0.045) |
| $MKT$ | 1.104*** | 0.957*** | -0.147*** | 1.103*** | 0.963*** | -0.139*** | 1.097*** | 0.962*** | -0.134*** | 1.095*** | 0.961*** | -0.134*** |
| | (0.008) | (0.011) | (0.017) | (0.009) | (0.011) | (0.017) | (0.008) | (0.012) | (0.018) | (0.009) | (0.013) | (0.019) |
| $N$ | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 |
| $R^2(\%)$ | 95.15 | 88.83 | 7.09 | 95.15 | 88.82 | 7.06 | 95.18 | 88.81 | 7.21 | 95.19 | 88.84 | 7.39 |
| Post 2016 | | | | | | | | | | | | |
| $\alpha(\%)$ | 0.035*** | 0.024** | -0.010 | 0.033*** | 0.024** | -0.008 | 0.033*** | 0.026** | -0.007 | 0.036*** | 0.023* | -0.013 |
| | (0.006) | (0.012) | (0.016) | (0.006) | (0.011) | (0.015) | (0.007) | (0.012) | (0.016) | (0.007) | (0.013) | (0.018) |
| $PrCOP(\%)$ | -0.039 | 0.024 | 0.063 | | | | | | | -0.040 | 0.025 | 0.065 |
| | (0.024) | (0.031) | (0.050) | | | | | | | (0.025) | (0.032) | (0.051) |
| $MKT \cdot PrCOP$ | 0.064** | -0.076* | -0.140** | | | | | | | 0.066** | -0.078* | -0.144** |
| | (0.030) | (0.041) | (0.068) | | | | | | | (0.031) | (0.042) | (0.069) |
| $ICOP(\%)$ | | | | -0.009 | 0.031 | 0.040 | | | | -0.012 | 0.033 | 0.045 |
| | | | | (0.027) | (0.038) | (0.053) | | | | (0.027) | (0.038) | (0.054) |
| $MKT \cdot ICOP$ | | | | 0.013 | -0.017 | -0.030 | | | | 0.016 | -0.022 | -0.038 |
| | | | | (0.046) | (0.030) | (0.067) | | | | (0.046) | (0.031) | (0.067) |
| $PoCOP(\%)$ | | | | | | | -0.004 | -0.001 | 0.003 | -0.007 | 0.001 | 0.008 |
| | | | | | | | (0.017) | (0.027) | (0.038) | (0.017) | (0.027) | (0.038) |
| $MKT \cdot PoCOP$ | | | | | | | 0.014 | -0.015 | -0.029 | 0.017 | -0.019 | -0.036 |
| | | | | | | | (0.019) | (0.034) | (0.047) | (0.020) | (0.035) | (0.04) |
| $MKT$ | 1.095*** | 0.943*** | -0.152*** | 1.097*** | 0.941*** | -0.157*** | 1.097*** | 0.941*** | -0.155*** | 1.093*** | 0.945*** | -0.148*** |
| | (0.008) | (0.017) | (0.021) | (0.008) | (0.017) | (0.021) | (0.008) | (0.018) | (0.022) | (0.008) | (0.019) | (0.023) |
| $N$ | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 |
| $R^2(\%)$ | 97.02 | 88.06 | 10.46 | 97.01 | 88.04 | 10.16 | 97.01 | 88.04 | 10.16 | 97.02 | 88.07 | 10.53 |

Table 9 Standard errors (in parentheses) are computed under $t$ of contemporaneous cross-sectional correlation between panel portfolio residuals. *, **, ***, denote statistical significance at the 10%, 5%, and 1% levels. Regressions are: (1) = PreCOP, (2) = IntraCOP, (3)= PostCOP, and (3) = PrCOP + ICOP + PoCOP. N is the number of companies times the number of COPs. L = Low carbon-intensity portfolio returns, H = High carbon-intensity portfolio returns and H-L = spread between the two portfolio returns.

| | (1) | | | (2) | | | (3) | | | (4) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L | H | H-L | L | H | H-L | L | H | H-L | L | H | H-L |
| $\alpha_0(\%)$ | 0.032*** | 0.018** | -0.013 | 0.030*** | 0.019** | -0.011 | 0.032*** | 0.018** | -0.015 | 0.029*** | 0.020** | -0.009 |
| | (0.005) | (0.008) | (0.012) | (0.006) | (0.008) | (0.012) | (0.006) | (0.008) | (0.012) | (0.006) | (0.008) | (0.012) |
| $\Delta VIX(\%)$ | 0.016** | -0.020 | -0.036** | | | | | | | 0.014* | -0.019 | -0.034* |
| | (0.008) | (0.012) | (0.018) | | | | | | | (0.008) | (0.013) | (0.018) |
| $\Delta MCCC(\%)$ | | | | -0.007 | 0.018 | 0.024 | | | | -0.005 | 0.016 | 0.021 |
| | | | | (0.014) | (0.019) | (0.030) | | | | (0.014) | (0.019) | (0.030) |
| $\Delta UCCP(\%)$ | | | | | | | 0.002 | -0.002 | -0.005 | 0.002 | -0.003 | -0.004 |
| | | | | | | | (0.004) | (0.007) | (0.009) | (0.004) | (0.008) | (0.009) |
| $PrCOP(\%)$ | -0.020 | 0.036 | 0.056 | -0.012 | 0.029 | 0.041 | -0.021 | 0.037 | 0.058 | -0.011 | 0.028 | 0.039 |
| | (0.019) | (0.025) | (0.040) | (0.019) | (0.026) | (0.041) | (0.019) | (0.025) | (0.040) | (0.019) | (0.026) | (0.041) |
| $MKT{\cdot}PrCOP$ | 0.003 | 0.042 | 0.039 | 0.001 | 0.053 | 0.052 | 0.005 | 0.040 | 0.035 | 0.001 | 0.053 | 0.052 |
| | (0.038) | (0.042) | (0.075) | (0.041) | (0.045) | (0.081) | (0.038) | (0.042) | (0.075) | (0.041) | (0.045) | (0.082) |
| $ICOP(\%)$ | -0.011 | -0.003 | 0.008 | -0.011 | -0.002 | 0.009 | -0.010 | -0.004 | 0.006 | -0.011 | -0.002 | 0.010 |
| | (0.022) | (0.033) | (0.050) | (0.023) | (0.035) | (0.053) | (0.022) | (0.033) | (0.051) | (0.023) | (0.034) | (0.053) |
| $MKT \cdot ICOP$ | 0.025 | -0.043 | -0.069 | 0.029 | -0.053 | -0.082 | 0.029 | -0.048 | -0.078 | 0.026 | -0.049 | -0.076 |
| | (0.025) | (0.032) | (0.051) | (0.027) | (0.036) | (0.057) | (0.025) | (0.032) | (0.051) | (0.028) | (0.036) | (0.057) |
| $PoCOP(\%)$ | -0.024* | 0.008 | 0.032 | -0.022 | 0.006 | 0.028 | -0.025* | 0.009 | 0.033 | -0.022 | 0.005 | 0.027 |
| | (0.014) | (0.017) | (0.027) | (0.015) | (0.018) | (0.028) | (0.014) | (0.017) | (0.027) | (0.015) | (0.018) | (0.028) |
| $MKT{\cdot}PoCOP$ | 0.068** | -0.009 | -0.076* | 0.074** | -0.011 | -0.085* | 0.070** | -0.011 | -0.081* | 0.072** | -0.009 | -0.081* |
| | (0.031) | (0.022) | (0.046) | (0.032) | (0.022) | (0.048) | (0.030) | (0.022) | (0.045) | (0.033) | (0.023) | (0.049) |
| $MKT$ | 1.115*** | 0.935*** | -0.180*** | 1.092*** | 0.961*** | -0.132*** | 1.094*** | 0.961*** | -0.133*** | 1.111*** | 0.935*** | -0.176*** |
| | (0.014) | (0.021) | (0.030) | (0.009) | (0.014) | (0.020) | (0.009) | (0.013) | (0.019) | (0.015) | (0.023) | (0.032) |
| $N$ | 4402 | 4402 | 4402 | 4068 | 4068 | 4068 | 4276 | 4276 | 4276 | 4068 | 4068 | 4068 |
| $R^2 Adj.(\%)$ | 95.19 | 88.85 | 7.57 | 95.25 | 88.78 | 6.98 | 95.22 | 88.91 | 7.25 | 95.26 | 88.80 | 7.26 |

Table 10 Standard errors (in parentheses) are computed under $t$ of contemporaneous cross-sectional correlation between panel portfolio residuals. *, **, ***, denote statistical significance at the 10%, 5%, and 1%. Regressions are: (1) = VIX, (2)= Ardia et al. (2022) measure and (3) = Faccini et al. (2023) measure and (4) = all indexes together. N is the number of companies times the nmber of COP. L = Low carbon-intensity portfolio returns, H = High carbon-intensity portfolio returns and H-L = spread between the two portfolio returns.

| | (1) | | | (2) | | | (3) | | | (4) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L | H | H-L | L | H | H-L | L | H | H-L | L | H | H-L |
| $\alpha(\%)$ | $0.031^{***}$ | $0.017^{**}$ | $-0.014$ | $0.030^{***}$ | $0.021^{**}$ | $-0.009$ | $0.033^{***}$ | $0.020^{**}$ | $-0.013$ | $0.035^{***}$ | $0.016^{**}$ | $-0.018$ |
| | [3.72] | [2.23] | [-1.05] | [3.65] | [2.69] | [-0.77] | [3.43] | [2.35] | [-0.94] | [3.35] | [2.05] | [-1.22] |
| $PrCOP(\%)$ | $-0.016$ | 0.038 | $0.054^{*}$ | | | | | | | $-0.020^{*}$ | 0.039 | $0.059^{*}$ |
| | [-1.51] | [1.45] | [1.68] | | | | | | | [-1.68] | [1.51] | [1.75] |
| $ICOP(\%)$ | | | | 0.003 | $-0.009$ | $-0.012$ | | | | $-0.001$ | $-0.004$ | $-0.003$ |
| | | | | [0.25] | [-0.42] | [-0.40] | | | | [-0.11] | [-0.22] | [-0.10] |
| $PCOP(\%)$ | | | | | | | $-0.016$ | 0.005 | 0.021 | $-0.018$ | 0.008 | 0.026 |
| | | | | | | | [-1.40] | [0.33] | [0.91] | [-1.49] | [0.57] | [1.10] |
| $MKT$ | $1.073^{***}$ | $0.936^{***}$ | $-0.137^{***}$ | $1.073^{***}$ | $0.936^{***}$ | $-0.137^{***}$ | $1.073^{***}$ | $0.936^{***}$ | $-0.137^{***}$ | $1.073^{***}$ | $0.937^{***}$ | $-0.136^{***}$ |
| | [93.08] | [50.82] | [-6.24] | [92.41] | [50.82] | [-6.20] | [93.21] | [50.95] | [-6.29] | [93.07] | [50.62] | [-6.19] |
| $R^2(\%)$ | 95.03 | 86.16 | 8.58 | 95.03 | 86.14 | 8.51 | 95.04 | 86.17 | 8.69 | 95.06 | 86.23 | 9.05 |

Table 11 t-stats [in parentheses] are computed as the average value of parameters across year, divided by the standard deviation divided by the number of COP; *, **, ***, denote statistical significance at the 10%, 5%, and 1%. Regressions are: (1) = PreCOP, (2) = IntraCOP, (3)= PostCOP, and (3) = PrCOP + ICOP + PoCOP. Results are in percentage. L = Low carbon-intensity portfolio returns, H = High carbon-intensity portfolio returns and H-L = spread between the two portfolio returns.

| Year | Low | | | | | High | | | | | High-minus-Low | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\alpha(\%)$ | $Pre(\%)$ | $I(\%)$ | $Post(\%)$ | $MKT$ | $\alpha(\%)$ | $Pre(\%)$ | $I(\%)$ | $Post(\%)$ | $MKT$ | $\alpha(\%)$ | $Pre(\%)$ | $I(\%)$ | $Post(\%)$ | $MKT$ |
| 2006 | 0.016 | −0.031 | −0.022 | 0.024 | 0.984*** | 0.038 | 0.091 | −0.092 | −0.094 | 0.966*** | 0.022 | 0.122 | −0.07 | −0.118 | −0.018 |
| | [1.19] | [−0.72] | [−0.36] | [0.73] | [54.80] | [1.43] | [1.07] | [−0.79] | [−1.45] | [27.74] | [0.59] | [1.04] | [−0.4z] | [−1.31] | [−0.37] |
| | | | 92.49 | | | | | 75.97 | | | | | 1.41 | | |
| 2007 | −0.007 | 0.041 | −0.053 | 0.023 | 1.057*** | 0.094** | 0.017 | 0.196 | −0.063 | 0.880*** | 0.101 | −0.024 | 0.249 | −0.086 | −0.177*** |
| | [−0.25] | [0.48] | [−0.46] | [0.37] | [59.41] | [2.36] | [0.13] | [1.16] | [−0.66] | [32.44] | [1.62] | [−0.12] | [0.91] | [−0.58] | [−41.79] |
| | | | 93.47 | | | | | 81.09 | | | | | 7.00 | | |
| 2008 | 0.186*** | −0.109 | −0.056 | −0.186 | 1.181*** | 0.001 | 0.405 | −0.116 | 0.076 | 0.999*** | −0.185 | 0.514 | −0.061 | 0.261 | −0.182*** |
| | [2.91] | [−0.52] | [−0.20] | [−1.22] | [60.57] | [0.01 | [1.88] | [−0.40] | [0.48] | [49.89] | [−1.57] | [1.33] | [−0.12] | [0.92] | [−50.52] |
| | | | 93.72 | | | | | 90.98 | | | | | 10.29 | | |
| 2009 | 0.025 | −0.046 | 0.009 | −0.039 | 1.070*** | −0.002 | 0.008 | −0.010 | −0.009 | 1.035*** | −0.027 | 0.054 | −0.019 | 0.030 | −0.029*** |
| | [1.29] | [−0.72] | [0.10] | [−0.82] | [75.58] | [−0.07] | [0.10] | [−0.10] | [−0.16] | [61.36] | [−0.69] | [0.42] | [−0.11] | [0.31] | [−10.45] |
| | | | 95.86 | | | | | 93.85 | | | | | 0.54 | | |
| 2010 | −0.019 | −0.049 | 0.132* | 0.031 | 1.015*** | 0.032 | 0.027 | −0.048 | 0.015 | 1.009*** | 0.051 | 0.076 | −0.118 | −0.016 | −0.006 |
| | [−1.08] | [−0.84] | [1.68] | [0.75] | [61.15] | [1.51] | [0.38] | [−0.51] | [0.30] | [50.91] | [1.49] | [0.67] | [−1.18] | [−0.20] | [−0.19] |
| | | | 93.85 | | | | | 91.31 | | | | | 0.83 | | |
| 2011 | 0.044*** | −0.042 | −0.011 | 0.017 | 1.037*** | −0.001 | 0.001 | 0.008 | −0.042 | 0.945*** | −0.045 | 0.044 | 0.019 | −0.059 | −0.092*** |
| | [2.71] | [−0.80] | [−0.16] | [0.43] | [11.43] | [−0.06] | [0.02] | [0.09] | [−0.86] | [82.47] | [−1.37] | [0.41] | [0.13] | [−0.75] | [−49.99] |
| | | | 98.19 | | | | | 96.57 | | | | | 9.90 | | |
| 2012 | 0.031** | −0.004 | −0.082 | −0.041 | 1.047*** | −0.007 | −0.015 | 0.032 | 0.041 | 0.992*** | −0.038 | −0.011 | 0.114 | 0.082 | −0.055*** |
| | [2.31] | [−0.09] | [−1.41] | [−1.32] | [72.08] | [−0.45] | [−0.28] | [0.44] | [1.06] | [54.85] | [−1.45] | [−0.13] | [0.99] | [1.33] | [−19.17] |
| | | | 95.52 | | | | | 92.55 | | | | | 2.40 | | |
| 2013 | 0.006 | 0.025 | −0.003 | 0.022 | 1.042*** | 0.033* | 0.019 | −0.024 | −0.061 | 0.824*** | 0.027 | −0.006 | −0.022 | −0.083 | −0.218*** |
| | [0.49] | [0.65] | [−0.05] | [0.77] | [68.38] | [1.84] | [0.34] | [−0.31] | [−1.43] | [37.23] | [1.00] | [−0.07] | [−0.19] | [−1.30] | [−65.10] |
| | | | 95.00 | | | | | 84.94 | | | | | 15.19 | | |
| 2014 | 0.036** | −0.008 | 0.026 | −0.049 | 1.030*** | −0.046** | −0.046 | −0.048 | 0.076 | 0.956*** | −0.082** | −0.038 | −0.074 | 0.125* | −0.074*** |
| | [2.69] | [−0.18] | [0.44] | [−1.56] | [68.95] | [−2.10] | [−0.65] | [−0.50] | [1.49] | [39.38] | [−2.53] | [−0.36] | [−0.52] | [1.66] | [−20.63] |
| | | | 95.10 | | | | | 86.49 | | | | | 2.88 | | |
| 2015 | 0.006 | 0.005 | 0.092 | −0.044 | 1.102*** | 0.034 | −0.077 | −0.103 | 0.134* | 0.955*** | 0.028 | −0.083 | −0.195 | 0.178 | −0.147*** |
| | [0.31] | [0.09] | [1.07] | [−0.94] | [72.39] | [1.03] | [−0.72] | [−0.71] | [1.71] | [37.09] | [0.58] | [−0.53] | [−0.93] | [1.56] | [−39.44] |
| | | | 95.56 | | | | | 84.90 | | | | | 7.67 | | |
| 2016 | 0.041*** | 0.047 | 0.040 | −0.025 | 1.037*** | −0.028 | 0.122 | −0.085 | 0.058 | 0.986*** | −0.070** | 0.075 | −0.125 | 0.084 | −0.050 |
| | [3.15] | [1.11] | [0.68] | [−0.81] | [49.86] | [−1.17] | [1.57] | [−0.79] | [1.00] | [25.75] | [−2.04] | [0.69] | [−0.82] | [1.02] | [−0.93] |
| | | | 91.38 | | | | | 73.51 | | | | | 1.45 | | |
| 2017 | 0.026** | 0.024 | −0.041 | −0.026 | 1.082*** | 0.022 | 0.050 | 0.026 | 0.018 | 0.870*** | −0.004 | 0.026 | 0.067 | 0.044 | −0.212*** |
| | [2.08] | [0.61] | [−0.75] | [−0.88] | [80.76] | [1.30] | [0.95] | [0.36] | [0.45] | [48.14] | [−0.15] | [0.31] | [0.58] | [0.69] | [−73.93] |
| | | | 96.39 | | | | | 90.48 | | | | | 18.31 | | |
| 2018 | 0.023 | −0.060 | 0.020 | 0.005 | 1.106*** | 0.006 | 0.092 | 0.080 | −0.010 | 0.921*** | −0.017 | 0.153 | 0.061 | −0.015 | −0.185*** |
| | [1.35] | [−1.12] | [0.25] | [0.11] | [76.38] | [0.31] | [1.64] | [0.98] | [−0.24] | [60.68] | [−0.55] | [1.52] | [0.41] | [−0.19] | [−68.36] |
| | | | 96.05 | | | | | 93.87 | | | | | 17.33 | | |
| 2019 | 0.056*** | −0.011 | −0.058 | 0.010 | 1.092*** | −0.012 | −0.103 | 0.066 | −0.075 | 1.057*** | −0.068 | −0.092 | 0.124 | −0.085 | −0.035*** |
| | [3.03] | [−0.18] | [−0.71] | [0.22] | [14.58] | [−0.31] | [−0.83] | [0.40] | [−0.82] | [68.47] | [−1.38] | [−0.57] | [0.57] | [−0.72] | [−17.39] |
| | | | 98.85 | | | | | 94.98 | | | | | 1.71 | | |
| 2021 | 0.030* | 0.010 | −0.024 | 0.015 | 1.076*** | 0.061 | −0.009 | 0.105 | 0.044 | 0.740*** | 0.031 | −0.019 | 0.129 | 0.029 | −0.336*** |
| | [1.73] | [0.18] | [−0.31] | [0.36] | [97.11] | [1.63] | [−0.08] | [0.65] | [0.50] | [31.00] | [0.65] | [−0.13] | [0.63] | [0.27] | [−11.18] |
| | | | 97.47 | | | | | 79.74 | | | | | 33.83 | | |
| 2022 | 0.074*** | −0.143* | 0.005 | −0.059 | 1.142*** | 0.013 | 0.124 | −0.061 | 0.038 | 0.923*** | −0.061 | 0.267* | −0.066 | 0.097 | −0.219*** |
| | [3.08] | [−1.93] | [0.06] | [−1.05] | [70.64] | [0.46] | [1.39] | [−0.49] | [0.57] | [47.55] | [−1.27] | [1.81] | [−0.32] | [0.87] | [−68.10] |
| | | | 95.34 | | | | | 90.22 | | | | | 17.36 | | |

Table 12 t-stats [in parentheses] are computed as the average value of parameters across year, divided by the standard deviation divided by the number of COP; *, **, ***, denote statistical significance at the 10%, 5%, and 1%. Below each year I report also the $R^2$ in percentage. Regressions are: (1) = PreCOP, (2) = IntraCOP, (3)= PostCOP, and (3) = PrCOP + ICOP + PoCOP. Results are in percentage. L = Low carbon-intensity portfolio returns, H = High carbon-intensity portfolio returns and H-L = spread between the two portfolio returns.

| | MDR | PACAR | *t-stat* | MDR | PACAR | *t-stat* | MDR | PACAR | *t-stat* |
|---|---|---|---|---|---|---|---|---|---|
| (Panel A) | | | | | | | | | |
| | [0,5] | | | [0,15] | | | [0,30] | | |
| Low | 0.0779% | -0.0257% | [1.01] | 0.1181% | -0.0230% | [−1.06] | 0.0706% | -0.0229% | [−1.35] |
| High | 0.0608% | -0.0555% | [−0.39] | 0.1177% | 0.0045% | [0.56] | 0.0650% | -0.0090% | [−0.11] |
| High-minus-Low | -0.0171% | -0.0298% | [0.28] | -0.0003% | 0.0274% | [1.28] | -0.0056% | 0.0139% | [0.91] |
| (Panel B) | | | | | | | | | |
| | [5,0] | | | [15,0] | | | [30,0] | | |
| Low | 0.1858% | 0.0031% | [0.29] | 0.0551% | 0.0398% | [1.72*] | 0.0770% | 0.0372% | [1.47] |
| High | 0.1471% | 0.0993% | [1.10] | 0.0645% | -0.0243% | [−0.37] | 0.0980% | -0.0630% | [−1.99**] |
| High-minus-Low | -0.0386% | 0.0961% | [0.61] | 0.0095% | -0.0641% | [−1.23] | 0.0210% | -0.1002% | [−2.25**] |

Table 13 This table presents the mean daily returns (MDR) and the portfolio average cumulative abnormal returns (PACAR) respectively for a Low, High and High-minus-Low portfolio across all the COP events from 2006 to 2022. Panel A reports results for 3 separate windows: from the start of the COP event until 5 days, 15 days and 30 days after the COP event, so to capture a reaction to the effects of the COP effect. Panel B reports results for 3 separate windows: namely 5 days, 15 days and 30 days prior to the COP beginning until the end date of the COP, so to capture an anticipation on the effects of the COP. Results are in percentage. Expected (normal) returns are computed using a market model. Statistical significance is based on the Boehmer et al. (1991) test statistic. Note: *** significant at 1% level, ** at 5% level, * at 10% level.

| | VIX | Ardia (A) | Ardia (CLR) | Ardia (CS) | Faccini (USCP) | Faccini (IS) | Buckman (S) |
|---|---|---|---|---|---|---|---|
| VIX | 1.00 | - | - | - | - | - | - |
| Ardia (A) | -0.08 | 1.00 | - | - | - | - | - |
| Ardia (CLR) | 0.01 | 0.62 | 1.00 | - | - | - | - |
| Ardia (CS) | -0.02 | 0.69 | 0.48 | 1.00 | - | - | - |
| Faccini (USCP) | 0.10 | 0.30 | 0.31 | 0.28 | 1.00 | - | - |
| Faccini (IS) | 0.09 | 0.14 | 0.16 | 0.47 | 0.18 | 1.00 | - |
| Buckman (S) | -0.66 | 0.11 | 0.01 | 0.09 | -0.04 | -0.01 | 1.00 |

Table 14 Correlations between different predictors for climate-sentiment measure. Ardia (A) = Ardia - Aggregate, Ardia (CLR) = Ardia - Climate Legislation/Regulations, Ardia (CS) = Ardia - Climate Summits, Faccini (USCP) = Faccini - US climate policy, Faccini (IS) = Faccini - International summits, Buckman (S) = Buckman - Sentiment. The measures come from: CBOE website, Ardia et al. (2022), Faccini et al. (2023), Buckman et al. (2020).

## Estimation using Carbon Intensity (Scope 2)

I also report the summary statistics of my data.

| Summary Statistics - returns | | | | | |
|---|---|---|---|---|---|
| | L | H | H-L | $\widehat{Mkt}_{VW}$ | $\widehat{Mkt}_{EW}$ |
| mean($r_t$) (%) | 0.0745 | 0.0708 | -0.0036 | 0.0712 | 0.0579 |
| std($r_t$) (%) | 1.3636 | 1.2725 | 0.4959 | 1.2805 | 1.4892 |
| skew($r_t$) | -0.0654 | -0.0976 | -0.3276 | -0.1840 | -0.3428 |
| kurt($r_t$) | 12.3284 | 12.3950 | 6.2077 | 11.5411 | 7.4427 |

Table 15 Summary statistics of the two portfolios, namely Low carbon-intensity and High carbon-intensity. I also report the values for a Market portfolio investing in the universe of CRSP stocks (whose firms are reported in S&P Trucost). I display the mean, standard deviation, skewness and kurtosis of the excess returns at daily frequency.

| Summary Statistics - CI1 | | | | |
|---|---|---|---|---|
| | Low | | High | |
| Year | Mean(CI1) | N. Firms | Mean(CI1) | N. Firms |
| 2005 | 4.77 | 258 | 86.75 | 260 |
| 2006 | 4.92 | 258 | 91.77 | 260 |
| 2007 | 4.83 | 255 | 90.62 | 258 |
| 2008 | 4.95 | 259 | 97.86 | 259 |
| 2009 | 5.24 | 260 | 101.12 | 262 |
| 2010 | 5.36 | 258 | 99.86 | 260 |
| 2011 | 5.37 | 256 | 94.61 | 258 |
| 2012 | 5.18 | 256 | 93.73 | 257 |
| 2013 | 4.93 | 283 | 94.68 | 286 |
| 2014 | 5.30 | 281 | 104.59 | 283 |
| 2015 | 5.11 | 274 | 109.56 | 277 |
| 2016 | 4.12 | 735 | 83.12 | 736 |
| 2017 | 4.30 | 741 | 82.87 | 743 |
| 2018 | 4.11 | 739 | 75.68 | 734 |
| 2019 | 3.75 | 744 | 77.01 | 743 |
| 2020 | 3.70 | 854 | 78.42 | 851 |
| 2021 | 3.52 | 873 | 72.13 | 874 |
| 2022 | 2.58 | 932 | 58.85 | 916 |
| 2023 | 2.20 | 324 | 27.45 | 324 |

Table 16 Summary statistics of the two portfolios, namely Low carbon-intensity and High carbon-intensity. I display for each year the average emission as well as number of firms per year in the portfolios.

| Summary Mkt Cap - CI1 | | | | | | |
|---|---|---|---|---|---|---|
| | Low | | | High | | |
| Year | 5% | Mean | 95% | 5% | Mean | 95% |
| 2006 | 1.19 | 16.30 | 53.15 | 1.13 | 15.12 | 44.09 |
| 2007 | 1.12 | 13.11 | 43.15 | 0.87 | 14.08 | 50.02 |
| 2008 | 0.94 | 10.84 | 30.41 | 0.78 | 12.29 | 43.60 |
| 2009 | 1.47 | 12.10 | 36.03 | 1.05 | 13.85 | 44.68 |
| 2010 | 1.25 | 12.80 | 36.57 | 0.89 | 14.62 | 43.86 |
| 2011 | 0.86 | 13.29 | 48.23 | 0.78 | 16.36 | 59.45 |
| 2012 | 1.54 | 15.68 | 51.61 | 0.81 | 16.58 | 57.64 |
| 2013 | 1.44 | 17.40 | 65.50 | 0.76 | 18.44 | 66.31 |
| 2014 | 1.14 | 18.09 | 68.19 | 0.36 | 18.12 | 65.95 |
| 2015 | 0.59 | 19.17 | 67.86 | 0.29 | 15.61 | 51.87 |
| 2016 | 0.71 | 24.29 | 79.73 | 0.43 | 19.26 | 69.11 |
| 2017 | 0.18 | 8.78 | 41.32 | 0.12 | 10.90 | 41.01 |
| 2018 | 0.18 | 11.00 | 44.75 | 0.10 | 12.21 | 39.07 |
| 2019 | 0.18 | 14.29 | 61.09 | 0.12 | 10.81 | 40.21 |
| 2020 | 0.18 | 17.20 | 68.60 | 0.14 | 16.63 | 47.60 |
| 2021 | 0.13 | 15.79 | 51.51 | 0.10 | 14.25 | 46.09 |
| 2022 | 0.12 | 20.95 | 86.54 | 0.06 | 12.21 | 37.29 |
| 2023 | 0.10 | 18.30 | 59.27 | 0.04 | 16.28 | 41.92 |

Table 17 Summary Mat Cap of the two portfolios, namely Low carbon-intensity and High carbon-intensity, expressed in billions of dollars. I display also the percentile at 5% and 95% confidence interval.

| | (1) | | | (2) | | | (3) | | | (4) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L | H | H-L | L | H | H-L | L | H | H-L | L | H | H-L |
| $\alpha(\%)$ | 0.031*** | 0.031*** | -0.000 | 0.074*** | 0.071*** | -0.004 | 0.077*** | 0.072*** | -0.004 | 0.031*** | 0.030*** | -0.001 |
| | (0.004) | (0.005) | (0.007) | (0.020) | (0.019) | (0.007) | (0.020) | (0.019) | (0.007) | (0.004) | (0.005) | (0.007) |
| $MKT$ | 1.048*** | 0.968*** | -0.079*** | | | | | | | 1.047*** | 0.979*** | -0.068*** |
| | (0.007) | (0.007) | (0.011) | | | | | | | (0.006) | (0.007) | (0.010) |
| $SMB$ | | | | 0.300*** | 0.293*** | -0.007 | | | | -0.073*** | -0.062*** | 0.011 |
| | | | | (0.063) | (0.059) | (0.020) | | | | (0.011) | (0.014) | (0.020) |
| $HML$ | | | | | | | 0.357*** | 0.237*** | -0.120*** | 0.060*** | -0.041*** | -0.101*** |
| | | | | | | | (0.049) | (0.041) | (0.017) | (0.009) | (0.010) | (0.016) |
| $N$ | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 |
| $R^2(\%)$ | 96.08 | 94.24 | 4.17 | 1.91 | 2.09 | 0.01 | 4.83 | 2.44 | 4.13 | 96.34 | 94.39 | 7.03 |

Table 18 Standard errors (in parentheses) are computed under $t$ of contemporaneous cross-sectional correlation between panel portfolio residuals. *, **, ***, denote statistical significance at the 10%, 5%, and 1%. N is the number of companies times the number of COP. L = Low carbon-intensity portfolio returns, H = High carbon-intensity portfolio returns and H-L = spread between the two portfolio returns.

| | (1) | | | (2) | | | (3) | | | (4) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L | H | H-L | L | H | H-L | L | H | H-L | L | H | H-L |
| $\alpha(\%)$ | 0.032*** | 0.029*** | -0.002 | 0.031*** | 0.030*** | -0.001 | 0.034*** | 0.032*** | -0.002 | 0.035*** | 0.030*** | -0.005 |
| | (0.004) | (0.005) | (0.008) | (0.004) | (0.005) | (0.007) | (0.004) | (0.005) | (0.008) | (0.005) | (0.005) | (0.008) |
| $PrCOP(\%)$ | -0.009 | 0.019 | 0.027 | | | | | | | -0.012 | 0.018 | 0.031 |
| | (0.015) | (0.020) | (0.030) | | | | | | | (0.015) | (0.020) | (0.031) |
| $ICOP(\%)$ | | | | -0.012 | 0.010 | 0.022 | | | | -0.016 | 0.011 | 0.026 |
| | | | | (0.020) | (0.026) | (0.039) | | | | (0.020) | (0.027) | (0.040) |
| $PoCOP(\%)$ | | | | | | | -0.019 | -0.009 | 0.010 | -0.021* | -0.007 | 0.014 |
| | | | | | | | (0.012) | (0.013) | (0.021) | (0.012) | (0.013) | (0.021) |
| $MKT$ | 1.048*** | 0.968*** | -0.079*** | 1.048*** | 0.968*** | -0.079*** | 1.048*** | 0.968*** | -0.079*** | 1.048*** | 0.968*** | -0.080*** |
| | (0.007) | (0.007) | (0.011) | (0.007) | (0.007) | (0.011) | (0.007) | (0.007) | (0.011) | (0.007) | (0.007) | (0.011) |
| $N$ | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 |
| $R^2(\%)$ | 96.08 | 94.25 | 4.19 | 96.08 | 94.24 | 4.18 | 96.08 | 94.25 | 4.17 | 96.08 | 94.25 | 4.21 |

Table 19 Standard errors (in parentheses) are computed under $t$ of contemporaneous cross-sectional correlation between panel portfolio residuals. *, **, ***, denote statistical significance at the 10%, 5%, and 1% levels. Regressions are: (1) = ICOP, (2)= PCOP, and (3) = ICOP + PCOP. N is the number of companies times the number of COPs. L = Low carbon-intensity portfolio returns, H = High carbon-intensity portfolio returns and H-L = spread between the two portfolio returns.

| | (1) | | | (2) | | | (3) | | | (4) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L | H | H-L | L | H | H-L | L | H | H-L | L | H | H-L |
| Full Sample | | | | | | | | | | | | |
| $\alpha(\%)$ | 0.032*** | 0.029*** | -0.003 | 0.032*** | 0.029*** | -0.002 | 0.034*** | 0.031*** | -0.003 | 0.036*** | 0.029*** | -0.007 |
| | (0.004) | (0.005) | (0.007) | (0.004) | (0.005) | (0.007) | (0.004) | (0.005) | (0.008) | (0.005) | (0.005) | (0.008) |
| $PrCOP(\%)$ | -0.013 | 0.016 | 0.029 | | | | | | | -0.017 | 0.015 | 0.032 |
| | (0.014) | (0.020) | (0.030) | | | | | | | (0.015) | (0.020) | (0.030) |
| $ICOP(\%)$ | | | | -0.006 | 0.016 | 0.022 | | | | -0.011 | 0.016 | 0.027 |
| | | | | (0.019) | (0.025) | (0.038) | | | | (0.019) | (0.025) | (0.038) |
| $PoCOP(\%)$ | | | | | | | -0.021* | -0.009 | 0.012 | -0.023** | -0.007 | 0.016 |
| | | | | | | | (0.012) | (0.012) | (0.021) | (0.012) | (0.013) | (0.021) |
| $MKT$ | 1.047*** | 0.979*** | -0.068*** | 1.047*** | 0.979*** | -0.068*** | 1.047*** | 0.979*** | -0.068*** | 1.047*** | 0.979*** | -0.068*** |
| | (0.006) | (0.007) | (0.010) | (0.006) | (0.007) | (0.010) | (0.006) | (0.007) | (0.010) | (0.006) | (0.007) | (0.010) |
| $SMB$ | -0.073*** | -0.062*** | 0.012 | -0.073*** | -0.062*** | 0.011 | -0.073*** | -0.062*** | 0.011 | -0.073*** | -0.062*** | 0.011 |
| | (0.011) | (0.014) | (0.020) | (0.011) | (0.014) | (0.020) | (0.011) | (0.014) | (0.020) | (0.011) | (0.014) | (0.020) |
| $HML$ | 0.060*** | -0.041*** | -0.101*** | 0.060*** | -0.041*** | -0.101*** | 0.060*** | -0.041*** | -0.101*** | 0.060*** | -0.041*** | -0.101*** |
| | (0.009) | (0.010) | (0.016) | (0.009) | (0.010) | (0.016) | (0.009) | (0.010) | (0.016) | (0.009) | (0.010) | (0.016) |
| $N$ | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 |
| $R^2(\%)$ | 96.34 | 94.39 | 7.05 | 96.34 | 94.39 | 7.03 | 96.35 | 94.39 | 7.03 | 96.35 | 94.39 | 7.07 |
| Post 2016 | | | | | | | | | | | | |
| $\alpha(\%)$ | 0.031*** | 0.035*** | 0.004 | 0.031*** | 0.030*** | -0.001 | 0.031*** | 0.037*** | 0.005 | 0.033*** | 0.035*** | 0.003 |
| | (0.006) | (0.007) | (0.011) | (0.006) | (0.007) | (0.011) | (0.006) | (0.008) | (0.011) | (0.007) | (0.008) | (0.012) |
| $PrCOP(\%)$ | -0.009 | -0.029 -0.019 | | | | | | | | -0.011 | -0.029 | -0.018 |
| | (0.023) | (0.036) | (0.053) | | | | | | | (0.023) | (0.036) | (0.053) |
| $ICOP(\%)$ | | | | -0.010 | 0.107*** | 0.117** | | | | -0.012 | 0.102*** | 0.113** |
| | | | | (0.024) | (0.030) | (0.046) | | | | (0.024) | (0.030) | (0.046) |
| $PoCOP(\%)$ | | | | | | | -0.007 | -0.030 | -0.023 | -0.009 | -0.029 | -0.020 |
| | | | | | | | (0.017) | (0.019) | (0.030) | (0.017) | (0.019) | (0.030) |
| $MKT$ | 1.053*** | 0.982*** | -0.071*** | 1.053*** | 0.982*** | -0.071*** | 1.053*** | 0.982*** | -0.071*** | 1.053*** | 0.982*** | -0.071*** |
| | (0.007) | (0.007) | (0.010) | (0.007) | (0.007) | (0.010) | (0.007) | (0.007) | (0.010) | (0.007) | (0.007) | (0.010) |
| $SMB$ | -0.036*** | -0.040*** | -0.003 | -0.036*** | -0.039*** | -0.003 | -0.036*** | -0.040*** | -0.003 | -0.037*** | -0.040*** | -0.004 |
| | (0.012) | (0.015) | (0.017) | (0.012) | (0.015) | (0.017) | (0.012) | (0.015) | (0.017) | (0.013) | (0.015) | (0.017) |
| $HML$ | 0.022*** | 0.058*** | 0.036*** | 0.022*** | 0.058*** | 0.036*** | 0.022*** | 0.058*** | 0.036*** | 0.022*** | 0.058*** | 0.036*** |
| | (0.008) | (0.009) | (0.013) | (0.008) | (0.009) | (0.013) | (0.008) | (0.009) | (0.013) | (0.008) | (0.009) | (0.013) |
| $N$ | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 |
| $R^2(\%)$ | 97.12 | 94.80 | 5.39 | 97.12 | 94.82 | 5.58 | 97.12 | 94.81 | 5.41 | 97.12 | 94.83 | 5.61 |

Table 20 Standard errors (in parentheses) are computed under $t$ of contemporaneous cross-sectional correlation between panel portfolio residuals. *, **, ***, denote statistical significance at the 10%, 5%, and 1% levels. Regressions are: (1) = ICOP, (2)= PCOP, and (3) = ICOP + PCOP. N is the number of companies times the number of COPs. L = Low carbon-intensity portfolio returns, H = High carbon-intensity portfolio returns and H-L = spread between the two portfolio returns.

| | (1) | | | (2) | | | (3) | | | (4) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L | H | H-L | L | H | H-L | L | H | H-L | L | H | H-L |
| Full Sample | | | | | | | | | | | | |
| $\alpha(\%)$ | 0.032*** | 0.030*** | -0.002 | 0.031*** | 0.030*** | -0.001 | 0.034*** | 0.032*** | -0.002 | 0.036*** | 0.030*** | -0.005 |
| | (0.004) | (0.005) | (0.008) | (0.004) | (0.005) | (0.007) | (0.004) | (0.005) | (0.008) | (0.005) | (0.005) | (0.008) |
| $PrCOP(\%)$ | -0.009 | 0.018 | 0.027 | | | | | | | -0.012 | 0.018 | 0.030 |
| | (0.015) | (0.020) | (0.030) | | | | | | | (0.015) | (0.020) | (0.030) |
| $MKT \cdot PrCOP$ | -0.010 | 0.049* | 0.059 | | | | | | | -0.007 | 0.048* | 0.055 |
| | (0.022) | (0.027) | (0.042) | | | | | | | (0.022) | (0.027) | (0.042) |
| $ICOP(\%)$ | | | | -0.012 | 0.016 | 0.027 | | | | -0.016 | 0.016 | 0.032 |
| | | | | (0.019) | (0.026) | (0.038) | | | | (0.019) | (0.026) | (0.039) |
| $MKT \cdot ICOP$ | | | | 0.002 | -0.050** | -0.053 | | | | 0.004 | -0.045** | -0.050 |
| | | | | (0.025) | (0.021) | (0.039) | | | | (0.025) | (0.021) | (0.039) |
| $PoCOP(\%)$ | | | | | | | -0.020* | -0.009 | 0.011 | -0.022* | -0.007 | 0.015 |
| | | | | | | | (0.012) | (0.013) | (0.021) | (0.012) | (0.013) | (0.021) |
| $MKT \cdot PoCOP$ | | | | | | | 0.024 | 0.003 | -0.021 | 0.024 | 0.006 | -0.018 |
| | | | | | | | (0.021) | (0.016) | (0.033) | (0.022) | (0.016) | (0.033) |
| $MKT$ | 1.048*** | 0.964*** | -0.085*** | 1.047*** | 0.970*** | -0.077*** | 1.045*** | 0.968*** | -0.077*** | 1.046*** | 0.965*** | -0.080*** |
| | (0.007) | (0.007) | (0.011) | (0.007) | (0.007) | (0.011) | (0.007) | (0.00763) | (0.011) | (0.008) | (0.008) | (0.012) |
| $N$ | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 | 4404 |
| $R^2(\%)$ | 96.08 | 94.27 | 4.38 | 96.08 | 94.26 | 4.26 | 96.09 | 94.25 | 4.20 | 96.09 | 94.28 | 4.48 |
| Post 2016 | | | | | | | | | | | | |
| $\alpha(\%)$ | 0.031*** | 0.034*** | 0.003 | 0.031*** | 0.030*** | -0.001 | 0.031*** | 0.036*** | 0.005 | 0.032*** | 0.034*** | 0.002 |
| | (0.006) | (0.008) | (0.011) | (0.006) | (0.008) | (0.011) | (0.006) | (0.008) | (0.011) | (0.007) | (0.009) | (0.012) |
| $PrCOP(\%)$ | -0.005 | -0.024 | -0.019 | | | | | | | -0.006 | -0.024 | -0.018 |
| | (0.024) | (0.036) | (0.054) | | | | | | | (0.024) | (0.037) | (0.055) |
| $MKT \cdot PrCOP$ | 0.012 | 0.050* | 0.038 | | | | | | | 0.010 | 0.052* | 0.042 |
| | (0.026) | (0.029) | (0.043) | | | | | | | (0.026) | (0.029) | (0.043) |
| $ICOP(\%)$ | | | | -0.012 | 0.101*** | 0.112** | | | | -0.013 | 0.096*** | 0.109** |
| | | | | (0.024) | (0.029) | (0.044) | | | | (0.024) | (0.029) | (0.044) |
| $MKT \cdot ICOP$ | | | | -0.039*** | 0.027 | 0.065** | | | | -0.039** | 0.030* | 0.069*** |
| | | | | (0.015) | (0.017) | (0.025) | | | | (0.015) | (0.017) | (0.026) |
| $PoCOP(\%)$ | | | | | | | -0.004 | -0.027 | -0.023 | -0.005 | -0.025 | -0.020 |
| | | | | | | | (0.017) | (0.020) | (0.031) | (0.017) | (0.020) | (0.031) |
| $MKT \cdot PoCOP$ | | | | | | | -0.002 | 0.016 | 0.017 | -0.003 | 0.019 | 0.021 |
| | | | | | | | (0.020) | (0.023) | (0.036) | (0.021) | (0.024) | (0.036) |
| $MKT$ | 1.047*** | 0.972*** | -0.075*** | 1.049*** | 0.974*** | -0.075*** | 1.048*** | 0.973*** | -0.075*** | 1.049*** | 0.970*** | -0.079*** |
| | (0.007) | (0.007) | (0.010) | (0.007) | (0.007) | (0.010) | (0.008) | (0.007) | (0.010) | (0.008) | (0.008) | (0.011) |
| $N$ | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 | 1635 |
| $R^2(\%)$ | 97.06 | 94.56 | 4.74 | 97.06 | 94.57 | 4.98 | 97.06 | 94.56 | 4.73 | 97.06 | 94.59 | 5.08 |

Table 21 Standard errors (in parentheses) are computed under $t$ of contemporaneous cross-sectional correlation between panel portfolio residuals. *, **, ***, denote statistical significance at the 10%, 5%, and 1% levels. Regressions are: (1) = ICOP, (2)= PCOP, and (3) = ICOP + PCOP. N is the number of companies times the number of COPs. L = Low carbon-intensity portfolio returns, H = High carbon-intensity portfolio returns and H-L = spread between the two portfolio returns.

| | (1) | | | (2) | | | (3) | | | (4) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L | H | H-L | L | H | H-L | L | H | H-L | L | H | H-L |
| $\alpha_0(\%)$ | 0.035*** | 0.031*** | -0.004 | 0.035*** | 0.029*** | -0.006 | 0.036*** | 0.030*** | -0.005 | 0.034*** | 0.030*** | -0.004 |
| | (0.005) | (0.005) | (0.008) | (0.005) | (0.005) | (0.009) | (0.005) | (0.005) | (0.009) | (0.005) | (0.005) | (0.009) |
| $\Delta VIX(\%)$ | 0.011* | -0.016** | -0.027** | | | | | | | 0.013** | -0.021*** | -0.034*** |
| | (0.006) | (0.007) | (0.011) | | | | | | | (0.006) | (0.008) | (0.011) |
| $\Delta MCCC(\%)$ | | | | -0.007 | 0.019 | 0.026 | | | | -0.006 | 0.017 | 0.023 |
| | | | | (0.013) | (0.013) | (0.022) | | | | (0.013) | (0.013) | (0.022) |
| $\Delta UCCP(\%)$ | | | | | | | 0.004 | -0.002 | -0.007 | 0.004 | -0.002 | -0.006 |
| | | | | | | | (0.003) | (0.003) | (0.006) | (0.003) | (0.003) | (0.006) |
| $PrCOP(\%)$ | -0.012 | 0.016 | 0.028 | -0.018 | 0.027 | 0.045 | -0.013 | 0.017 | 0.030 | -0.017 | 0.026 | 0.043 |
| | (0.015) | (0.020) | (0.030) | (0.016) | (0.020) | (0.030) | (0.015) | (0.020) | (0.030) | (0.016) | (0.020) | (0.030) |
| $MKT{\cdot}PrCOP$ | -0.008 | 0.049* | 0.057 | -0.003 | 0.048 | 0.051 | -0.005 | 0.048* | 0.053 | -0.003 | 0.048 | 0.051 |
| | (0.023) | (0.027) | (0.042) | (0.024) | (0.030) | (0.046) | (0.023) | (0.027) | (0.042) | (0.024) | (0.030) | (0.046) |
| $ICOP(\%)$ | -0.016 | 0.016 | 0.033 | -0.012 | 0.004 | 0.016 | -0.016 | 0.016 | 0.032 | -0.012 | 0.004 | 0.017 |
| | (0.019) | (0.026) | (0.039) | (0.020) | (0.027) | (0.040) | (0.019) | (0.026) | (0.039) | (0.020) | (0.026) | (0.040) |
| $MKT \cdot ICOP$ | 0.002 | -0.041* | -0.043 | 0.014 | -0.054** | -0.067* | 0.005 | -0.044** | -0.049 | 0.011 | -0.050** | -0.061 |
| | (0.026) | (0.022) | (0.041) | (0.027) | (0.021) | (0.040) | (0.025) | (0.022) | (0.040) | (0.028) | (0.021) | (0.041) |
| $PoCOP(\%)$ | -0.022* | -0.008 | 0.014 | -0.021* | -0.007 | 0.015 | -0.022* | -0.008 | 0.015 | -0.021* | -0.007 | 0.014 |
| | (0.012) | (0.013) | (0.021) | (0.012) | (0.013) | (0.022) | (0.012) | (0.013) | (0.021) | (0.012) | (0.013) | (0.022) |
| $MKT{\cdot}PoCOP$ | 0.022 | 0.008 | -0.014 | 0.027 | 0.006 | -0.021 | 0.024 | 0.007 | -0.018 | 0.025 | 0.008 | -0.017 |
| | (0.022) | (0.016) | (0.034) | (0.023) | (0.017) | (0.035) | (0.022) | (0.016) | (0.033) | (0.024) | (0.017) | (0.036) |
| $MKT$ | 1.060*** | 0.945*** | -0.115*** | 1.044*** | 0.962*** | -0.083*** | 1.044*** | 0.965*** | -0.080*** | 1.061*** | 0.934*** | -0.127*** |
| | (0.012) | (0.012) | (0.018) | (0.008) | (0.009) | (0.013) | (0.008) | (0.008) | (0.012) | (0.013) | (0.013) | (0.019) |
| $N$ | 4402 | 4402 | 4402 | 4068 | 4068 | 4068 | 4276 | 4276 | 4276 | 4068 | 4068 | 4068 |
| $R^2 Adj.(\%)$ | 96.10 | 94.30 | 4.87 | 96.15 | 94.60 | 5.14 | 96.14 | 94.37 | 4.53 | 96.17 | 94.63 | 5.80 |

Table 22 Standard errors (in parentheses) are computed under $t$ of contemporaneous cross-sectional correlation between panel portfolio residuals. *, **, ***, denote statistical significance at the 10%, 5%, and 1%. Regressions are: (1) = VIX, (2)= Ardia et al. (2022) measure and (3) = Faccini et al. (2023) measure and (4) = all indexes together. N is the number of companies times the nmber of COP. L = Low carbon-intensity portfolio returns, H = High carbon-intensity portfolio returns and H-L = spread between the two portfolio returns.

| | (1) | | | (2) | | | (3) | | | (4) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L | H | H-L | L | H | H-L | L | H | H-L | L | H | H-L |
| $\alpha(\%)$ | $0.034^{***}$ | $0.029^{**}$ | $-0.005$ | $0.033^{***}$ | $0.030^{**}$ | $-0.004$ | $0.036^{**}$ | 0.031 | $-0.004^{***}$ | $0.037^{**}$ | 0.029 | $-0.008$ |
| | [4.99] | [5.12] | [-0.59] | [4.64] | [5.39 | [-0.44] | [5.07] | [5.13] | [-0.52] | [5.15 | [5.23] | [-0.92] |
| $PrCOP(\%)$ | $-0.012$ | 0.018 | $0.029^{*}$ | | | | | | | $-0.015^{*}$ | 0.018 | $0.033^{*}$ |
| | [-1.07] | [0.96] | [1.17] | | | | | | | [-1.40] | [0.93] | [1.29] |
| $ICOP(\%)$ | | | | $-0.004$ | 0.014 | 0.018 | | | | $-0.009$ | 0.015 | 0.023 |
| | | | | [-0.35] | [0.66] | [0.65] | | | | [-0.69] | [0.71] | [0.82] |
| $PCOP(\%)$ | | | | | | | $-0.017^{**}$ | $-0.007$ | 0.010 | $-0.019^{***}$ | $-0.005$ | 0.014 |
| | | | | | | | [-2.64] | [-0.68] | [ 0.72] | [-2.93] | [-0.47] | [1.00] |
| $MKT$ | $1.021^{***}$ | $0.967^{***}$ | $-0.054^{***}$ | $1.021^{***}$ | $0.968^{***}$ | $-0.053^{***}$ | $1.021^{***}$ | $0.967^{***}$ | $-0.054^{***}$ | $1.022^{***}$ | $0.968^{***}$ | $-0.054^{***}$ |
| | [81.71] | [75.90] | [-3.39] | [81.71] | [75.50] | [3.30] | [81.98] | [75.72] | [-3.38] | [82.12] | [75.37] | [-3.33] |
| $R^2(\%)$ | 95.24 | 92.99 | 5.16 | 95.23 | 93.01 | 5.12 | 95.24 | 93.00 | 5.14 | 95.26 | 93.06 | 5.76 |

Table 23 t-stats [in parentheses] are computed as the average value of parameters across year, divided by the standard deviation divided by the number of COP; *, **, ***, denote statistical significance at the 10%, 5%, and 1%. Regressions are: (1) = ICOP, (2)= PCOP and (3) = ICOP + PCOP. Results are in percentage. L = Low carbon-intensity portfolio returns, H = High carbon-intensity portfolio returns and H-L = spread between the two portfolio returns.

| Year | Low | | | | | High | | | | | High-minus-Low | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\alpha(\%)$ | $Pre(\%)$ | $I(\%)$ | $Post(\%)$ | $MKT$ | $\alpha(\%)$ | $Pre(\%)$ | $I(\%)$ | $Post(\%)$ | $MKT$ | $\alpha(\%)$ | $Pre(\%)$ | $I(\%)$ | $Post(\%)$ | $MKT$ |
| 2006 | 0.022 | −0.013 | 0.030 | 0.008 | 0.961*** | 0.035* | 0.009 | −0.079 | −0.068 | 1.088*** | 0.013 | 0.022 | −0.109 | −0.077 | 0.127*** |
| | [1.48] | [−0.26] | [0.45] | [0.22] | [48.59] | [1.70] | [0.14] | [−0.86] | [−1.35] | [39.98] | [0.40] | [0.21] | [−0.77] | [−0.97] | [3.00] |
| | | | 90.65 | | | | | 86.76 | | | | | 4.02 | | |
| 2007 | 0.030 | 0.030 | −0.031 | −0.050 | 1.061*** | 0.082*** | 0.006 | 0.122 | −0.001 | 0.964*** | 0.053 | −0.024 | 0.153 | 0.050 | −0.097*** |
| | [1.21] | [0.38] | [−0.29] | [−0.86] | [63.77] | [2.96] | [0.07] | [1.00] | [−0.01] | [50.89] | [1.10] | [−0.15] | [0.73] | [0.44] | [−2.97] |
| | | | 94.30 | | | | | 91.32 | | | | | 3.79 | | |
| 2008 | 0.146*** | −0.041 | −0.122 | −0.052 | 1.111*** | 0.034 | 0.283* | 0.095 | 0.048 | 0.987*** | −0.112 | 0.324 | 0.217 | 0.100 | −0.124*** |
| | [3.13] | [−0.27] | [−0.59] | [−0.46] | [78.46] | [0.69] | [1.77] | [0.44] | [0.41] | [66.51] | [−1.30] | [1.15] | [0.57] | [0.49] | [−47.40] |
| | | | 96.15 | | | | | 94.71 | | | | | 9.00 | | |
| 2009 | 0.026* | 0.007 | 0.130** | −0.041 | 0.992*** | 0.014 | 0.043 | −0.010 | 0.005 | 0.977*** | −0.012 | 0.035 | −0.140 | 0.046 | −0.016*** |
| | [1.90] | [0.16] | [2.11] | [−1.23] | [100.31] | [0.86] | [0.78] | [−0.14] | [0.12] | [82.10] | [−0.46] | [0.42] | [−1.23] | [0.73] | [−0.84] |
| | | | 97.61 | | | | | 96.47 | | | | | 1.23 | | |
| 2010 | 0.039*** | −0.083* | −0.024 | −0.045 | 0.952*** | 0.037** | 0.046 | −0.080 | −0.024 | 0.939*** | −0.002 | 0.129* | −0.055 | 0.021 | −0.013 |
| | [2.82] | [−1.83] | [−0.40] | [−1.38] | [73.53] | [2.48] | [0.93] | [−1.21] | [−0.69] | [67.45] | [−0.09] | [1.65] | [−0.52] | [0.38] | [−0.58] |
| | | | 95.64 | | | | | 94.85 | | | | | 1.42 | | |
| 2011 | 0.053*** | −0.030 | −0.050 | −0.010 | 0.959*** | 0.023 | 0.026 | 0.012 | −0.040 | 0.888*** | −0.031 | 0.056 | 0.062 | −0.030 | −0.070*** |
| | [3.38] | [−0.58] | [−0.72] | [−0.27] | [108.89] | [1.57] | [0.55] | [0.19] | [−1.18] | [110.58] | [−1.23] | [0.68] | [0.57] | [−0.51] | [−50.32] |
| | | | 98.01 | | | | | 98.06 | | | | | 10.01 | | |
| 2012 | 0.013 | −0.046 | −0.068 | −0.043 | 1.008*** | 0.004 | 0.017 | 0.017 | 0.010 | 0.968*** | −0.009 | 0.063 | 0.085 | 0.053 | −0.041*** |
| | [0.78] | [−0.86] | [−0.97] | [−1.14] | [56.88] | [0.34] | [0.42] | [0.33] | [0.36] | [73.70] | [−0.36] | [0.79] | [0.82] | [0.95] | [−15.44] |
| | | | 93.01 | | | | | 95.72 | | | | | 1.66 | | |
| 2013 | 0.023* | −0.033 | 0.006 | 0.011 | 1.048*** | 0.026** | 0.001 | −0.040 | −0.053* | 0.903*** | 0.003 | 0.034 | −0.047 | −0.064 | −0.146*** |
| | [1.79] | [−0.81] | [0.11] | [0.36] | [64.78] | [2.07] | [0.01] | [−0.73] | [−1.76] | [57.67] | [0.13] | [0.50] | [−0.50] | [−1.25] | [−5.46] |
| | | | 94.45 | | | | | 93.11 | | | | | 11.46 | | |
| 2014 | 0.045*** | 0.009 | 0.025 | −0.019 | 1.013*** | −0.010 | 0.025 | −0.093 | 0.093*** | 0.928*** | −0.055** | 0.016 | −0.118 | 0.113** | −0.085*** |
| | [3.18] | [0.20] | [0.41] | [−0.59] | [65.01] | [−0.73] | [0.53] | [−1.47] | [2.78] | [58.07] | [−2.29] | [0.20] | [−1.12] | [2.01] | [−3.17] |
| | | | 94.53 | | | | | 93.34 | | | | | 5.58 | | |
| 2015 | 0.007 | −0.071 | 0.036 | −0.033 | 1.010*** | 0.060*** | −0.049 | −0.029 | 0.019 | 0.985*** | 0.0531 | 0.023 | −0.065 | 0.052 | −0.025 |
| | [0.46] | [−1.41] | [0.53] | [−0.89] | [83.39] | [2.75] | [−0.68] | [−0.30] | [0.36] | [57.73] | [1.63] | [0.21] | [−0.46] | [0.67] | [−0.98] |
| | | | 96.62 | | | | | 93.18 | | | | | 0.71 | | |
| 2016 | 0.039*** | 0.049 | 0.008 | −0.010 | 0.997*** | −0.004 | −0.026 | −0.161** | 0.050 | 0.970*** | −0.043* | −0.076 | −0.169 | 0.060 | −0.026 |
| | [3.36] | [1.34] | [0.16] | [−0.37] | [54.53] | [−0.26] | [−0.51] | [−2.25] | [1.29] | [38.07] | [−1.79] | [−0.99] | [−1.59] | [1.04] | [−0.70] |
| | | | 92.66 | | | | | 85.93 | | | | | 2.31 | | |
| 2017 | 0.025** | 0.007 | 0.012 | −0.042 | 0.943*** | 0.017 | 0.068 | 0.091 | 0.016 | 0.956*** | −0.008 | 0.061 | 0.078 | 0.058 | 0.013 |
| | [2.03] | [0.18] | [0.23] | [−1.40] | [70.27] | [1.21] | [1.56] | [1.52] | [0.49] | [64.36] | [−0.38] | [0.85] | [0.80] | [1.07] | [0.55] |
| | | | 95.27 | | | | | 94.44 | | | | | 1.00 | | |
| 2018 | 0.030** | −0.115** | −0.013 | −0.007 | 1.043*** | 0.017 | 0.071 | 0.166** | −0.048 | 1.009*** | −0.014 | 0.187** | 0.179 | −0.041 | −0.034 |
| | [2.02] | [−2.42] | [−0.19] | [−0.20] | [81.13] | [1.14] | [1.52] | [2.42] | [−1.37] | [79.98] | [−0.53] | [2.28] | [1.49] | [−0.67] | [−1.53] |
| | | | 96.49 | | | | | 96.36 | | | | | 4.44 | | |
| 2019 | 0.055*** | 0.020 | −0.027 | −0.017 | 1.083*** | 0.027 | −0.094 | 0.080 | −0.084* | 0.998*** | −0.028 | −0.114 | 0.107 | −0.068 | −0.085*** |
| | [3.40] | [0.37] | [−0.38] | [−0.44] | [166.42] | [1.34] | [−1.43] | [0.90] | [−1.75] | [122.52] | [−1.02] | [−1.27] | [0.89] | [−1.04] | [−7.71] |
| | | | 99.11 | | | | | 98.38 | | | | | 20.40 | | |
| 2021 | 0.040** | −0.020 | −0.002 | 0.052 | 1.010*** | 0.066 | 0.008 | 0.031 | −0.014 | 0.851*** | 0.027 | 0.028 | 0.033 | −0.065 | −0.159*** |
| | [2.21] | [−0.36] | [−0.03] | [1.24] | [87.76] | [2.56] | [0.10] | [0.27] | [−0.22] | [51.32] | [0.77] | [0.27] | [0.22] | [−0.81] | [−7.18] |
| | | | 96.92 | | | | | 91.51 | | | | | 17.53 | | |
| 2022 | 0.051** | 0.060 | −0.065 | −0.041 | 1.019*** | 0.042 | −0.110 | 0.144 | 0.004 | 1.031*** | −0.009 | −0.170 | 0.209 | 0.045 | 0.011 |
| | [2.53] | [0.97] | [−0.74] | [−0.88] | [75.47] | [1.39] | [−1.18] | [1.10] | [0.05] | [50.76] | [−0.21] | [−1.31] | [1.14] | [0.46] | [0.40] |
| | | | 95.88 | | | | | 91.37 | | | | | 1.52 | | |

Table 24 t-stats [in parentheses] are computed as the average value of parameters across year, divided by the standard deviation divided by the number of COP; *, **, ***, denote statistical significance at the 10%, 5%, and 1%. Below each year I report also the $R^2$ in percentage. Regressions are: (1) = ICOP, (2)= PCOP and (3) = ICOP + PCOP. Results are in percentage. L = Low carbon-intensity portfolio returns, H = High carbon-intensity portfolio returns and H-L = spread between the two portfolio returns.

| | MDR | PACAR | *t-stat* | MDR | PACAR | *t-stat* | MDR | PACAR | *t-stat* |
|---|---|---|---|---|---|---|---|---|---|
| (Panel A) | | | | | | | | | |
| | [0,5] | | | [0,15] | | | [0,30] | | |
| Low | 0.0763% | -0.0424% | [−1.24] | 0.1113% | -0.0318% | [−1.82] | 0.0676% | -0.0301% | [−2.89] |
| High | 0.0868% | 0.0182% | [0.52] | 0.1265% | 0.0141% | [0.42] | 0.0745% | -0.0017% | [−0.24] |
| High-minus-Low | 0.0106% | 0.0606% | [1.25] | 0.0152% | 0.0459% | [1.48] | 0.0070% | 0.0284% | [1.46] |
| (Panel B) | | | | | | | | | |
| | [5,0] | | | [15,0] | | | [30,0] | | |
| Low | 0.1762% | 0.0463% | [0.50] | 0.0614% | 0.0280% | [0.70*] | 0.0836% | 0.0249% | [0.78] |
| High | 0.1766% | -0.0182% | [0.16] | 0.0701% | -0.0150% | [0.22] | 0.0992% | -0.0378% | [−0.70] |
| High-minus-Low | 0.0004% | -0.0645% | [−0.10] | 0.0087% | -0.0429% | [−0.37] | 0.0156% | -0.0627% | [−1.21] |

Table 25 This table presents the mean daily returns (MDR) and the portfolio average cumulative abnormal returns (PACAR) respectively for a Low, High and High-minus-Low portfolio across all the COP events from 2006 to 2022. Panel A reports results for 3 separate windows: from the start of the COP event until 5 days, 15 days and 30 days after the COP event, so to capture a reaction to the effects of the COP effect. Panel B reports results for 3 separate windows: namely 5 days, 15 days and 30 days prior to the COP beginning until the end date of the COP, so to capture an anticipation on the effects of the COP. Results are in percentage. Expected (normal) returns are computed using a market model. Statistical significance is based on the Boehmer et al. (1991) test statistic. Note: *** significant at 1% level, ** at 5% level, * at 10% level.