Taste-Driven Capital Market Separation: Impact on Firm Valuation*

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Abstract.

We study whether climate-related investor tastes translate into firm valuation effects in segmented equity markets. Using global ownership filings, we construct firm-level shareholder carbon preferences from investors' portfolio carbon intensity and merge them with financial and accounting data for 11,811 firms in 53 countries (2004–2022). In panel regressions of industry-adjusted Tobin's Q, valuation depends on preference alignment: the valuation discount associated with poor corporate carbon performance is substantially stronger when firms are held by climate-conscious owners and markedly weaker—and in the extreme tail can turn into a premium—when ownership is dominated by brown-preference investors. The interaction strengthens in the post–Paris period and is more pronounced in the United States than in the European Union. Results are robust to alternative carbon and valuation measures, investor subsamples, lag structures, and placebo preference assignments. Overall, corporate carbon performance affects firm value not in isolation, but through its match with the preferences of the shareholder base.

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1 Introduction

Over the past decade, climate change has emerged as a defining challenge for the global economy, drawing increasing attention to the environmental role of business. As a major source of greenhouse gas emissions, companies are being called upon to play a central role in addressing this crisis. In response to growing expectations from regulators, society and financial markets, companies are increasingly expected to account for their environmental externalities. As a result, many companies are now adopting science-based climate targets and formulating plans to significantly reduce their carbon footprint—some even committing to net-zero targets (Bolton and Kacperczyk, 2021a).

In parallel to these efforts, capital markets are increasingly seen as a lever for climate action. Investors are developing preferences that go beyond the traditional risk–return trade-off, expressing a taste for sustainability (Fama and French, 2007). A growing body of theoretical work proposes a separation of capital markets along these environmental preferences: green investors hold green firms, while brown firms are owned by the rest of the market (Heinkel et al., 2001; Pastor et al., 2021; Pedersen et al., 2021). Leister et al. (2025) empirically confirm this theoretical phenomenon by documenting the presence of capital market separation based on carbon-related ownership preferences.

This raises a crucial question: how do climate-related investor preferences affect firm valuations? If markets are indeed segmented along environmental lines, and if green investors are willing to pay a premium to align their portfolios with their values ("warm-glow" utility), then alignment with these preferences may result in valuation premiums (Dreyer et al., 2023). Conversely, brown firms may face valuation discounts. We test whether capital market separation relates to the valuation effects predicted by theory (Heinkel et al., 2001; Pastor et al., 2021; Pedersen et al., 2021). To the best of our knowledge, we are the first to provide empirical evidence of this using comprehensive ownership data and various carbon metrics.

Our study contributes to the debate between shareholder value maximization and corporate environmental performance. While Friedman (1970) rejected voluntary social spending, Freeman (1984) emphasized the importance of the interests of all stakeholders. Barnett (2007, 2019) reconciles these views, suggesting that forms of corporate social responsibility (CSR) can enhance value when aligned with stakeholder preferences. We follow this reasoning, focusing on shareholders whose environmental preferences may shape firm outcomes. Firms with low emissions may receive favorable valuations when their investors value strong carbon performance. Thus, the valuation benefit depends on the alignment between firm emissions and owner preferences.

We test this empirically by matching firm-level emissions data with owner-level carbon preferences, calculated from actual portfolio compositions. Using fixed effects regressions with interaction terms, we identify robust valuation effects across a variety of carbon performance and valuation measures consistent with theory. Interestingly, we also find that these valuation effects are conditional on external developments. Following the Paris Agreement, capital market separation increased globally (Leister et al., 2025). Building on this, our results show that the valuation effects intensified in the post-Paris period, when climate-related norms and regulatory pressures became more prominent. Moreover, we document, that these valuation differentials are more pronounced in the United States (U.S.), while stricter European Union (EU) regulation may have reduced the gap between firm behavior and investor expectations (Bolton and Kacperczyk, 2021b)[1]. In line with Barnett's theory (2007, 2019), we find that brown firms can benefit from becoming even browner, but only on the condition that they are owned by investors whose preferences are aligned with the firm's carbon performance.

[1] See the unpublished version of Bolton and Kacperczyk (2023) for these insights.

Our findings offer several implications. For investors, carbon alignment matters for valuation. For managers, the findings underscore the financial relevance of decarbonization—not just for managing risk, but for attracting valuation premiums. For policymakers, the composition of investor preferences and regulatory context shape the effectiveness of market-based climate action. Finally, our findings are critical for evaluating the effectiveness of impact investing through the portfolio allocation channel (see Wilkens et al., 2025). If investor preferences merely separate the market but do not affect valuations, then no financial incentive exists for brown firms to become greener. However, if separation leads to systematic valuation differences, then expected returns (and thus financing costs) vary by firm greenness. This creates a powerful incentive mechanism: lower cost of capital for green firms and higher cost for brown firms. Indeed, we find that for most firms moving toward sustainability can enhance shareholder value. Yet for firms with highly brown shareholders, the optimal strategy under shareholder value maximization may be to remain brown or even become browner, raising complex questions for climate policy design and corporate governance.

In the remainder of this paper, Section 2 reviews the literature, introduces a stylized conceptual framework, and develops four hypotheses. Section 3 outlines our data and methodology, while Section 4 presents our empirical results. Section 5 discusses robustness checks, including restrictions on emission data quality, investor types, and industry scope, as well as alternative carbon and valuation measures, while Section 6 concludes with the key implications of the study.

2 Literature Review, Theoretical Framework, and Hypothesis Development

2.1 Literature Review

Shareholder welfare, sustainability, and firm value

Our study relates to the long-standing debate on the purpose of the firm and whether corporate environmental performance can be reconciled with shareholder value maximization. While Friedman (1970) famously argued that firms should focus on profit maximization within the law, stakeholder-oriented perspectives emphasize that firms may create value by responding to the preferences of relevant constituencies (Freeman, 1984). Barnett (2007, 2019) reconciles these views by introducing the notion of stakeholder influence capacity: CSR can be value-enhancing when it aligns with stakeholder preferences and affects competitive positioning, risk, or reputation.

A particularly relevant refinement is the shareholder-welfare view of Hart and Zingales (2017), who argue that when shareholders have pro-social preferences in addition to financial ones, corporate policies that align with these preferences can be welfare-improving even if they do not strictly maximize market value in a narrow sense. If individuals are willing to internalize externalities in their personal behavior—such as by paying more for environmentally or socially responsible goods—they may also demand firms they invest in to act accordingly. In the climate context, this view implies that investor tastes for (or against) low-carbon firms can shape demand for equity and thus firm valuation. We build on this logic by focusing on shareholders as a pivotal stakeholder group whose climate-related preferences can be inferred from portfolio holdings and linked to valuation outcomes.

Taste-based asset pricing and capital market separation

The theoretical foundation for our approach is the idea that investors may derive non-pecuniary utility from holding certain assets. Fama and French (2007) formalize investor "tastes" as an additional driver of equilibrium prices. Complementing this view, Mackey et al. (2007) argue that sustainability attributes can be understood as a valued "product" offered to investors: when demand for such firms exceeds supply, investors' willingness to pay increases share prices even in the absence of higher expected cash flows. In sustainable investing, such tastes are often interpreted as "warm-glow" utility from holding green assets (or disutility from holding brown assets), which can push prices away from purely mean–variance efficient allocations and depress expected returns on green assets (Dreyer et al., 2023).[2]

A key implication of heterogeneous tastes is capital market separation: investors sort into different segments, so that green investors disproportionately hold green firms, while brown firms are increasingly held by investors with weak or opposite climate tastes. Heinkel et al. (2001) provide an early and influential model of such segmentation, showing that divestment by green investors can reduce the buyer base for brown stocks and thereby increase the required return (and lower the price) of brown firms, creating incentives for firms to improve environmental performance. Recent equilibrium models sharpen these predictions. Pastor et al. (2021) show how sustainable investing can generate systematic differences in required returns and cost of capital across firms with different ESG characteristics. Pedersen et al. (2021) derive an ESG-efficient frontier and highlight how investor demand can translate into valuation differences as the share of taste-motivated investors grows. Zerbib (2022) develops a sustainable CAPM with heterogeneous tastes and relates it to partial segmentation mechanisms.[3,4]

[2] Traditional asset pricing frameworks assume homogeneous investors who trade off risk and return only, implying that all investors hold the market portfolio in equilibrium (e.g., Sharpe, 1964; Lintner, 1965; Mossin, 1966). We abstract from these foundations and focus on taste heterogeneity as the key departure relevant for sustainability-related segmentation.

[3] Related concepts of partial market segmentation and exclusion premia appear in earlier work on segmented international markets (e.g., Errunza and Losq, 1985; de Jong and de Roon, 2005).

[4] More broadly, limited attention and incomplete information can generate pricing effects through a reduced investor base (Merton, 1987), which is conceptually related to the idea that exclusion or divestment can affect asset prices via demand shifts.

Empirical evidence on carbon performance and valuation

Empirically, a rapidly growing climate-finance literature documents that markets respond to carbon-related firm characteristics. Studies such as Bolton and Kacperczyk (2021a, 2023) link emissions to returns and valuations, consistent with the view that investors price carbon risk and/or express climate-related preferences. Accounting evidence likewise suggests valuation relevance of emissions and carbon disclosure (e.g., Matsumura et al., 2014).

An important challenge in this literature is that valuation effects can operate through multiple channels—expected cash flows, discount rates, or non-pecuniary investor utility—and these channels are difficult to disentangle empirically (Edmans, 2021).[5] A complementary stream emphasizes that sustainability-related valuation effects may be stronger when stakeholders pay attention (e.g., customer awareness, media coverage, or public sentiment), highlighting the role of perception and information.[6]

From separation to valuation: the missing link and our contribution

While capital market separation is well grounded in theory, comprehensive empirical evidence—especially in equity markets and across carbon-specific metrics—has long been limited. Related work in bond markets shows that sustainability preferences affect pricing and ownership patterns (e.g., Zerbib, 2019; Flammer, 2021; Baker et al., 2022). More recently, Leister et al. (2025) provide broad ownership-based evidence that firms sort into green and brown shareholder clienteles based on carbon performance, offering direct empirical support for the existence of climate-related capital market separation.

[5] Evidence consistent with a cost-of-capital channel includes lower implied cost of equity for firms with stronger environmental performance (El Ghoul et al., 2011) and higher loan spreads for firms with environmental concerns in bank lending settings (Chava, 2014).

[6] For perception-based channels, see Servaes and Tamayo (2013) on customer awareness, Cahan et al. (2015) on CSR disclosure and reputation, and Serafeim (2020) on public sentiment and sustainability pricing.

This paper builds on that separation evidence and asks a distinct corporate-finance question: What are the valuation consequences of preference-based separation? If tastes segment the market, valuation effects should not depend on corporate carbon performance in isolation, but on the alignment between a firm's carbon profile and the preferences of its shareholder base. Consistent with this view, Paulus and Rohleder (2022) show that CSR can be valuation-relevant precisely when it matches shareholder preferences. Moreover, broad ESG scores bundle multiple dimensions and differ substantially across providers (Berg et al., 2022), which limits their usefulness in isolating the impact of climate-specific factors on firm valuation. For this reason, we focus on carbon emissions-based measures as a more targeted and conceptually transparent proxy for corporate climate performance.

Taken together, the literature motivates an interaction-based design in which valuation depends jointly on corporate carbon performance and the revealed carbon preferences of shareholders. The next section introduces a parsimonious stylized conceptual framework that formalizes this intuition and yields the testable predictions summarized in our hypotheses.

2.2 Conceptual Framework and Testable Predictions

This section provides a parsimonious, testable conceptual framework that links (i) heterogeneity in investors' climate-related tastes, (ii) capital market separation by carbon profiles, and (iii) firm valuation effects that depend on the alignment between corporate carbon performance (CCP) and the shareholder base. The framework is intentionally stylized and serves two purposes: it motivates our interaction-based empirical design and clarifies the sign predictions that we summarize in the hypotheses in Subsection 2.3.

Investor preferences, portfolio choice, and taste wedges

Consider a set of firms $s = 1, \dots, N$. Let $R_{t+1} \in \mathbb{R}^N$ denote the vector of one-period returns and let $\mu_t = \mathbb{E}_t[R_{t+1}]$ and $\Sigma_t = \mathrm{Var}_t(R_{t+1})$. Each firm has an observable climate attribute $CCP_{s,t}$.

Investor j allocates wealth across risky assets with portfolio weights $w_{j,t}$. Following taste-based asset-pricing models of sustainable investing, we assume that investors may derive non-financial (dis)utility from holding carbon-intensive firms. We capture this with a mean–variance objective augmented by a linear taste term:

$$\max_{w_{i,t}} w_{j,t}^{\top}\mu_t - \frac{\gamma_j}{2} w_{j,t}^{\top}\Sigma_t w_{j,t} - \tau_j w_{j,t}^{\top} CCP_t, \quad (1)$$

where $CCP_t = (CCP_{1,t}, \ldots, CCP_{N,t})^{\top}$, $\gamma_j > 0$ is risk aversion, and τ_j captures climate taste. A "green" investor has $\tau_j > 0$ (disutility from high CCP, i.e., from carbon intensity), while a "brown" investor has $\tau_j < 0$ (a relative preference for high-CCP assets).

The first-order condition implies:

$$w_{j,t} = \frac{1}{\gamma_j} \Sigma_t^{-1} (\mu_t - \tau_j CCP_t). \quad (2)$$

Thus, tastes tilt portfolios away from high-CCP firms when $\tau_j > 0$ and toward them when $\tau_j < 0$. In equilibrium, heterogeneous tastes can generate sorting (separation): high-CCP firms become disproportionately owned by investors with weak or negative climate tastes, while low-CCP firms are disproportionately owned by climate-conscious investors. This is the core "capital market separation" mechanism motivating our interaction design.

From investor tastes to firm-level shareholder preference measures

Our empirical setting does not observe τ_j directly. Instead, we infer revealed carbon preferences from investors' portfolio compositions, consistent with revealed preference logic (Samuelson, 1938, 1948). We then aggregate (circularity-adjusted) investor preferences to the firm level by weighing each owner by its ownership share, yielding a firm-specific shareholder preference measure.

Intuitively, shareholder preference is the climate "orientation" of the firm's marginal investor base: the firm is a "portfolio of owners," and owners with larger stakes exert greater influence on the firm-level preference metric.

In the baseline carbon-intensity setup, higher shareholder preference indicates that the shareholder base is tilted toward carbon-intensive portfolios (i.e., the firm is held by relatively "brown" owners).

Testable valuation implication: alignment generates an interaction effect

To connect preferences to valuation, let firm valuation reflect the discount rate and/or pricing wedge implied by the tastes of the marginal owners who set prices. In a segmented market interpretation, the relevant taste parameter is not a global average but an owner-base-specific composite, $\bar{\tau}_{s,t}$, increasing in the weight of climate-conscious investors among the owners of s. Since our observable firm-level shareholder preference measure $Shareholder\ preference_{s,t}$ increases in "brownness" (higher shareholder preference-CI), it is natural to treat $\bar{\tau}_{s,t}$ as decreasing in $Shareholder\ preference_{s,t}$. A simple mapping is:

$$\bar{\tau}_{s,t} = a - b\, Shareholder\ preference_{s,t}, \qquad b > 0. \tag{3}$$

Then the valuation effect of carbon intensity depends on the shareholder base. In reduced form, this yields a linear interaction structure with firm-level controls as well as industry fixed effects (λ_s) and time fixed effects (τ_t):

$$Valuation_{s,t} = \alpha + \beta_1\, CCP_{s,t} + \beta_2\, Shareholder\ preference_{s,t} + \beta_3\, (CCP_{s,t} \times Shareholder\ preference_{s,t}) + \eta'\, Controls_{s,t} + \lambda_s + \tau_t + \varepsilon_{s,t}. \tag{4}$$

This is exactly the interaction-based regression logic implemented in our baseline panel specification, with industry-adjusted Tobin's Q as the main valuation outcome, carbon intensity as the main measure of CCP, and a comprehensive set of financial and ownership controls.

The key object for interpretation is the marginal effect of carbon intensity on valuation:

$$\frac{\partial Valuation_{s,t}}{\partial CCP_{s,t}} = \beta_1 + \beta_3\, Shareholder\, preference_{s,t}. \quad (5)$$

Because higher $Shareholder\ preference_{s,t}$ corresponds to a more brown shareholder base, the capital market separation mechanism predicts $\beta_3 > 0$: the negative valuation effect of poor carbon performance is stronger when ownership is predominantly climate-conscious (low $Shareholder\ preference_{s,t}$) and weaker when ownership is dominated by brown investors (high $Shareholder\ preference_{s,t}$). This is precisely the core alignment prediction that motivates our main interaction test.

The same framework also clarifies the direct preference effect. If $Shareholder\ preference_{s,t}$ captures a shareholder base tilted toward carbon-intensive portfolios, then—holding firm characteristics fixed—such firms may exhibit lower valuation (e.g., due to poorer governance/quality correlates, higher transition risk exposure, or discounting by the broader investor population), implying $\beta_2 < 0$ as a testable reduced-form prediction.

Finally, the framework naturally accommodates time and region heterogeneity. If the salience of climate tastes rises after the Paris Agreement or differs across institutional environments (e.g., due to preference polarization or regulatory harmonization), then the strength of separation and the associated alignment channel should change, which in the interaction setup corresponds to shifts in β_3 across subsamples (post- vs pre-Paris; U.S. vs EU).

In summary, the conceptual framework yields a sharp empirical prediction: valuation effects of carbon intensity are not constant across firms but vary systematically with the carbon preferences of the shareholder base. This is why the interaction term between firm-level carbon performance and shareholder preference is the central test statistic in our empirical design. We summarize these predictions in four hypotheses next.

2.3 Hypotheses

Building on the conceptual framework in Subsection 2.2, we formulate four testable hypotheses. Focusing on carbon emissions as a relatively reliable, objective and specific measure of corporate climate performance, we formulate four hypotheses to empirically assess the valuation effects of capital market separation based on carbon preferences and firm performance. The first hypothesis (H1) tests the general valuation effect associated with shareholder carbon preferences:

> *H1: Firms owned by shareholders with portfolios tilted toward poor corporate carbon performance exhibit lower firm valuation.*

If capital markets are segmented according to investor carbon preferences, valuation effects should further depend on the alignment between a firm's carbon performance and its shareholder base. Firms with poor carbon performance are expected to face stronger valuation discounts when held by climate-conscious investors, while this penalty should be mitigated when ownership is dominated by investors with weaker climate-related preferences. This leads to the second hypothesis (H2):

> *H2: Due to capital market separation, the negative relationship between poor corporate carbon performance and firm valuation is stronger for firms predominantly held by climate-conscious ("green") investors and weaker when ownership is concentrated among investors with neutral or less climate-sensitive ("brown") preferences.*

The Paris Agreement of 2015 represents a pivotal moment in global climate governance and has reshaped the landscape of sustainable investing. It has catalyzed shifts in regulatory expectations, investor norms, and data availability on corporate climate impacts. Previous findings by Leister et al. (2025) suggest that, following the Paris Agreement, the degree of capital market separation has significantly increased, as climate-related investor preferences became more salient and better reflected in ownership patterns. This development is consistent with Monasterolo and De Angelis (2020), who show that the Paris Agreement has altered the risk–return profiles of low-carbon assets, and Pedersen et al. (2021), who argue that such shifts lead to changes in investors' utility functions and generate discriminatory tastes—a response likely triggered by the Paris Agreement.[7] These changes have arguably strengthened the relationship between firm valuation and the alignment of investor carbon preferences with firm behavior. Supporting this view, Zerbib (2022) finds an increased taste premium over time, particularly in the post-Paris period. Complementing this evidence, Owolabi et al. (2024) provide evidence that, for firms operating in G7 countries, lender sensitivity to corporate carbon exposure is more pronounced in the post-Paris period, coinciding with a stronger pricing of climate-related risks in corporate debt markets. Hence, we propose our third hypothesis (H3):

> *H3: The positive valuation effect of the interaction between corporate carbon performance and shareholder preferences is more pronounced in the post-Paris Agreement period than in the pre-Paris Agreement period.*

Regional institutional differences are another key driver of the strength of capital market separation and its associated valuation effects. While the EU has been a global frontrunner in

[7] While Monasterolo and De Angelis (2020) primarily reflect statistical discrimination—where emissions serve as informative signals about risk and return (Phelps, 1972)—the findings of Pedersen et al. (2021) and Leister et al. (2025) suggest that taste-based discrimination (Becker, 1957) may also be at play. Bolton and Kacperczyk (2023) note that both mechanisms can yield similar effects on firm valuation.

sustainable finance regulation, this regulatory harmonization may have diminished the marginal value of alignment between firm behavior and investor preferences by standardizing firm disclosure and investor expectations. In contrast, the U.S. market—characterized by greater heterogeneity in ESG preferences and less regulatory guidance—may allow for stronger valuation differentials based on investor taste. Findings by Bardos et al. (2025) strengthen this interpretation. They show that green firms are more distinct and more strongly favored by climate-conscious investors in environments with weaker political support for climate action, higher exposure to physical climate risks, and more carbon-intensive local economies. They argue that in such contexts, investor preferences play a greater role in shaping capital allocation, while brown firms face comparatively higher financing costs due to the increased likelihood of future transition risks. These conditions closely mirror the structure of U.S. capital markets, helping explain why earlier empirical evidence finds capital market separation to be more pronounced in the U.S. than in the EU (Leister et al., 2025). This observation aligns with Bolton and Kacperczyk (2021b), who argue that more rigid regulation in the EU compresses carbon-related return differentials, while the more fragmented U.S. landscape fosters a broader dispersion in investor preferences and outcomes. Therefore, we formulate our fourth hypothesis (H4):

> *H4: The positive valuation effect of the interaction between corporate carbon performance and shareholder preferences is more pronounced in the United States than in the European Union.*

3 Data and Construction of Key Variables

3.1 Assessment of Corporate Carbon Performance

To capture the climate-related performance of firms, we rely on a set of emissions-based indicators that we collectively refer to as corporate carbon performance (CCP). These metrics aim to reflect a firm's contribution to climate change as well as its exposure to carbon-related financial risks, whereby higher CCP values indicate a greater potential to drive global temperature rise and signal increased transition risk. In other words, higher CCP indicates dirtier firms and higher shareholder preference indicates browner owners.

Our primary focus lies on carbon intensity, measured as the ratio of Scope 1 and Scope 2 emissions to a firm's revenue, following the approach proposed by Aswani et al. (2024). This metric standardizes emissions across firms of varying size and sectoral affiliation and allows for a more nuanced assessment of performance in relation to firm activity, rather than absolute scale. Using carbon intensity as the central measure is motivated both by its relevance for investor decision-making and its suitability for isolating firm-level variation. Aswani et al. (2024) argue that scaled emissions better capture the proportional burden a firm places on the climate system and align more closely with how responsible investors evaluate environmental performance. As larger firms are typically subject to stricter regulatory oversight and higher carbon costs, their ability to reduce emissions relative to output provides a more meaningful indication of adaptive capacity, making it a more suitable metric for evaluating performance. Unlike absolute emissions, which may lead to the exclusion of large firms purely due to their size, carbon intensity allows for a consistent judgment across firms and sectors. It thus serves as a more appropriate filter for taste-based investors, since total emissions would still allow for investing in smaller firms within a brown sector due to their lower absolute emissions. Taste-based investors, however, typically shun entire brown industries—similar to the systematic exclusion strategies used in the case of "sin stocks" (Hong and Kacperczyk, 2009).

Importantly, we exclude Scope 3 emissions from our analysis. While these upstream and downstream emissions are theoretically relevant, they are characterized by substantial measurement uncertainty and duplication issues. As shown by Busch et al. (2022), Scope 3 estimates are highly inconsistent over time and across providers. By contrast, Scope 1 and Scope 2 data exhibit strong correlation across major data vendors, particularly when both scopes are aggregated. This is further supported by Kalesnik et al. (2022), who demonstrate that third-party estimates often fail to identify the highest-emitting firms and may obscure important risks. Meanwhile, Busch et al. (2022) highlight that third-party estimations become significantly more consistent when aggregating Scope 1 and Scope 2 emissions. Therefore, to maximize data availability and ensure the broadest possible coverage of global emissions, we incorporate both reported and estimated emissions. Reported Scope 1 and Scope 2 emissions are directly sourced from corporate disclosures. When firms do not disclose their emissions, investors' capital allocation decisions—and thus the preferences we seek to measure—must necessarily rely on estimated emission data. Their values are estimated following a structured multi-step estimation process. This procedure relies on model-based predictions that incorporate firm-specific characteristics such as sector, energy use, employee count, and revenues. Emissions are estimated using one of three model types from the data provider Refinitiv: a CO_2 emissions model, an energy-based model, or a sectoral median approach.

In line with the Task Force on Climate-Related Financial Disclosures (TCFD, 2021), we define a firm's carbon intensity as total Scope 1 and Scope 2 emissions (Greenhouse Gas Protocol emission classification), measured in metric tons of CO_2-equivalents (t CO_2e) per USD ($) million of revenues (see also Bolton and Kacperczyk, 2021a, 2023; Aswani et al., 2024). The calculation formula is presented in Equation (6):

$$Carbon\ intensity_{s,t} = \frac{(Scope\ 1 + Scope\ 2\ emissions)\ t\ CO_2e_{s,t}}{\$\ million\ revenues_{s,t}}. \tag{6}$$

We supplement our main analysis with additional metrics to ensure the robustness of results. These include total emissions (in kt CO_2e), carbon intensity scaled by market capitalization and enterprise value, respectively, as well as a carbon risk rating. These alternative measures help assess the sensitivity of our findings to different definitions of firm-level carbon performance across specifications.[8]

3.2 Measurement of Shareholder Carbon Preferences

Through the application of a methodology based on measurable preferences, the study aims to assess investor preferences directly through their portfolio compositions. Building on the methodology introduced by Paulus and Rohleder (2022), we refrain from assigning investors to predetermined categories or assuming homogeneous motivations within such categories. Instead, our approach quantifies carbon preferences by analyzing actual equity holdings. This framework allows for the application of any firm-level environmental metric, such as carbon intensity, and captures the extent to which investors prioritize such characteristics in their allocation decisions. Rather than treating investor types as unified groups, we incorporate the preferences of all disclosed shareholders, recognizing that divergent views may coexist among them. While earlier studies often aggregate the influence of shareholder types (e.g., Dyck et al., 2019; Chen et al., 2020), such approaches tend to overlook intra-group heterogeneity, which has been shown to be substantial (e.g., Bushee, 1998; Hoskisson et al., 2002).

We estimate investors' carbon preferences in a multi-step process. First, we compute the portfolio weights $w_{j,s,t}$ of firm s in investor j's portfolio at time t by dividing the value of the holdings in firm i by the total portfolio value, as presented in Equation (7):

$$w_{j,i,t} = \frac{Company\ holdings\ value_{j,s,t}}{Investor\ portfolio\ value_{j,t}}. \quad (7)$$

Using a continuous measure, we next calculate the weighted carbon performance of each investor's portfolio, which represents the carbon preference of investor j, as presented in Equation (8):

[8] See Subsection 5.5 for the description of alternative corporate carbon performance metrics.

$$Investor\ preference_{j,t} = \sum_{s=1}^{N^{j,t}} w_{j,s,t}\ CCP_{s,t}. \tag{8}$$

This results in a portfolio-level average of the selected carbon metric, yielding a value equivalent to the weighted average carbon intensity (WACI) recommended by the TCFD (2021) for comparing equity portfolios. Consistent with the revealed preference theory of Samuelson (1938, 1948), this metric serves as the investor's climate preference.

To address potential endogeneity between a firm's carbon performance and the investor's preference metric, we recalculate preferences excluding the target firm s. This "leave-one-out" adjustment ensures that the investor's preference reflects the external portfolio composition of portfolio j for the respective period t based on the other holdings, rather than the firm s under analysis, as specified in Equation (9):

$$\begin{aligned} &Investor\ preference\ (adj)_{j,s,t} \\ &= Investor\ preference_{j,t} - \frac{w_{j,s,t}\ (Investor\ preference_{j,t} - CCP_{s,t})}{w_{j,s,t} - 1}. \end{aligned} \tag{9}$$

Within this setting, the analysis moves from an evaluation of investor portfolios to a firm-level assessment of shareholder preferences regarding carbon performance. The firm is understood as a "portfolio of owners", each with potentially differing climate-related priorities. These individual preferences are aggregated into a single firm-specific metric by weighting each shareholder's adjusted climate orientation according to their ownership share. Shareholders with larger stakes thus exert greater influence on the overall preference measure. The resulting shareholder preference for firm s in period t is captured in Equation (10) as a value-weighted average of adjusted investor preferences across all owners, scaled by shareholdings:[9]

[9] Neither CCPs, investor preferences, nor shareholder preferences are strictly divided into green or brown categories, but rather are continuous variables.

$$Shareholder\ preference_{s,t} = \sum_{j=1}^{N^s} \frac{Shares\ held_{j,s,t}}{\sum_j^{J^s} Shares\ held_{j,s,t}}\ Investor\ preference\ (adj)_{j,s,t}. \quad (10)$$

This ownership-weighted aggregation provides a nuanced view of the firm's climate profile as perceived through the lens of its actual investor base. It reveals how corporate climate actions may attract or repel certain types of investors, and how ownership structures reflect underlying environmental preferences. Higher firm-CI thus indicates dirtier firms while higher shareholder preference-CI indicates browner preferences. We further validate this approach using lag structures and randomized-placebo preference assignments.

Our empirical design is motivated by taste-based market separation, but several identification concerns arise when linking firm valuation to shareholder carbon preferences. First, a mechanical overlap concern emerges because shareholder preferences are constructed from firm-level carbon metrics. To mitigate this issue, we compute investor preferences in leave-one-out form, excluding the target firm from the investor's preference measure (Equation (9)), and then aggregate these adjusted preferences to the firm level (Equation (10)). Second, shareholder preferences may proxy for correlated ownership characteristics (e.g., investor clientele, monitoring, or governance) that also affect valuation. We therefore control for the ownership structure by including ownership shares for 17 investor categories (Equation (13)), which absorbs systematic valuation differences associated with investor type composition. Third, valuation could itself influence ownership (reverse causality) or both valuation and ownership could respond to common shocks. Our baseline specifications include industry and time fixed effects and a rich set of firm controls, thereby netting out sectoral valuation norms and global time shocks while preserving the cross-sectional variation that is central to our research question. Accordingly, we interpret the estimated interaction effects as valuation patterns consistent with preference-based segmentation and alignment, rather than as strictly causal estimates of the effect of preferences on valuation.

3.3 Assessment of Firm Valuation

As investor preferences increasingly influence capital allocation, this alignment—or misalignment—can have direct implications for a firm's valuation, with climate-conscious ownership potentially translating into valuation premiums for green stocks or, conversely, preference misalignment resulting in discounted market perceptions. To capture firm valuation from a shareholder-oriented perspective, we rely on an industry-adjusted Tobin's Q as our primary valuation metric.[10] As a market-based outcome measure, Tobin's Q is particularly well-suited for capturing long-term investor expectations and aligns closely with our focus on how shareholders respond to climate-related firm characteristics (Peloza, 2009). Although firm value is ultimately determined by shareholder perceptions, it can still reflect the broader value implications—positive or negative—of a firm's environmental profile for all stakeholder groups. Gabbioneta et al. (2007) emphasize that investors incorporate expectations about a firm's future potential into their valuations. In this context, a strong environmental strategy that improves stakeholder relationships may enhance the firm's operating environment and be rewarded accordingly by the market.

In operational terms, we construct Tobin's Q following the approximation proposed by Chung and Pruitt (1994) in our first step, using firm-level accounting and market data. Market capitalization is calculated by multiplying the firm's stock price by its number of outstanding common shares, preferred stock reflects the liquidation value of outstanding preferred shares, debt is defined as short-term liabilities net of its short-term assets plus the book value of long-term debt, and total assets corresponds to the book value of all assets. For firm s at time t, we define Tobin's Q as shown in Equation (11):

[10] See Subsection 5.4 for the description of alternative firm valuation metrics.

$$Tobin's\ Q_{s,t} = \frac{Market\ capitalization_{s,t} + Preferred\ stock\ value_{s,t} + Debt_{s,t}}{Total\ assets_{s,t}}. \quad (11)$$

In essence, Tobin's Q expresses how capital markets value a firm relative to the book-based replacement cost of its assets. Deviations from parity (Q ≠ 1) signal that investors perceive intangible value—such as anticipated growth, innovation capacity, or sustainability orientation—that is not fully captured in accounting measures. In this context, corporate efforts in areas like climate risk management or ESG performance may be priced in by investors, potentially increasing its net present value, while simultaneously appearing as costs in the firm's accounting base.

A potential limitation of using Tobin's Q to compare firm valuations lies in its strong variation across industries, driven by sector-specific characteristics such as capital intensity, innovation cycles, and asset structure (Lang and Stulz, 1994). To address this issue and allow for meaningful cross-industry comparisons, we calculate an industry-adjusted Tobin's Q by normalizing each firm's s Tobin's Q with the median value of its respective industry in a given period t. This adjustment is presented in Equation (12):

$$Tobin's\ Q_{s,t}\ (adj) = \frac{Tobin's\ Q_{s,t}}{Tobin's\ Q_{industry,t}}. \quad (12)$$

An adjusted Tobin's Q greater than 1 indicates that the firm is valued above the industry median, while values below 1 imply below-median valuation. This normalization facilitates clearer interpretation of valuation statistics and ensures that observed differences are not merely artifacts of industry-specific valuation norms.

3.4 Sample Selection and Summary Statistics

The empirical analysis is based on a global equity universe comprising 39,804 publicly listed firms obtained from Refinitiv Datastream and Worldscope (RDW). Firm-level ownership information is drawn from the Refinitiv Ownership and Profiles (ROP) database and is available at a quarterly frequency from 2004 to 2022. The raw ownership dataset contains 753,349 unique investors holding equity positions in 30,723 firms. To ensure reliable measurement of both ownership structure and carbon performance, the sample is restricted to firms with sufficient coverage of ownership and emissions data. This filtering procedure yields a final sample of 11,811 firms headquartered in 53 countries and operating across 30 industries, as classified by Refinitiv's Thomson Reuters Business Classification (TRBC).[11] Descriptive statistics for the resulting sample are reported in Table 1.

[Insert Table 1 here.]

The final panel comprises 291,358 distinct owners over the sample period and achieves broad coverage of global equity markets. On average, the firms included in the dataset account for 76.27% of global equity market capitalization as reported by the World Bank (2024), with coverage increasing steadily over time and reaching approximately 90% in later years. Ownership transparency improves throughout the sample period, as reflected in the rising share of reported ownership stakes. Across all observations, disclosed ownership corresponds to an average of 66.22% of firm-level market capitalization, a level of coverage largely driven by the inclusion of large, internationally active corporations.

Panel A of Table 2 summarizes the key variables used in the analysis, including valuation measures, firm-level carbon performance indicators, investor- and shareholder-level carbon preferences, and standard financial controls. Tobin's Q and industry-adjusted Tobin's Q are measured quarterly. Following a similar approach to Serafeim (2020), Tobin's Q is calculated at the end of each quarter using contemporaneous market capitalization and the most recent publicly available balance-sheet information. Revenues, total assets, and leverage are

[11] See Tables A1, A2, and A3 in the Appendix for summary statistics on the ownership sample, as well as industry- and country-level statistics.

observed annually. In the few cases where annual accounting variables are missing for intermediate years, linear interpolation is applied to preserve continuity, while return on assets is reported without interpolation.

[Insert Table 2 here.]

Tobin's Q exhibits a mean value of 1.58 and a median of 1.02, whereas industry-adjusted Tobin's Q has a mean of 1.38 and, by construction, a median of 1.00. Firm-level carbon emissions display substantial heterogeneity. Average total emissions (firm-TE) amount to 1,948.29 kt CO_2e, with a standard deviation of 7,586.67 kt CO_2e. The distribution is highly skewed, ranging from 0.05 kt CO_2e at the 1st percentile to 45,200.00 kt CO_2e at the 99th percentile, indicating that a small subset of highly emitting firms drives much of the aggregate variation. Carbon intensity (firm-CI), defined as emissions relative to revenues, shows a mean of 335.27 t CO_2e per $ million and a standard deviation of 1,020.35 t CO_2e per $ million. Values span from 0.28 t CO_2e at the 1st percentile to 6,287.43 t CO_2e at the 99th percentile, highlighting pronounced differences in carbon efficiency across firms and industries.

At the investor level, unadjusted carbon preferences exhibit mean values of 1,927.75 kt CO_2e for investor preference-TE and 275.84 t CO_2e per $ million for investor preference-CI. When aggregated to the firm level, shareholder preferences for carbon performance display means of 3,155.71 kt CO_2e (shareholder preference-TE) and 199.25 t CO_2e per $ million (shareholder preference-CI). Compared to investor-level preferences, shareholder preferences are less extreme, reflecting the aggregation of heterogeneous investor portfolios within firms. Differences between firm-level carbon metrics and investor preferences arise from the weighting scheme used to construct investor-level measures, which places greater emphasis on firms with large emissions exposures. When investor preferences are weighted by market capitalization, they coincide exactly with firm-level metrics. The remaining divergence relative to shareholder preferences is attributable to adjustments implemented to mitigate mechanical circularity in the preference construction. The distribution of shareholder preferences is skewed toward green and neutral positions, while explicitly brown shareholder profiles are relatively uncommon. However, brown shareholders tend to concentrate their holdings in firms with particularly high carbon intensity, resulting in more pronounced preferences at the investor level. At the firm level, this concentration effect is dampened by diversified ownership structures, leading to less polarized shareholder preference measures that reflect a combination of green, neutral, and brown investor types.

Panel B of Table 2 reports pairwise Pearson correlations among the main variables. Tobin's Q is negatively correlated with firm-CI and firm-TE, as well as with the corresponding shareholder preference measures, providing initial descriptive evidence of valuation differences between green and brown firms. Revenues are positively correlated with firm-TE, consistent with the notion that total emissions scale with production volume, while firm-CI exhibits correlations close to zero. Overall, correlation coefficients among the explanatory variables remain modest, suggesting that multicollinearity is unlikely to affect the regression analyses that follow.

4 Empirical Findings

4.1 Valuation Effects of the Capital Market Separation

In this section, we examine how capital market separation—defined as the systematic sorting of green firms into portfolios of green investors and brown firms into those of brown investors—affects firm valuation. This separation pattern, previously documented empirically by Leister et al. (2025), suggests that investor preferences and CCP jointly shape financial market outcomes. To analyze this relationship, we introduce an interaction term between a firm's carbon performance and the carbon preference of its shareholders. This interaction serves as the central variable in testing our main hypothesis (H2) regarding the valuation effects of capital market separation and is consistently applied across all four hypotheses.

Table 3 examines valuation patterns using single-sorts of firms based on carbon intensity and the corresponding shareholder preference measure. To illustrate the impact of industry adjustment, we analyze average firm valuations—measured by Tobin's Q and industry-adjusted Tobin's Q—across quintiles for each sorting variable. The results reveal a clear valuation gradient. A similar pattern emerges when firms are sorted by shareholder preferences: firms in the lowest quintile (i.e., predominantly held by the most climate-conscious investors) exhibit significantly higher valuations than firms in the highest quintile (i.e., predominantly held by the least climate-conscious investors). Notably, the increase in Tobin's Q is particularly pronounced and strictly monotonic when moving from firms with predominantly brown owners to firms with predominantly green owners using the industry-adjusted measure, underscoring the strong association between investor composition and firm valuation.

[Insert Table 3 here.]

To further investigate the joint relationship between firm-level carbon performance and shareholder carbon preferences, Table 4 reports a double-sorting analysis. This descriptive approach allows us to assess the association of these two dimensions with firm valuation, abstracting from the influence of additional control variables. Using Tobin's Q, we observe a general valuation gradient: firms that simultaneously exhibit low carbon intensity and are predominantly held by climate-conscious investors tend to exhibit higher valuations than their more carbon-intensive counterparts held by brown investors. However, this pattern is less sharp and less monotonic than when valuations are measured using industry-adjusted Tobin's Q. The stronger and more consistent gradient in the industry-adjusted measure indicates that industry affiliation plays an important role in shaping raw Tobin's Q differences, and that carbon-related valuation effects become more clearly visible once sectoral influences are accounted for.

[Insert Table 4 here.]

Overall, this descriptive evidence supports the notion that capital market separation is associated with meaningful differences in firm valuation. Firms that align with the carbon preferences of their investor base—particularly those that are both low-emission and owned by green investors—are rewarded with higher market valuations.

To rigorously test whether these valuation effects persist when controlling for potential confounders, we proceed by estimating a set of panel regressions. These regressions allow us to isolate the independent and joint effects of CCP and shareholder carbon preferences on firm valuation. As our primary carbon performance measure, we use carbon intensity, while industry-adjusted Tobin's Q serves as the main valuation metric. For convenience, the regression specification outlined in Equation (4) from subsection 2.2 is repeated below. The baseline model incorporates firm-level controls, industry fixed effects (λ_s), and time fixed effects (τ_t) in order to capture unobserved heterogeneity:

$$Valuation_{s,t} = \alpha + \beta_1\, CCP_{s,t} + \beta_2\, Shareholder\ preference_{s,t} + \beta_3\, \big(CCP_{s,t} \times Shareholder\ preference_{s,t}\big) + \eta'\, Controls_{s,t} + \lambda_s + \tau_t + \varepsilon_{s,t}. \quad (4)$$

To ensure that the observed valuation effects are not confounded by other firm-specific characteristics, our regression models include a comprehensive set of control variables covering key financial and ownership dimensions. Following the approach of Paulus and Rohleder (2022), we control for firm size, profitability, capital expenditures, and leverage. In addition, we account for the firm's ownership structure to capture the potential influence of different investor types on valuation outcomes. Firm size is measured as the natural logarithm of total assets, reflecting the notion that larger firms are typically more exposed to public scrutiny and regulatory oversight, which may influence both their ESG engagement and investor composition (Durnev and Kim, 2005). Profitability is proxied by return on assets, defined as net income prior to financing costs divided by total assets. This metric captures a firm's operational efficiency and overall financial performance, which are important determinants of valuation. Capital expenditures, scaled by total assets, serve as a proxy for investment intensity and capture differences in firms' growth strategies and capital allocation behavior (Lins, 2003). Leverage, calculated as the ratio of total liabilities to total assets, accounts for differences in firms' capital structure and the potential disciplining role of creditors (Jensen and Meckling, 1976; Myers, 1977).

As outlined in the literature section, prior studies suggest that it is preferable to avoid assuming uniform preferences within broad investor groups (e.g., Bushee, 1998; Hoskisson et al., 2002). In addition, empirical evidence indicates that ownership structure can have a direct impact on firm value (e.g., De Miguel et al., 2004; Wei et al., 2009). To account for potential heterogeneity in investor influence, we include ownership shares ($Ownership\ share_{k,s,t}$) for 17 distinct investor categories as control variables. Each ownership share is computed as the proportion of shares held by investor category k relative to the total ownership of firm s at time t. The calculation of ownership share is presented in Equation (13):

$$Ownership\ share_{k,s,t} = \frac{Shares\ held_{k,s,t}}{\sum_{k=1}^{17} Shares\ held_{k,s,t}}. \tag{13}$$

Since the ownership shares across categories aggregate to one by construction, one category must be omitted to avoid perfect multicollinearity. We use "Bank and Trust" investors as the reference group, as this category is broadly represented and does not systematically align with either green or brown firms.[12] This approach enables us to capture variation in firms' shareholder composition across investor types and to control for ownership-related valuation effects.

All variables are winsorized at the 1% and 99% level to reduce the influence of outliers, except for the ownership shares. Standard errors are clustered at the firm level, and our models include fixed effects for industry and time to control for unobserved heterogeneity. This specification ensures that the estimated interaction effects between CCP and shareholder preference are not driven by omitted variable bias or structural differences across sectors or time periods. The regression results are reported in Table 5.

[Insert Table 5 here.]

The results show that both CCP and shareholder preference for carbon-intensive portfolios are negatively related to firm valuation, measured by industry-adjusted Tobin's Q. While the coefficient on firm-CI is not consistently statistically significant across specifications, the effect of shareholder preference-CI is negative and statistically significant throughout. Most importantly, the interaction term between firm-CI and shareholder preference-CI is positive and statistically significant for both valuation measures. This finding indicates that the negative valuation effect associated with poor CCP is moderated by shareholder preferences. In economic terms, the valuation discount from poor carbon performance is less pronounced the more a firm is owned by investors with brown (i.e., weak or absent climate-related) preferences.

A natural concern is that shareholder preferences may respond to contemporaneous firm valuation or to short-run shocks that also affect both ownership and prices. To mitigate such concerns, we re-estimate our baseline specification using lagged shareholder preferences and,

[12] See Table A4 in the Appendix for summary statistics on the different investor types.

more stringently, using lagged preferences and lagged CCP. Across both lag structures, the coefficient on the interaction term remains statistically and economically consistent with our baseline results, indicating that the alignment channel is not driven by contemporaneous co-movements. In addition, we conduct a placebo test in which shareholder preferences are randomly reassigned within industry-quarters, which eliminates the overall effect of shareholder preferences as well as the interaction effect, as expected.[13]

These results are consistent with our hypotheses. H1 is supported insofar as firms owned by shareholders with portfolios tilted toward poor CCP exhibit lower firm valuation. H2 is supported by the positive interaction effect, which shows that due to capital market separation, the negative relationship between poor CCP and firm valuation is stronger for firms predominantly held by climate-conscious ("green") investors and weaker when ownership is concentrated among investors with neutral or less climate-sensitive ("brown") preferences. In very rare cases—at the very extreme of brown preferences—the interaction effect can even imply a positive valuation effect for firms with poor CCP when ownership is dominated by strongly brown investors whose preferences align with the firm's emission profile. This pattern is consistent with the stakeholder influence capacity framework of Barnett (2007, 2019), which posits that firms can enhance value by aligning their strategies with the preferences of their most salient stakeholders—here, their shareholders. To further strengthen the robustness of our findings, we incorporate firm and country fixed effects, which control for firm-specific and regional characteristics that might influence firms' carbon performance and investors' preferences. The effects remain robust not only in the fully specified models but also in a univariate and multiple pooled regression.[14] It is important to note, that firm fixed effects represent the most stringent specification and absorb all cross-sectional variation that is central

[13] The results for the lagged shareholder preference-CI / firm-CI regressions and the placebo test are available upon request.
[14] The results for the pooled regression models are available upon request.

to our analysis. Since our research question explicitly relies on cross-sectional differences in CCP and shareholder preferences, we adopt industry and time fixed effects as our baseline specification. This approach allows us to control for sectoral and temporal heterogeneity while preserving the economically meaningful variation required to identify valuation effects associated with capital market separation.

To gauge economic significance, note that in the interaction model the marginal valuation effect of carbon intensity depends on shareholder preferences, $\frac{\partial Q_{s,t}}{\partial CI_{s,t}} = \beta_1 + \beta_3\, Shareholder\ preference_{s,t}$. Using the industry- and time-fixed effects estimates in Table 5 (Column (3), $\widehat{\beta_1} = -0.013, \widehat{\beta_3} = 0.027$) and the dispersion in our sample, a one–standard deviation increase in firm carbon intensity ($SD\ (CI) = 1{,}020.35$ t CO_2e per $ million revenues) is associated with a change in industry-adjusted Tobin's Q of $\left(\widehat{\beta_1} + \widehat{\beta_3}\ Shareholder\ preference_{s,t}\right) \times SD\ (CI)$ evaluated at a given preference level.[15] Evaluating this expression at the 10th percentile of shareholder preference-CI ($Shareholder\ preference_{s,t}\ =\ 38.48$) and at the 90th percentile ($Shareholder\ preference_{s,t}\ =\ 310.71$) shows that the valuation penalty from poor carbon performance is substantially larger for firms predominantly held by green owners ($\Delta Q = -0.0122$) and markedly attenuated for firms held by brown owners ($\Delta Q = -0.0047$). This back-of-the-envelope comparison makes the alignment channel transparent and mirrors the marginal-effects patterns depicted in Figure 1.

[Insert Figure 1 here.]

To graphically illustrate the joint effects of firm-level carbon performance, shareholder preferences, and their interaction on firm valuation, Figure 1 visualizes the estimated marginal

[15] As firm-CI and shareholder preference-CI have been devided by 1,000 in Table 5 to yield meaningful coefficients, the variables must be devided by 1,000 in this calculation as well.

effects. Panel A shows that for moderate percentiles of shareholder preference, the linear predictions are downward sloping. Further, the higher the preference, the stronger the downward slope. This indicates that, for the vast majority of firms, improving CCP—becoming greener—is associated with higher firm valuation. This effect is stronger, the greener the shareholder base.

In Panel B, the extremes of firms with a green shareholder base do not differ visibly from one another as all green lines are strongly downward sloping. However, there are distinct differences between the extremes of firms with a brown shareholder base. While the 95th percentile still shows a downward sloping but almost flat linear prediction—in line with the remainder of the distribution, the 97th percentile shows an upward sloping linear prediction. This indicates that for these investors, the non-financial utility from holding brown stocks outweighs the non-financial utility from holding green stocks experienced by green investors—in other words, becoming browner increases firm valuation. Looking at the 99th percentile, the upward slope becomes extremely steep, consistent with a small tail of owners with strongly brown revealed preferences, representing a non-negligible counterweight to green investors regarding the valuation of brown firms.

To further investigate why such patterns persist, we analyze transition matrices that track the stability of firms' and shareholders' positions over time.[16] The transition matrices indicate that firms at both ends of the owner-preference distribution—the greenest and the brownest—which, due to capital market separation, are also predominantly green and brown

[16] See Table A5 in the Appendix for the results of the transition matrices.

firms, respectively—exhibit particularly strong persistence within their respective deciles, both in the short-term (one-year horizon) and long-term (full observation period).[17]

Given that a firm's observation period can extend up to 19 years, the observed persistence rates are remarkably high. This persistence suggests that capital market separation is not only present but deeply entrenched. Investors with strong climate-related preferences—whether favoring green or brown assets—show little inclination to adjust their holdings. This behavior aligns with the notion that some investors derive non-financial utility from holding green assets ("warm-glow"), while others deliberately hold brown assets, potentially to exploit pricing effects induced by these discriminatory tastes. Our finding that the number of brown investors is relatively small but characterized by particularly strong preferences is also broadly consistent with the neglected-stock argument for sin assets proposed by Hong and Kacperczyk (2009).

A potential explanation for this persistence and the observed valuation effects draws on insights from Albuquerque et al. (2019), who argue that firms' commitment to sustainability fosters stakeholder loyalty, enhancing profitability, firm value, and risk profiles. Analogous to customer loyalty, firm valuation may benefit when investors are willing to hold equity stakes over longer horizons and act as loyal owners. Our findings indicate that such ownership loyalty is particularly pronounced when a firm's climate profile—whether green or, in rare cases, brown—aligns with the climate-related preferences of its shareholders.

[17] To further strengthen the robustness of our findings, we examine whether the observed effects at the extreme ends of the shareholder preference distribution could be driven by strategic or non-financial ownership stakes, as suggested by Benz et al. (2020). Certain investors, such as state owners of energy companies, may not plausibly reflect climate-related preferences, and persistent strategic holdings may not result from portfolio rebalancing. To address this concern, we restrict the sample to investor types that are plausibly motivated to align their portfolios with carbon-related preferences, including investment advisors and hedge funds, pension funds, insurance companies, endowment funds, venture capital funds, and private equity funds. The results of this robustness test remain comparable to those obtained using the full investor sample.

Overall, evidence from the regression analysis, marginal effects, and transition matrices jointly indicates that firm valuation reflects the interaction between CCP and shareholder carbon preferences. Consistent with theories of capital market segmentation and stakeholder influence, poor CCP is associated with negative valuation effects when ownership is dominated by climate-conscious investors. When CCP aligns with shareholder carbon preferences, these negative valuation effects are mitigated and may even translate into positive valuation effects.

4.2 Temporal and Regional Valuation Effects of the Capital Market Separation

Building on the baseline valuation results presented in Subsection 4.1, this section examines whether the valuation effects of capital market separation vary systematically across time and regions. Motivated by Hypotheses H3 and H4, we focus on two dimensions that are central to the evolution and relevance of climate-related investor preferences: the introduction of the Paris Agreement in 2015 and differences between the U.S. and the EU. The regression results are reported in Table 6.

[Insert Table 6 here.]

We first investigate whether the interaction between CCP and shareholder carbon preferences has become more relevant following the Paris Agreement. To this end, we split the sample into a pre-Paris period and a post-Paris period and re-estimate the baseline regression specification separately for both subsamples. The results indicate that the positive moderating effect of shareholder preferences on the relationship between CCP and firm valuation is more pronounced in the post-Paris period. Specifically, the interaction term between CCP and shareholder preferences exhibits a stronger positive association with Tobin's Q after 2015, suggesting that the valuation implications of capital market separation have intensified in the wake of the Paris Agreement. At the same time, shareholder preferences themselves exert a stronger negative direct effect on firm valuation in the post-Paris period, consistent with heightened investor sensitivity to carbon-related firm characteristics. Importantly, both the direct effect of shareholder preferences and the interaction effect remain statistically significant in the pre-Paris period, indicating that capital market separation was already present before the Paris Agreement. However, the amplification of these effects in the post-Paris period supports Hypothesis H3.

We next turn to regional differences by estimating the model separately for firms headquartered in the U.S. and the EU. This analysis sheds light on whether institutional, regulatory, and market-structure differences translate into heterogeneous valuation effects of capital market separation across regions. The results reveal a stark contrast between the two regions. In the U.S., we find a consistently significant negative valuation effect of shareholder carbon preferences in both the pre- and post-Paris periods. Moreover, this effect is significantly moderated by CCP, as indicated by a positive and statistically significant interaction term. These findings suggest that U.S. capital markets exhibit a pronounced and persistent form of carbon-based segmentation, in which the alignment between firm-level carbon performance and shareholder preferences plays a central role in shaping firm valuation. In contrast, for firms headquartered in the EU, neither the direct effect of shareholder preferences nor the interaction between CCP and shareholder preferences is statistically significant in either period. This absence of significant valuation effects suggests that, despite increasing regulatory attention to climate issues in the EU, carbon-related investor preferences are not yet reflected in firm valuation through the same pricing channel observed in the U.S. Taken together, these results support Hypothesis H4 and point to meaningful regional heterogeneity in the valuation effects of capital market separation. While the U.S. market appears to consistently price the interaction between CCP and shareholder preferences, such effects are not detectable in the EU during the sample period. By contrast, the absence of comparable valuation effects in the EU may reflect a setting in which sustainability considerations are more deeply embedded in regulation and mainstream investment practices. In such environments, investor preferences may be broader but less extreme, reducing the scope for pronounced valuation differentials driven by preference alignment. Rather than being reflected in equity pricing, climate considerations may therefore operate primarily through regulatory and institutional channels.

The cross-regional differences in valuation effects between the U.S. and the EU are in line with prior evidence on political polarization and region-specific ESG investment dynamics. Prior research shows that climate change beliefs and their behavioral implications vary substantially across countries and within U.S. states, particularly along political and cultural dimensions (e.g., Hornsey et al., 2018; Mildenberger et al., 2017). Chan and Tam (2023) demonstrate that political divides over climate change are especially pronounced in societies characterized by high individualism and fossil fuel dependence—features that are particularly salient in the U.S. These conditions are conducive to sharply differentiated investor preferences, which can translate into stronger valuation effects when shareholder preferences interact with firm-level carbon performance. In line with this view, Mani et al. (2018) document heterogeneous regional reactions to the Paris Agreement, suggesting that political and social contexts shape how climate-related information is incorporated into market prices. Bardos et al. (2025) further show that in regions with weak political support for sustainable investing but high exposure to climate risks—such as the U.S.—investors are more likely to develop strong individual climate preferences and express them actively in their investment decisions. Consistent with this interpretation, the ESG debate in the U.S. has become increasingly polarized (Smith et al., 2024), giving rise to investor segments with strongly opposing climate-related views. Such polarization amplifies valuation-relevant capital market separation, as firm value becomes more sensitive to the alignment between CCP and shareholder preferences. Complementary evidence is provided by Görgen et al. (2025), who document post-Paris capital market separation in U.S. stock lending markets, pointing to additional channels through which climate-related preferences affect asset pricing.

Overall, the temporal and regional analyses reinforce the view that capital market separation is a dynamic phenomenon whose valuation implications depend on country-specific circumstances. Following the Paris Agreement, carbon-related preferences appear to have become more strongly reflected in market valuations, particularly in the U.S., where investor behavior is more closely associated with firm valuation outcomes.

5 Robustness Analyses

5.1 Emission Data Quality

A recurring concern in empirical research on climate finance relates to the quality and comparability of carbon emission data. In particular, the use of model-estimated emission figures alongside firm-reported values may introduce measurement error, which could potentially affect inference. This issue is especially relevant because estimated emissions are known to be less precise and may fail to correctly identify firms with particularly high emission levels (Kalesnik et al., 2022). At the same time, existing evidence suggests that such estimated data can be used with relatively limited bias in cross-sectional settings, while analyses that focus on changes over time should be interpreted more cautiously (Rohleder et al., 2022).

In our baseline analysis, we follow the standard approach in the literature and rely on the best available emissions data, recognizing that investors' portfolio decisions—and thus revealed preferences—are necessarily formed based on imperfect and partly estimated information. To ensure that our results are not driven by potential noise in model-based emission estimates, we conduct a robustness check in which we restrict the sample to firms that directly report Scope 1 and Scope 2 emissions. By excluding all observations with estimated emissions data, we increase data reliability at the cost of a smaller sample.

The results of this exercise are reported in Table 7. The estimated coefficients remain economically meaningful and statistically significant, and their magnitude is closely aligned with those obtained in the baseline specifications. This confirms that our main findings are not sensitive to the inclusion of estimated emissions and that the observed valuation effects related to capital market separation are not an artifact of emission data quality.

[Insert Table 7 here.]

5.2 Investor Type Composition

A further robustness concern relates to the heterogeneity of shareholder types included in our ownership-based preference measure. Aggregating all owners—from institutional investors to governments or corporate insiders—could potentially blur the interpretation of carbon-related preferences. In particular, certain holdings may reflect strategic, political, or long-term control motives rather than active portfolio choices based on environmental considerations. For example, state ownership in carbon-intensive firms or entrenched insider stakes are unlikely to adjust in response to climate-related preferences.

To address this concern, we re-estimate our main specifications using a restricted investor sample that focuses on owner types for which portfolio allocation decisions plausibly reflect carbon-related preferences. This subsample includes investment advisors and hedge funds, pension funds, insurance companies, endowment funds, venture capital funds, and private equity funds. These investors are typically characterized by professional asset management and greater flexibility in reallocating capital.

The results, reported in Table 8, remain statistically and economically robust and closely mirror our baseline findings. This suggests that the documented valuation effects and the associated capital market separation are not driven by strategic or non-adjustable ownership positions but persist among investor groups for whom climate-related preferences are more likely to be reflected in active investment decisions.

[Insert Table 8 here.]

5.3 Industry Scope

Another potential concern is that the relevance of carbon-related investor preferences may differ across industries, as emissions are not equally material for all types of firms. In sectors with limited direct emissions, carbon performance may play only a secondary role in investment decisions, potentially weakening the interpretation of capital market separation.

To address this issue, we conduct an additional robustness test by focusing on industries in which carbon emissions are most economically salient. Specifically, we restrict the sample to the most carbon-intensive TRBC business sectors: Basic Materials (Chemicals, Mineral Resources, Applied Resources), Energy (Energy - Fossil Fuels, Renewable Energy, Uranium), and Utilities. These sectors account for a substantial share of global corporate emissions and are therefore particularly exposed to carbon-related scrutiny by investors.[18]

The results for this industry-focused subsample are reported in Table 9. Consistent with our baseline analysis, the estimated valuation effects remain statistically significant and economically meaningful. This indicates that our findings are not driven by low-emission industries where carbon performance may be less relevant, but also hold in sectors where emissions are central to firms' economic activities.

[Insert Table 9 here.]

[18] See Table A2 in the Appendix for a comparison of industry-specific firm-CI.

5.4 Alternative Firm Valuation Metrics

In our primary analyses, we rely on industry-adjusted Tobin's Q as the main proxy for firm valuation. Tobin's Q is widely used in the finance literature to capture market-based valuation effects (e.g., Servaes and Tamayo, 2013; Cahan et al., 2015; Serafeim, 2020; Bolton and Kacperczyk, 2023). Nevertheless, prior research highlights several limitations of Tobin's Q, particularly when it is used to assess firm performance or valuation effects in the presence of investment frictions and measurement error. For example, Dybvig and Warachka (2015) argue that Tobin's Q does not adequately capture firm performance and that performance can have an ambiguous effect on Tobin's Q, especially under underinvestment. Similarly, Bartlett and Partnoy (2020) document that Tobin's Q may produce biased estimates due to omitted assets and unobserved, time-varying firm-specific characteristics.

To ensure that our main results are not driven by these limitations, we extend our analysis by employing alternative firm valuation metrics. In addition to the industry-adjusted Tobin's Q, we also use the standard (non-industry-adjusted) Tobin's Q as an alternative valuation proxy to confirm the robustness of our findings. In line with the notion that relative performance measures are most naturally evaluated against relative valuation metrics, we complement our baseline specifications with both absolute and relative valuation measures based on enterprise value (EV). Enterprise value is frequently used in practice and academic research as a comprehensive measure of firm value, as it reflects the market value of both equity and debt claims. Following Matsumura et al. (2014), we first use enterprise value as an unscaled, absolute measure of firm valuation and combine it with firm-level total emissions. Prior studies show that unscaled market value models often outperform scaled specifications and yield more intuitive and economically meaningful coefficients (e.g., Barth and McNichols, 1994; Barth and Clinch, 2009). The enterprise value (EV) of firm s at time t is calculated using Equation (14):

$$EV_{s,t} = Market\ capitalization_{s,t} + Net\ debt_{s,t} - Cash_{s,t} + Minority\ interest_{s,t} + Preferred\ stock\ value_{s,t}. \quad (14)$$

Because enterprise value is a total valuation measure and therefore does not directly allow for comparisons in terms of over- or undervaluation, we additionally employ a relative valuation metric based on enterprise value multiples. Specifically, we calculate the enterprise value multiple (EVM) as the ratio of enterprise value to earnings before interest, taxes, depreciation, and amortization (EBITDA). Valuation multiples based on EV have been shown to possess substantial explanatory power and to provide consistent and accurate representations of firm value (e.g., Chullen et al., 2015; Lin and Sanger, 2019). The enterprise value multiple (EVM) of firm s at time t is calculated using Equation (15):

$$EVM_{s,t} = \frac{EV_{s,t}}{EBITDA_{s,t}}. \quad (15)$$

Analogous to our baseline analyses employing Tobin's Q, we also construct an industry-adjusted version of the EVM to account for systematic differences in valuation across sectors. Finally, to focus exclusively on equity-based valuation, we further employ the price-to-earnings (P/E) ratio as an additional robustness measure.

Across all alternative valuation metrics—EV, EVM (both raw and industry-adjusted), and the P/E ratio—our results remain qualitatively unchanged.[19] Shareholder carbon preferences continue to exhibit valuation relevance, and the interaction between CCP and shareholder preferences remains statistically significant. These findings confirm that our main conclusions are not specific to Tobin's Q but reflect a robust relationship between capital market separation and firm valuation across a broad set of valuation metrics.

[19] The regression results based on the alternative firm valuation metrics are available upon request.

5.5 Alternative Carbon Metrics

Our baseline results rely on carbon intensity as the central proxy for CCP. To assess whether the observed valuation effects of capital market separation depend on this specific metric, we broaden the empirical design along several dimensions. First, we augment the analysis with firms' total greenhouse gas emissions. This provides an absolute measure of a company's carbon footprint rather than emissions scaled by firm activity. Second, we consider alternative intensity-based measures by normalizing emissions with market capitalization or enterprise value instead of revenues. Finally, to account for investors' exposure to climate-related risks beyond realized emissions, we incorporate firms' carbon risk ratings as an additional dimension of climate performance.

The carbon risk rating, provided by Sustainalytics and accessed via Morningstar Direct, is an inherently forward-looking indicator and quantifies a firm's unmitigated exposure to carbon-related risks on a scale from 0 to 100. The assessment combines two core components. The exposure dimension captures the relevance of carbon risks along the firm's value chain, encompassing upstream supply chains, internal operations, and downstream products or services. The management dimension evaluates the extent to which a firm has implemented policies and practices to address and reduce these risks. The resulting score reflects the residual level of carbon risk after accounting for existing mitigation efforts, thereby separating risks that are unavoidable from those that remain insufficiently managed (Morningstar, 2018).

We continue to observe consistent and robust valuation effects linked to the interaction between CCP and shareholder preferences across all alternative carbon metrics, lending further support to our main results.[20] After accounting for financial characteristics and ownership structure, the interaction term remains statistically significant at the 1% level for all CCP

[20] The regression results based on the alternative corporate carbon performance metrics are available upon request.

measures, except when using the carbon risk rating, for which it is significant only at the 10% level. This indicates that the valuation effects associated with capital market separation primarily reflect investors' preference for green companies rather than variations in risk exposure.

Nevertheless, several limitations related to the selection of carbon metrics and data availability may impact the comparability of these findings. Total emissions are closely tied to firm size, making it difficult to fully disentangle carbon preferences from scale effects. Similarly, the carbon risk rating may be subject to selection concerns, as coverage is determined by Sustainalytics and may influence the extent of the observed separation. In addition, the availability of carbon risk ratings is limited to the post-2013 period, resulting in a substantially shorter time series than for the other CCP measures.

6 Conclusion and Implications

This paper examines whether climate-related investor preferences translate into valuation effects in segmented capital markets. Building on theoretical models of capital market separation and recent empirical evidence on carbon-based ownership patterns, we analyze how the interaction between firms' carbon performance and the carbon preferences of their shareholder base affects firm valuation. By combining comprehensive ownership data with multiple emissions measures and valuation metrics, our study provides novel empirical evidence on the pricing implications of climate-related capital market separation.

Our main finding is that shareholder carbon preferences have economically and statistically significant valuation effects that are conditional on firms' carbon performance. Firms are valued more favorably when their emissions profile is aligned with the preferences of their owners. In segmented capital markets, green firms benefit from valuation premiums when held by investors with strong preferences for low carbon exposure, consistent with the existence of non-financial utility (“taste” or “warm-glow”) in investment decisions. Conversely, firms with high emissions can also experience valuation benefits when they are predominantly owned by investors with extremely brown preferences. These results imply that valuation effects do not depend on carbon performance in isolation, but crucially on the alignment between firm characteristics and the shareholder base.

We further show that these valuation effects are dynamic and heterogeneous across time and regions. In line with prior evidence on capital market separation, valuation differentials intensify in the post-Paris Agreement period, when climate-related norms, regulatory expectations, and investor awareness increased markedly. A significant valuation effect is observed in the U.S., but not in the EU. This regional asymmetry is consistent with the interpretation that stricter and more uniform EU climate regulation may have reduced the dispersion between firm behavior and investor expectations, whereas in the U.S. the Paris Agreement coincided with a sharper polarization of investor preferences.

Our results are robust across a wide range of specifications. The valuation effects persist when using alternative measures of carbon performance, including total emissions, different carbon intensity definitions, and risk-based carbon scores, as well as across various firm valuation metrics. The findings are also robust to different fixed effects structures, demonstrating that the documented effects are not driven by unobserved firm characteristics, industry composition, or time-specific shocks.

The findings carry several important implications for a carbon-preference-based capital market separation. For firms, our results highlight that corporate “greenness” shapes not only their investor base but also their valuation through the preferences of that investor base. From a shareholder value perspective, it is therefore strategically important for firms to understand the preferences of their owners. Firms positioned near the boundary between green and brown markets may increase their valuation by improving carbon performance and attracting sustainability-oriented investors. However, firms with a strongly brown shareholder base may face incentives to maintain—or even intensify—their carbon-intensive business model if this aligns with investor preferences. This interpretation is supported by the transition matrices, which show high persistence for firms with the greenest and especially the brownest owners, both in the short run and over the full sample period.

For the debate on impact investing, our results provide nuanced insights. On the one hand, the existence of valuation differentials between green and brown firms suggests that the portfolio allocation channel can be effective: capital market separation leads to differences in expected returns and financing costs, thereby creating financial incentives for firms to decarbonize. On the other hand, our findings also indicate potential limits to this mechanism. If brown firms are owned by investors with persistently brown preferences, these firms may continue to receive favorable valuations without reducing emissions, which raises questions about the aggregate real-world impact of preference-driven investing through portfolio reallocation alone.

These dynamics resonate with the theoretical arguments of Friedman and Heinle (2016), who show that firms may strategically reshape their shareholder base—for example through spin-offs—to enhance valuation by improving preference alignment. In a climate context, this suggests that firms may have incentives to separate carbon-intensive activities rather than transform them, potentially increasing valuation without delivering corresponding emissions reductions. While such strategies may be value-enhancing for shareholders, they could weaken the environmental effectiveness of market-based climate action if they primarily reallocate ownership rather than reduce real emissions.

Several limitations should be acknowledged. While our ownership data cover the largest and most relevant shareholders—on average around two-thirds of market capitalization—investor preferences cannot be perfectly observed, particularly for small, nonreporting investors. In addition, emissions data availability remains limited, especially for Scope 3 emissions, which may bias the sample toward firms with stronger disclosure incentives. Nevertheless, the robustness of our results across multiple measures and specifications suggests that these limitations do not drive our main conclusions. Moreover, while we document revealed preferences from actual investment behavior, we cannot distinguish whether these preferences are driven by taste, impact motives, or risk considerations.

Overall, our findings contribute to the growing literature on sustainable finance by demonstrating that capital market separation does not stop at ownership patterns but extends to firm valuation. Investor preferences matter for prices, but their effects depend critically on alignment with firm characteristics and on the broader regulatory and institutional environment. Understanding these dynamics is essential for investors, corporate managers, and policymakers seeking to harness financial markets as a lever for the transition toward a more sustainable economy.

Appendix

Table A1: Global market capitalization and ownership coverage of the ownership sample

Year	Global market capitalization (World Bank)	Aggregated market capitalization in stock dataset		Ownership data			
	$ Trillion	$ Trillion	As % of global market capitalization	Number of owners	Number of firms held	Value held in $ trillion	Covered ownership share
2004	36.54	33.07	90.50%	105,850	15,744	18.72	56.60%
2005	40.51	37.66	92.96%	129,311	17,135	22.16	58.84%
2006	50.07	46.28	92.42%	147,411	17,666	27.81	60.09%
2007	60.46	55.98	92.60%	166,621	18,596	34.82	62.21%
2008	32.42	29.75	91.77%	171,573	18,524	19.88	66.83%
2009	47.47	42.75	90.05%	175,728	18,697	27.14	63.48%
2010	54.26	49.20	90.68%	178,492	19,072	32.48	66.02%
2011	47.52	43.41	91.35%	183,314	19,170	28.46	65.56%
2012	54.50	49.42	90.67%	178,106	19,245	32.55	65.86%
2013	64.37	58.82	91.38%	177,906	19,405	39.87	67.79%
2014	67.18	59.65	88.79%	178,092	19,393	40.83	68.44%
2015	62.27	61.89	99.39%	193,313	20,219	42.66	68.93%
2016	65.12	63.74	97.88%	203,201	20,268	44.15	69.26%
2017	79.50	77.95	98.05%	211,662	20,523	54.32	69.68%
2018	69.03	66.86	96.86%	222,807	20,466	47.20	70.60%
2019	79.41	83.91	105.66%	222,887	20,287	59.55	70.97%
2020	95.20	98.06	103.01%	215,742	20,352	69.18	70.55%
2021	111.16	111.19	100.03%	223,712	19,573	79.53	71.53%
2022	93.69	89.02	95.02%	221,670	19,042	63.00	70.77%
Mean	63.72	60.98	94.69%	184,600	19,125	41.28	66.53%
Count				753,349	30,723		

This table shows summary statistics for the yearly coverage of global market capitalization and ownership data for our ownership sample from 2004 to 2022. Global market capitalization is the worldwide market value of common equity according to World Bank (2024). Aggregated market capitalization is the aggregated market value at each year-end out of our sample of 30,723 firms. The values exceeding 100% in certain years arise due to reporting discrepancies across countries in the World Bank's dataset. We report ownership data, including the number of owners observed, the number of firms held, the value held in $ trillion, and the covered ownership share, expressed as a proportion of aggregate market capitalization. The data are from the RDW database, ROP database, and World Bank (2024).

Table A2: Summary statistics by industry

Industry	Number of firms	Covered ownership share	Firm-TE	Firm-CI	Shareholder preference -TE	Shareholder preference -CI
Academic & Educational Services	44	78.91%	32.44	40.44	2,508.57	156.02
Applied Resources	140	71.60%	2,018.09	404.80	3,146.43	231.99
Automobiles & Auto Parts	252	67.06%	870.77	110.51	2,907.42	158.38
Banking & Investment Services	1,275	64.01%	77.43	24.22	3,247.51	199.11
Chemicals	365	65.93%	3,621.17	565.03	3,519.70	196.38
Collective Investments	63	46.59%	112.46	239.23	2,522.68	175.12
Consumer Goods Conglomerates	54	60.23%	2,772.46	226.11	3,471.32	245.23
Cyclical Consumer Products	420	74.40%	355.08	69.39	2,973.68	161.94
Cyclical Consumer Services	553	74.40%	286.88	108.91	2,567.03	152.71
Energy - Fossil Fuels	623	66.79%	6,566.70	869.15	4,075.45	306.57
Financial Technology (Fintech) & Infrastructure	33	70.46%	26.19	38.34	2,049.94	119.92
Food & Beverages	490	69.55%	832.37	150.78	2,692.41	175.96
Food & Drug Retailing	132	68.14%	1,264.29	55.40	2,885.02	168.82
Healthcare Services & Equipment	482	77.26%	174.43	64.43	2,786.19	164.23
Industrial & Commercial Services	658	70.69%	724.31	112.00	3,165.20	180.19
Industrial Goods	666	70.53%	303.01	54.06	3,346.09	174.95
Insurance	272	71.12%	73.56	33.72	3,445.31	183.05
Investment Holding Companies	53	63.94%	766.72	324.26	3,949.40	159.68
Mineral Resources	652	62.13%	6,692.22	1,299.00	3,196.84	270.32
Personal & Household Products & Services	90	73.99%	602.82	80.08	3,003.94	153.61
Pharmaceuticals & Medical Research	849	70.49%	142.53	250.42	2,201.99	168.82
Real Estate	795	71.25%	180.89	157.44	2,661.18	170.48
Renewable Energy	71	69.93%	592.46	342.89	3,059.84	165.10
Retailers	365	79.09%	271.85	54.74	2,769.74	165.06
Software & IT Services	777	76.41%	111.93	29.85	2,578.57	146.26
Technology Equipment	627	69.36%	413.93	78.40	3,023.86	163.54
Telecommunications Services	220	68.25%	1,141.59	115.75	3,476.67	233.81
Transportation	377	65.44%	3,487.42	478.49	3,715.70	222.84
Uranium	15	46.86%	117.81	1,158.96	2,253.60	214.84
Utilities	399	65.81%	14,777.19	2,251.49	5,166.86	375.66

This table shows descriptive statistics by business sector, based on the Thomson Reuters Business Classification (TRBC) over the sample period from 2004 to 2022. It reports ownership details, including the number of firms per industry and the mean covered ownership share, expressed as a proportion of aggregate market capitalization. Additionally, it provides information on carbon emissions data, such as the mean firm-TE (in kt CO_2e), the mean firm-CI (in t CO_2e per $ million revenues) per firm within each industry, and the mean shareholder preferences for total emissions and carbon intensity.

Table A3: Summary statistics by country

Country	Number of firms	Covered ownerhip share	Firm-TE	Firm-CI	Shareholder preference -TE	Shareholder preference -CI
Argentina	55	44.40%	1,454.67	931.20	1,915.59	728.37
Australia	534	47.71%	780.57	398.09	2,128.84	181.89
Austria	39	64.03%	2,052.03	344.42	2,583.47	128.91
Belgium	56	56.80%	900.32	301.41	3,369.30	132.73
Bermuda	52	78.81%	539.82	469.03	3,397.75	277.08
Brazil	145	69.51%	2,390.18	387.40	3,404.36	215.09
Canada	538	55.44%	1,193.17	552.05	2,958.46	258.93
Cayman Islands	12	77.71%	194.61	374.14	2,488.98	154.67
Chile	43	82.13%	3,117.08	858.58	1,959.41	388.84
China	1,130	65.05%	3,759.28	406.70	2,061.70	165.58
Colombia	23	79.57%	2,700.43	575.98	1,922.44	345.76
Cyprus	13	72.39%	299.06	205.85	1,949.27	111.31
Denmark	65	50.78%	2,409.08	143.74	4,177.31	161.43
Egypt	14	62.39%	330.10	163.71	966.55	67.81
Finland	82	57.04%	1,242.25	203.69	3,243.41	226.62
France	175	63.64%	4,002.47	217.31	4,722.96	146.84
Germany	292	62.34%	3,299.60	168.46	3,079.65	132.10
Greece	37	53.64%	2,262.43	499.11	3,247.50	250.56
Guernsey	18	64.47%	18.73	492.74	2,994.15	179.95
Hong Kong	179	69.70%	2,653.21	716.57	2,125.13	203.04
India	453	77.38%	3,657.41	727.56	4,538.32	516.58
Indonesia	68	74.19%	2,032.08	869.05	1,275.37	225.30
Ireland	61	74.15%	1,152.63	166.44	3,916.86	183.39
Israel	41	60.38%	496.12	148.69	1,455.89	84.49
Italy	116	62.33%	3,738.07	342.33	5,234.12	163.47
Japan	502	50.44%	2,252.47	203.81	3,283.28	164.73
Jersey	11	68.69%	267.38	826.95	2,672.55	165.25
Korea; South	172	61.42%	1,924.53	147.67	2,709.32	120.80
Kuwait	14	51.55%	140.48	86.60	2,092.48	97.30
Luxembourg	38	70.91%	5,763.65	372.00	3,761.54	162.32
Malaysia	205	76.48%	1,504.28	560.14	2,227.35	396.40
Mexico	67	52.92%	2,458.62	342.05	2,169.55	123.15
Netherlands	93	58.14%	798.77	127.63	3,696.23	164.69
New Zealand	62	44.04%	279.33	298.61	1,384.22	151.86
Norway	87	68.38%	1,828.74	372.86	3,225.09	171.88
Peru	31	76.09%	357.79	595.95	1,235.56	292.90
Philippines	31	69.91%	1,087.35	637.97	1,031.47	203.30
Poland	42	76.65%	3,868.92	764.14	4,508.00	507.26
Portugal	17	70.07%	3,379.09	732.09	2,464.19	143.62
Qatar	44	45.44%	174.32	226.38	2,138.94	234.48
Russia	56	62.51%	13,031.41	1,191.02	5,843.63	326.16
Saudi Arabia	39	50.69%	4,998.09	501.89	11,035.53	361.94
Singapore	111	62.74%	1,424.00	326.29	2,060.84	162.56
South Africa	151	76.89%	1,256.15	525.23	3,621.71	329.03
Spain	90	59.94%	3,212.77	340.56	3,089.67	158.04
Sweden	311	65.05%	281.50	155.86	1,785.03	115.88
Switzerland	214	58.32%	1,429.91	150.55	3,023.22	136.93
Taiwan	174	51.39%	1,234.57	286.97	2,524.09	215.91
Thailand	136	58.45%	2,840.83	597.29	2,790.27	270.47
Turkey	88	71.57%	2,282.52	743.45	1,177.94	142.68
United Arab Emirates	24	63.12%	803.75	137.86	1,487.33	101.38
United Kingdom	768	76.22%	1,592.25	229.42	4,189.48	184.88
United States of America	3,992	85.13%	1,499.82	264.05	3,347.12	189.30

This Table shows the number of firms, mean covered ownership share as a proportion of aggregate market capitalization over the sample period from 2004 to 2022. Additionally, it provides information on carbon emissions data, such as the mean firm-TE (in kt CO_2e), the mean firm-CI (in t CO_2e per $ million revenues) per firm within each country, and the mean shareholder preferences for total emissions and carbon intensity. The country refers to the location of the firm's headquarters.

Table A4: Portfolio characteristics by investor type

Investor type	Number of investors	Value held in $ tsd.	Number of firms held	Portfolio return	Investor preference -TE	Investor preference -TE (SD)	Investor preference -CI	Investor preference -CI (SD)
Bank and Trust	950	1,429,629	127.19	3.00%	1,635.39	2,266.57	295.08	551.41
Corporation	31,171	695,576	2.27	2.30%	462.62	1,674.08	322.92	976.60
Endowment Fund	34	906,634	25.72	3.60%	1,319.74	2,826.26	359.29	1,012.25
Hedge Fund	2,348	825,826	53.81	4.50%	607.79	1,094.07	268.74	562.35
Holding Company	556	2,342,312	5.53	3.00%	502.30	1,639.77	350.05	937.42
Individual Investor	236,248	31,026	1.12	2.80%	378.01	1,564.50	270.16	886.48
Institutions	144	48,341	1.07	1.20%	233.06	907.82	217.34	615.09
Insurance Company	370	3,654,766	70.81	3.00%	944.96	1,570.70	246.86	483.71
Investment Advisor	12,035	2,122,312	144.30	3.70%	1,191.49	1,579.89	251.11	408.44
Investment Adv./Hedge F.	2,298	6,770,919	251.50	4.00%	1,116.22	1,605.83	278.26	427.50
Other Insider Investor	2,590	1,335,590	1.14	2.80%	255.24	1,318.57	255.34	911.41
Others	816	9,696,400	10.64	2.80%	1,043.53	2,517.98	406.36	828.03
Pension Fund	394	6,074,558	274.06	3.40%	1,053.09	1,485.75	313.29	608.81
Private Equity	696	663,942	5.25	3.20%	345.31	1,298.11	357.29	1,092.56
Research Firm	275	5,405,366	327.72	3.00%	869.54	1,324.72	224.76	404.75
Sovereign Wealth Fund	52	26,104,863	258.66	3.10%	1,620.65	2,546.92	440.02	870.33
Venture Capital	381	360,574	6.67	3.20%	108.15	544.72	320.88	1,160.96

This table shows summary statistics of portfolio characteristics categorized by the Refinitiv's predefined typology. Portfolio characteristics are shown as mean values or standard deviations (SD) within each investor type over the sample period from 2004 to 2022. Investor preference-TE is displayed in kt CO_2e. Investor preference-CI is displayed in t CO_2e per $ million revenues.

Table A5: Transition matrices

Panel A. Annual transition matrices

Firm-CI (t = 1)

Firm-CI (t = 0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1)	84%	10%	2%	1%	1%	1%	1%	1%	0%	0%
(2)	9%	77%	11%	2%	1%	0%	0%	0%	0%	0%
(3)	3%	9%	74%	11%	2%	1%	1%	0%	0%	0%
(4)	1%	2%	9%	73%	11%	2%	1%	0%	0%	0%
(5)	1%	1%	2%	10%	73%	11%	2%	1%	0%	0%
(6)	1%	1%	1%	2%	10%	74%	10%	2%	0%	0%
(7)	1%	0%	0%	1%	2%	10%	76%	9%	1%	1%
(8)	0%	0%	0%	0%	1%	1%	8%	80%	8%	1%
(9)	0%	0%	0%	0%	0%	0%	1%	6%	85%	7%
(10)	0%	0%	0%	0%	0%	0%	0%	1%	7%	90%

Shareholder preference-CI (t = 1)

Shareholder preference-CI (t = 0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1)	88%	9%	1%	0%	0%	0%	0%	0%	0%	1%
(2)	7%	79%	12%	1%	0%	0%	0%	0%	0%	0%
(3)	1%	9%	72%	14%	1%	1%	0%	0%	0%	1%
(4)	0%	1%	11%	67%	16%	2%	1%	1%	1%	1%
(5)	0%	0%	1%	12%	62%	18%	3%	2%	1%	1%
(6)	0%	0%	0%	2%	15%	59%	18%	4%	2%	1%
(7)	0%	0%	0%	1%	3%	16%	58%	18%	3%	1%
(8)	0%	0%	0%	1%	1%	3%	17%	61%	14%	1%
(9)	0%	0%	0%	1%	1%	2%	3%	14%	68%	10%
(10)	1%	0%	1%	1%	1%	1%	1%	1%	10%	84%

Panel B. Transition matrices from first to last observation

Firm-CI (t = T)

Firm-CI (t = 0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1)	54%	15%	8%	4%	3%	4%	4%	5%	2%	2%
(2)	15%	47%	23%	7%	3%	2%	1%	1%	1%	1%
(3)	8%	20%	38%	19%	6%	2%	3%	1%	1%	1%
(4)	4%	8%	14%	35%	18%	9%	6%	4%	2%	1%
(5)	4%	4%	7%	15%	37%	16%	8%	5%	2%	1%
(6)	3%	2%	4%	8%	17%	35%	16%	9%	4%	2%
(7)	3%	2%	3%	5%	6%	16%	39%	18%	8%	2%
(8)	2%	1%	2%	4%	5%	8%	16%	39%	17%	7%
(9)	2%	1%	1%	1%	2%	3%	4%	13%	54%	20%
(10)	2%	0%	1%	3%	2%	2%	2%	5%	19%	64%

Shareholder preference-CI (t = T)

Shareholder preference-CI (t = 0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1)	42%	20%	11%	7%	4%	2%	2%	2%	3%	6%
(2)	12%	24%	21%	14%	8%	5%	5%	3%	4%	5%
(3)	7%	10%	19%	17%	14%	8%	6%	7%	7%	6%
(4)	5%	4%	8%	18%	17%	15%	10%	8%	7%	6%
(5)	6%	4%	4%	11%	17%	17%	17%	12%	8%	5%
(6)	3%	3%	4%	7%	11%	19%	22%	18%	9%	4%
(7)	4%	3%	3%	5%	10%	13%	21%	25%	10%	6%
(8)	4%	4%	3%	6%	7%	13%	15%	24%	17%	7%
(9)	5%	4%	6%	5%	8%	9%	11%	13%	24%	14%
(10)	4%	3%	3%	4%	6%	6%	6%	7%	20%	40%

Panel A shows annual transition rates of firm-CI and shareholder preference-CI, capturing changes of firms between deciles within each year (t) across all firms of our study sample. Panel B shows long-term transition rates, capturing changes from a firm's first (t = 0) to its last observation (t = T) in the dataset, spanning from a maximum of Q1 2004 to Q4 2022. Decile (1) represents the greenest submarket and Decile (10) the brownest submarket.

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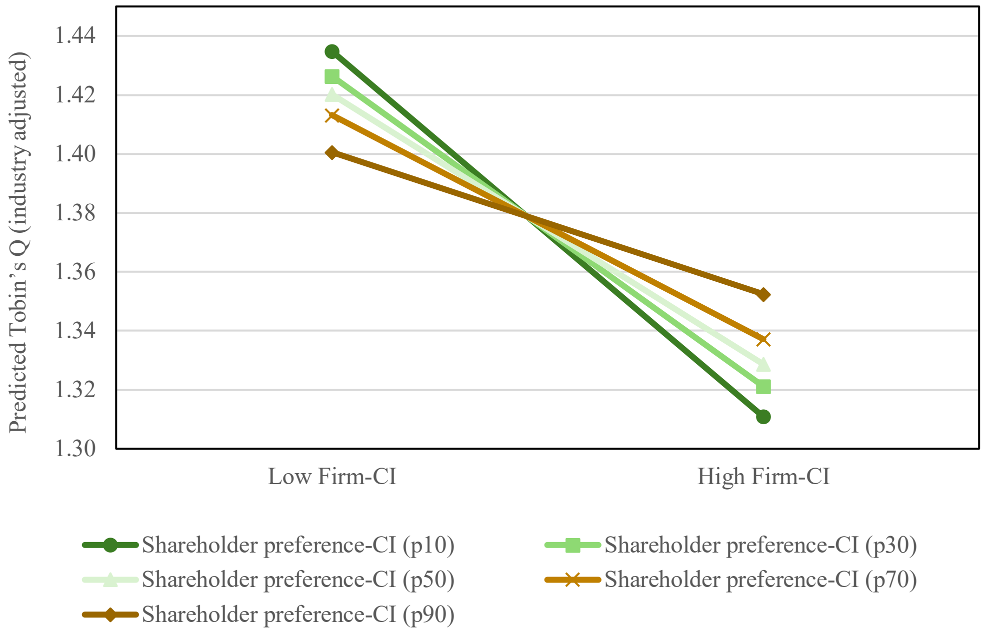
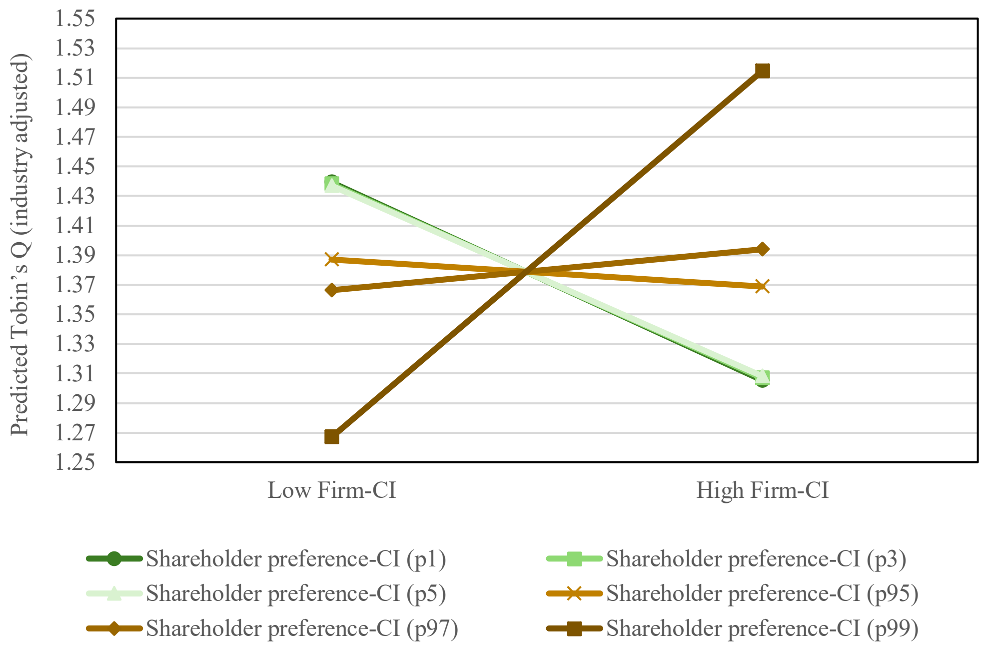
Figures

Figure 1: Impact of the interaction between firm-CI and shareholder preference-CI on industry-adjusted Tobin's Q

Panel A. Moderate percentiles



Panel B. Extreme percentiles



This plots shows the linear prediction of industry-adjusted Tobin's Q (vertical axis) as a function of firm-CI (horizontal axis) and shareholder preference-CI according to model (3) in Table 5. The marginal effects are evaluated at different points of the shareholder preference–CI distribution, corresponding to moderate percentiles in Panel A (10, 30, 50, 70, 90) and to extreme percentiles in Panel B (1, 3, 5, 95, 97, 99) percentiles. On the horizonal axis, "Low" corresponds to the minimum firm-CI and "High" corresponds to the maximum firm-CI.

Tables

Table 1: Global market capitalization and ownership coverage of the study sample

Year	Global market capitalization (World Bank)	Aggregated market capitalization in stock dataset		Ownership data			
	$ Trillion	$ Trillion	As % of global market capitalization	Number of owners	Number of firms held	Value held in $ trillion	Covered ownership share
2004	36.54	19.99	54.71%	20,733	1,418	11.10	55.50%
2005	40.51	25.35	62.57%	27,822	1,864	14.29	56.40%
2006	50.07	32.16	64.22%	30,724	2,046	18.49	57.50%
2007	60.46	38.48	63.65%	33,825	2,238	23.94	62.20%
2008	32.42	23.14	71.38%	37,894	2,568	15.35	66.35%
2009	47.47	33.02	69.56%	41,654	2,966	20.63	62.49%
2010	54.26	38.45	70.86%	45,486	3,508	25.07	65.21%
2011	47.52	34.97	73.59%	48,032	3,758	22.54	64.47%
2012	54.50	40.17	73.70%	47,227	3,874	26.01	64.74%
2013	64.37	47.61	73.97%	47,614	3,976	31.77	66.72%
2014	67.18	46.88	69.79%	47,815	3,993	31.89	68.02%
2015	62.27	47.87	76.88%	60,127	4,632	33.21	69.38%
2016	65.12	51.38	78.90%	76,658	5,467	36.06	70.18%
2017	79.50	66.45	83.58%	90,634	6,571	46.90	70.58%
2018	69.03	59.21	85.78%	100,833	7,335	42.24	71.34%
2019	79.41	76.58	96.43%	113,585	8,345	55.13	71.99%
2020	95.20	91.48	96.10%	124,876	9,493	65.35	71.43%
2021	111.16	104.08	93.63%	133,658	9,724	75.19	72.24%
2022	93.69	84.16	89.83%	137,414	9,910	60.17	71.50%
Mean	63.72	50.78	76.27%	66,664	4,931	34.49	66.22%
Count				291,358	11,811		

This table shows summary statistics for the yearly coverage of global market capitalization and ownership data for our study sample from 2004 to 2022. Global market capitalization is the worldwide market value of common equity according to World Bank (2024). Aggregated market capitalization is the aggregated market value at each year-end out of our sample of 11,811 firms. We report ownership data, including the number of owners observed, the number of firms held, the value held in $ trillion, and the covered ownership share, expressed as a proportion of aggregate market capitalization. The data are from the RDW database, ROP database, and World Bank (2024).

Table 2: Descriptive statistics

Panel A. Summary statistics

	N	Mean	Standard deviation	p1	Median	p99
Firm-level						
Tobin's Q	346,578	1.51	1.58	0.12	1.02	8.70
Tobin's Q (adj)	346,578	1.38	1.20	0.27	1.00	6.52
Shareholder preference-TE	350,911	3,155.71	3,415.72	25.27	2,601.72	15,259.64
Shareholder preference-CI	350,911	199.25	301.10	2.64	154.87	1,373.25
Firm-TE	350,911	1,948.29	7,586.67	0.05	71.84	45,200.00
Firm-CI	350,421	335.27	1,020.35	0.28	35.16	6,287.43
Revenues	350,911	6.89	14.48	0.00	1.92	83.18
Market capitalization	350,911	10.38	35.77	0.03	3.06	126.44
Total assets	347,662	26.00	83.68	0.05	4.24	464.69
Return on assets	345,338	6.27	44.69	-191.97	10.31	135.25
Leverage	350,911	37.88	26.27	0.00	36.35	99.90
Capital expenditures	350,156	12.98	34.30	0.00	3.86	201.85
Investor-level						
Investor preference-TE	4,811,001	1,927.75	6,413.83	0.07	96.38	34,839.90
Investor preference-CI	4,811,001	275.84	857.49	0.31	39.34	4,987.91

Panel B. Correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) Tobin's Q	1.00											
(2) Tobin's Q (adj)	0.81	1.00										
(3) Shareholder preference-TE	-0.10	-0.07	1.00									
(4) Shareholder preference-CI	-0.07	-0.05	0.51	1.00								
(5) Firm-TE	-0.09	-0.09	0.23	0.13	1.00							
(6) Firm-CI	-0.04	-0.04	0.07	0.16	0.47	1.00						
(7) Revenues	-0.12	-0.14	0.20	0.03	0.39	-0.03	1.00					
(8) Market capitalization	0.08	0.06	0.10	0.01	0.17	-0.03	0.50	1.00				
(9) Total assets	-0.17	-0.12	0.14	0.02	0.12	-0.04	0.47	0.37	1.00			
(10) Return on assets	0.11	0.20	0.06	-0.00	0.03	-0.05	0.05	0.09	-0.03	1.00		
(11) Leverage	-0.18	-0.11	0.06	0.02	0.07	0.02	0.11	0.03	0.22	-0.07	1.00	
(12) Capital expenditures	0.01	0.01	-0.01	0.02	0.00	0.14	-0.08	-0.03	-0.06	-0.13	-0.02	1.00

Panel A of this table shows summary statistics for firm characteristics relating to 11,811 distinct firms over the sample period from 2004 to 2022. All displayed variables are winsorized at the 1% and the 99% level. Tobin's Q is calculated as the sum of the market value of equity, the value of preferred stock, and total debt, divided by total assets. Tobin's Q (adj) equals the ratio of firm-level Tobin's Q to the industry median Tobin's Q. Firm-TE, shareholder preference-TE, and investor preference-TE are displayed in kt CO_2e. Firm-CI, shareholder preference-CI, and investor preference-CI are displayed in t CO_2e per $ million revenues. Revenues, market capitalization, and total assets are displayed in $ billion. Return on assets is calculated as net income prior to financing costs divided by total assets (in percent). Leverage is the ratio of total debt to total financing (in percent). Capital expenditures are scaled by total assets (in percent). Panel B shows Pearson correlations for key variables and each pair of variables used in our main analysis.

Table 3: Single-sorting analysis

Panel A. Firms sorted by: Firm-CI

Quintile	Firm-CI	Tobin's Q	Tobin's Q (adj)
(1) Green	4.09	1.44	1.66
(2)	15.00	1.73	1.41
(3)	36.39	1.62	1.32
(4)	114.39	1.52	1.30
(5) Brown	1,506.52	1.23	1.19
Brown – Green	1,502.43	-0.21	-0.47

Panel B. Firms sorted by: Shareholder preference-CI

Quintile	Shareholder preference-CI	Tobin's Q	Tobin's Q (adj)
(1) Green	37.64	1.66	1.50
(2)	104.34	1.71	1.48
(3)	155.41	1.54	1.39
(4)	212.16	1.42	1.31
(5) Brown	486.69	1.21	1.19
Brown – Green	449.05	-0.45	-0.31

This table shows mean firm characteristics across carbon-based submarkets formed by single-sorting. Firms are sorted into quintiles based on firm-level carbon intensity (firm-CI) as well as on shareholder preference-CI. Panel A shows results for submarkets formed on firm-level carbon intensity (firm-CI). Panel B shows results for submarkets based on shareholder preference for carbon intensity (shareholder preference-CI). Quintile (1) represents the greenest submarket and Quintile (5) the brownest submarket. The last row reports the difference between the brownest and the greenest submarket. Firm-CI and shareholder preference-CI are expressed in t CO_2e per $ million revenues. Tobin's Q is calculated as the sum of the market value of equity, the value of preferred stock, and total debt, divided by total assets. Tobin's Q (adj) equals the ratio of firm-level Tobin's Q to the industry median Tobin's Q.

Table 4: Double-sorting analysis

Panel A. Firm-CI

Shareholder preference-CI	Firm-CI (1) Green	(2)	(3)	(4)	(5) Brown
(1) Green	3.87	15.01	36.22	114.80	1628.31
(2)	3.91	14.86	36.23	112.15	1429.74
(3)	4.34	14.95	36.24	111.14	1218.60
(4)	4.33	15.06	36.46	113.41	1306.17
(5) Brown	4.13	15.18	36.84	119.94	1690.01

Panel B. Shareholder preference-CI

Shareholder preference-CI	Firm-CI (1) Green	(2)	(3)	(4)	(5) Brown
(1) Green	38.56	40.05	38.94	37.93	33.89
(2)	104.88	105.55	104.08	103.73	102.35
(3)	153.82	155.02	155.98	155.98	156.95
(4)	209.91	210.95	212.57	213.28	213.51
(5) Brown	470.52	417.45	439.97	437.04	572.75

Panel C. Tobin's Q

Shareholder preference-CI	Firm-CI (1) Green	(2)	(3)	(4)	(5) Brown
(1) Green	1.57	1.87	1.76	1.70	1.38
(2)	1.77	1.95	1.68	1.63	1.30
(3)	1.37	1.86	1.67	1.43	1.22
(4)	1.11	1.58	1.58	1.51	1.19
(5) Brown	0.94	1.21	1.35	1.36	1.15

Panel D. Tobin's Q (adj)

Shareholder preference-CI	Firm-CI (1) Green	(2)	(3)	(4)	(5) Brown
(1) Green	1.82	1.51	1.39	1.41	1.33
(2)	1.75	1.48	1.36	1.34	1.21
(3)	1.62	1.44	1.36	1.23	1.17
(4)	1.52	1.34	1.28	1.30	1.18
(5) Brown	1.43	1.19	1.16	1.21	1.12

This table reports mean values from a double-sorting procedure in which firms are jointly sorted into quintiles based on firm-level carbon intensity (firm-CI) and shareholder preference carbon intensity (shareholder preference-CI). Quintile (1) represents firms with the lowest firm-CI and the lowest shareholder preference-CI (the greenest submarket), while Quintile (5) represents firms with the highest firm-CI and the highest shareholder preference-CI (the brownest submarket). Panel A shows mean firm-CI by quintile, Panel B shows mean shareholder preference-CI, Panel C shows mean Tobin's Q, and Panel D shows mean industry-adjusted Tobin's Q. Firm-CI and shareholder preference-CI are expressed in t CO_2e per $ million revenues. Tobin's Q is calculated as the sum of the market value of equity, the value of preferred stock, and total debt divided by total assets. Tobin's Q (adj) equals the ratio of firm-level Tobin's Q to the industry median Tobin's Q.

Table 5: Panel regression of industry-adjusted Tobin's Q on firm-CI and shareholder preference-CI

Dependent: Tobin's Q (adj)	(1)	(2)	(3)	(4)	(5)
Firm-CI	-0.015*	-0.037***	-0.013	-0.010	-0.034***
	(-1.703)	(-4.588)	(-1.463)	(-1.388)	(-4.338)
Shareholder preference-CI	-0.146***	-0.125***	-0.126***	-0.023*	-0.143***
	(-6.672)	(-5.081)	(-5.893)	(-1.654)	(-5.775)
Firm-CI x Shareholder preference-CI	0.031***	0.029***	0.027***	0.013***	0.016***
	(5.731)	(5.013)	(5.106)	(3.274)	(2.704)
Firm size (log. total assets)	-0.217***	-0.184***	-0.212***	-0.306***	-0.199***
	(-29.699)	(-24.747)	(-29.244)	(-16.222)	(-25.766)
Return on assets	0.027***	0.027***	0.028***	0.014***	0.027***
	(21.413)	(20.501)	(21.455)	(18.450)	(20.441)
Leverage	-0.001**	-0.001	-0.001***	0.001**	-0.001**
	(-2.537)	(-1.598)	(-2.844)	(2.232)	(-2.228)
Capital expenditures	0.002***	0.001***	0.002***	0.001***	0.001***
	(6.259)	(2.986)	(6.557)	(3.637)	(3.371)
Ownership share Corporation	0.006***	0.007***	0.005***	-0.003**	-0.000
	(4.689)	(4.777)	(3.946)	(-2.567)	(-0.070)
Ownership share Endowment Fund	0.015	0.017	0.014	-0.007	0.004
	(0.687)	(0.822)	(0.659)	(-0.492)	(0.217)
Ownership share Hedge Fund	0.005***	0.006***	0.004**	-0.009***	-0.008***
	(3.169)	(3.127)	(2.426)	(-6.679)	(-4.012)
Ownership share Holding Company	0.004***	0.007***	0.003**	-0.002	0.001
	(2.947)	(3.797)	(2.417)	(-1.187)	(0.537)
Ownership share Individual Investor	0.007***	0.009***	0.006***	-0.003**	0.002
	(5.205)	(6.023)	(4.516)	(-2.285)	(1.033)
Ownership share Institutions	0.011	0.013**	0.011*	-0.001	0.003
	(1.623)	(2.043)	(1.708)	(-0.265)	(0.485)
Ownership share Insurance Company	0.001	0.004	0.001	-0.003**	-0.002
	(0.466)	(1.285)	(0.377)	(-2.218)	(-0.545)
Ownership share Investment Advisor	0.010***	0.012***	0.010***	-0.000	0.004**
	(8.062)	(7.631)	(7.605)	(-0.163)	(2.216)
Ownership share Investment Adv./Hedge F.	0.005***	0.007***	0.004***	-0.001	-0.003*
	(4.120)	(4.312)	(3.463)	(-1.103)	(-1.908)
Ownership share Other Insider Investor	0.005***	0.007***	0.005***	0.001	0.002
	(3.053)	(3.719)	(2.599)	(0.536)	(0.844)
Ownership share Others	0.007***	0.008***	0.006***	-0.000	0.001
	(5.333)	(5.042)	(4.695)	(-0.186)	(0.404)
Ownership share Pension Fund	0.003*	0.003	0.002	0.000	0.001
	(1.838)	(1.608)	(1.435)	(0.124)	(0.634)
Ownership share Private Equity	0.004**	0.005***	0.003*	-0.002	-0.004*
	(2.406)	(2.665)	(1.708)	(-1.639)	(-1.786)
Ownership share Research Firm	0.023***	0.027***	0.023***	0.003	0.016***
	(5.290)	(7.691)	(5.311)	(1.609)	(5.351)
Ownership share Sovereign Wealth Fund	0.003*	0.003*	0.002	-0.001	0.001
	(1.946)	(1.877)	(1.238)	(-0.609)	(0.492)
Ownership share Venture Capital	0.021***	0.022***	0.020***	-0.007*	0.011***
	(6.593)	(6.674)	(6.340)	(-1.706)	(3.308)
Industry fixed effects	Yes	No	Yes	No	No
Firm fixed effects	No	No	No	Yes	No
Country fixed effects	No	No	No	No	Yes
Time fixed effects	No	Yes	Yes	Yes	Yes
N	300,433	300,433	300,433	299,681	300,433
Adjusted R^2	0.25	0.14	0.25	0.80	0.17

This table shows quarterly panel regression estimates for Tobin's Q (adj) as a function of firm-CI, shareholder preference-CI (both divided by 1,000) and their interaction, controlling for key financial and ownership characteristics. Firm size is the natural logarithm of the book value of assets. Return on assets is calculated as net income prior to financing costs divided by total assets (in percent). Leverage is defined as the ratio of total debt to total financing (in percent). Capital expenditures are scaled by total assets (in percent). Ownership share by investor type reflects the mean proportion of a firm's equity held by a specific investor type (in percent). Standard errors are clustered at the firm level, and t-values are reported in parentheses. Significance levels are indicated by asterisks (*** p<0.01, ** p<0.05, * p<0.1).

Table 6: Panel regression of industry-adjusted Tobin's Q on firm-CI and shareholder preference-CI (Temporal and regional separation)

Dependent: Tobin's Q (adj)	Pre-Paris	Post-Paris	U.S.	EU	U.S. Pre-Paris	EU Pre-Paris	U.S. Post-Paris	EU Post-Paris
Firm-CI	-0.002	-0.021*	-0.022	-0.011	-0.027	0.000	-0.020	-0.018
	(-0.246)	(-1.776)	(-1.253)	(-0.523)	(-1.418)	(0.012)	(-0.961)	(-0.649)
Shareholder preference-CI	-0.073***	-0.147***	-0.494***	-0.060	-0.486**	-0.064	-0.443***	-0.028
	(-3.282)	(-5.207)	(-3.710)	(-1.002)	(-2.236)	(-0.924)	(-3.101)	(-0.360)
Firm-CI x Shareholder preference-CI	0.017***	0.032***	0.126***	-0.057	0.120***	-0.036	0.126***	-0.084
	(3.454)	(4.382)	(3.502)	(-1.381)	(2.857)	(-1.019)	(2.840)	(-1.243)
Firm size (log. total assets)	-0.206***	-0.210***	-0.250***	-0.214***	-0.289***	-0.189***	-0.233***	-0.229***
	(-25.475)	(-24.187)	(-15.625)	(-11.357)	(-15.047)	(-8.556)	(-11.961)	(-10.095)
Return on assets	0.046***	0.022***	0.020***	0.033***	0.045***	0.048***	0.014***	0.028***
	(23.672)	(15.747)	(10.662)	(7.782)	(12.346)	(7.692)	(7.218)	(6.213)
Leverage	0.001	-0.002***	0.001	-0.003**	0.001	-0.001	0.001	-0.004**
	(1.080)	(-3.515)	(1.055)	(-2.042)	(1.037)	(-0.638)	(1.048)	(-2.113)
Capital expenditures	0.001***	0.002***	0.002***	0.003***	0.002***	0.002**	0.002**	0.004***
	(5.704)	(5.468)	(3.478)	(4.642)	(4.740)	(1.973)	(2.477)	(4.185)
Ownership share controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	118,950	181,483	91,683	41,112	31,884	17,665	59,799	23,447
Adjusted R^2	0.38	0.22	0.22	0.27	0.42	0.41	0.19	0.23

This table shows quarterly panel regression estimates for Tobin's Q (adj) as a function of firm-CI, shareholder preference-CI (both divided by 1,000) and their interaction, with separate analyses for the pre- and post-Paris Agreement periods, as well as the U.S. and EU. Additionally, regional subsamples are further divided into pre- and post-Paris Agreement periods. The regressions control for key financial and ownership characteristics. Firm size is the natural logarithm of the book value of assets. Return on assets is calculated as net income prior to financing costs divided by total assets (in percent). Leverage is defined as the ratio of total debt to total financing (in percent). Capital expenditures are scaled by total assets (in percent). Ownership share by investor type reflects the mean proportion of a firm's equity held by a specific investor type (in percent). Standard errors are clustered at the firm level, and t-values are reported in parentheses. Significance levels are indicated by asterisks (*** p<0.01, ** p<0.05, * p<0.1).

Table 7: Robustness—Panel regression of industry-adjusted Tobin's Q on firm-CI and shareholder preference-CI (reported emissions only)

Dependent: Tobin's Q (adj)	(1)	(2)	(3)
Firm-CI	-0.044***	-0.046***	-0.042***
	(-4.063)	(-5.049)	(-3.881)
Shareholder preference-CI	-0.125***	-0.090***	-0.099***
	(-3.601)	(-2.600)	(-2.877)
Firm-CI x Shareholder preference-CI	0.036***	0.029***	0.031***
	(4.548)	(3.706)	(3.888)
Firm size (log. total assets)	-0.174***	-0.140***	-0.168***
	(-19.893)	(-16.095)	(-19.264)
Return on assets	0.049***	0.049***	0.049***
	(21.410)	(20.323)	(21.486)
Leverage	0.001	0.001**	0.001
	(1.278)	(2.078)	(1.001)
Capital expenditures	0.002***	0.000	0.002***
	(3.595)	(0.644)	(3.666)
Ownership share controls	Yes	Yes	Yes
Industry fixed effects	Yes	No	Yes
Time fixed effects	No	Yes	Yes
N	146,738	146,738	146,738
Adjusted R^2	0.30	0.20	0.31

This table shows quarterly panel regression estimates for Tobin's Q (adj) as a function of firm-CI, shareholder preference-CI (both divided by 1,000) and their interaction, controlling for key financial and ownership characteristics. Firm size is the natural logarithm of the book value of assets. Return on assets is calculated as net income prior to financing costs divided by total assets (in percent). Leverage is defined as the ratio of total debt to total financing (in percent). Capital expenditures are scaled by total assets (in percent). Ownership share by investor type reflects the mean proportion of a firm's equity held by a specific investor type (in percent). Standard errors are clustered at the firm level, and t-values are reported in parentheses. Significance levels are indicated by asterisks (*** p<0.01, ** p<0.05, * p<0.1).

Table 8: Robustness—Panel regression of industry-adjusted Tobin's Q on firm-CI and shareholder preference-CI (selected investor types)

Dependent: Tobin's Q (adj)	(1)	(2)	(3)
Firm-CI	-0.032***	-0.055***	-0.029***
	(-3.078)	(-5.714)	(-2.807)
Shareholder preference-CI	-0.434***	-0.372***	-0.372***
	(-8.834)	(-7.293)	(-7.482)
Firm-CI x Shareholder preference-CI	0.092***	0.100***	0.085***
	(4.618)	(4.926)	(4.244)
Firm size (log. total assets)	-0.219***	-0.186***	-0.215***
	(-29.925)	(-24.984)	(-29.529)
Return on assets	0.028***	0.028***	0.028***
	(21.997)	(20.984)	(21.999)
Leverage	-0.001**	-0.001	-0.001**
	(-2.332)	(-1.300)	(-2.576)
Capital expenditures	0.002***	0.001***	0.002***
	(6.238)	(2.898)	(6.446)
Ownership share controls	Yes	Yes	Yes
Industry fixed effects	Yes	No	Yes
Time fixed effects	No	Yes	Yes
N	299,478	299,478	299,478
Adjusted R^2	0.25	0.14	0.25

This table shows quarterly panel regression estimates for Tobin's Q (adj) as a function of firm-CI, shareholder preference-CI (both divided by 1,000) and their interaction, controlling for key financial and ownership characteristics. Firm size is the natural logarithm of the book value of assets. Return on assets is calculated as net income prior to financing costs divided by total assets (in percent). Leverage is defined as the ratio of total debt to total financing (in percent). Capital expenditures are scaled by total assets (in percent). Ownership share by investor type reflects the mean proportion of a firm's equity held by a specific investor type (in percent). Standard errors are clustered at the firm level, and t-values are reported in parentheses. Significance levels are indicated by asterisks (*** p<0.01, ** p<0.05, * p<0.1).

Table 9: Robustness—Panel regression of industry-adjusted Tobin's Q on firm-CI and shareholder preference-CI (selected industries)

Dependent: Tobin's Q (adj)	(1)	(2)	(3)
Firm-CI	-0.029***	-0.020*	-0.028**
	(-2.632)	(-1.717)	(-2.561)
Shareholder preference-CI	-0.032**	-0.022	-0.024*
	(-2.372)	(-0.964)	(-1.812)
Firm-CI x Shareholder preference-CI	0.015***	0.010	0.015***
	(3.380)	(1.633)	(3.190)
Firm size (log. total assets)	-0.329***	-0.020*	-0.367***
	(-9.066)	(-1.717)	(-8.903)
Return on assets	0.008***	-0.022	0.009***
	(7.246)	(-0.964)	(7.296)
Leverage	0.001	0.010	0.001
	(0.818)	(1.633)	(0.803)
Capital expenditures	0.001	-0.020*	0.001
	(1.554)	(-1.717)	(1.532)
Ownership share controls	Yes	Yes	Yes
Firm fixed effects	Yes	No	Yes
Time fixed effects	No	Yes	Yes
N	69,671	69,860	69,671
Adjusted R^2	0.68	0.11	0.68

This table shows quarterly panel regression estimates estimates for Tobin's Q (adj) as a function of firm-CI, shareholder preference-CI (both divided by 1,000) and their interaction, controlling for key financial and ownership characteristics. Due to the limited number of industries in the selected sample, we employ firm fixed effects rather than industry fixed effects. Firm size is the natural logarithm of the book value of assets. Return on assets is calculated as net income prior to financing costs divided by total assets (in percent). Leverage is defined as the ratio of total debt to total financing (in percent). Capital expenditures are scaled by total assets (in percent). Ownership share by investor type reflects the mean proportion of a firm's equity held by a specific investor type (in percent). Standard errors are clustered at the firm level, and t-values are reported in parentheses. Significance levels are indicated by asterisks (*** p<0.01, ** p<0.05, * p<0.1).