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Ownership Structures and Sustainability in Big Tech Firms

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Abstract

In this paper, we examine the association between institutional ownership, common ownership, ownership concentration and ESG performance among major publicly traded technology firms. Using a panel of 14 large technology companies over the period 2004–2025, we combine ESG, ownership, and financial data to investigate whether sustainability outcomes are associated with ownership by the largest institutional investors, ownership concentration, and common ownership structures. We find that ownership by the Big Three asset managers is unrelated to ESG performance once firm and year fixed effects are included. However, broader ownership by the largest institutional investors, measured using a Big Four ownership variable, is positively associated with ESG outcomes across multiple specifications. We also find that ownership concentration and common ownership exhibit negative associations with several ESG measures, particularly environmental and emissions-related outcomes. The findings indicate that ownership identity and ownership structure represent distinct governance channels with different implications for sustainability outcomes.

Keywords: Systematic Stewardship, Common Ownership, ESG Performance, Big Tec

JEL Classifications: G23, G30, G34, M14

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Abstract

In this paper, we examine the association between institutional ownership, common ownership, ownership concentration and ESG performance among major publicly traded technology firms. Using a panel of 14 large technology companies over the period 2004–2025, we combine ESG, ownership, and financial data to investigate whether sustainability outcomes are associated with ownership by the largest institutional investors, ownership concentration, and common ownership structures. We find that ownership by the Big Three asset managers is unrelated to ESG performance once firm and year fixed effects are included. However, broader ownership by the largest institutional investors, measured using a Big Four ownership variable, is positively associated with ESG outcomes across multiple specifications. We also find that ownership concentration and common ownership exhibit negative associations with several ESG measures, particularly environmental and emissions-related outcomes. The findings indicate that ownership identity and ownership structure represent distinct governance channels with different implications for sustainability outcomes.

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1. Introduction

The rise of institutional investors has transformed corporate ownership and governance. In many of the world's largest publicly traded firms, institutional investors now control substantial proportions of outstanding shares and exercise considerable influence through voting, engagement, and stewardship activities. For example, the Big Three asset managers (BlackRock, Vanguard and State Street Global Advisors) control about 25% of all votes in S&P 500 companies (IBF 2026). At the same time, environmental, social, and governance (ESG) issues have become increasingly important to regulators, investors, and corporate managers. These parallel developments have generated a growing debate regarding the role of institutional investors in promoting corporate sustainability through shareholder engagement strategies. In this study, we aim to fill a gap in the literature by studying how ownership identity and ownership structure function as distinct governance channels with different implications for sustainability outcomes.

Big Tech is worth studying for several reasons. First, large technology firms such as Apple, Microsoft, Alphabet, Amazon, Meta, and Nvidia occupy increasingly central positions in the global economy and are among the firms most heavily owned by institutional investors. Second, they are also prominent participants in contemporary sustainability debates involving climate change, carbon emissions, artificial intelligence, data governance, workforce management, and corporate governance. Third, this combination of high institutional ownership and important sustainability risks allows us to test whether ownership structures are associated with sustainability outcomes.

Recent scholarship offers competing perspectives on the sustainability implications of institutional ownership. One strand of the literature argues that large diversified investors have incentives to promote sustainability because ESG-related externalities affect the value of their portfolios as a whole. Gordon's (2022) theory of systematic stewardship suggests that diversified institutional investors may support ESG initiatives because they internalize portfolio-wide risks, particularly environmental risks such as climate change. A second strand of the literature is more sceptical. Bebchuk and Hirst (2019) argue that the largest asset managers may face relatively weak incentives to engage in meaningful stewardship because the costs of engagement are concentrated, while the benefits are dispersed across investors. Under this view, public ESG commitments may exceed the actual incentives for active monitoring and intervention.

At the same time, a rapidly expanding literature has examined the implications of common ownership. The growth of passive investing has increased the extent to which the same institutional investors simultaneously hold significant stakes in multiple firms. Common ownership has been linked to a variety of governance and economic outcomes, including competition, corporate decision-making, and stewardship behavior (Azar et al. 2018; Azar 2020; Azar et al. 2022; Backus et al. 2020; Rosati et

al. 2024; Khoo et al. 2024; Anton et al. 2025; Lewellen and Lowry 2021). Yet relatively little is known about how common ownership and broader ownership structures influence sustainability outcomes within sectors characterized by especially high levels of institutional ownership.

In this context, we examine the three different ownership channels through which institutional investors may influence corporate sustainability outcomes. First, we examine ownership by the largest asset managers, capturing the systematic stewardship channel emphasized in recent governance research. Second, we examine common ownership, which reflects the extent to which the same investors simultaneously hold stakes in multiple firms. Third, we study ownership concentration, which captures how ownership is distributed across shareholders within individual firms. While prior studies typically focus on one of these dimensions in isolation, we analyze them jointly within a unified empirical framework. This approach allows us to evaluate whether ownership identity, ownership overlap, and ownership concentration represent distinct governance mechanisms with different implications for ESG performance.

Using a panel of 14 major technology firms between 2004 and 2025, we find that these ownership channels exhibit markedly different relationships with sustainability outcomes. Broad institutional ownership is positively associated with ESG performance, whereas common ownership and ownership concentration are generally negatively associated with ESG outcomes. These findings suggest that understanding the sustainability implications of institutional investors requires distinguishing between different forms of ownership rather than treating institutional ownership as a single homogeneous governance mechanism.

The empirical results reveal a relationship between ownership and sustainability more nuanced than those suggested by either the strongest versions of systematic stewardship theory or the assumption that common ownership necessarily promotes ESG outcomes. We find that ownership by the Big Three asset managers is generally unrelated to ESG performance once firm and year fixed effects are included, but ownership by the four largest asset managers is indeed positively related to ESG performance. This distinction suggests that systematic stewardship may not be a uniform characteristic of the largest passive asset managers, but rather a broader feature of very large institutional ownership more generally.

Next, we explore the relation between broader ownership and ESG outcomes. Our findings show that there is a positive association between the largest institutional investors, measured using a Big Four ownership variable, and ESG outcomes across multiple specifications. The result is consistent with the view that institutional investors respond to portfolio-wide risks in Big Tech firms that face heightened sustainability and regulatory scrutiny.

Finally, in our channel analysis, we show that ownership concentration and common ownership exhibit negative associations with several ESG measures, particularly environmental and emissions-related outcomes. These findings suggest that ownership identity and ownership structure represent distinct governance channels with potentially different implications for sustainability outcomes.

The paper contributes to the literature in several ways. First, we show that systematic stewardship, common ownership, and institutional ownership more generally have distinct channels for affecting firms' sustainability performance. While the prior literature on institutional ownership and sustainability has focused on the heterogeneity of institutional investors (Velte 2023), we extend this literature by considering how the heterogeneity of firm ownership is associated with distinct outcomes regarding firms' sustainability performance. Second, we show that common ownership is associated with worse sustainability outcomes of firms. Yet this is consistent with the different effects that common ownership implies in areas of firm governance (Azar 2020). Finally, we contribute to the literature on systematic stewardship (Gordon 2022) by illustrating that Big Three ownership alone does not lead to better sustainability outcomes, but that Big Four ownership does, thus indicating that the systematic stewardship channel affects sustainability outcomes only when very large diversified investors are considered more broadly.

This paper proceeds as follows. Section 2 considers the channels by which institutional investors, systematic stewardship, and common ownership relate to firm ESG performance. Section 3 describes the sample set construction process and descriptive statistics of the data. Section 4 outlines the empirical methodology. Section 5 presents the regression results. Section 6 discusses the implications of the findings for the stewardship and common ownership literatures. Section 7 concludes.

2. Institutional Investors, Systematic Stewardship, Common Ownership, and Sustainability

The rapid growth of institutional ownership has transformed the governance of publicly traded corporations. Over the past three decades, institutional investors have become the dominant shareholders in many of the world's largest firms, particularly in the United States. At the same time, environmental, social, and governance (ESG) issues have become increasingly important to investors, regulators, and corporate managers. These developments have generated a substantial literature examining whether institutional investors influence corporate sustainability outcomes and, if so, through what mechanisms.

2.1. Institutional Investors and ESG

A large body of research suggests that institutional investors can influence corporate sustainability practices. Institutional investors commonly employ a wide range of engagement strategies to

encourage the integration of ESG into firms' corporate policies and strategies. In general, the evidence indicates that institutional investors are associated with stronger sustainability outcomes, although the magnitude and direction of these effects vary across investor types (Velte 2023).

Dyck et al. (2019) find that institutional ownership is positively associated with firms' environmental and social performance, most notably when ownership is concentrated among investors with long investment horizons and stronger incentives to engage with management. Similarly, Ceccarelli et al. (2021) report that institutional investors can promote CSR-related activities, while Kim et al. (2019) show that institutional ownership is associated with more- proactive environmental policies. Lopez-de-Silanes et al. (2024) take a different approach. They examine how ESG preferences influenced the portfolio holdings and weightings of institutional investors in 853 firms over the 2004 to 2025 period. They emphasize that the sustainability preferences of institutional investors were heterogeneous, with some investors displaying stronger ESG preferences than others.

Nevertheless, the literature remains divided regarding the mechanisms through which institutional investors influence sustainability outcomes. While some emphasize various direct monitoring and shareholder engagement channels (Barko et al. 2018; Ceccarelli et al. 2021; Azar et al. 2020), others argue that institutional ownership may simply reflect investor selection, "clientele," effects, whereby firms with stronger ESG profiles attract institutional capital (Lopez-de-Silanes et al. 2024; Edmans et al. 2024; Heinkel et al. 2001). Given the contrasting predictions, identifying the governance channels through which institutional investors affect ESG outcomes remains an important challenge.

2.2. The Rise of the Big Three and Systematic Stewardship

Recent research has increasingly examined the governance role of very large diversified institutional investors. In particular, the "Big Three" have become dominant shareholders in a large proportion of publicly traded corporations and have, therefore, attracted considerable attention from scholars of corporate governance and sustainable finance (Fichtner et al. 2017; Bebchuk and Hirst 2019).

A central contribution to this debate is the theory of systematic stewardship. Gordon (2022) argues that highly diversified investors internalize portfolio-wide externalities and, therefore, have incentives to encourage firms to address risks that affect the broader economy and financial system. Under this perspective, sustainability issues such as climate change, biodiversity loss, and other environmental externalities represent portfolio-wide risks rather than firm-specific concerns. Thus, large diversified investors may support ESG initiatives because the benefits accrue across their portfolios, even when individual firms bear some of the associated costs.

While systematic stewardship provides a key theoretical explanation for the growing emphasis that large asset managers place on sustainability, there are significant criticisms. Bebchuk and Hirst (2019) argue that the largest asset managers face weak incentives to invest heavily in stewardship because the costs of engagement are concentrated while the benefits are shared across all investors. According to this view, the business model of passive investing encourages relatively low-cost stewardship and may limit the effectiveness of ESG-related engagement. As a result, public commitments to sustainability may exceed the actual incentives for active monitoring and intervention.

These competing views generate different empirical predictions. Systematic stewardship implies a positive relationship between large diversified ownership and sustainability outcomes, consistent with the internalization of portfolio-wide externalities. In contrast, stewardship skepticism predicts that the influence of large asset managers on firm-level ESG policies may be more limited than often assumed. Two reasons for this prediction are that large passive index funds have limited use of exit as a governance mechanism (McCahery et al. 2016), and common ownership can further decrease the incentives for large fund managers to engage in certain companies (Lewellen and Lewellen 2021).

2.3. Common Ownership

A related literature examines the implications of the high levels of common ownership. Common ownership arises when the same investors simultaneously hold significant stakes in multiple firms (Backus et al. 2020). The growth of passive investing has increased common ownership substantially, particularly among large publicly traded companies. As a result, large index-fund managers often hold sizeable stakes across multiple firms within the same sector, increasing ownership overlap across competitors.

Prior studies have investigated how common ownership affects product-market competition. Researchers argue that common ownership may reduce competitive incentives because investors internalize profits across competing firms. In this vein, Azar et al. (2018) provide evidence that airline ticket prices on U.S. routes controlled by common owners were higher between 2001 to 2014. Subsequent studies have expanded this literature and explored broader implications for corporate behavior, governance, and public policy (Azar 2020; Backus et al. 2020; Anton et al. 2025).

Although much of the extant literature focuses on competition, common ownership may also have implications for sustainability. On the one hand, common owners may be more willing to support ESG initiatives because they internalize externalities across multiple firms and sectors. This logic is closely related to that of systematic stewardship. On the other hand, common ownership does not necessarily imply active engagement. Overlapping ownership structures may exist without meaningful stewardship activity, particularly when investors have limited incentives to monitor individual firms.

Common ownership can exacerbate collective action problems decreasing the incentives for each investor to engage in a costly activity that benefits other owners. Khoo (2022) found that after an increase in common ownership due to a merger of two large institutional investors, environmental scores of portfolio companies decreased. Recent reviews emphasize that the theoretical and empirical implications of common ownership remain contested and may depend on how common ownership is measured and interpreted (Backus et al. 2020; Gerardi et al. 2024).

Ownership structure itself may matter independently of investor identity. Ownership concentration, for example, may influence managerial incentives, monitoring intensity, and the allocation of corporate resources. Similarly, Villalonga et al. (2025) suggest that ownership identity and structure are associated with ESG performance. Consequently, understanding sustainability outcomes requires attention not only to who owns firms, but also to how ownership is structured within and across firms.

2.4. Big Tech as a Setting for Examining Institutional Ownership and ESG

The Big Tech sector provides a particularly useful setting for examining these issues. The largest technology firms are among the most widely held corporations in the world and are characterized by extensive ownership overlap among institutional investors. At the same time, these firms have become increasingly prominent participants in ESG debates involving climate change, data-center emissions, artificial intelligence, privacy, workforce management, and corporate governance (Krueger et al. 2020; Bolton and Kacperczuk 2021; Li et al. 2024).

The combination of substantial institutional ownership, high levels of common ownership, and increasing attention to sustainability makes Big Tech an especially informative environment for evaluating competing theories of institutional investor influence. Therefore, the empirical analysis that follows examines whether sustainability outcomes among major technology firms are associated with large-investor ownership, ownership concentration, and common ownership structures. Hence, our study contributes to the growing stream of literature examining the role of institutional investors in promoting corporate sustainability. Our findings also provide new evidence on the relationship between ownership structure and ESG performance in one of the most economically important sectors of the global economy.

3. Dataset Construction

This section describes our sample selection procedure, lists data sources, discusses the construction of the ownership data and provides descriptive statistics.

The empirical analysis is based on a panel of 14 large publicly traded technology firms that are commonly regarded as constituting the core of the contemporary Big Tech sector: Apple, Microsoft,

Alphabet, Amazon, Meta, Nvidia, Adobe, Oracle, Intel, Cisco, Qualcomm, Salesforce, Tesla, and Netflix. We focus on the largest publicly traded technology firms because prior work shows that common ownership is concentrated among large firms, and that BlackRock, Vanguard, and State Street are the dominant investors in most major U.S. listed companies (see, for example, Fichtner et al. 2017; Bebchuk and Hirst 2019; Anton et al. 2025).

Data were obtained from LSEG Workspace. ESG data include overall ESG scores; environmental, social, and governance pillar scores; emissions-related measures; and selected governance indicators. Financial data include standard accounting and market variables such as total assets, liabilities, debt, revenue, net income, and market capitalization. The dataset was assembled using annual year-end observations

Following the standard convention in the ownership literature, we define the "Big Three" as BlackRock, Vanguard, and State Street, the three asset managers most frequently identified as the dominant passive index-fund investors and the central actors in debates surrounding common ownership and systematic stewardship. Fichtner et al. (2017) characterize these firms as the dominant passive asset managers, while Bebchuk and Hirst (2019) emphasize their growing ownership and voting power in public corporations. Because some studies distinguish between passive-index dominance and total assets under management, a supplementary "Big Four" measure is also constructed by adding Fidelity, which is large in overall equity asset management. Although Fidelity is less central to the passive-index-investing model (Fichtner et al. 2017), we add it in order to test systematic stewardship theory more broadly.

Ownership structure is measured using several complementary indicators. Ownership concentration is captured through a Herfindahl-Hirschman Index (HHI) and through the combined holdings of the ten largest shareholders. Common ownership is measured using overlap-based indicators that capture the extent to which the same investors simultaneously hold positions in multiple firms within the sample. Specifically, the analysis employs measures based on investor overlap across firms and pairwise ownership overlap between firms. This approach follows recent developments in the common-ownership literature—developments that emphasize the importance of ownership overlap while recognizing the limitations of more-structurally-demanding measures such as the Modified Herfindahl-Hirschman Index (MHHI), particularly in settings where market boundaries are difficult to define (Backus et al. 2020; Gerardi et al. 2024). These measures are especially relevant in the Big Tech context, in which ownership overlap among large institutional investors has increased substantially over time and is heavily influenced by the holdings of the Big Three (Anton et al. 2025).

Our final dataset contains 298 firm-year observations covering the period 2004–2025. Continuous variables used in the empirical analysis were winsorized at the 1st and 99th percentiles to mitigate the

influence of extreme observations. Table 1 presents descriptive statistics of the variables in the dataset.

Table 1: Descriptive statistics

	N	Mean	SD	Min	Median	Max
esg_score	265	60.8679	21.3088	11.1588	61.9444	93.3164
env_score	265	56.6696	26.8676	0.0000	67.0374	92.2983
soc_score	265	64.1386	22.4822	11.7206	66.8004	96.6948
gov_score	265	60.8416	25.0302	8.3402	63.2716	96.0097
emissions_score	265	69.5386	33.6553	0.0000	85.3261	99.4527
big3_pct	298	14.6756	4.8418	0.0000	14.9829	24.9594
big4_pct	298	19.1839	5.9309	0.0000	19.5607	35.3708
ownership_hhi	298	0.0297	0.0313	0.0000	0.0170	0.1854
co_overlap_share	298	0.7230	0.1541	0.0000	0.7346	1.1193
co_pairwise_avg_min	298	0.4042	0.1063	0.0000	0.4232	0.5803
top10_pct	298	36.3508	12.9315	0.0000	32.7561	76.6798
ln_total_assets	293	24.2244	1.8390	18.2452	24.6096	26.9643
debt_to_assets	293	0.1631	0.1513	0.0000	0.1486	0.6750
mktcap_to_assets	288	5.1763	5.3572	0.4532	3.7943	50.0359

Table 2 presents Pearson pairwise correlations among the main variables used in the analysis. Several patterns are noteworthy. First, the ownership variables exhibit meaningful but imperfect correlations, suggesting that they capture related but distinct dimensions of ownership structure. For example, Big Three and Big Four ownership are positively correlated ($\rho = 0.756$), reflecting their overlapping investor base. Yet the correlation is sufficiently below one, indicating that the broader Big Four measure contains additional variation beyond the Big Three alone. Similarly, the two common ownership measures are positively related ($\rho = 0.466$) but not perfectly correlated, indicating that they capture different aspects of ownership overlap among firms.

Second, ownership concentration is negatively associated with most ESG measures. The ownership HHI variable exhibits negative and statistically significant correlations with ESG environmental, social, governance, and emissions scores, while Top 10 ownership displays even stronger negative correlations. These patterns are consistent with the regression results reported later in the chapter and suggest that concentrated ownership structures are associated with weaker sustainability outcomes.

Third, the common ownership measures display contrasting relationships with ESG performance. The baseline common ownership measure is weakly negatively correlated with ESG outcomes, whereas the pairwise overlap measure is positively correlated with ESG scores. This divergence reinforces the view that alternative common ownership measures capture different ownership mechanisms and motivate the use of multiple measures in the subsequent robustness analyses.

Overall, the correlations suggest that institutional ownership, common ownership, and ownership concentration should not be viewed as equivalent constructs. Rather, they appear to represent distinct ownership channels that may have different implications for sustainability performance.

Table 2: Correlation coefficients

Table 2: Correlation Coefficients

	esg_score	env_score	soc_score	gov_score	emissions_score	big3_pct	big4_pct	ownership_hhi	co_overlap_share	co_pairwise_avg_min	top10_pct	ln_total_assets	mktcap_to_assets	debt_to_assets
esg_score	1.000***	0.818***	0.920***	0.854***	0.791***	0.500***	0.180***	-0.392***	-0.125**	0.464***	-0.561***	0.619***	-0.120*	0.009
env_score	0.818***	1.000***	0.753***	0.526***	0.887***	0.435***	0.175***	-0.246***	-0.107*	0.454***	-0.451***	0.611***	-0.214***	0.092
soc_score	0.920***	0.753***	1.000***	0.643***	0.776***	0.528***	0.161***	-0.257***	-0.093	0.469***	-0.506***	0.640***	-0.141**	0.121*
gov_score	0.854***	0.526***	0.643***	1.000***	0.514***	0.363***	0.143**	-0.444***	-0.137**	0.334***	-0.494***	0.443***	-0.026	-0.128**
emissions_score	0.791***	0.887***	0.776***	0.514***	1.000***	0.563***	0.230***	-0.294***	-0.044	0.557***	-0.554***	0.666***	-0.231***	0.141**
big3_pct	0.500***	0.435***	0.528***	0.363***	0.563***	1.000***	0.756***	-0.379***	0.410***	0.896***	-0.316***	0.582***	-0.038	0.184***
big4_pct	0.180***	0.175***	0.161***	0.143**	0.230***	0.756***	1.000***	-0.240***	0.609***	0.727***	0.02	0.166***	0.093	0.014
ownership_hhi	-0.392***	-0.246***	-0.257***	-0.444***	-0.294***	-0.379***	-0.240***	1.000***	-0.076	-0.390***	0.790***	-0.286***	0.013	0.501***
co_overlap_share	-0.125**	-0.107*	-0.093	-0.137**	-0.044	0.410***	0.609***	-0.076	1.000***	0.466***	0.279***	-0.159***	-0.121**	-0.101*
co_pairwise_avg_min	0.464***	0.454***	0.469***	0.334***	0.557***	0.896***	0.727***	-0.390***	0.466***	1.000***	-0.294***	0.673***	0.018	0.098*
top10_pct	-0.561***	-0.451***	-0.506***	-0.494***	-0.554***	-0.316***	0.02	0.790***	0.279***	-0.294***	1.000***	-0.566***	0.116**	0.267***
ln_total_assets	0.619***	0.611***	0.640***	0.443***	0.666***	0.582***	0.166***	-0.286***	-0.159***	0.673***	-0.566***	1.000***	-0.217***	0.142**
mktcap_to_assets	-0.120*	-0.214***	-0.141**	-0.026	-0.231***	-0.038	0.093	0.013	-0.121**	0.018	0.116**	-0.217***	1.000***	-0.067
debt_to_assets	0.009	0.092	0.121*	-0.128**	0.141**	0.184***	0.014	0.501***	-0.101*	0.098*	0.267***	0.142**	-0.067	1.000***

This table reports Pearsons pairwise correlation coefficients. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively

3.1. Ownership and ESG trends over time

3.1.1. Ownership over time

Figures A and B present the evolution of ownership structure among major Big Tech firms between 2004 and 2025. Three broad patterns emerge. First, ownership by the largest diversified asset managers increased substantially over the sample period. The combined holdings of BlackRock, Vanguard, and State Street rose steadily across the sector, reflecting the rapid growth of index investing and the increasing concentration of assets under management among a small number of large institutions. By the late 2010s and early 2020s, the Big Three had become significant shareholders in virtually every major firm in the sample, resulting in substantial overlap in ownership structures across competing technology companies.

Second, ownership became increasingly concentrated. Measures based on the largest shareholders, including the Top 10 ownership share and ownership concentration indices, indicate that a relatively small number of institutional investors came to control a growing proportion of outstanding equity. This pattern is consistent with the broader literature documenting the rise of common ownership and the growing importance of large passive asset managers in public equity markets (Azar et al. 2018; Edmans et al. 2019; Backus et al. 2020; Antón et al. 2025).

Third, common ownership increased over time. The common-ownership measures show that the same institutional investors increasingly held substantial positions across multiple Big Tech firms simultaneously. This trend, particularly visible from the mid-2010s onward, coincided with the rapid expansion of passive investment vehicles and the growing market share of index funds. As a result, the ownership structures of major technology firms became progressively more interconnected.

Conventional within-firm ownership concentration, measured by HHI, was broadly stable over time, with a modest decline in the early part of the sample and little evidence of sustained increase thereafter. This suggests that the main ownership change in Big Tech was not a simple rise in concentration within firms, but rather the growing overlap of large diversified investors across multiple firms. However, the dispersion across firms increased in the later years because the standard deviation rose and the maximum HHI got larger. So, while the average was stable, the sector became more heterogeneous.

Ownership in Big Tech became more interconnected over the same period, even though conventional concentration measures such as HHI remained broadly stable. This suggests that the main ownership transformation was not a simple rise in within-firm concentration, but rather the growth in importance of the same large institutional investors across multiple firms. This evidences the rise of the Big Three with increased cross-firm ownership overlap and the opportunity for systematic stewardship (Gordon 2020), even without a sharp change in the distribution of ownership within individual firms.

In sum, while the evidence does not support a strong claim that ownership became more concentrated in the narrow within-firm sense, our findings reveal that ownership became more common, more overlapping, and more institutionally dominated across the Big Tech sector.

Figures A and B: Ownership trends over time

Figure A: Ownership trends of large investors over time (mean with +/- 1 SD bands)

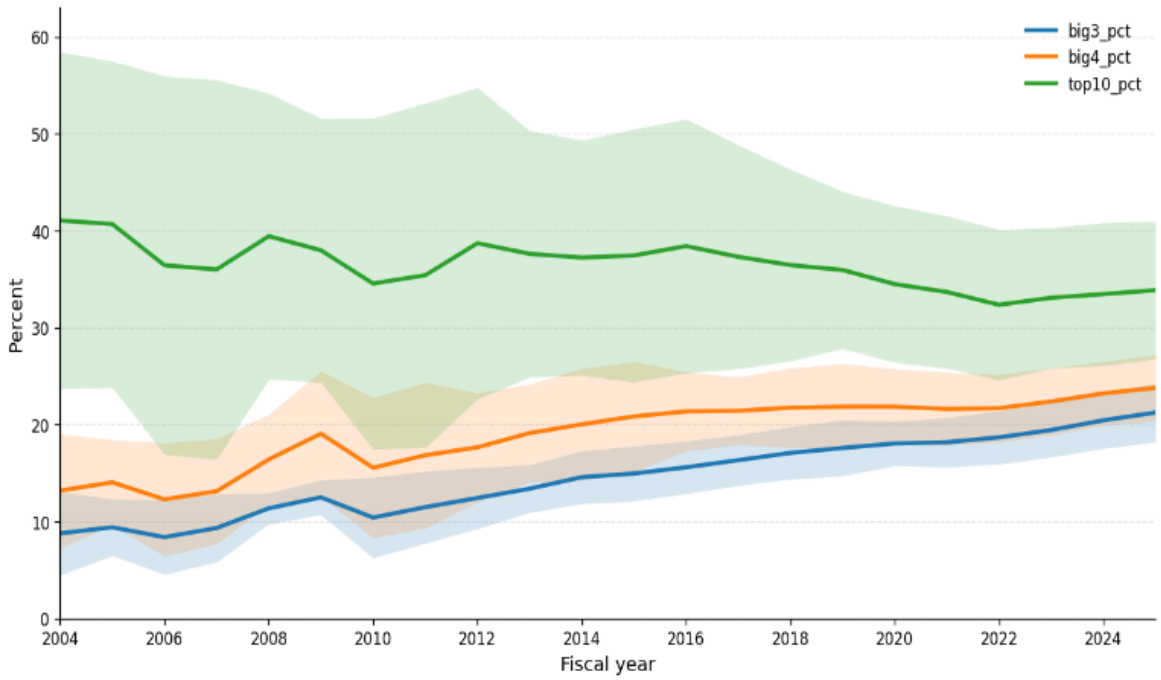
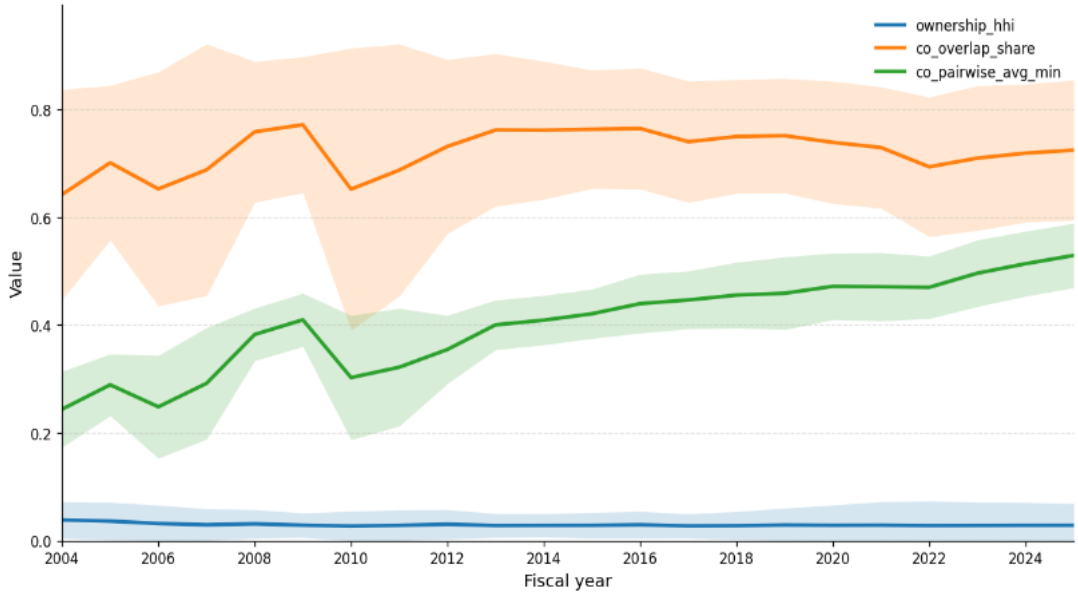


Figure B: Ownership concentration and common ownership trends over time (mean with +/- 1 SD bands)



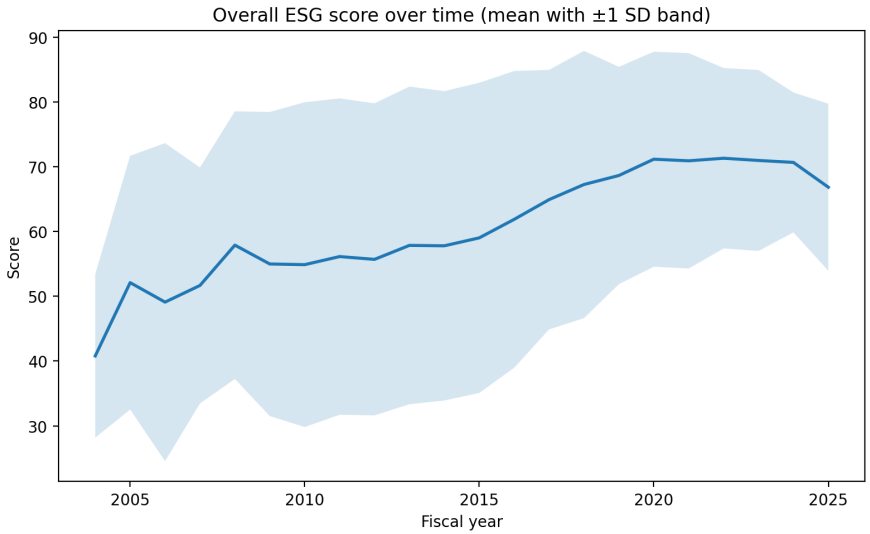
3.1.2. ESG over time

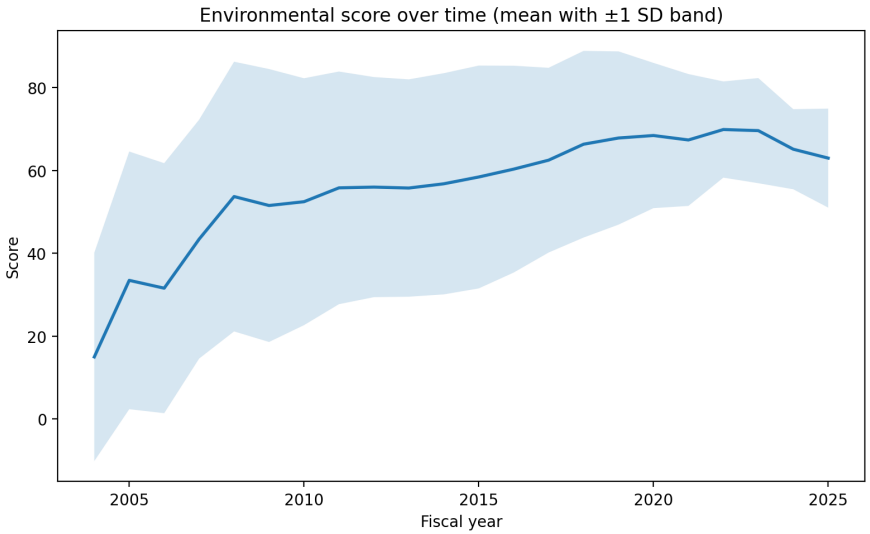
Alongside the increasing ownership concentration and common ownership, Figures C-G present the evolution of ESG performance among major Big Tech firms between 2004 and 2025. Several patterns emerge. First, over the period, ESG performance improved substantially across the sample. The average overall ESG score (Figure C) increased from approximately 40 in the early 2000s to above 70 by the early 2020s, indicating a marked strengthening of sustainability-related disclosure and performance. Second, improvements were not uniform across dimensions. Environmental and emissions-related scores (Figures D and G) exhibited the strongest growth, largely after the late 2000s, while social scores (Figure F) increased more gradually. Governance scores (Figure G) also trended upward but displayed greater volatility over time. Third, the dispersion of scores across firms generally declined, as evidenced by the narrowing standard-deviation bands in the later years of the sample. This suggests a process of convergence within the sector, whereby firms with weaker sustainability profiles increasingly adopted practices and reporting standards similar to those of industry leaders.

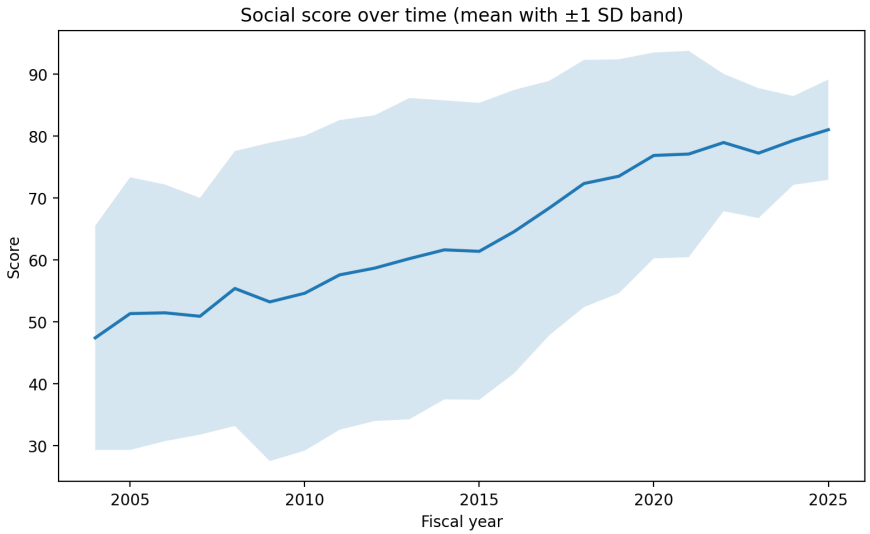
Considered alongside one another, the trends in ownership metrics and ESG data reveal two parallel transformations. Over the last two decades, Big Tech became both more heavily owned by large diversified institutional investors and more highly rated on sustainability dimensions. These patterns are consistent with the proposition that large institutional investors increasingly view sustainability issues as financially material, particularly where such issues create portfolio-wide risks. The timing of the most pronounced improvements in environmental and emissions-related scores is noteworthy in this respect, given large institutional investors' growing emphasis on climate risk during the same period.

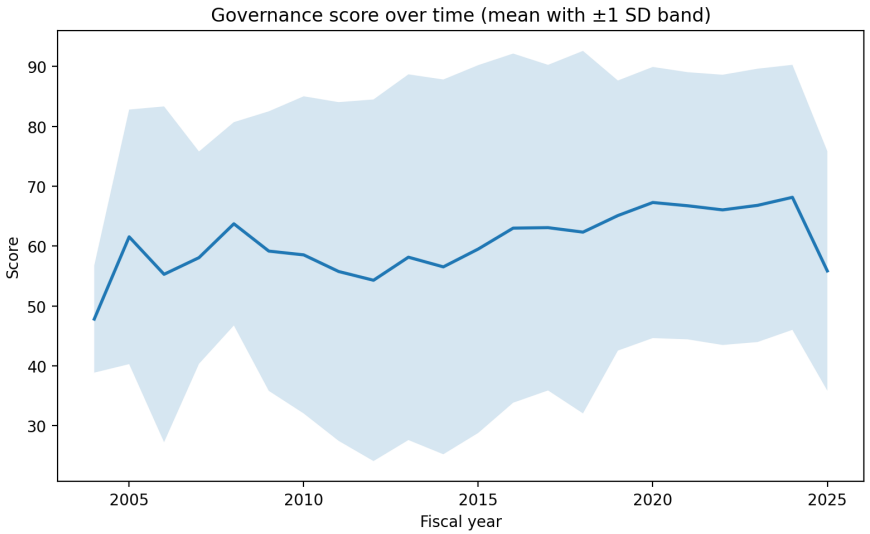
The descriptive evidence alone cannot establish a causal relationship between common or Big 3 ownership and ESG outcomes. Regulatory developments, evolving disclosure standards, stakeholder pressure, and changes in public expectations may also have contributed to the observed improvements. Therefore, we now examine whether variation in ownership concentration, common ownership, and Big Three ownership is systematically associated with differences in ESG outcomes across firms and over time.

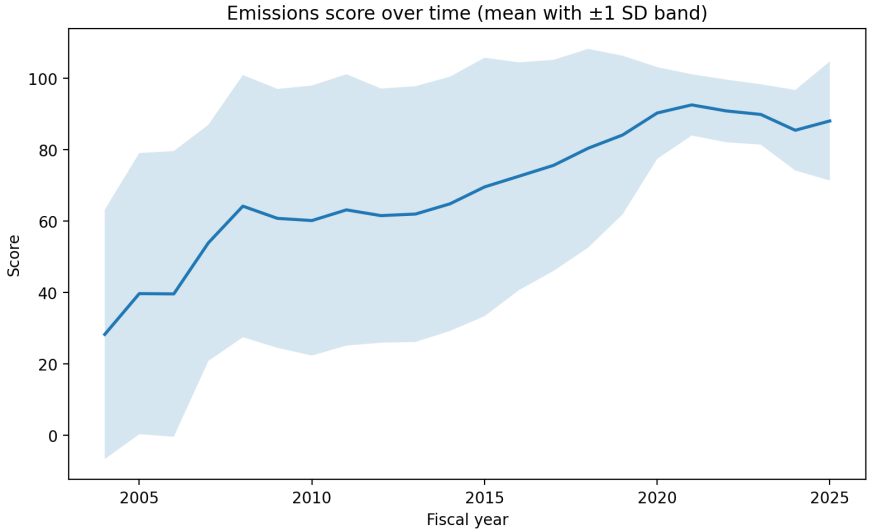
Figures C-G: ESG trends over time










Emissions score over time (mean with ±1 SD band)
Score
Fiscal year
0
20
40
60
80
100
2005
2010
2015
2020
2025

4. Methodology

4.1. Empirical Framework

The objective of the empirical analysis is to examine whether institutional ownership structures are associated with sustainability outcomes among major technology firms. The analysis is motivated by two related strands of literature. The first is the systematic stewardship literature, which argues that large diversified investors may have incentives to encourage firms to address portfolio-wide externalities such as climate risk and other sustainability concerns (Gordon 2022). The second is the common ownership literature, which examines the implications of overlapping ownership structures in which the same institutional investors hold substantial stakes in multiple firms simultaneously (Backus et al. 2020; Anton et al. 2025).

Having presented descriptive evidence regarding the evolution of ownership structures and ESG outcomes within the Big Tech sector, we now proceed with econometric analysis to evaluate whether variation in ownership structures is systematically associated with variation in ESG outcomes after controlling for firm-specific and time-specific effects.

4.2. Dependent Variables

The analysis considers five measures of firm sustainability performance from LSEG data as dependent variables:

- esg_score: a composite measure of overall ESG performance.
- env_score, measuring environmental policies, disclosure, and performance.
- soc_score, measuring social and stakeholder-related performance.
- gov_score, measuring governance quality and governance-related practices.
- emissions_score, capturing carbon-emissions management and related environmental practices.

These measures, widely used in the ESG literature, provide a multidimensional assessment of corporate sustainability performance (see for examples, Dyck et al. 2019; Ceccarelli et al. 2021; Lopez-de-Silanes et al. 2024).

4.3. Ownership Variables

Three categories of ownership variables are examined.

Institutional Ownership

Institutional ownership is measured using the combined ownership share of the largest asset managers. We calculate two measures:

- big3_pct, measures Big Three ownership by calculating the combined ownership share in the firm by summing the percentage ownership stakes of BlackRock, Vanguard, and State Street.
- big4_pct, defined as the combined ownership share in the firm by summing the percentage ownership stakes of BlackRock, Vanguard, State Street, and Fidelity.

The Big Three are the dominant passive asset managers identified in the common ownership and stewardship literature (Fichtner et al. 2017; Bebchuk and Hirst 2019). Fidelity is included to calculate a Big Four measure in order to more robustly check for effects of ownership by the largest institutional investors.

Ownership Concentration

Ownership concentration is measured using:

- ownership_hhi, calculated as a Herfindahl-Hirschman Index based on reported shareholder ownership stakes in the firm by summing the square of the ownership share of each shareholder in the firm.
- top10_pct, measured as the combined ownership share of the ten largest shareholders in each firm.

These variables capture the extent to which ownership is concentrated among a small number of investors.

Common Ownership

Common ownership is measured using two alternative indicators:

- co_overlap_share, measures common ownership overlap by calculating the proportion of ownership attributable to investors that simultaneously hold shares other firm in the sample.
- co_pairwise_avg_min, measures pairwise ownership overlap by calculating the average ownership overlap between each firm and the other firms in the sample.

The use of multiple measures reflects the growing literature emphasizing that common ownership is multidimensional and may be captured through different overlap structures (Backus et al. 2020; Gerardi et al. 2024).

4.4. Control Variables

Several firm-level controls are included to account for differences in firm characteristics that may influence ESG performance.

- ln_total_assets, we use the log of total assets to control for firm size.
- debt_to_assets, the ratio of total debt to book assets is used to control for firm leverage.
- mktcap_to_assets, the ratio of market capitalization to book assets is used to control for growth opportunities and intangible asset intensity.

All variables are winsorized at the 1st and 99th percentiles to reduce the influence of outliers.

4.5. Regression Specifications

The baseline empirical specification is:

$$ESG_{it}=\beta_1*Ownership_{it}+\beta_2*Controls_{it}+\alpha_i+\delta_t+\varepsilon_{it},$$

where:

- ESG_{it} represents one of the ESG outcome measures for firm (i) in year (t);
- $Ownership_{it}$ represents the ownership variables of interest;
- $Controls_{it}$ denotes the vector of firm-level controls;
- α_i represents firm fixed effects;
- δ_t represents year fixed effects; and
- ε_{it} is the error term.

Firm fixed effects control for time-invariant firm characteristics, while year fixed effects absorb macroeconomic conditions, regulatory developments, disclosure trends, and other common shocks affecting all firms.

The preferred specification simultaneously includes institutional ownership, ownership concentration, and common ownership measures:

$$ESG_{it}=\beta_1*Big4_{it}+\beta_2*HHI_{it}+\beta_3*CommonOwnership_{it}+\beta_4*Controls_{it}+\alpha_i+\delta_t+\varepsilon_{it}$$

This specification allows ownership identity, ownership concentration, and common ownership to be evaluated separately within the same regression framework.

4.6. Robustness Tests

Three robustness exercises are conducted.

First, alternative common ownership measures are employed to assess whether the results depend on the specific definition of ownership overlap.

Second, Big Three ownership is replaced with Big Four ownership to evaluate whether the results are driven by the largest passive asset managers specifically or by broader institutional ownership.

Third, lagged ownership specifications are estimated:

$$ESG_{it}=\beta_1*Big4_{i,t-1}+\beta_2*HHI_{i,t-1}+\beta_3*CommonOwnership_{i,t-1}+\beta_4*Controls_{i,t-1}+\alpha_i+\delta_t+\varepsilon_{it}$$

These models examine whether ownership structure measured in the previous year is associated with subsequent ESG outcomes, thereby reducing concerns regarding contemporaneous reverse causality.

5. Results

5.1. Ownership and ESG Trends in Big Tech

The descriptive evidence presented above reveals two important developments within the Big Tech sector over the period 2004–2025. First, ESG-related indicators improved substantially over time. Average ESG scores increased across the sample, with particularly strong gains in environmental and emissions-related measures. At the same time, the dispersion of ESG scores across firms generally declined, suggesting convergence toward more uniform sustainability practices and disclosure standards. These patterns are consistent with broader trends documented in the ESG literature, which identifies increasing institutional attention, enhanced disclosure requirements, and growing stakeholder pressure as important drivers of ESG performance (Dyck et al. 2019; Ceccarelli et al. 2021; Kim et al. 2019).

Second, ownership structures evolved substantially during the same period. Ownership by the largest institutional investors increased steadily, while common ownership among major technology firms became more pronounced. Consistent with the broader literature on common ownership, the same large asset managers increasingly held substantial positions across multiple firms within the sector (Fichtner et al. 2017; Anton et al. 2025). Importantly, conventional ownership concentration measured by HHI remained relatively stable over time. Thus, the principal ownership transformation appears to have been increasing ownership overlap across firms rather than a substantial increase in concentration within individual firms.

5.2. Baseline Regression Results

Table 3 presents the full model specification using firm and year fixed effects. The dependent variables are ESG score, environmental score, social score, governance score, and emissions score. The explanatory variables include ownership by the largest institutional investors, ownership concentration, common ownership, and standard firm-level controls.

Table 3

Dependent variable:	esg_score	env_score	soc_score	gov_score	emissions_score
big3_pct	0.373	-1.344*	0.611	0.825	-0.841
	(0.603)	(0.770)	(0.702)	(0.947)	(0.986)
ownership_hhi	-112.897***	-280.100***	-28.950	-102.483	-173.762**
	(43.201)	(59.191)	(47.799)	(79.749)	(78.241)
co_overlap_share	-13.415*	17.853	-24.867***	-16.273	-15.071
	(7.412)	(14.013)	(9.101)	(12.743)	(17.015)
ln_total_assets	3.827***	9.257***	2.760**	2.106	13.471***
	(1.071)	(1.772)	(1.187)	(1.729)	(2.050)
debt_to_assets	-1.194	11.756	2.900	-11.992	40.705***
	(6.992)	(10.053)	(8.211)	(13.524)	(11.459)
mktcap_to_assets	0.323	-0.362**	0.350*	0.558*	-0.506**
	(0.200)	(0.182)	(0.182)	(0.293)	(0.227)
N	259	259	259	259	259
R^2	0.843	0.803	0.815	0.725	0.820
Adj. R^2	0.814	0.767	0.781	0.674	0.787
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

This table reports firm-level panel regressions estimated using ordinary least squares (OLS) with firm and year fixed effects. Robust standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variables are winsorized at the 1st and 99th percentiles. All variable definitions are provided in the methodology section.

Strikingly, we find that ownership by the Big Three asset managers is generally unrelated to ESG outcomes once control variables and firm and year fixed effects are included. Across all ESG dimensions, the coefficients on Big Three ownership are statistically insignificant, with the exception of a weak negative association with environmental performance at the 10% level. The estimated coefficients are also economically modest relative to those of ownership concentration and common ownership. Taken together, these results provide little evidence that ownership by BlackRock, Vanguard, and State Street alone is systematically associated with stronger sustainability outcomes in Big Tech firms. This finding contrasts with the strongest version of the systematic stewardship hypothesis, which predicts that the largest diversified asset managers should promote sustainability initiatives because they internalize portfolio-wide externalities (Gordon 2022).

The environmental and emissions specifications are particularly noteworthy. The magnitude and statistical significance of the ownership variables are strongest for environmental and emissions-related measures. Ownership concentration exhibits large negative coefficients in both models, with statistically significant effects for environmental and emissions scores. Similarly, the strongest ownership-related effects generally emerge in these two dimensions rather than in the broader ESG or governance measures. This pattern is consistent with the view that environmental and climate-related

risks represent portfolio-wide externalities that are particularly relevant for diversified investors because they affect the performance of the broader economy and, consequently, the value of diversified portfolios (Gordon 2022). As a result, environmental outcomes may provide a more direct test of stewardship-related incentives than do broader ESG indicators that incorporate a wider range of firm-specific governance and social considerations.

In contrast, ownership concentration and common ownership display more consistent relationships with ESG outcomes. Ownership concentration, measured by HHI, is negatively associated with several ESG measures, most notably environmental and emissions-related outcomes. Similarly, the common-ownership measure exhibits a negative relationship with ESG performance in several specifications. These results suggest that greater ownership overlap and more concentrated ownership structures are not necessarily associated with stronger sustainability outcomes. The negative coefficients on ownership concentration and common ownership are noteworthy because they contrast with the prediction that overlapping ownership structures necessarily promote sustainability. Possible explanations are explored further in the discussion section below.

5.3. Robustness Tests

Alternative Common Ownership Measures

We conduct several robustness tests. First, Table 4 evaluates whether the results depend on the specific measure of common ownership employed. Replacing the baseline overlap measure with a pairwise ownership-overlap measure produces qualitatively similar results, although the magnitude and statistical significance of the coefficients vary across ESG dimensions. The persistence of statistically significant coefficients under alternative definitions suggests that the observed relationship is not driven by a particular measurement approach. At the same time, differences across specifications indicate that common ownership is a multidimensional concept and that alternative measures capture distinct aspects of ownership overlap, a point emphasized by Backus et al. (2020) and Gerardi et al. (2024).

Table 4

Dependent variable:	esg_score	env_score	soc_score	gov_score	emissions_score
big3_pct	0.527	-1.192	1.015	0.626	-1.129
	(0.659)	(0.811)	(0.722)	(0.951)	(1.038)
ownership_hhi	-157.914***	-241.916***	-119.539***	-133.651	-196.328***
	(47.597)	(59.489)	(45.536)	(87.929)	(73.494)
co_pairwise_avg_min	-55.610*	29.212	-117.811***	-19.131	-4.726
	(29.035)	(38.297)	(30.034)	(45.797)	(45.365)
ln_total_assets	4.786***	8.712***	4.778***	2.481	13.606***
	(1.164)	(1.785)	(1.392)	(1.685)	(2.103)
debt_to_assets	-2.708	13.593	0.034	-13.636	39.235***
	(6.708)	(9.901)	(7.974)	(13.118)	(12.143)
mktcap_to_assets	0.428**	-0.434**	0.567***	0.612**	-0.475**
	(0.199)	(0.179)	(0.196)	(0.287)	(0.236)
N	259	259	259	259	259
R^2	0.844	0.802	0.822	0.723	0.820
Adj. R^2	0.816	0.765	0.790	0.673	0.787
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

This table reports firm-level panel regressions estimated using ordinary least squares (OLS) with firm and year fixed effects. Robust standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variables are winsorized at the 1st and 99th percentiles. All variable definitions are provided in the methodology section.

Big Three versus Big Four Ownership

Next, Table 5a replaces Big Three ownership with a broader Big Four measure that includes Fidelity. The results change substantially. Whereas Big Three ownership is generally insignificant in the baseline models, Big Four ownership is positive and statistically significant across all ESG dimensions. This finding suggests that the relevant mechanism may not be passive-index stewardship alone, but rather broader institutional ownership by large asset managers.

The distinction is significant because the systematic stewardship literature has focused primarily on BlackRock, Vanguard, and State Street (Gordon 2022), whereas other institutional investors may possess different incentives, investment horizons, and stewardship practices. The results, therefore, provide stronger support for a broader institutional-investor effect than for a narrowly defined Big Three effect.

Table 5b repeats these regressions using the alternative measure of common ownership. This shows that the results are robust to how we measure common ownership.

Table 5a

Dependent variable:	esg_score	env_score	soc_score	gov_score	emissions_score
big4_pct	1.001***	0.634*	0.473*	1.374***	1.325***
	(0.258)	(0.342)	(0.272)	(0.423)	(0.410)
ownership_hhi	-99.547**	-202.999***	-41.559	-97.785	-98.126
	(41.636)	(52.969)	(41.401)	(72.621)	(69.486)
co_overlap_share	-25.718***	-0.478	-27.773***	-31.065**	-40.254**
	(7.659)	(14.564)	(9.945)	(12.729)	(19.081)
ln_total_assets	4.976***	10.806***	3.076**	3.520**	15.685***
	(1.087)	(1.940)	(1.204)	(1.731)	(2.300)
debt_to_assets	1.329	16.442*	3.241	-9.143	46.652***
	(6.685)	(9.807)	(7.900)	(13.397)	(11.821)
mktcap_to_assets	0.368**	-0.214	0.339**	0.596**	-0.346*
	(0.186)	(0.169)	(0.166)	(0.272)	(0.192)
N	259	259	259	259	259
R^2	0.854	0.803	0.816	0.739	0.828
Adj. R^2	0.827	0.767	0.783	0.691	0.796
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

This table reports firm-level panel regressions estimated using ordinary least squares (OLS) with firm and year fixed effects. Robust standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variables are winsorized at the 1st and 99th percentiles. All variable definitions are provided in the methodology section.

Table 5b

Dependent variable:	esg_score	env_score	soc_score	gov_score	emissions_score
big4_pct	1.244***	0.808**	0.830***	1.431***	1.371***
	-0.252	-0.391	-0.267	-0.439	-0.456
ownership_hhi	-196.625***	-230.901***	-161.010***	-178.640**	198.664***
	-44.982	-55.16	-44.66	-84.883	-64.484
co_pairwise_avg_min	-111.951***	-39.154	-141.659***	-83.507*	-102.195**
	-26.173	-38.589	-27.537	-49.293	-42.059
ln_total_assets	7.074***	11.533***	5.727***	5.095***	17.614***
	-1.281	-2.084	-1.444	-1.91	-2.609
debt_to_assets	-1.554	16.179	0.01	-12.332	42.552***
	-6.822	-10.016	-7.713	-13.413	-13.216
mktcap_to_assets	0.574***	-0.163	0.588***	0.778***	-0.118
	-0.185	-0.195	-0.163	-0.277	-0.244
N	259	259	259	259	259
R^2	0.859	0.804	0.826	0.737	0.826
Adj. R^2	0.833	0.768	0.794	0.689	0.794
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

This table reports firm-level panel regressions estimated using ordinary least squares (OLS) with firm and year fixed effects. Robust standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variables are winsorized at the 1st and 99th percentiles. All variable definitions are provided in the methodology section.

Lagged Ownership Models

In the next test, we introduce a more demanding specification by lagging the ownership variables by one year. While this approach does not establish causality, it addresses concerns that ownership and ESG outcomes are determined simultaneously. Our findings from Table 6 remain broadly intact. Ownership concentration and common ownership continue to exhibit significant relationships with ESG outcomes, particularly environmental and emissions measures.

Table 6

Dependent variable:	**esg_score**	**env_score**	**soc_score**	**gov_score**	**emissions_score**
L1_big3_pct	0.606	0.062	0.908	0.819	-0.371
	(0.539)	(0.764)	(0.620)	(0.905)	(1.015)
L1_ownership_hhi	-58.975	-246.174***	16.999	-34.704	-173.351*
	(52.320)	(64.840)	(52.166)	(89.013)	(91.135)
L1_co_overlap_share	-11.769	12.204	-26.425***	-8.677	-20.452
	(7.922)	(12.188)	(8.791)	(14.512)	(14.862)
L1_ln_total_assets	5.269***	8.908***	4.105***	4.841**	12.990***
	(1.283)	(1.860)	(1.367)	(1.947)	(2.192)
L1_debt_to_assets	-6.729	10.335	0.900	-18.670	35.694***
	(6.742)	(8.815)	(7.832)	(11.376)	(11.495)
L1_mktcap_to_assets	0.548*	-0.116	0.485**	0.852*	-0.483
	(0.289)	(0.261)	(0.215)	(0.452)	(0.367)
N	249	249	249	249	249
R^2	0.845	0.787	0.824	0.744	0.822
Adj. R^2	0.817	0.747	0.791	0.696	0.789
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

This table reports firm-level panel regressions estimated using ordinary least squares (OLS) with firm and year fixed effects. Robust standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variables are winsorized at the 1st and 99th percentiles. All variable definitions are provided in the methodology section.

Most notably, Table 7 shows that lagged Big Four ownership remains positively associated with subsequent ESG performance across all dimensions. This result is important because it indicates that ownership structure precedes the observed ESG outcomes. Although endogeneity concerns remain, the findings are consistent with the proposition that institutional ownership structures influence subsequent sustainability outcomes rather than merely reflecting them.

Table 7

Dependent variable:	**esg_score**	**env_score**	**soc_score**	**gov_score**	**emissions_score**
L1_big4_pct	1.206***	1.519***	0.711***	1.378***	1.627***
	(0.249)	(0.368)	(0.245)	(0.417)	(0.450)
L1_ownership_hhi	-156.636***	-272.593***	-126.093***	-114.369	-241.795***
	(46.937)	(53.935)	(45.375)	(85.535)	(68.481)
L1_co_pairwise_avg_min	-101.614***	-68.274*	-119.456***	-75.280*	-118.789***
	(24.202)	(35.936)	(26.341)	(44.950)	(41.680)
L1_ln_total_assets	8.375***	11.995***	6.712***	7.676***	17.885***
	(1.435)	(2.215)	(1.592)	(2.006)	(2.561)
L1_debt_to_assets	-5.744	14.637	-0.906	-16.975*	37.928***
	(6.071)	(9.183)	(7.748)	(10.271)	(13.147)
L1_mktcap_to_assets	0.776***	0.069	0.699***	1.037***	-0.001
	(0.206)	(0.259)	(0.167)	(0.368)	(0.372)
N	249	249	249	249	249
R^2	0.862	0.803	0.831	0.757	0.833
Adj. R^2	0.836	0.767	0.799	0.712	0.802
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

This table reports firm-level panel regressions estimated using ordinary least squares (OLS) with firm and year fixed effects. Robust standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variables are winsorized at the 1st and 99th percentiles. All variable definitions are provided in the methodology section.

Ownership Identity versus Ownership Structure

The final robustness test, reported in Table 8, simultaneously incorporates ownership identity, ownership concentration, and common ownership. Big Four ownership remains positive and statistically significant across ESG dimensions, even after controlling for HHI, common ownership, and ownership concentration among the ten largest shareholders. By contrast, ownership concentration and common ownership remain negatively associated with ESG outcomes in many specifications.

Table 8

Dependent variable:	**esg_score**	**env_score**	**soc_score**	**gov_score**	**emissions_score**
big4_pct	0.934***	0.636*	0.594**	1.112***	1.361***
	(0.248)	(0.351)	(0.269)	(0.414)	(0.427)
top10_pct	0.249	-0.008	-0.442**	0.959***	-0.130
	(0.173)	(0.271)	(0.177)	(0.265)	(0.315)
ownership_hhi	-144.407***	-201.532***	38.118	-270.848***	-74.657
	(50.320)	(57.224)	(49.111)	(85.039)	(78.769)
co_overlap_share	-29.348***	-0.359	-21.326**	-45.068***	-38.355*
	(8.276)	(15.921)	(10.247)	(12.721)	(20.518)
ln_total_assets	5.689***	10.783***	1.810	6.270***	15.312***
	(1.254)	(2.054)	(1.240)	(2.012)	(2.377)
debt_to_assets	-0.310	16.495	6.151	-15.464	47.509***
	(6.496)	(10.187)	(7.763)	(12.331)	(12.361)
mktcap_to_assets	0.398**	-0.215	0.286*	0.712**	-0.361*
	(0.193)	(0.177)	(0.163)	(0.286)	(0.203)
N	259	259	259	259	259
R^2	0.855	0.803	0.820	0.752	0.828
Adj. R^2	0.828	0.766	0.786	0.705	0.796
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

This table reports firm-level panel regressions estimated using ordinary least squares (OLS) with firm and year fixed effects. Robust standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variables are winsorized at the 1st and 99th percentiles. All variable definitions are provided in the methodology section.

This result suggests that ownership identity and ownership structure represent distinct channels. Firms with greater ownership by large institutional investors tend to exhibit stronger ESG performance, whereas more-concentrated ownership structures and greater ownership overlap are generally associated with weaker ESG outcomes. Consequently, the evidence does not support a simple narrative in which all forms of institutional ownership uniformly improve sustainability performance.

The distinction between ownership identity and ownership structure is further supported by the correlation analysis (Table 2). Although Big Three and Big Four ownership are strongly positively

correlated, the relationship is far from perfect (ρ = 0.756), indicating that the broader Big Four measure captures meaningful variation beyond the ownership stakes of BlackRock, Vanguard, and State Street alone. This distinction is important because the regression results reveal substantially different relationships between Big Three and Big Four ownership and ESG outcomes. Our evidence suggests that broad institutional ownership may operate through channels that extend beyond the influence of the largest passive asset managers.

At the same time, the ownership structure measures exhibit strong interrelationships. The pairwise common ownership measure is highly correlated with Big Three ownership (ρ = 0.896), consistent with the argument that the growth of common ownership has been driven in large part by the expansion of large diversified asset managers (Anton et al. 2025). However, despite this close relationship, the pairwise common ownership measure and the Big Four ownership measure remain simultaneously significant in the multivariate specifications. With regard to our hypothesis, the results indicate that common ownership captures a governance mechanism distinct from institutional ownership itself.

Similarly, ownership concentration measured by HHI is strongly correlated with Top-10 ownership (ρ = 0.790), indicating that both variables capture a common underlying dimension of concentrated ownership. Yet the inclusion of both concentration measures alongside institutional ownership and common ownership in Table 8 allows the analysis to separate the effects of ownership concentration from those associated with investor identity and ownership overlap. In sum, the evidence shows that institutional ownership, common ownership, and ownership concentration represent related but conceptually distinct dimensions of ownership structure, each with potentially different implications for sustainability outcomes.

5.4. Overall results

Taken together, the results provide partial support for theories of systematic stewardship while simultaneously highlighting important limitations. The positive association between Big Four ownership and ESG outcomes is consistent with the idea that diversified institutional investors have incentives to address sustainability issues that generate portfolio-wide risks (Gordon 2022). However, the absence of comparable effects for Big Three ownership suggests that stewardship benefits may not be confined to the largest passive asset managers.

At the same time, the consistently negative coefficients on ownership concentration and common ownership raise important questions for both the stewardship and common-ownership literatures. These findings suggest that overlapping ownership structures do not automatically translate into

improved sustainability outcomes. Rather, the relationship between institutional ownership and ESG appears to depend on both the identity of the owners and the structure of ownership itself.

Overall, the evidence indicates that ownership structure matters for ESG outcomes in Big Tech, but in a more nuanced manner than implied by either the strongest versions of systematic stewardship theory or the assumption that common ownership necessarily promotes sustainability. Institutional ownership appears to contain both beneficial and potentially adverse governance channels, with the net effect depending on the specific ownership configuration under consideration.

The findings are broadly consistent with a synthesis of these two perspectives. The results provide little evidence that ownership by the Big Three alone is systematically associated with stronger ESG outcomes. However, broader ownership by the largest institutional investors, as captured by the Big Four measure, is positively associated with ESG performance across multiple specifications, including lagged models. This suggests that the stewardship channel may be more diffuse than often assumed in the literature. Rather than reflecting the influence of the Big Three specifically, the results are more consistent with the proposition that sustainability outcomes are associated with broader institutional ownership by large, diversified investors. At the same time, the negative coefficients on ownership concentration and common ownership indicate that not all ownership structures operate in the same manner. Consequently, the evidence does not support either a strong stewardship view or a strong sceptical view in isolation. Instead, it suggests that the sustainability implications of institutional ownership depend on both the identity of the owners and the structure of ownership itself.

6. Discussion

6.1. Institutional Ownership and Systematic Stewardship

One of the central debates in the contemporary corporate governance literature concerns the extent to which large institutional investors can promote sustainability through stewardship.

The empirical results provide partial support for this perspective. Across the various specifications, ownership by the largest institutional investors is generally associated with stronger ESG outcomes. In particular, the Big Four ownership measure exhibits a positive and statistically significant relationship with ESG performance across all major dimensions, including environmental, social, governance, and emissions-related outcomes. These findings are broadly consistent with the proposition that large diversified investors may contribute to the diffusion of sustainability practices and encourage greater attention to ESG-related risks.

At the same time, the results do not support the strongest version of the systematic stewardship hypothesis. Ownership by the Big Three alone, defined as BlackRock, Vanguard, and State Street, is

generally unrelated to ESG outcomes once firm and year fixed effects are introduced. This finding contrasts with the expectation that the largest passive asset managers should be the principal drivers of ESG-related stewardship. Instead, the evidence suggests that the positive relationship between institutional ownership and sustainability outcomes is broader than the influence of the Big Three alone.

These findings are particularly relevant in light of the critique advanced by Bebchuk and Hirst (2019). They argue that the largest asset managers face relatively weak incentives to invest heavily in stewardship because the costs of engagement are concentrated, while the benefits are dispersed across investors. Consequently, stewardship activities may be more limited than public statements regarding ESG commitments would suggest. The absence of a robust Big Three effect is consistent with this skepticism and suggests that passive ownership alone may be insufficient to generate meaningful sustainability improvements.

However, the positive and persistent Big Four results indicate that the relationship between institutional ownership and ESG cannot be dismissed entirely. One possible interpretation is that the stewardship channel is more diffuse than commonly assumed. Rather than reflecting the influence of the Big Three specifically, sustainability outcomes may be associated with broader ownership by large institutional investors, including those whose business models rely less on passive index investing. Under this interpretation, the findings are consistent with a synthesis of the systematic stewardship and stewardship skepticism perspectives. Large institutional investors appear capable of influencing sustainability outcomes, but the effects are not confined to the largest passive asset managers and may depend on a wider set of governance mechanisms than those emphasized in the existing stewardship literature.

More broadly, the results suggest that discussions of institutional investor influence should distinguish between ownership identity and ownership structure. The empirical evidence indicates that who owns firms may matter for sustainability outcomes, but that ownership structure itself, including concentration and common ownership, may exert separate and potentially offsetting effects. Therefore, understanding the sustainability implications of institutional ownership requires attention not only to the presence of large investors but also to the governance environment in which those investors operate.

6.2. Common Ownership, Ownership Concentration, and ESG Performance

The negative relationship between common ownership, ownership concentration, and ESG outcomes observed in the empirical analysis may appear surprising given recent arguments that large diversified investors have incentives to internalize portfolio-wide externalities. However, several strands of the

literature suggest reasons that concentrated and overlapping ownership structures may not necessarily produce stronger sustainability outcomes and may in fact lead to poorer sustainability performance.

One explanation derives from the distinction between ownership overlap and active stewardship. Systematic stewardship theory argues that diversified investors may support ESG initiatives because sustainability-related externalities often affect portfolio-wide returns (Gordon 2022). However, ownership overlap alone does not imply meaningful engagement. Common ownership measures capture the extent to which investors hold multiple firms simultaneously, but they do not directly measure monitoring intensity, shareholder engagement, or stewardship activity. As Bebchuk and Hirst (2019) emphasize, the largest asset managers may face relatively weak incentives to invest heavily in firm-specific monitoring because the costs of stewardship are concentrated, while the benefits are dispersed across investors. Under this interpretation, common ownership may increase without generating corresponding improvements in sustainability or even lead to decreased sustainability outcomes in the absence of effective shareholder support.

A second explanation emerges from the broader common ownership literature. Although common ownership may encourage investors to internalize externalities across firms, it may also weaken incentives for active intervention. Backus et al. (2020) highlight that the welfare implications of common ownership depend critically on the mechanisms through which investors influence corporate decision-making. Similarly, Gerardi et al. (2024) argue that many theoretical claims regarding common ownership remain contingent on strong assumptions regarding investor behavior and corporate governance. Consequently, overlapping ownership structures may not automatically translate into stronger ESG performance.

A third possibility is that concentrated ownership structures prioritize financial performance over broader stakeholder objectives. Traditional corporate governance theory often views concentrated ownership as beneficial because it strengthens monitoring incentives and reduces managerial agency problems. However, concentrated owners may also place greater emphasis on short- and medium-term financial outcomes, particularly where ESG initiatives involve uncertain payoffs or require substantial investment. Under such circumstances, concentrated ownership may reduce managerial discretion while simultaneously discouraging costly sustainability initiatives. This interpretation is consistent with the stewardship skepticism advanced by Bebchuk and Hirst (2019), who argue that institutional investors may have limited incentives to pursue ESG objectives that do not clearly enhance shareholder value.

The common ownership literature also raises a broader concern regarding incentives. Several studies argue that common ownership may alter competitive dynamics by reducing incentives for aggressive competition among portfolio firms (Azar et al. 2018; Azar 2020). While these arguments were

originally developed in the context of product-market competition, they imply the more general possibility that overlapping ownership structures may soften incentives for managerial effort and strategic differentiation. If ESG investments are viewed as one dimension of competitive differentiation or long-term strategic positioning, common ownership could indirectly reduce incentives for sustainability-related innovation.

Finally, reverse causality cannot be fully excluded. Firms with stronger ESG performance may attract a broader and more diverse shareholder base, thereby reducing ownership concentration. Conversely, firms with weaker ESG performance may remain more heavily dominated by a smaller set of investors. Although the fixed-effects and lagged specifications employed in this chapter reduce concerns regarding contemporaneous reverse causality, they cannot fully eliminate endogeneity concerns. However, our results with respect to common ownership and decreased sustainability performance are also consistent with Khoo (2022) which finds that increased common ownership after a merger of large asset managers resulted in decreased sustainability performance of portfolio companies.

Overall, these competing explanations suggest that the relationship between ownership structure and sustainability is likely more complex than implied by either the strongest versions of systematic stewardship theory or the assumption that common ownership automatically promotes ESG outcomes. The empirical evidence presented here is, therefore, most consistent with a nuanced interpretation: while broad institutional ownership appears positively associated with sustainability outcomes, concentrated and overlapping ownership structures may simultaneously constrain and even weaken the mechanisms through which stewardship influences corporate sustainability behavior.

7. Conclusion

In this paper, we examine how common ownership and broader ownership structures influence sustainability outcomes within sectors characterized by especially high levels of institutional ownership. Using a unique dataset covering the period 2004 to 2025, we focus our analysis on ESG, ownership and financial data to test the relationship between ownership and sustainability in US publicly listed firms. This study contributes new evidence on the relationship between the largest institutional investors, including the Big Three and Big Four asset managers, and sustainability.

We establish three main results. First, we find that ownership by the Big Three asset managers is generally unrelated to ESG performance once firm and year fixed effects are included. Second, we find that that broader ownership by the largest institutional investors, measured using a Big Four ownership variable, is positively associated with ESG outcomes across multiple specifications. Our finding conforms to the view that diversified institutional investors may have incentives to deal with

sustainability issues that produce portfolio-wide risks. Third, we find that ownership concentration and common ownership exhibit negative associations with several ESG measures—environmental and emissions-related outcomes in particular. Overall, our results suggest that broad institutional ownership is associated with stronger sustainability outcomes, but that ownership concentration and ownership overlap capture distinct governance channels that may weaken the link between stewardship incentives and firm-level ESG performance.

Our study adds to the emerging literature on common ownership, and the results inform the recent policy debate on stewardship. We emphasize the importance of distinguishing investor identity, ownership concentration, ownership overlap and the channels through which investors exercise influence. The findings might also be of interest to regulators who seek to understand whether institutional ownership is an effective mechanism for improving sustainability outcomes in publicly listed Big Tech firms.

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