



**Shared Stakes, Shared Future:
The Role of Institutional Common Ownership in
Corporate ESG Performance**

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Abstrato:

Nome da tese: "Shared Stakes, Shared Future: The Role of Institutional Common Ownership in Corporate ESG Performance"

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A tese investiga o efeito de uma definição alternativa de propriedade comum no desempenho ESG das empresas, uma questão crítica na gestão de carteiras e na sustentabilidade. A propriedade comum é observada quando pelo menos dois investidores institucionais detêm participações significativas numa empresa. Ao analisar vários limiares de propriedade comum, esta investigação tem como objetivo compreender o efeito no desempenho ESG e fornecer implicações para investidores, reguladores, empresas e sociedade em geral.

Os resultados indicam que, embora a presença de propriedade comum nas empresas esteja inicialmente correlacionada com pontuações ESG mais baixas, esta conduz a melhorias no desempenho ESG ao longo do tempo.

As diferenças regionais são evidentes, com a propriedade comum a ter um impacto mais pronunciado no desempenho ESG nos USA do que na Europa, provavelmente devido a diferenças regulamentares. A análise setorial revela impactos variáveis.

A análise temporal revela que, embora os efeitos a curto prazo sejam frequentemente negativos, os impactos a longo prazo, especialmente após 3 ou mais anos, são positivos. Os resultados sugerem que o envolvimento institucional comum sustentado pode conduzir a um desempenho ESG substancial.

No entanto, o estudo reconhece as suas limitações, incluindo a variabilidade das métricas ESG, a seleção potencial e o enviesamento de sobrevivência, bem como o âmbito geográfico, setorial e temporal limitado.

A investigação futura deve explorar efeitos mais amplos desta definição alternativa de propriedade comum em diferentes dimensões do desempenho das empresas, melhorar a qualidade dos dados ESG, incorporar práticas de análise adicionais e investigar mecanismos de envolvimento específicos.

Abstract

Name of Thesis: "Shared Stakes, Shared Future: The Role of Institutional Common Ownership in Corporate ESG Performance"

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The thesis "Shared Stakes, Shared Future: The Role of Institutional Common Ownership in Corporate ESG Performance" by David Miles Wolf investigates the effect of an alternative definition of common ownership on corporate ESG performance, a critical issue in portfolio management and sustainability. Common ownership is observed when at least two institutional investors hold significant stakes in a firm. By analysing various thresholds of common ownership, this research aims to understand the effect on ESG performance and provide implications for investors, regulators, firms, and society at large.

The findings indicate that while the presence of common ownership within firms initially correlates with lower ESG Scores, it drives improvements in ESG performance over time. Regional differences are evident, with common ownership having a more pronounced impact on ESG performance in the US compared to Europe, likely due to regulatory differences. Sectoral analysis shows varying impacts.

Temporal analysis reveals that while short-term effects are often negative long term-impacts, especially after 3+ years, are positive. The findings suggest that sustained common institutional engagement can lead to substantial ESG performance.

However, the study acknowledges limitations including variability in ESG metrics, potential selection, and survivorship bias, and limited geographical, sectoral as well as time scope. Future research should explore broader effects of this alternative definition of common ownership on different dimensions of corporate performance, enhance ESG data quality, incorporate additional analysis practices and investigate specific engagement mechanisms.

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1. Introduction

In the dynamic realms of finance, the integration of sustainability considerations into investment decision-making processes marks a significant paradigm shift. Due to increased occurrence, common ownership by institutional investors – entities that often hold substantial stakes in various companies – has emerged as a pivotal influence on corporate strategy and decision making. This research reflects on the global impetus towards sustainable development, with a particular focus on different structures of common ownership.

Exploring the impact of common ownership on ESG performance resonates profoundly with institutional investors. This cohort is leveraging their significant influence claiming to foster corporate responsibility and sustainability. The stewardship theory posits that institutional investors can indeed act as catalysts for change, invoking responsible corporate behavior (Donaldson, Lex, & Davis, 1991) . This is further substantiated by recent empirical studies, which provides evidence that institutional investors possess the ability to significantly enhance corporate ESG outcomes. These findings are a testament to the potential of aligned investment strategies to yield both ESG benefits and financial returns (Dyck, Lins, Roth, & Wagner, 2019). For corporations themselves, ESG is no longer a peripheral concern but a central aspect of operational as well as strategic imperatives. The natural-resource-based view of the firm (Hart, 1995) established, that integrating ESG considerations can endow firm with valuable intangible assets, fostering competitive advantages. More recent studies delineate the relationship between institutional ownership and ESG performance, illustrating the benefits that accrue from sustainable practices. Their findings not only include an augmentation of corporate reputation but also reduced financing constraints (Bai, Han, Ma, & Zhang, 2022). The relevance of this research futhers extends to regulators and policy makers, who are vested with the authority and responsibility to shape the financial ecosystem. Insights derived from the study of common ownership and ESG performance are instrumental in crafting policies that nudge institutional investors towards more sustainable practices. The work of (Scholtens, 2006) highlights the role of regulatory interventions in aligning financial markets with sustainability objective, therefore highlighting the importance of informed policymaking. Lastly, this study aims at targeting societal implications. As the general public becomes increasingly aware of and concerned with corporate sustainability, the influence of common institutional ownership on ESG performance becomes a matter of public interest. The societal push towards sustainable practices represents a broad cultural shift towards responsibility and accountability.

2. Theoretical Discussion

2.1 The importance of stakeholder alignment and sustainable business practices

Building up on the foundational stakeholder theory (Freeman, Harrison, Wicks, Parmar, & De Colle, 2010), recent studies have further emphasized the important role of stakeholders in driving ESG performance. The successful alignment of sustainable action targets and corporate strategy can stimulate a competitive advantage in term of profitability and long-term existence of businesses (Adda, Donkor, Azigwe, & Odai, 2021). Further, ESG performance, driven by stakeholder engagement, positively influences a companies market value trough a mediating effect on financial performance (Zhou, Liu, & Luo, 2022) and it was found that companies with a higher ESG score outperform their peers in financial terms, underscoring the materiality of ESG factors in corporate valuation (García-Sánchez, Husillos, & Larrinaga, 2021).

To adress and resolve conflicts is a prerequisite to commonly reach sustainability goals. The agency theory (Meckling & Jensen, 1976), which posits that conflicts of interest arise between principals (owners) and agents (managers) due to differing goals and information asymmetry, highlights the importance of alignment through control mechanisms and incentive structures. Recent studies even discuss the increasing trend of linking executive compensation to ESG targets, emphasizing how these alignments can drive better sustainability outcomes by motivating executives to prioritize ESG performance (O'Connor, Harris, & Gosling, 2021).

Thirdly the Resource-Based View (Lockett, Thompson, & Morgenstern, 2009) suggests that firms can achieve competitive advantages through the effective management of their resources, including intangible assets like corporate reputation for sustainable practices.

These fundamental theories, supported by more recent studies, underpin the relevancy of ownership structures, its influence on companies and executives as well as the associated positive outcome for firms which align business operations with broader societal values and expectations.

2.2 The relevancy of institutional ownership in shaping corporate governance

The focus of this study lays on institutional investors, as they are pivotal in shaping corporate governance. There has been a significant shift in the asset allocation of institutional investors over the last half century. While they almost exclusively invested in domestic, fixed income instruments during the 1970s, the investments in the domestic equity market already began during the 1980s. In the 1990s institutional investors recognized the benefits of global diversification and made their first forays to international markets.

On a global basis, institutional investors hold more than US\$70 trillion in investable assets and as such yield significant influence over capital market. In 2019 institutional investors already held approximately 65.2% of the total market capitalization worldwide (Tsang, Xie, & Xin, 2019).

As institutional investors typically codify their mission, investment objectives and guidelines in an Investment Policy Statement (IPS) (CFA Institute, 2024) they aim to increase transparency regarding their investment activities. Additionally institutional investors tend to integrate ESG preferences into their trading strategies, leading to a more efficient pricing of ESG-related risk and opportunities in the market. Their emphasis on ESG scores helps to correct mispricings and contributes to overall market efficiencies by promoting a better risk management and long-term value creation (Cao, Titman, Zhan, & Zhang, 2019). Institutional investors drive corporate social responsibility as well as environmental and social performance. Findings suggest that this leads to improved ESG performance for firms held by institutional investors (Dyck, Lins, Roth, & Wagner, 2019).

Institutional investors claim to drive ESG performance by leveraging substantial stakes in various companies to influence corporate behavior by promoting sustainable practices. They assert their investment strategies by actively enhancing corporate responsibility and performance in ESG areas. Through engagement mechanisms, such as aligning with management or voting on shareholder resolutions they advocate sustainable practices, which can lead to improved ESG outcomes and long-term financial returns.

2.3 Conceptualizing Common Ownership

As this study does not focus on sole institutional ownership but common ownership, where multiple institutional investors hold significant ownership in the same company, this section defines how this term is constructed.

While existing literature predominantly defines common ownership as the situation, where an investor holds shares in multiple firms within the same industry, this study considers scenarios where the following scenario is observed:

"Common institutional ownership refers to the scenario, in which any number (but at least two) of institutional investors hold significant stakes within the same company."

To provide a nuanced overview of the effect of common ownership on ESG performance, this study includes multiple thresholds of the term "*significant stakes*". The goal is to provide a more comprehensive understanding of how different levels and structures of institutional common ownership reflect in corporate behavior in connection to environmental, social, and governance practices. On the one hand this allows us to investigate potential threshold effects within this definition, giving the results more robustness, and on the other hand provides comparative insights in regards to the classic definition.

$CO \geq 1\%$

The base threshold for common ownership states two or more institutional investors to individually hold at least one percent in a company. This threshold captures a wide array of investors and includes also those that may not have substantial control but can still collectively influence corporate governance and strategy through voting and shareholder activism (Brochet, Ferri, & Miller, 2021). A more dispersed ownership among investors can lead to varied influences on corporate strategy, including ESG practices. This setup may lead to a more comprehensive integration of diverse ESG-related goals and objectives, by reflecting broader interests (Gilson & Gordon, 2003).

$CO \geq 5\%$

This threshold, where individual investors hold at least five percent, tightens the scope to only include scenarios where influence is exerted by investors who hold significant, though not necessarily controlling stakes in a company. Investors with small levels of influential leverage might be more likely to affect corporate policies without the need for a majority control. Investors with a stake of at least 5% in a firm are typically more engaged and have the resources to monitor firm activities closely (Connelly, Tihanyi, Certo, & Hitt, 2010).

$CO \geq 10\%$

The third threshold sets a criterion which says that institutional investors must at least hold ten percent in a firm individually. This high threshold implies a significant level of influence, which potentially impact corporate governance and strategic decision making. Investors holding significant stakes often engage more active in the formulation and implementation of strategic decision making. They are more likely to demand higher levels of transparency and accountability, influence long term incentive such as ESG practices (Dyck, Lins, Roth, & Wagner, 2019). Large shareholders can effect change by directly participating in board meetings or through more informal channels. Their investment size gives them the leverage to influence decision making (Ferreira & Matos, 2008).

2.4 Existing findings on Common Ownership

Existing literature conceptualizing common ownership mostly as the situation where an investor holds shares in multiple firms within the same industry highlights both collusive and synergy effects, reflecting a nuanced view of its impacts on corporate behavior. Even though these findings do not resemble to the definition chosen for this study, the current view on this definition later enables a comparison of findings.

Collusive effects of common ownership

In their paper "The Common Ownership Hypotheses: Theory and Evidence" Backus and colleagues build on the hypotheses that common ownership leads to a situation where firms with overlapping institutional investors are more likely to internalize each other's profits,

resulting in less aggressive competition. Their model predicts a reduction in competitive intensity as firms are incentivized to consider profitability of their common owner's other holdings. Their findings support this hypotheses, pointing at increased communication as well as strategic voting by institutional investors to align firms' strategies. Their findings raise important questions for antitrust policy and regulation, calling for regulatory scrutiny of ownership patterns to preserve competitive markets. However they also acknowledge the challenges in measuring the exact impact of common ownership (Backus, Conlon, & Sinkinson, 2019), calling for further research to better understand the complexity of ownership structures across different industries and geographic regions.

Other findings underpin these concerns, by analyzing network structures of common owners leadings to higher prices (Ederer & Pellegrino, 2019) and even highly coordinated pricing strategies (Koch, Panayides, & Thomas, 2021).

Synergy effects of common ownership

Common ownership can also influence the competition in the takeover market, where the presence of a common owner between the acquirer and potential competitors reduces the likelihood of receiving competing bids by 45 percent, leading to better acquisition deals with greater synergy gains for acquired companies (Irani, Yang, & Zhang, 2019).

Studies also indicate a positive association between common ownership and a firm's CSR (Corporate Social Responsibility) score, suggesting that these scenarios can motivate firms towards socially responsible behaviors, contributing to a broad positive impact beyond financial performance (Dai & Qiu, 2021). Further findings examine how common ownership by institutional investors influences the ESG companies in China, suggesting that companies with shared ownership structures are more likely to collaborate and adopt sustainable practices, leading to improved ESG performance (Zahid, Wang, Younas, & Maqsood, 2023) and also show improved governance practices, better alignment of managerial incentives with shareholder interests, enhancing oversight and reducing agency costs (Gilje, Gormley, & Levit, 2020).

These studies collectively underscore the complexity of relationships within the predominant definition of common ownership, raising concerns in regards to reduced competition while also highlighting potential upsides.

2.5 Research Gaps

The traditional focus of common ownership research has been on scenarios where institutional investors hold stakes in multiple firms within the same industry. However, despite the extensive literature on this definition, there is a significant research gap in exploring the implications when multiple investors hold substantial stakes in the same company.

This scenario leaves room for exploring distinct governance dynamics and strategic implications that are not fully understood yet.

Another gap in the current literature is the lack of studies examining how common ownership impacts different regions and sectors. Most research sheds light on specific markets, not incorporating potential differences in effects. Additionally, sector-specific studies are scarce. Different industries may exhibit unique responses to common ownership, due to varying regulatory environments and competitive dynamics. Understanding these differences can provide deep insights into the dynamics of common ownership.

Lastly the long-term consequences as well as the temporal dynamics of common ownership remain underexplored. While there is research on short-term-effects like price adjustments and immediate changes in governance, the sustained impact is less understood.

In summary, this study aims to explore an alternative approach to common ownership, highlighting potential implications for different regions and sectors shedding light on temporal dynamics of potential effects.

2.6 ESG metrics as performance indicator

Environmental, social and governance (ESG) metrics have become a critical indicator in terms of a firm's sustainability measurement. They encompass a wide range of factors, which go beyond traditional financial measures.

This study provides a holistic view in corporate sustainability performance by using (1) the ESG score and (2) the magnitude of the score change per year as measures to provide a holistic view of corporate performance. These metrics capture dimensions that traditional metrics tend to overlook. Further, they are quantifiable and comparable, allowing for comparisons across

firms, industries and markets within the sample. and are increasingly acknowledged by institutional investors and closely monitored by regulators and policymakers.

2.7 Resulting Research Questions & Hypothesis

RQ1: How does common ownership, where multiple investors hold substantial stakes within the same company, influence corporate governance and strategic decision-making as measured by ESG metrics?

When a firm is held by multiple institutional investors it is expected to benefit from increased oversight and enhances governance practices. Institutional investors often have the resources and expertise to closely monitor the firm's strategic decision making.

The collective scrutiny derived from common ownership is expected to lead to improved transparency, accountability and adherence to better ESG performance as they bring a variety of perspectives to the table. Each institutional investor may have different priorities, such as sustainability, long-term growth, or innovation, which is expected to collectively contribute to a more balanced and well-rounded approach towards ESG practices (Dyck, Lins, Roth, & Wagner, 2019).

To develop clear expectations of results, the potential advantages and downsides of the three thresholds for ESG performance are considered.

For $CO \geq 1\%$ the broad range of institutional investors can collectively influence corporate governance, by bringing a wide array of ESG-related goals and objectives of institutional investors to the table. The reflecting of broader interests can promote a comprehensive integration of sustainability practices, resulting in better ESG performance (Gilson & Gordon, 2003). On the other hand, the average influence of investors is relatively small, potentially leading to a diffusion of responsibility (Brochet, Ferri, & Miller, 2021). This dispersion might result in less coordinated advocacy for ESG improvements and therefore worse performance.

For $CO \geq 5\%$ the increased engagement can lead to more proactive measures in improving ESG performance, leveraging their significant but not controlling influence to push for responsible corporate policies (Connelly, Tihanyi, Certo, & Hitt, 2010). On the other hand, these investors may prioritize certain ESG aspects, aligning with their specific interests, potentially neglecting a holistic approach (Connelly, Tihanyi, Certo, & Hitt, 2010). This could result in uneven focus on ESG dimensions.

For $CO \geq 10\%$ the significant leverage of investors enables them to actively participate in strategic decision-making processes. Their significant investment size grants them to leverage to demand higher levels of transparency and accountability, fostering better ESG practices (Dyck, Lins, Roth, & Wagner, 2019). On the other hand, such significant stakes might lead investors to exert too much influence, potentially pushing corporate strategies that favor short-term financial gains over long-term ESG commitments. Their domination position could skew corporate priorities, possibly undermining balanced and sustainable practices (Ferreira & Matos, 2008). Additionally the presence of at least two major investors might lead to a conflict of interest which results in contrary influence on management and strategy development.

As the thresholds of common ownership do not mandatorily exclude each other (investors with 5% or 10% of holdings do also fall under the 1% threshold) $CO \geq 1\%$ aims to capture the combined effects of all investors, while $CO \geq 5\%$ and $CO \geq 10\%$ narrow the perspective down to medium and large investor effects only.

The existing findings of institutional investors driving ESG performance combined with the idea that diverse influences form a holistic approach to pursuing sustainability goals, outweigh the potential problems, which might arise from multiple investors influence. Therefore, make the expectations of a higher level of common ownership on ESG performance positive for all three scenarios.

H1: Common ownership by multiple investors leads to enhanced corporate governance practices and strategic decision making, as reflected in improved overall ESG scores as well as ESG performance due to increased oversight and active engagement.

RQ2: How do the effects of common ownership on ESG performance vary across different regions and sectors, considering the varying regulatory environments and competitive dynamics?

This addresses regional and sectoral variations in the effect of common ownership. In terms of regional expectations, the selected regions of the USA and Europe are expected to show different magnitude of results based on their regulatory environments. In general Europe is considered as stricter in terms of ESG performance regulations compared to the United States, as being reflected in the comprehensive regulations such as the EU Taxonomy for Sustainable

Activities, the Non-Financial Reporting Directive (NFRD) and the Sustainable Finance Disclosure Regulation (SFDR). These frameworks require companies to disclose more detailed information about ESG practices. On the other hand, European institutional investors are generally placing a higher emphasis on ESG criteria in their investment decisions (Ferrarini & Siri, 2023). In contrast, while the US has made progress in promoting ESG, its regulatory approach has been less comprehensive and uniform. The Securities and Exchange Commission (SEC) has taken steps, but there is still significant variability in how ESG is regulated.

As ESG impacts firms differently the formulation of expected results on the effect of common ownership on ESG performance is not clear. As sectors (such as energy, industrials, materials) face significant environmental risks and scrutiny and must adopt robust management practices to mitigate these risks and comply with regulations, sectors with high societal impact (e.g., health care) are under more scrutiny for their impact on public impact and sectors (e.g., information technology, communication services) face governance concerns such as data privacy, cybersecurity, and ethical use of AI and are therefore closely monitored in regard to their governance practices.

However, previous findings, that ESG performance can enhance a company's value and be a competitive advantage is applicable to all sectors and posits that the effect will be more pronounced in sectors with higher competition, which is measured by the Herfindahl-Hirschmann-Index (HHI). These firms are under higher peer pressure and can't afford to perform poorly in ESG.

H2: The impact of common ownership on ESG performance differs significantly across regions and sectors, with (1) more regulated regions and (2) more competitive industries showing greater overall scores as well as improvements in ESG scores due to higher levels of scrutiny and required strategic coordination to meet diverse stakeholder expectations.

RQ3: What are the long-term consequences and time-specific dynamics of common ownership on firm performance as measured by ESG metrics?

This hypotheses addresses the expected time lagged effect of common ownership, suggesting that combined long-term engagement by institutional investors will lead to better overall ESG performance. These expectations are based on the findings that ESG integration, such as reducing carbon emission or improving labor practices, involve long-term investment that do

not yield immediate returns (Edmans, 2011) and institutional investors' efforts to influence corporate behavior regarding ESG often results in observable improvement only over a medium to long-term horizon (Dimson, Karakaş, & Li, 2015).

H3: Common ownership has an observable positive time lagged response as well as an even more pronounced long-term effect on ESG performance, resulting in sustained improvement in ESG metrics, driven the continuous engagement of investors and the alignment of managerial incentives with long-term strategic goals.

3. Methodology

To rigorously test the hypotheses outlined, regarding the impact of common ownership on ESG performance, this section details the data requirements and testing methods and connects them to the research questions derived from gaps in existing literature.

3.1 Data Requirements

To investigate the effect of common ownership on ESG performance, data for public companies was derived from "LSEG Data & Analytics". To analyze a diverse set of firms and enable the geographic as well as sectoral split, the full data sample includes US and European companies from the sectors energy, materials, industrials, materials, information technology, health care and communication services.

A total of 8,102 companies are included in the raw sample. The time period includes data from 2014 until 2023. To ensure a high-quality data sample, only companies with data on ESG performance over the full period were considered, leaving a total sample of 770 firms.

Yearly ESG data was derived from LSEG, which consists of a combined score calculated by taking the mean of environmental, social and governance pillar scores. Further, the financial metrics Opex, Capex and turnover were derived as control variables (*Appendix 1: Definitions of Metrics from LSEG*). These variables were selected for several reasons. First, they reflect fundamental aspects of a company's health and operations, driving company performance. Additionally, they are likely to correlate with ESG outcomes. Companies that spend more on Capex and Opex may also invest in ESG initiatives. Similarly, firms with a higher turnover may allocate more resources towards ESG goals. The goal is to accurately isolate the effect of

common ownership on ESG metrics by filtering the effects of the control variables as they vary significantly across the different industries and company sizes.

To construct the different thresholds of common ownership, yearly shareholder reports for all 770 companies were individually downloaded from LSEG, including only institutional investors (*Appendix 2: Sample Shareholder Report from LSEG*). Afterwards the percentages of the three thresholds were calculated for each company

These three steps result in a dataset of ESG performance metrics, common ownership data, and financial metrics for the sample of 770 firms.

(H1) To measure the overall effect of common ownership on ESG the full dataset was considered.

(H2) To measure the differential influences of common ownership between regions and sectors the sample was divided by region as well as sector. The regional split to test if European companies show a more pronounced effect of common ownership on ESG performance due to a stricter regulatory environment, is based on the country of headquarters and results in two subsamples: "United States of America" and "Europe".

The sectoral split is based on the standard classification system GICS and results in six subsamples: energy, industrials, materials, information technology, health care and communication services from both regions.

To test if the results meet the expectation, that samples in more competitive industries show better ESG performance due to higher levels of scrutiny and required strategic coordination they were ranked by the Herfindahl Hirschmann Index calculated for each sector subsample, which is a commonly used measure of market concentration (*Appendix 3: sector values for HHI*).

$$HHI = \sum_{i=1}^n s_i^2$$

where:

- HHI is the "Herfindahl Hirschmann Index" ranging from 0 to 10,000
- s is the percent market share of each sample firm within the sector, calculated with average revenues of entity divided by sum of average revenues of all entities over the period 2014-2023

(H3) To test for a potentially lagged response of effects, lagged variables were created for each CO threshold by shifting the values of the variables by one, two and three years in the past. To further test for a long-term effect, the average CO values from 2014-2017 as well as the ESG score improvement in the following years of 2018-2023 were calculated.

3.2 Data cleaning and transformation

The raw list of 8,102 companies was filtered to only include firms with a full history of ESG metrics from 2014-2023. Further, the 1.5 IQR method was used for all values to ensure the exclusion of outliers (*Appendix 4: 1.5 IQR method*).

A first sample check of descriptive as well as distributional analysis led to the conclusion, that the ESG scores followed a positive trend over years (*Appendix 5: Visualisation of ESG Trends*). To guarantee comparability, the ESG metrics the data was standardized, using the Z-score formula (*Appendix 6: Z-score Standardization Formula*). Due to the trend, an independent standardization approach was chosen. This method ensures that each year is standardized independently, ensuring that the standardized values reflect the relative performance within one year.

Further, common ownership percentages as well as the control variables were standardized to make the data from different time periods and different scales comparable. It ensures an accurate interpretation of patterns and relationships in regression analysis which otherwise might be deferred by the different scales of the data.

To prepare the datasets for the panel data regression the setup was changed from a wide to a long format, using a melting function. This allows the regression model to properly account for the temporal and cross-sectional dimensions of the data. In panel data, each entity is observed across multiple time periods. The new format allows for clear indexing by both entity and time which is essential for the panel data regression methods. The adjusted format is crucial for the fixed effects model to subtract group means and for the random effects model to correctly estimate variance components.

3.3 Descriptive Statistics and Distribution Analysis

To get an overview of the data and identify trends, descriptive statistics were calculated and the distribution of absolute as well as standardized values were plotted. This was done before and after the standardization of data.

3.4 Specification of Models

Models for H1:

To test for the overall effect of common ownership on ESG performance, panel data regression models were used to examine the relationship.

Dependant variables	Independent variables	Control variables
ESG Score	CO>=1%	Opex
Change in ESG Score	CO>=5%	Capex
	CO>=10%	Turnover

For each combination of dependent and independent variables a "Fixed Effects Model" as well as a "Random Effects Model" was run.

"Fixed Effect Models" control for time-invariant characteristics of entities, eliminating bias from omitted variables that do not change over the time period. These models especially look at the changes within an entity over time, making them useful for understanding the impact of common ownership that varies over time for the entity. Additionally these models provide consistent estimates if unobserved heterogeneity is correlated with the explanatory variables, which could be the case for common institutional ownership.

$$ESG_Score_{it} = \alpha_i + \beta_1 CO_{it} + \beta_2 Opex_{it} + \beta_3 Capex_{it} + \beta_4 Turnover_{it} + u_{it}$$

where:

- ESG_Score_{it} is the dependent variable for entity i at time t
- α_i is the entity-specific intercept (fixed effect), capturing all time-invariant characteristics of the entity i
- $\beta_1 \beta_2 \beta_3 \beta_4$ are the coefficients for the respective independent and control variable
- CO_{it} is the independent variable of interest
- $Opex_{it}, Capex_{it}, Turnover_{it}$ are control variables

- u_{it} is the idiosyncratic error term

"Random Effects Models" on the other hand are more efficient, usually providing more precise estimates, when the unobserved individual effects are uncorrelated with the explanatory variables. They further account for within-group as well as between-group variation, providing a broader understanding of the data.

$$ESG_Score_{it} = \alpha_i + \beta_1 CO_{it} + \beta_2 Opex_{it} + \beta_3 Capex_{it} + \beta_4 Turnover_{it} + \mu_i + u_{it}$$

where:

- ESG_Score_{it} is the dependent variable for entity i at time t
- α_i is the overall intercept
- $\beta_1 \beta_2 \beta_3 \beta_4$ are the coefficients for the respective independent and control variable
- CO_{it} is the independent variable of interest
- $Opex_{it}, Capex_{it}, Turnover_{it}$ are control variables
- μ_i is the entity-specific random effect, which is assumed to be uncorrelated with the independent variables
- u_{it} is the idiosyncratic error term

Afterwards the results were analyzed and tested for significance. The measures used to determine these results are the overall model fit R^2 , which indicates the proportion of variance in the dependent variable that is predictable from the independent variables, with a higher value indicating a higher fit. Additionally the significance of coefficients, the Hausman test (*Appendix 7: Hausman test*) which checks for differences in fixed vs. random effects models (with a high p-value > 0.05, indicating no differences and vice-versa), the Variance Inflation Factor (VIF) (*Appendix 8: VIF*) which checks for multicollinearity concerns. and the Durbin-Watson (*Appendix 9: Durbin-Watson test for autocorrelation of residuals*) to check for issues regarding model fit, multicollinearity and autocorrelation of errors were conducted.

Models for H2:

To test for differences across the different regions and sectors, the same setup was used.

Models for H3:

Additionally, the panel data regressions used to test for *H1* and *H2* were modified to investigate whether past levels of common ownership have an influence on the ESG scores and ESG score improvement of firms in subsequent years. To achieve this, lagged variables of common ownership were incorporated into the regression models. These variables help to establish a causal relationship by examining the effect of past values of independent variables on more recent values of dependent variables. This helps to account for temporal dynamics and persistence in the data to capture the potentially delayed effects of common ownership on ESG scores and ESG score improvements. Additionally, it can improve the robustness of the regressions by mitigating autocorrelation in the residuals, which are tested for by using the Durbin-Watson test.

For each CO threshold, lagged variables were created by shifting the values of the variables by one, two and three years in the past.

One-year lag: $CO \geq 1\%_{lag1}$, $CO \geq 1\%_{lag2}$, $CO \geq 1\%_{lag3}$

Two-year lag: $CO \geq 5\%_{lag1}$, $CO \geq 5\%_{lag2}$, $CO \geq 5\%_{lag3}$

Three-year lag: $CO \geq 10\%_{lag1}$, $CO \geq 10\%_{lag2}$, $CO \geq 10\%_{lag3}$

The creation of lagged variables introduces additional missing values at the beginning of the time series. To maintain data integrity and ensure meaningful results, rows with missing values in lagged variables were dropped. The regression models again specifies the ESG scores and their subcomponents or the ESG score Improvement and their subcomponents as the dependent variables and the lagged variables as the independent variables. Again, fixed as well as random effects models were run and the overall model fit R^2 , Hausman test, VIF and the Durbin-Watson test were conducted.

To lastly test for the potential presence of long term effects, linear regression models were specified:

$$ESG_Score_Improvement_i = \beta_0 + \beta_1 CO_i + \beta_2 Opex_i + \beta_3 Capex_i + \beta_4 Turnover_i + \epsilon_i$$

where:

- $ESG_Score_Improvement_i$ is the dependent variable representing the change in ESG scores from 2018-2023 for company i
- β_0 is the intercept
- $\beta_1 \beta_2 \beta_3 \beta_4$ are the coefficients for the respective independent and control variables
- CO_i is the independent variable of interest representing the common ownership percentage for company i
- $Opex_i, Capex_i, Turnover_i$ are control variables
- ϵ_i is the error term

4. Analyses and Results

4.1 Descriptive Statistics for Unstandardized Data

Full period: (*Appendix 10: Descriptive Statistics - Unstandardized Data*)

In total 770 firms were included, 358 from the US and 412 from Europe. The number of observations within the sectors ranges from 73 firms for the communication services sector to maximum 233 firms for industrials (*Appendix 11: Distribution of Firms*).

ESG scores

Over the full period the mean ESG score for all firms was 56.91. While US companies indicate a lower score with 52.82, European firms perform above average with 60.47.

Within the sectors the average scores were 51.09 for energy, 57.92 for industrials, 56.56 for materials, 58.61 for information technology, 59.53 for health care and 52.89 for communication services.

The average variation within the data was 17.15 for the full sample, 16.90 for US firms and 16.59 for European firms, indicating a balanced variation between the regions. The sector with the highest variation in scores is communication services with a STDEV of 20.50 and energy at 18.80. The other sectors revolve around a STDEV of 16.

The overall minimum ESG score was 8.49 for a European firm in the energy sector, and the highest one at 91.99 for an US firm in the information technology sector.

ESG score change

ESG score change measures the magnitude of score changes within one year.

Over the full period the mean change in ESG score (per year) was positive with a value of 1.88. While US firms show a higher mean change of 2.15, European firms only increased their score by 1.65 per year.

The overall score change per year is positive across all samples, indicating a positive trend in overall ESG performance.

The sector with the highest yearly improvement is health care with 2.27, while information technology lags with a value of 1.65.

The overall variation in yearly score changes is 1.75. The average variation is higher for US firms with 1.81 than for European firms with 1.66. The sector with the highest variation in changes is energy with 1.97, while communication services have the least variation with 1.56. The highest improvement a firm achieved within a year is 7.86 for a US firm from the health care sector. The highest negative change is -5.97 for a US firm in the information technology sector.

These results indicate an overall higher ESG score for European firms. It seems that they operate at a higher baseline than US firms. On the other hand, US firms show higher positive changes in ESG scores, indicating that scores will converge to more balanced scores, if this trend is continued in the future.

Sectoral differences are likely due to the nature of operations. While some sectors show a higher baseline, the positive trend for all sectors indicates that all sectors try to increase sustainability.

Common ownership

The average number of observations for the different variables shows high variation. While full transparency regarding ESG performance was mandatory to be included in the analysis (770 firms with full transparency out of 8,102) the presence of common ownership was not a

prerequisite. Over the full period the mean number of firms where each threshold of common ownership could be observed varies strongly (*Appendix 12: Presence and holdings of Common Owners*).

While the average number of firms per year with common ownership $CO \geq 1\%$ was at 87%, the average number of firms showing a degree of $CO \geq 5\%$ is at 69% and $CO \geq 10\%$ is only at 27%.

There is a clear gap between US and European firms: for US firms the average number of firms with $CO \geq 1\%$ was at 99%, $CO \geq 5\%$ at 95% and $CO \geq 10\%$ at 40% while for European firms the average were at 76% for $CO \geq 1\%$, 45% for $CO \geq 5\%$ and only 15% for $CO \geq 10\%$.

Within the different sectors the average presence of $CO \geq 1\%$ revolves at around 83-88% for all sectors, while the discrepancies for $CO \geq 5\%$ are bigger with a range of 55-77%. For $CO \geq 10\%$ the inter-sector differences are the biggest, ranging from 18% for health care to 44% for the energy sector.

These results indicate an overall stronger presence of common ownership in the US. While institutional investors seemingly tend to invest in their domestic market, the observation, that the average presence of common owners within the sectors is quite similar, confirms the holistic investment approach of institutional investors across different market segments.

The average holding percentage of common owners within a firm for the full sample resembles around 40% for $CO > 1\%$, 26% for $CO > 5\%$ and 29% for $CO \geq 10\%$.

For US firms, the average holding percentage for $CO \geq 1\%$ is at 51%, $CO \geq 5\%$ at 26% and $CO \geq 10\%$ at 27%. For European firms the percentages are 27% for $CO \geq 1\%$, 25% for $CO \geq 5\%$ and 32% for $CO \geq 10\%$ indicating that even though the overall presence of common owners is higher in the US, the holding percentages of these owners (if they exist) tends to be smaller for investors with at least 1% and 5% but higher for investors with at least 10% in a firm.

Development over time

ESG score

The mean ESG score shows a clear upward trend over the period of 2014 to 2023, while the variation in scores declines over time (*Appendix 4: Visualisation of ESG score developments*)

The ESG score starts from an average of 48 and increases to 65 over the past ten years.

The trends for US firms as well as European firms are in line with the full dataset, indicating an overall improvement in ESG scores. For the different sectors the results are also in line with these findings. The ESG scores showed a clear upward trend with a decrease in variability, indicating a convergence towards more uniform ESG scores across geographic locations and sectors.

ESG score change

Over the time periods of 2014 to 2023 the results do not only show a general improvement in scores but also a positive trend in the magnitude of change. The mean improvement across all samples shows the highest average changes in the years 2020 and 2021. The overall high STDEVs indicate substantial variability in ESG performance improvement, with some firms making stronger progress while others lag behind. The highest mean improvement can be seen in 2021 with a value of 2.59 while the lowest improvement is seen in 2015 with a mean of 0.94. US firms generally show consistent improvements with a peak in 2021 (mean improvement of 3.1). European companies also show a peak in 2021 but actually show a slight decline in mean improvement in 2023 with an average decrease in ESG scores of -0.13. US firms generally show a more consistent and a higher level of improvement when compared to European firms. This may reflect increasing pressure due to historically worse performance or changes in regulatory environments, market pressure and corporate strategies. The different sectors show varying trends in ESG improvements. Health care for example shows consistently strong performance while the energy sector exhibits fluctuations, possibly due to inherent challenges in the sector. Overall the positive trend in the magnitude of improvements per year peaked in 2021 and has declined since then, resulting in significantly smaller improvements in scores per year. The high variability highlights the diverse approaches and success levels among companies in improving their ESG performance. This suggests that some companies are already

leading examples of ESG improvements, while others need additional support and strategy. (*Appendix 13: Visualisation of change in ESG scores per year*)

Common Ownership

The number of firms where $CO \geq 1\%$ is present remains stable over time with a yearly average of 600 out of 770 firms for the full sample. $CO \geq 5\%$ shows an increase from 2014 to 2016 but has remained relatively stable since then. $CO \geq 10\%$ however shows a clear increase, being only present for 37 firms in 2014 but for 87 in 2023. The trends for US firms, European firms and the individual sectors are in line with the full dataset. However while the number of institutional common owners remains relatively stable for all samples, the percentages held by common owners show a drop from 40% to 30% for European firms (*Appendix 14: Visualisation of Common Ownership Development*).

Control variables

The control variables show high variability over the full time period, being in line with the expectations of the diverse set of firms.

4.2 Descriptive Statistics for Standardized Data

Full period

To remove the effects of differing scales and units all values have been standardized to a mean of zero and a standard deviation of one (*Appendix 6: Z-score Standardization Formula*). For all companies the mean of ESG scores is now close to zero and the STDEV is at 0.92, indicating a fairly spread distribution. Sector specific findings are a higher variability in ESG scores and ownership percentages for energy firms, higher variability in ownership percentages for materials and communication services.

Development over time

The standardized data shows consistency across the full sample, US and European firms as well as the different sector for the ESG scores, ESG score improvements as well as common

ownership data and control variables based on the nature of standardized data. These results approve the exclusion of trends over time for use in regression models.

4.3 Regression Results

When using standardized data in regression models as independent variables, the coefficient can be understood in terms of standard deviations rather than the original units of measurement. The magnitude indicates the strength of the relationship, with larger values indicating a stronger effect.

To first test for the overall effect of common ownership on ESG scores and change in scores, panel data regression models were used. For each combination of dependent and independent variables a "Fixed Effects Model" as well as a "Random Effects Model" was run (*Appendix 15: Sample Output for Fixed and Random Effects Models*).

For the full sample, the overall influence of $CO \geq 1\%$ on ESG scores is negative, with a significant coefficient in the random effects model of -0.0314^{***} . This negative coefficient indicates that when the common ownership increases by one STDEV, the ESG score is expected to decrease by 0.0314 STDEVs.

$CO \geq 5\%$ has a negative but insignificant effect on ESG scores for both models, while $CO \geq 10\%$ has a positive but insignificant effect for both models.

The overall influence of $CO \geq 1\%$ on the change in ESG scores per year is positive with a significant coefficient of 0.0422^{***} for the random effects model.

$CO \geq 5\%$ has an insignificant negative effect in the fixed effects model and an insignificant positive effect in the random effects model. $CO > 10\%$ has an insignificant negative effect in both models.

Overall $CO \geq 1\%$ is the only form of common ownership with significant results for the full sample, indicating a negative effect on ESG scores but a positive effect on the change in ESG scores per year.

These results lead to a rejection of "*H1: Common ownership by multiple investors leads to enhanced corporate governance practices and strategic decision making, as reflected in improved overall ESG scores as well as ESG performance due to increased oversight and*

active engagement.". In this setup the overall influences are on the one hand negative on overall ESG scores and positive on changes in ESG scores, which draws a mixed picture that is not in line with the expected positive results.

To further compare the effects for the different regions of the USA and Europe, the panel data regressions were run on these two subsamples.

For US firms the influence of $CO \geq 1\%$ on ESG scores has a negative coefficient of -0.0314^{***} in the random effects model. $CO > 5\%$ has a negative but insignificant effect on ESG scores for both models, while $CO \geq 10\%$ has a positive but insignificant effect for both models.

The influence of $CO \geq 1\%$ on the change in ESG scores is positive with a significant coefficient of 0.0827^{***} for the random effects model.

$CO \geq 5\%$ has insignificant mixed results and $CO \geq 10\%$ has a significant negative effect with a coefficient of -0.1182^* .

For European firms the influence of $CO \geq 1\%$, $CO \geq 5\%$ and $CO \geq 10\%$ on ESG scores is positive but insignificant for all models, while the influence on change in ESG scores shows mixed but also insignificant results.

When comparing the results, it seems that common ownership only has significant influences on ESG scores and change in ESG scores for US firms.

To lastly compare the effects for different sectors, the panel data regressions were run on the six subsamples of energy, industrials, materials, information technology, health care and communication services.

For the energy sector a negative effect of $CO \geq 5\%$ on ESG scores with a coefficient of -0.0463^* was observed.

For industrials a negative effect of $CO \geq 1\%$ on ESG scores with coefficient of -0.0681^{**} for the fixed and -0.0929^{***} for the random effects model. Additionally, a significant positive effect of $CO \geq 1\%$ on the change in ESG scores with a coefficient of 0.0570^{**} was observed.

For the materials sector a significant negative effect of $CO \geq 10\%$ on ESG scores with a coefficient of -0.0461^* as well as a negative effect on ESG score changes with a coefficient of -0.1277^* was captured.

For information technology firms the effect of $CO \geq 1\%$ on ESG scores was observed as significant and positive with coefficient of 0.1011* for the fixed and 0.0754*** for the random effects model.

For health care the effect $CO \geq 10\%$ on ESG scores was significant and positive with a coefficient of 0.1443** for the fixed and 0.1473* for the random effects model.

Lastly, for communication services the only significant effect observed was from $CO \geq 5\%$ with a positive coefficient of 0.0590*.

Based on these results, all firms were ranked by count and then magnitude of positive effects of common ownership on ESG scores and changes in ESG scores to later compare them to the expected results based on the HHI Index:

Rank	Sector	Regression Results	HHI
1	Health Care	two positiv effects; zero negativ effects; highest magnitude + significance	504
2	Information Technology	two positiv effects; zero negativ effects	546
3	Communication Services	one positiv effect; zero negatic effects	807
4	Industrials	one positive effect/two negativ effects	172
5	Energy	one negativ effect	703
6	Materials	two negative effects	222

These results lead to a rejection of “*H2: The impact of common ownership on ESG performance differs significantly across regions and sectors, with (1) more regulated regions and (2) more competitive industries showing greater overall scores as well as improvements in ESG scores due to higher levels of scrutiny and required strategic coordination to meet diverse stakeholder expectations.*”. The expected results of more pronounced effects for a stricter regulatory environment within Europe was not observed. The results show that CO has a significant negative effect on ESG scores and a positive effect on ESG score changes and no effect on European firms, draws a different picture than expected..

The test for sectoral differences based on market concentration indicated by a ranking of the HHIs shows that in overall firms with higher market concentration tend to be more positively affected (values above 500), with the energy sector as a clear exception.

Overall, 12 of 54 coefficients of different common ownership thresholds on ESG scores were significant of which 7 were negative and 5 were positive.

For change in ESG scores only 5 of 54 coefficient were significant, of which 2 were negative and 3 positives.

While $CO \geq 1\%$ has a negative effect for 4 out of 6 significant findings on the ESG score, the variable only shows positive significant effects on the change in ESG scores.

$CO \geq 5\%$ has mixed effects on ESG scores and no significant effects on the change in ESG scores.

$CO \geq 10\%$ also has mixed effects on ESG scores and negative effects on changes in ESG scores.

An overview of all regression coefficient can be found in *Appendix 16: Coefficients of Common Ownership on ESG scores and change in ESG scores for different subsamples.*

For the panel data regressions used to test for *H1* and *H2*, the average R^2 value is 0.0053, indicating that only a small portion of the variance in the ESG scores as well as changes in ESG scores is explained by the models. Random effects models showed slightly higher values compared to fixed effects models. Average F-Statistics is 2,9672, varying in their significance levels and magnitudes across the samples and models. Generally, random effects models tend to have higher F-Statistics. The overall p-values are mostly insignificant.

The Hausman test Chi^2 of -1.6344, suggest that there is no strong evidence against using random effects models over fixed effects models, implying that the differences between fixed and random effects models are not statistically significant. The average VIF is 2.19292. It is generally low to moderate, indicating that multicollinearity is not a severe issue. Most values are below 2, suggesting that predictors are not highly correlated with each other. The Durbin-Watson statistic of 1.3401 on average, suggests moderate positive autocorrelation.

In the next step the panel data regressions used to test for *H1* and *H2* were modified to investigate whether past levels of common ownership have an influence on the ESG scores and ESG score Improvement of firms in subsequent years. To achieve this, lagged variables of common ownership were incorporated into the regression. (*Appendix 17: Sample output for regression with lagged variables*)

Lag1 on ESG score and ESG score changes

For the full sample negative and significant effects of $CO \geq 1\%_{Lag1}$ on ESG scores with a coefficient of -0.0365^{**} and $CO \geq 5\%_{Lag1}$ with a coefficient of -0.275^{**} were observed.

For US firms the same effects with coefficients of -0.0465^* for $CO \geq 1\%_{Lag1}$ and -0.0516^{***} were observed, while European firms showed no signs of significant effects.

The energy sector indicates a negative effect of $CO \geq 5\%_{Lag1}$ on ESG scores in both models with a coefficient of -0.1000^{**} for fixed and -0.1021^{***} for random effects models.

The industrials sector indicates a negative effect of $CO \geq 10\%_{Lag1}$ with a coefficient of -0.0477^* and health care indicates a negative effect of $CO \geq 1\%_{Lag1}$ with a coefficient of -0.0880^* .

While no significant effects were observed for information technology, communication services are the only subsample with an observed positive and significant effect of $CO > 5\%_{Lag1}$ in both models with coefficients of 0.0820^{**} for fixed and 0.0786^{**} for random effects models.

The only significant observations on change in ESG scores were a positive coefficient of 0.0096^* of $CO \geq 10\%$ in the industrials sector and negative coefficients of -0.2173^{**} for $CO \geq 1\%_{Lag1}$ and -0.1371^* for $CO \geq 5\%_{lag1}$ in the information technology sector,

Overall, 11 of 54 coefficients of different common ownership thresholds with Lag1 on ESG scores were significant of which 9 were negative and 2 were positive.

The observed effects of Lag1 variables on ESG score changes are significantly less than on absolute ESG scores. For change in ESG scores only 3 of 54 coefficients were significant, of which 2 were negative and 1 was positive. The negative effects were observed in the information technology sector for $CO \geq 1\%_{Lag1}$ with a coefficient of -0.2173^{**} and $CO \geq 5\%$ with a coefficient of -0.1371^* .

While $CO \geq 1\%_{Lag1}$ has a negative effect for all significant findings on the ESG score and change in scores, $CO \geq 5\%_{lag1}$ has five out of seven significant coefficients with negative presign for ESG score and one negative effect on ESG score changes.

$CO \geq 10\%_{Lag1}$ indicates one negative effect on ESG score and one positive effect on ESG score changes.

An overview of all regression coefficients can be found in *Appendix 18: Coefficients of Lag1 Common Ownership on ESG scores and change in ESG scores for different subsamples*

Lag2 on ESG score and ESG score change

For the full sample a negative effect of $CO \geq 5\%_{Lag2}$ on ESG scores with a coefficient of -0.0239^{**} was observed. While for US firms no effect was indicated, European firms seem to be negatively affected by $CO \geq 5\%_{lag2}$ with coefficients of -0.0522^{**} for fixed and -0.0518^{***} for random effects. Within the sectors, industrials indicate a negative effect with -0.0532^{**} for $COE \geq 5\%_{Lag2}$ and health care a negative effect with -0.1026^{**} for $CO \geq 1\%_{Lag2}$. Positive effects were only observed for information technology with 0.0812^{**} for fixed and 0.0689^* for random effects models.

Overall, 6 of 54 coefficients with Lag2 on ESG scores were significant of which 4 were negative and 2 positives.

The five significant effects of Lag2 variables on ESG score changes were all negative but only observable for sectors. industrials indicate a negative effect of $CO \geq 1\%_{Lag2}$ with -0.1546^* while communication services indicate a negative effect of $CO \geq 5\%_{Lag2}$ with -0.4496^{***} for fixed and -0.4314^{***} for random effects models (both significant at the 1% level). $CO \geq 10\%_{Lag2}$ only seems to affect health care with coefficients of -0.8763^{***} for fixed and -0.6209^{**} for random effects models.

While $CO = 1\%_{Lag2}$ indicates only positive effects on ESG scores, the observed effect on ESG score changes is negative. $CO \geq 5\%_{Lag2}$ seems to have the strongest negative implications for ESG score as well as score changes, with all six significant effects being negative. $CO \geq 10\%_{lag2}$ does not indicate effects on ESG scores but negative effects on ESG score changes.

An overview of all regression coefficients can be found in *Appendix 19: Coefficients of Lag2 Common Ownership on ESG scores and change in ESG scores for different subsamples*

Lag3 on ESG score and ESG score changes

For the full sample a positive effect of $CO \geq 10\%_{Lag3}$ on ESG scores with coefficients of 0.0315** for fixed and 0.0240** for random effect models was observed. For the US firms a similar effect with a coefficient of 0.0411** was indicated. Lag3 variables do not seem to impact ESG scores of European firms.

Within the sectors energy, information technology and health care do not indicate effects. For industrials, a negative effect for $CO \geq 1\%_{Lag3}$ with -0.0671** for random effects was observed. In contrast are the positive effects measure for both $CO \geq 5\%$ with coefficients of -0.0551** for fixed and -0.0486** for random effects and $CO10\%$ with 0.1109** and 0.1112**. The materials sector seems to be only significantly affected by $CO > 10\%_{lag3}$ with negative coefficients of -0.1487*** and -0.1457*** (both significant at the 1% level). communication services only indicate a positive effect of $CO > 5\%_{lag3}$ with 0.0742* in the random effects model.

Overall, 11 of 54 coefficients with Lag3 in ESG scores were significant of which 8 were positive and 3 negatives.

The eight significant effects of Lag3 variables on ESG score changes were all positive. For the full sample $CO > 5\%_{Lag3}$ seems to have a positive effect with a coefficient of 0.0678* for the fixed effects model. For US firms the effect is at 0.0778* for the fixed effects model. For European firms the effect is at 0.0826* for the random effects model. While energy, Material, information technology and health care do not seem to be affected by Lag3 common ownership, industrials indicate a positive effect of $CO \geq 5\%_{lag3}$ with coefficients of 0.1815** and 0.1674*** for fixed and random effect models. In communication services the positive effects were observed for $CO \geq 5\%$ with 0.2810** and 0.2595**, as well as for $CO \geq 10\%_{lag3}$ with 0.5746*** for the fixed effect model.

Overall, 8 of 54 coefficients with Lag3 on ESG score changes were significant of which all 8 positives.

While $CO \geq 1\%_{lag3}$ only indicates one negative effect on ESG scores, the observed effects for $CO \geq 5\%_{lag3}$ were positive across ESG scores and changes in ESG scores with 12 positive

and significant coefficients. $CO \geq 10\%_{lag3}$ overall has 5 significant coefficients of which 3 are positive and 2 negative.

An overview of all regression coefficients can be found in *Appendix 20: Coefficients of Lag3 Common Ownership on ESG scores and change in ESG scores for different subsamples*

For the panel data regressions, including lagged variables, the average R^2 value is very low (0.0066), indicating that the models explain only a small portion of the variance in ESG scores as well as ESG score changes. The average F-Statistic is 3.4737, suggesting that while some models are statistically significant, others are not. The average p-value is 0.1585, which indicates that the average model shows no significance at the 10%, 5% or 1% level, supporting the observation of weak model fit. Hausman Tests CHI^2 value is -0.8433 and the average p-value is very high (0.9805). This suggests that the random effects model is generally preferred over the fixed effects model, as there is no strong evidence against random effects. Average VIF is 2.0164, indicating that multicollinearity is not a severe issue, as values below 5 are considered acceptable. The average Durbin-Watson statistic is 1.2681, indicating mild to moderate positive autocorrelation in residuals. This suggests some correlation of residuals, which can affect the efficiency of estimates.

To lastly test for the potential presence of long-term effects of historic levels of common ownership on ESG score changes, linear regression models were run using historic values of average common ownership on recent data of average yearly ESG score changes. (*Appendix 21: Sample Output for Linear Regression Models*)

For the full sample a positive effect of Avg. $CO \geq 1\%$ (2014-2017) was observed with a coefficient of 0.1066. For US firms this effect seems to be even stronger with 0.2304***, while European firms seem to be negatively affected with a coefficient of -0.1220**. Within Sectors a positive effect of $CO \geq 1\%$ (2014-2017) on the Industrial sector with a coefficient of 0.1928** was measured as well as an effect of Avg. $CO \geq 5\%$ (2014-2017) of 0.2131* for materials. The ESG score improvements for energy, information technology, health care and communication services seem to be not significantly affected by historic common ownership levels.

Overall, the historical level of $CO \geq 1\%$ indicates the most effects on ESG score improvements in the following years with 3 positive and one negative effect measured. $CO \geq 5\%$ only seems

to impact the materials sector significantly, while $CO \geq 10\%$ does not seem to have any implications.

Based on the results "*H3: Common Ownership has an observable positive time lagged response as well as an even more pronounced long-term effect on ESG performance, resulting in sustained improvement in ESG metrics, driven by continuous engagement of investors and alignment of managerial incentives with long-term strategic goals*" should be partially rejected. While the data shows negative effects in the variables with one- and two-year time lags, the three-year time lag indicates a positive long-term impact on scores as well as a change in scores. The average historical level of common ownership only shows positive effects on recent score changes for the threshold of 1%, indicating that only this threshold shows significant effects on future ESG performance.

An overview of all regression coefficients can be found in *Appendix 21: Coefficients of Average historic Common Ownership Percentage (2014-2017) on change in ESG scores (2018-2023) for different Subsamples*

The average R^2 for the linear regression models is 0.0362m indicating that the models explain only a small portion of the variance in ESG score changes. The Average F-Statistic is 1.9830, suggesting weak model fit, with some models being significant. The average p.value of 0.2374, indicates that on average the models are not significant. The average Durbin-Watson statistic is 1.878, indicating mild to moderate positive autocorrelation between the residuals.

5. General Discussion

This study explores the impact of an alternative definition of common ownership on corporate ESG performance, a topic of growing importance in portfolio management and sustainability. Common ownership refers to the scenario, where at least two institutional investors hold significant stakes in a company. This study is particularly relevant for investors, who claim to have successfully influenced firms in the past towards more sustainable practices and are increasingly integrating further ESG considerations into their investment approaches. This study aims to understand how different threshold of common ownership affect ESG performance and to examine useful implications for various stakeholders, including investors, regulators, firms, and society at large.

5.1 Summary and Interpretation of Findings

The first interesting finding is that the overall improvement in ESG scores as well as magnitude of ESG score improvement is clearly observable, which is in line with increased effort in sustainability management.

Further this study corroborates findings substantiated by recent empirical studies, which provides evidence that institutional investors possess the ability to significantly enhance corporate ESG outcomes. These findings are a testament to the potential of aligned investment strategies to yield both ESG benefits and financial returns (Dyck, Lins, Roth, & Wagner, 2019).

The overall picture of common ownership presence also holds valuable insights. While the presence of firms within the threshold of 1% and 5% remains stable, the number of observed firms with multiple institutional investors holding at least 10% doubled over the observed time. This might be based on the approach of many institutional investors, who do not buy into a firm at one point in time only, but continuously reinvest new funds using passive investment strategies (e.g., ETFs or pension funds with accrued monthly client deposits).

Even though the presence of investors with large stakes increased significantly, the average holding percentages of these different investors within an individual firm remained stable over time. This might be attributed to a continuous rebalancing, where institutional investors, despite the size of their investments, aim to hold certain percentages of portfolio allocation within different firms for the sake of pursuing their initial investment approach and mitigating risk. Therefore, they tend to actively buy underfunded positions, financed by the sell of overfunded positions, which are caused by course changes in individual holdings over time.

When diving into the regression results, the first interesting findings are the partially significant negative effects especially for lower thresholds of common ownership on ESG scores, as well as the positive impact on the magnitude of positive score changes. This suggests, that while widespread institutional ownership within a firm might initially correlate with lower ESG scores, the improvement is driven at a rate that outperforms the average. The initial negative impact of widespread $CO \geq 1\%$ on ESG scores could reflect the challenges

and conflicts that arise from the diverse influences of different owners. This dispersion might lead to a diffusion of responsibility, where no single investor has sufficient control or interest to drive ESG improvements. However, this dynamic hints at institutional investors not hesitating to hold stakes in firms with overall lower scores, as they can be confident that their continuous influence simultaneously drives ESG score changes. This could potentially lead to overall better firm performance, as the improvements in ESG scores can be directly seen as intangible assets, driving financial performance.

Further, regional differences are evident. In the US common ownership tends to have a more pronounced impact on ESG scores and changes in ESG scores, when compared to European firms. While the more pronounceable effects observed in the US could be attributed to a relatively less stringent regulatory environment, allowing institutional investors more leverage in driving changes in ESG practices, I argue that this can be mainly attributed to an initially higher starting point for European firms as well as already established ESG practices based on the already more stringent regulatory requirements prior to 2014. Further, an industry bias across the region could be the reason, as the distribution of sectors across regions varies in the sample.

Additionally, sectoral differences indicate that the impact varies significantly. Even though this seems to be correlated with the market concentration, indicating higher pressure to perform well in ESG metrics, the data only partially confirmed these expectations.

In terms of temporal dynamics, the observed lagged the data shows negative effects in the variables with one- and two-year time lags but the three-year time lag mostly indicates a positive long-term impact on scores as well as a change in scores. The average historical level of common ownership only shows positive effects on recent score changes for the threshold of 1%. This implies that even though common ownership might negatively affect firms ESG performance in earlier time periods, the scores as well as the magnitude of score change seems to benefit in later years. These findings align with the stewardship theory, which posits that investors, through continuous oversight and engagement, can drive long-term improvement in corporate governance and sustainability practices. The lagged positive impact on ESG score changes highlights the need for a long-term perspective in evaluating effectiveness of sustainability practices.

5.2 Limitations

Several limitations must be acknowledged in this study. One limitation is the ongoing discussion about ESG metrics. Due to some leeway in measuring and reporting these metrics, variations in how different companies and industries report their ESG metrics can be observed. Additionally, the measurement is difficult by nature, as many ESG factors are qualitative and subjective. Lastly the criteria are continuously evolving as new issues emerge and societal expectations change. This dynamic nature of this makes it challenging to maintain a consistent framework.

Further the selection of firms with full ESG transparency might lead to a selection bias, as these firms might systemically differ from those with incomplete reporting. The difference could be related to many aspects like size or financial health, potentially skewing the results. Additionally, this might lead to a survivorship bias, where the analysis overlooks firms that may have exited the market, thereby painting an overly optimistic picture.

The geographic and sectoral scope of the study is another limitation. The findings might not apply to other markets with different regulatory environments and market dynamics. Similarly, the sectoral analysis might overlook intra-sectoral variations and specific nuances that could influence the relationship between common ownership and ESG.

Lastly, the methodological approach, while robust, has its clear limitations. The use of panel data regressions with and without lagged variables, including fixed and random effects, as well as linear regressions, provides a solid framework. However, the relatively low R^2 suggests that other unobserved factors might also play significant roles in determining ESG performance, which are not fully captured in the models.

5.3 Comparison with existing literature

The findings are consistent with and expand upon existing literature on the role of institutional investors in driving corporate ESG performance. Previous studies highlighted the potential of institutional investors to enhance governance and sustainability practices by active engagement and oversight (Dyck, Lins, Roth, & Wagner, 2019). This study contributes to the literature by providing empirical evidence on the specific impact of different thresholds of common ownership across regions and sectors.

The negative impact of common ownership on ESG scores at lower thresholds aligns with the concern raised in the agency theory (Meckling & Jensen, 1976) about potential conflicts of interest and the challenges in aligning divergent investor priorities. However, the positive impact on ESG score improvements over time supports the stewardship theory (Donaldson, Lex, & Davis, 1991), emphasizing long-term benefits of institutional oversight. Therefore, the definition used in this study draws a similar picture of mixed implications as the predominant definition explored in past research.

The regional differences observed complement findings from previous research on the influence of regulatory environments on sustainability practices (Scholtens, 2006). The more significant impact of common ownership in the US can exert greater influence in less regulated markets.

Sectoral variations are also supported by existing literature, which highlights the importance of industry-specific factors in shaping corporate ESG strategies (Lockett, Thompson, & Morgenstern, 2009). This study provides detailed insights into how common ownership influences ESG differently across sectors, contributing to a nuanced understanding of these dynamics.

The lagged positive impact on ESG score changes, highlights the importance of a long-term perspective in evaluating effectiveness of sustainability practices is in line with the expectation that institutional investors' efforts to influence corporate behavior regarding ESG often results in observable improvement only over a medium to long-term horizon (Dimson, Karakaş, & Li, 2015).

5.4 Recommendation for further research

The first recommendation is to explore the dynamic and multifaceted relationship between the definition of common ownership, used in this study, and other dimensions of corporate performance such as innovation, growth rates or financial metrics. This helps to provide a more holistic view of its impacts. Understanding implications of these findings can inform the development of regulatory frameworks to ensure market efficiency and enhanced competitiveness across different regions and sectors.

As this study uses the combined ESG score as well as the combined change in scores, a dive into the environmental, societal and governance pillar score is a potential field for further research. These pillar scores might hold valuable insights for different regions and individual sectors, which are lost by combining the three scores into an average.

Additionally, the improvement of the quality and consistency of ESG data remains a critical area for further research. Developing more standardized reporting frameworks or addressing the issue of subjectivity in reporting could enhance the reliability of these metrics, facilitating robust analysis and comparison across regions and sectors.

Further the variables could be adjusted. As the thresholds in this study do not mandatorily exclude each other (investors with 5% or 10% of holdings do also fall under the 1% threshold) $CO \geq 1\%$ aims to capture the combined effects of all investors, while $CO \geq 5\%$ and $CO \geq 10\%$ narrow the perspective down to medium and large investor effects only. Further studies could investigate if results change, when investigating solely the holding percentages of the three investor groups, by exempting medium and large investors from the 1% threshold and large investors from the 5% threshold. Additionally, the variables could be changed from the continuous approach in this study, to a dummy which is 1 if the scenario is observed in a firm and 0 else. With logit models the probability that the dependent variable (e.g., participation in a certain sustainability agreement) is 1 could be tested as a function of the independent dummy common ownership. Additionally, a probit model, using the cumulative distribution function (CDF) of the normal distribution instead of the logistic function could be used to provide complementary insights.

Another variable of interest for future research could be the number of investors who fall within the different thresholds. This study could analyze the different effects of concentrated and dispersed scenarios of common ownership.

Additional research on specific engagement mechanisms, such as shareholder activism or collaborative initiatives, could shed light on the success of different ways investors can influence corporate sustainability.

Further, recommendations are the expansion to further regions and sectors, controlling for different regulatory environments and market dynamics as well as longitudinal studies, exploring the developments over a longer period.

5.5 Conclusion

This study explores the impact of an alternative definition of common ownership on corporate ESG performance, an area of increasing relevance around portfolio management and sustainability. By investigating varying thresholds of common ownership, the study holds insights for investors, regulators, firms, and society on how these ownership structures influence sustainability practices.

The findings reveal that while the presence of common institutional ownership generally promotes enhanced ESG performance, the effects are nuanced and complex. The initial negative impact of lower thresholds suggests challenges in aligning the interests of diverse investors. However, the subsequent positive impact on the magnitude of score changes indicates that institutional investors' continuous engagement can drive improvement over time.

Regional and sectoral results underscore significant differences. In the US, the less stringent regulatory environment seems to allow greater leverage in influencing ESG practices, resulting in a more pronounced magnitude of score changes than for European firms. Sector-specific findings further highlight the varying influence of common institutional owners on different sectors.

Understanding temporal dynamics might be the most crucial part. While short term effects may be negative, the long-term effect, especially with a three-year lag or longer, highlights the importance of sustained engagement.

However, this study has several limitations. Variability in ESG metrics reporting standards, potential selection and survivorship bias and a limited geographical, sectoral and time scope as well as may also affect the generalizability of findings. Further, the methodological approach,

while robust, indicated that other unobserved factors may also significantly influence ESG performance.

Further research should explore the multifaceted relationship between common ownership and other dimensions of corporate performance. Enhancing the quality and consistency of ESG data is also crucial for facilitating the comparison of results across regions and sectors. Investigating the exclusive effects of different investor groups and using alternative analytical approaches might yield further insights. Lastly, examining the effect of specific engagement mechanisms as well as a wider scope would help to improve the complex and nuanced dynamics within the world of common ownership structures.

In conclusion, this study contributes to an ongoing discourse on sustainable investing by providing evidence on how institutional investors, through various thresholds of common ownership, influence corporate ESG performance. The findings emphasize the need for a long-term perspective as well as sustained engagement to realize the potential of common institutional ownership in driving ESG performance.

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Appendices

Appendix 1: Definition of LSEG metrics

ESG score	Refinitiv ESG score is an overall company score based on the self-reported information in the environmental, social and corporate governance pillars.
Capex	Capital Expenditures - Total [SCEX] encompass all expenditures for factories, equipment, software development costs and intangible assets that have a useful life of more than one year. These expenditures are not treated as an expense on the income statement when they are incurred. Rather, they are capitalized, meaning that they are expensed over time. Capital Expenditures consist of expenditures that are necessary to maintain the existing plant and equipment in premium condition, and discretionary expenditures for growth. Applicable to all industries.
Opex	Operating Expenses - Total [SOET] represents total operating expense as reported by the company. This item needs to be captured in a cost-by-nature or single-step income statement. Applicable to all industries.
Turnover	The unscaled turnover value (summation of the value of all trades during the market day) for a particular instrument.

Appendix 2: Sample Shareholder Report from LSEG

The screenshot displays the 'Shareholders Report' for Agilent Technologies Inc. on the LSEG platform. The report shows the percentage of shares outstanding for 141 investors as of 31-Dec-2023, 31-Dec-2022, 31-Dec-2021, 31-Dec-2020, 31-Dec-2019, 31-Dec-2018, 31-Dec-2017, 31-Dec-2016, and 31-Dec-2015. The top 20 investors are listed below:

Investor Name	31-Dec-2023	31-Dec-2022	31-Dec-2021	31-Dec-2020	31-Dec-2019	31-Dec-2018	31-Dec-2017	31-Dec-2016	31-Dec-2015
The Vanguard Group, Inc.	8.58%	8.48%	7.99%	7.68%	8.05%	7.66%	7.34%	6.60%	5.86%
BlackRock Institutional Trust Company, N.A.	5.58%	5.59%	5.76%	5.35%	4.95%	5.08%	5.34%	4.68%	4.25%
State Street Global Advisors (US)	4.31%	4.43%	4.43%	4.29%	4.36%	4.02%	4.27%	4.45%	4.05%
MFS Investment Management	4.21%	2.57%	1.26%	1.24%	0.03%	0.03%	0.02%	0.25%	0.21%
T. Rowe Price Investment Management, Inc.	3.47%	3.14%	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Wellington Management Company, LLP	3.37%	4.53%	3.02%	2.86%	2.25%	2.63%	0.64%	0.59%	2.78%
T. Rowe Price Associates, Inc.	2.42%	2.47%	7.18%	7.66%	6.80%	8.07%	8.59%	8.76%	9.55%
Geode Capital Management, L.L.C.	2.25%	2.05%	1.94%	1.67%	1.57%	1.33%	1.12%	0.94%	0.89%
Pictet Asset Management Ltd.	2.18%	1.83%	1.57%	1.09%	1.11%	0.70%	0.28%	0.11%	0.05%
State Farm Insurance Companies	1.31%	1.33%	1.31%	1.51%	1.50%	1.72%	2.14%	2.15%	2.08%
Norges Bank Investment Management (NB...)	1.25%	0.89%	0.95%	0.99%	0.99%	0.93%	0.87%	0.81%	0.77%
Cantillon Capital Management LLC	1.24%	1.14%	1.12%	1.33%	1.33%	1.12%	1.41%	1.64%	1.45%
DWS Investment GmbH	1.14%	0.61%	0.56%	0.77%	0.83%	0.40%	0.03%	0.09%	0.16%
Legal & General Investment Management ...	1.06%	0.92%	0.95%	0.88%	0.75%	0.58%	0.51%	0.45%	0.41%
BlackRock Asset Management Ireland Limi...	1.05%	1.13%	0.95%	0.62%	0.43%	0.38%	0.33%	0.28%	0.25%
Principal Global Investors (Equity)	0.99%	1.13%	0.51%	0.37%	0.14%	0.18%	0.23%	0.16%	0.14%
Van Eck Associates Corporation	0.94%	0.02%	0.01%	0.01%	0.00%	N/A	N/A	N/A	N/A
Northern Trust Investments, Inc.	0.93%	0.94%	0.99%	0.75%	0.77%	0.78%	0.79%	0.77%	0.76%

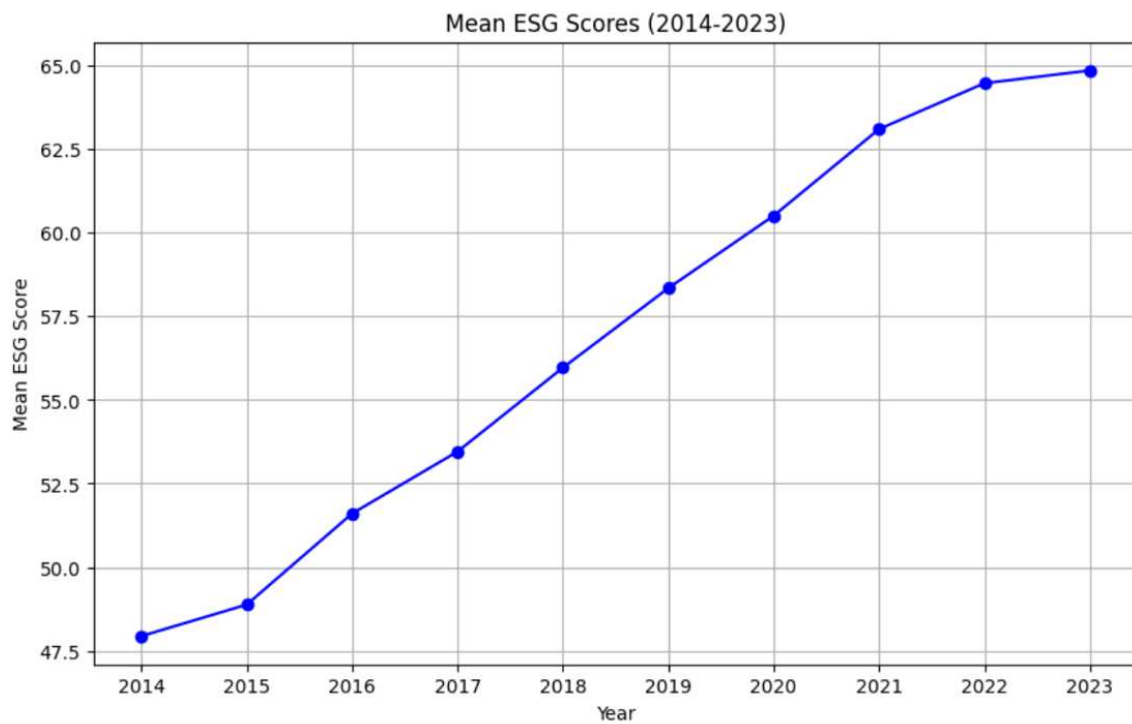
Appendix 3: sector values for HHI

Sector	HHI
Energy	703
Industrials	172
Materials	222
Information Technology	546
Health Care	504
Communication Services	807

Appendix 4: 1.5 IQR method

```
def remove_outliers(df):  
    for column in df.columns:  
        if pd.api.types.is_numeric_dtype(df[column]):  
            Q1 = df[column].quantile(0.25)  
            Q3 = df[column].quantile(0.75)  
            IQR = Q3 - Q1  
            lower_bound = Q1 - 1.5 * IQR  
            upper_bound = Q3 + 1.5 * IQR  
            df = df[(df[column] >= lower_bound) & (df[column] <= upper_bound)]  
    return df
```

Appendix 5: Visualisation of ESG score developments



Appendix 6: Z-score Standardization Formula

$$Z = \frac{x - \mu}{\sigma}$$

Standardization Formula:

z = Standardized value

x = Original value

μ = Mean of the dataset

σ = Standard deviation of the dataset

Appendix 7: Hausman Test

$\hat{\beta}_{FE}$: Coefficients from the Fixed Effects Model

$\hat{\beta}_{RE}$: Coefficients from the Random Effects Model

$\Delta\beta = \hat{\beta}_{FE} - \hat{\beta}_{RE}$: Difference in Coefficients

V_{FE} : Covariance matrix of the Fixed Effects Estimator

V_{RE} : Covariance matrix of the Random Effects Estimator

$\Delta V = V_{FE} - V_{RE}$: Difference in Covariance Matrices

$H = (\hat{\beta}_{FE} - \hat{\beta}_{RE})'(\Delta V)^{-1}(\hat{\beta}_{FE} - \hat{\beta}_{RE})$: Hausman Statistic

Null Hypothesis H_0 : Preferred model is Random Effects

Alternative Hypothesis H_1 : Preferred model is Fixed Effects

Appendix 8: VIF

$$VIF = 1 / (1 - R^2)$$

- Where VIF is the variance inflation factor
- R^2 is the coefficient of determination of the regression equation

Appendix 9: Durbin-Watson test for autocorrelation of residuals

$$DW = \frac{\sum_{t=2}^T (e_t - e_{t-1})^2}{\sum_{t=1}^T e_t^2}$$

This formula is used to test for the presence of autocorrelation in the residuals from a regression analysis. In the formula: e_t represents the residual at time t . The numerator sums the squared differences between consecutive residuals. The denominator sums the squared residuals. The Durbin-Watson statistic ranges from 0 to 4, where:

- A value close to 2 indicates no autocorrelation.
- A value close to 0 indicates positive autocorrelation.
- A value close to 4 indicates negative autocorrelation.

Appendix 10: Descriptive Statistics - Unstandardized data

Descriptive Statistics - Full Sample (2014-2023)					
	Mean ESG Score	Mean Change in ESG Score (per year)	Mean CO>=1%	Mean CO>=5%	Mean CO>=10%
count	770	770	667	527	203
mean	56,91	1,88	39,50%	25,94%	28,69%
std	17,15	1,75	21,13%	10,64%	9,80%
min	8,49	-5,97	2,00%	10,00%	20,00%
25%	45,70	0,65	21,00%	17,95%	22,75%
50%	57,71	1,80	41,40%	24,00%	25,80%
75%	69,37	3,04	56,45%	33,00%	30,92%
max	91,99	7,86	94,40%	83,71%	100,00%

Descriptive Statistics - US (2014-2023)					
	Mean ESG Score	Mean Change in ESG Score (per year)	Mean CO>=1%	Mean CO>=5%	Mean CO>=10%
count	358	358	355	340	140
mean	52,82	2,15	50,71%	26,33%	27,08%
std	16,90	1,81	15,14%	9,75%	7,45%
min	9,89	-3,41	4,40%	11,00%	20,00%
25%	41,66	0,82	40,60%	19,08%	22,31%
50%	52,77	2,12	50,70%	24,55%	24,92%
75%	65,67	3,48	61,60%	32,14%	28,00%
max	91,99	7,86	90,00%	68,00%	66,40%

Descriptive Statistics - Europe (2014-2023)					
	Mean ESG Score	Mean Change in ESG Score (per year)	Mean CO>=1%	Mean CO>=5%	Mean CO>=10%
count	412	412	312	187	63
mean	60,47	1,65	26,74%	25,24%	32,25%
std	16,59	1,66	19,70%	12,10%	13,04%
min	8,49	-5,97	2,00%	10,00%	20,00%
25%	50,58	0,46	10,28%	16,00%	25,00%
50%	61,11	1,62	20,90%	21,67%	29,20%
75%	72,61	2,62	40,65%	33,22%	36,17%
max	91,98	7,46	94,40%	83,71%	100,00%

Appendix 10: Descriptive Statistics - Unstandardized data cont.

Descriptive Statistics - Energy (2014-2023)					
	Mean ESG Score	Mean Change in ESG Score (per year)	Mean CO>=1%	Mean CO>=5%	Mean CO>=10%
count	79	79	68	61	35
mean	51,09	1,84	45,51%	29,74%	28,18%
std	18,80	1,97	20,67%	10,65%	7,71%
min	8,49	-1,80	3,14%	11,00%	21,00%
25%	39,87	0,50	31,43%	21,50%	23,38%
50%	50,96	1,59	46,00%	30,50%	25,80%
75%	65,98	2,99	63,88%	38,50%	30,75%
max	88,77	7,35	78,00%	49,56%	52,00%

Descriptive Statistics - Industrials (2014-2023)					
	Mean ESG Score	Mean Change in ESG Score (per year)	Mean CO>=1%	Mean CO>=5%	Mean CO>=10%
count	233	233	207	157	43
mean	57,92	1,79	36,97%	24,71%	28,55%
std	16,01	1,59	20,30%	10,14%	8,02%
min	13,24	-3,46	2,67%	10,00%	20,00%
25%	48,35	0,63	20,44%	17,50%	22,75%
50%	59,15	1,69	38,20%	22,40%	26,67%
75%	68,68	2,96	51,25%	29,20%	29,90%
max	90,80	6,27	84,30%	63,90%	54,33%

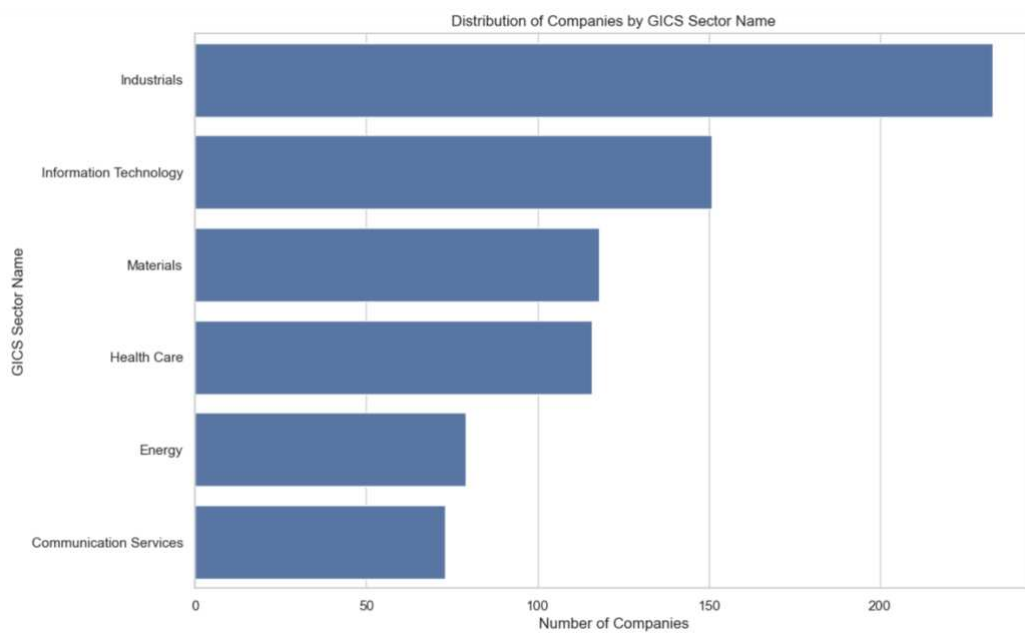
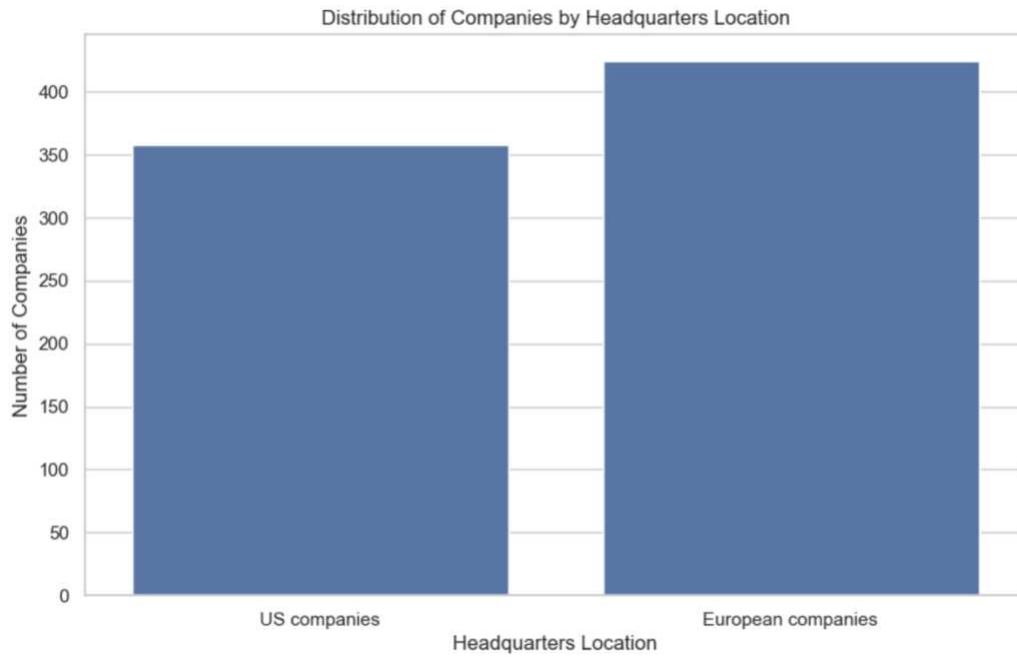
Descriptive Statistics - Materials (2014-2023)					
	Mean ESG Score	Mean Change in ESG Score (per year)	Mean CO>=1%	Mean CO>=5%	Mean CO>=10%
count	118	118	99	78	34
mean	56,56	2,00	37,61%	24,84%	30,05%
std	17,32	1,70	20,24%	9,32%	15,69%
min	12,67	-2,04	2,67%	11,00%	21,00%
25%	45,06	0,76	17,40%	19,43%	22,05%
50%	57,67	1,95	40,80%	23,45%	23,88%
75%	69,99	3,33	56,25%	29,98%	31,00%
max	84,65	6,63	87,25%	68,00%	100,00%

Descriptive Statistics - Information Technology (2014-2023)					
	Mean ESG Score	Mean Change in ESG Score (per year)	Mean CO>=1%	Mean CO>=5%	Mean CO>=10%
count	151	151	130	108	53
mean	58,61	1,68	43,47%	26,97%	28,50%
std	16,28	1,83	21,31%	11,96%	10,17%
min	16,89	-5,97	2,50%	10,00%	20,00%
25%	48,34	0,32	26,28%	18,28%	23,00%
50%	58,07	1,81	48,25%	24,68%	25,50%
75%	70,79	2,83	58,45%	33,78%	30,50%
max	91,99	6,02	94,40%	83,71%	83,71%

Descriptive Statistics - Health Care (2014-2023)					
	Mean ESG Score	Mean Change in ESG Score (per year)	Mean CO>=1%	Mean CO>=5%	Mean CO>=10%
count	116	116	101	83	21
mean	59,53	2,27	39,18%	23,90%	29,43%
std	15,82	1,90	19,73%	9,41%	6,34%
min	11,15	-3,41	2,00%	10,33%	22,00%
25%	48,51	0,92	25,50%	16,17%	25,75%
50%	59,06	2,34	42,20%	21,33%	27,71%
75%	71,22	3,56	54,10%	29,05%	32,25%
max	91,98	7,86	84,10%	50,80%	43,67%

Descriptive Statistics - Communication Services (2014-2023)					
	Mean ESG Score	Mean Change in ESG Score (per year)	Mean CO>=1%	Mean CO>=5%	Mean CO>=10%
count	73	73	62	40	17
mean	52,89	1,80	36,55%	28,59%	27,01%
std	20,50	1,56	25,43%	11,89%	3,89%
min	9,89	-0,80	3,00%	11,33%	22,00%
25%	41,19	0,79	12,63%	18,83%	24,50%
50%	54,57	1,73	30,35%	30,70%	27,00%
75%	66,92	2,77	62,20%	36,23%	27,75%
max	91,40	5,86	81,33%	52,00%	35,00%

Appendix 11: Distribution of Firms

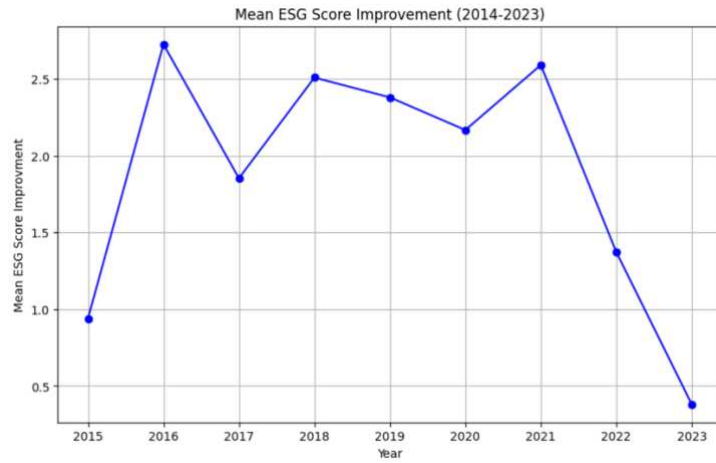


Appendix 12: Presence and holdings of Common Owners

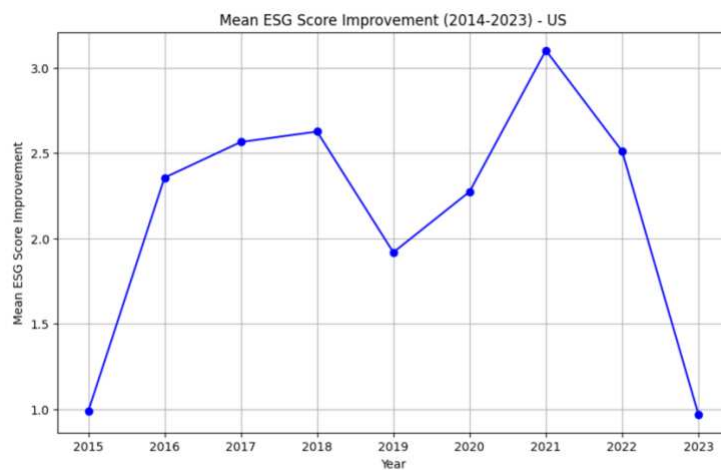
	Average number of firms with:			Average holding percentage of Common Owners:		
	CO>=1%	CO>=5%	CO>=10%	CO>=1%	CO>=5%	CO>=10%
Full Sample	86,62%	68,44%	26,36%	39,50%	25,94%	28,69%
US	99,16%	94,97%	39,11%	50,71%	26,33%	27,08%
Europe	75,73%	45,39%	15,29%	26,74%	25,24%	32,25%
Energy	86,08%	77,22%	44,30%	45,51%	29,74%	28,18%
Industrials	88,84%	67,38%	18,45%	36,97%	24,71%	28,55%
Materials	83,90%	66,10%	28,81%	37,61%	24,84%	30,05%
Information Technology	86,09%	71,52%	35,10%	43,47%	26,97%	28,50%
Health Care	87,07%	71,55%	18,10%	39,18%	23,90%	29,43%
Communication Services	84,93%	54,79%	23,29%	36,55%	28,59%	27,01%

Appendix 13: Visualisation of change in ESG scores per year

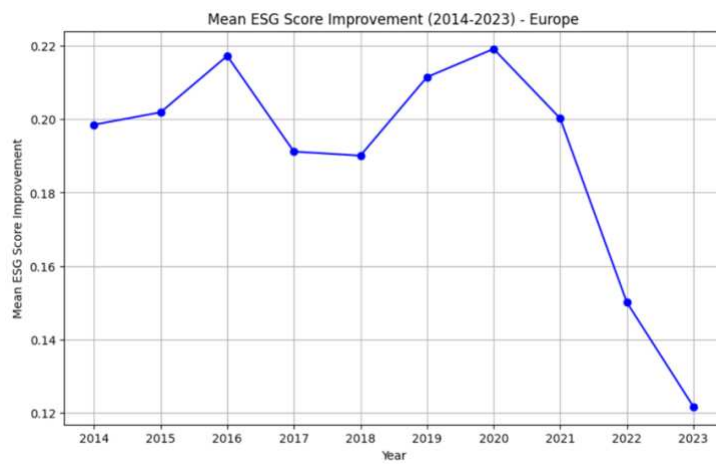
Full Sample



US firms



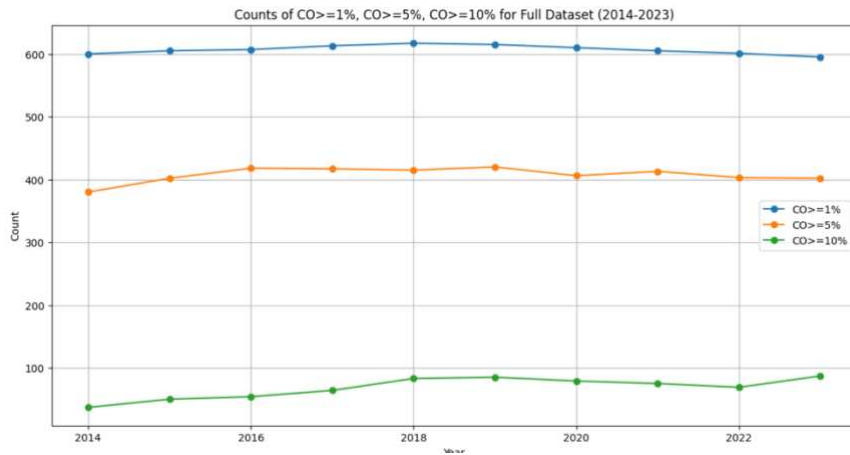
European firms



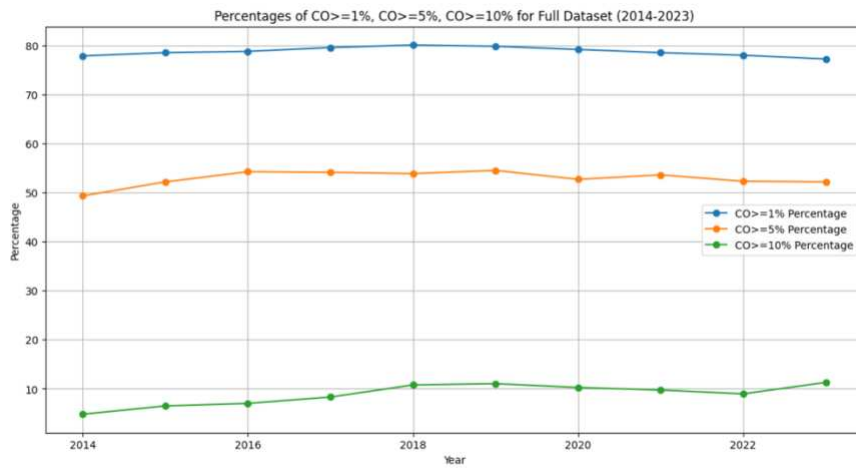
Appendix 14: Visualisation of Common Ownership Development

1. Full Sample

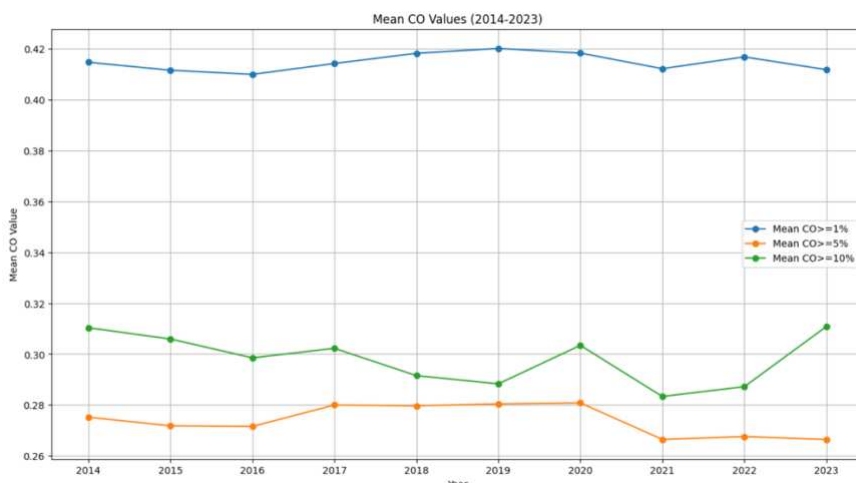
a) Number of firms with Common Ownership



b) Percentage of firms with Common Ownership

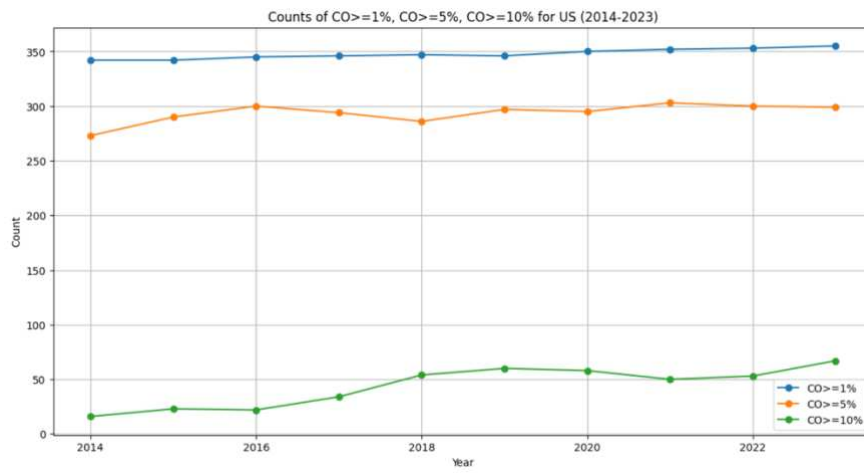


c) Average Holdings of Common Owners

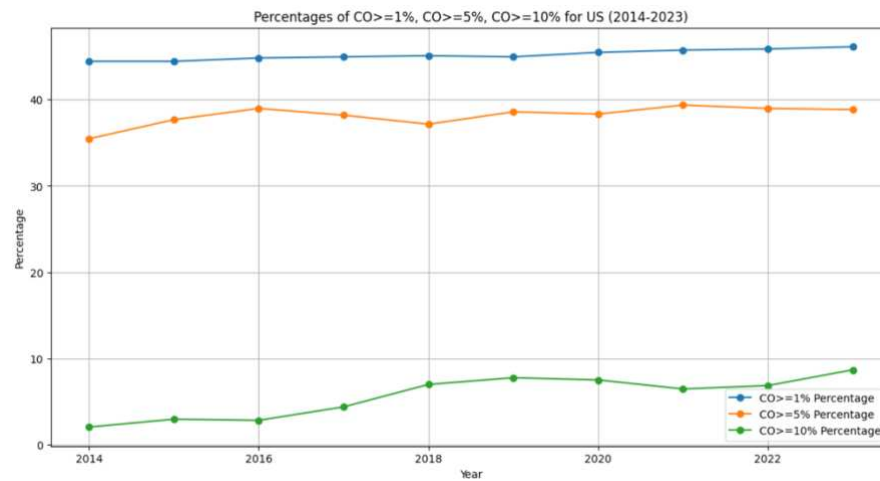


2. US firms

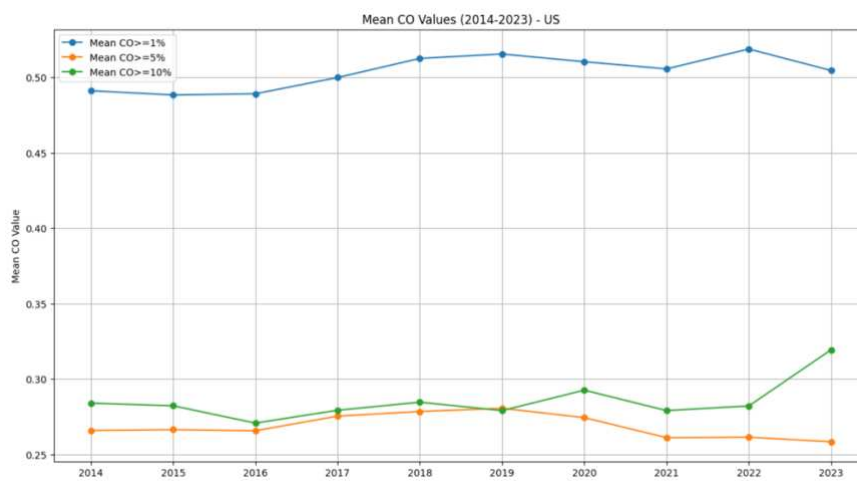
a) Number of firms with Common Ownership



b) Percentage of firms with Common Ownership

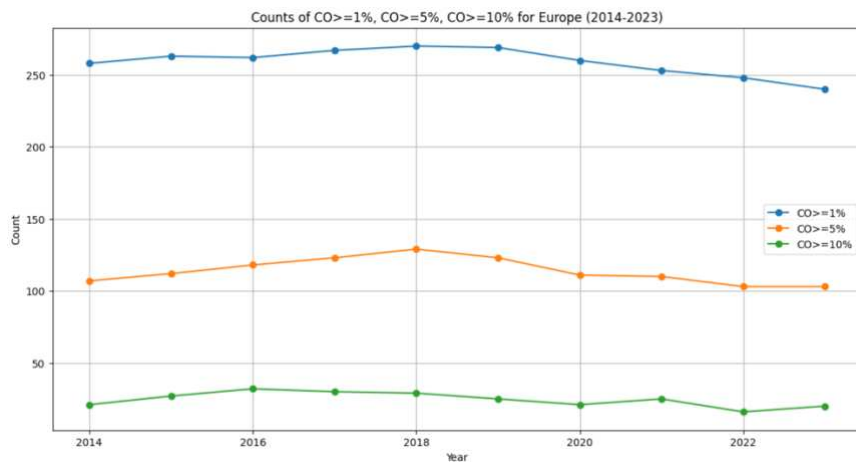


c) Average Holdings of Common Owners

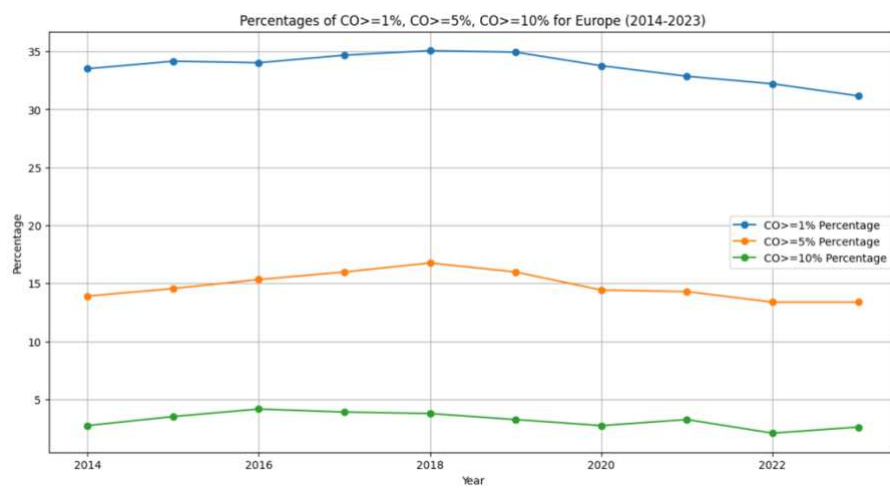


3. Europe

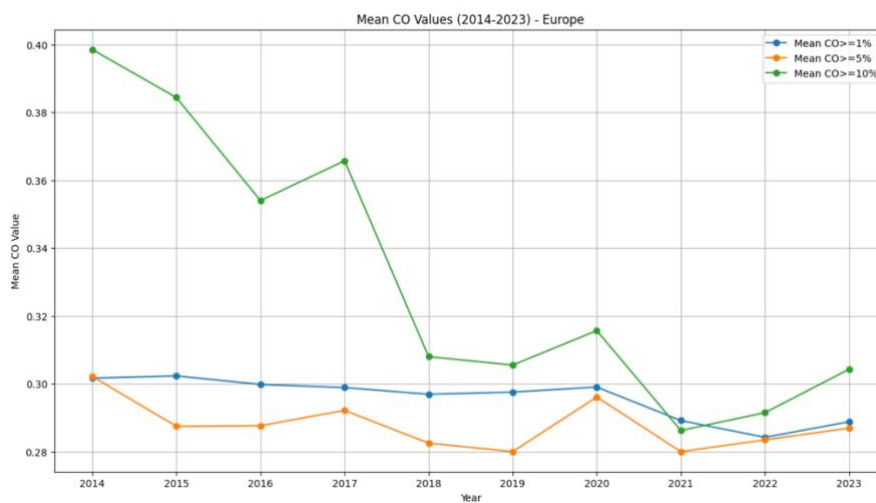
a) Number of firms with Common Ownership



b) Percentage of firms with Common Ownership



c) Average Holdings of Common Owners



Appendix 15: Sample Output for Fixed and Random Effects Models

```

=== Full Sample (CO>=1%) ESG Score ===
Fixed Effects Summary:
      PanelOLS Estimation Summary
=====
Dep. Variable:      ESG Score      R-squared:          0.0052
Estimator:         PanelOLS       R-squared (Between): 0.0283
No. Observations:  7700         R-squared (Within):  0.0052
Date:              Sat, May 25 2024 R-squared (Overall):  0.0249
Time:              08:41:49      Log-likelihood      -3540.3
Cov. Estimator:    Clustered
****
Entities:          770
Avg Obs:           10.0000
Min Obs:           10.0000
Max Obs:           10.0000
Time periods:     10
Avg Obs:           770.00
Min Obs:           770.00
Max Obs:           770.00
F-statistic:       9.0478
P-value:           0.0000
Distribution:       F(4,6926)
F-statistic (robust): 1.4606
P-value:           0.2114
Distribution:       F(4,6926)

Parameter Estimates
=====
      Parameter  Std. Err.   T-stat   P-value   Lower CI   Upper CI
-----
const          7.53e-06   6.721e-06  1.1204   0.2626   -5.645e-06  2.07e-05
CO>=1%         -0.0084    0.0220    -0.3796   0.7043   -0.0515     0.0348
Capex          -0.0173    0.0212    -0.8150   0.4151   -0.0589     0.0243
Opex           0.1364    0.0591     2.3086   0.0210    0.0206     0.2523
Turnover       0.0010    0.0080     0.1280   0.8982   -0.0147     0.0167
=====
F-test for Poolability: 47.707
P-value: 0.0000
Distribution: F(769,6926)
Included effects: Entity
Hausman Test:
Chi2 Statistic: -0.12999506923985263
P-value: 1.0
VIF Results:
feature      VIF
const 1.000000
CO>=1% 1.020655
Capex 1.709261
Opex 1.640602
Turnover 1.261364
=====
=== Full Sample (CO>=1%) ESG Score ===
Random Effects Summary:
      RandomEffects Estimation Summary
=====
Dep. Variable:      ESG Score      R-squared:          0.0084
Estimator:         RandomEffects  R-squared (Between): 0.0394
No. Observations:  7700         R-squared (Within):  0.0045
Date:              Sat, May 25 2024 R-squared (Overall):  0.0343
Time:              08:41:49      Log-likelihood      -3972.6
Cov. Estimator:    Unadjusted
****
Entities:          770
Avg Obs:           10.0000
Min Obs:           10.0000
Max Obs:           10.0000
Time periods:     10
Avg Obs:           770.00
Min Obs:           770.00
Max Obs:           770.00
F-statistic:       16.209
P-value:           0.0000
Distribution:       F(4,7695)
F-statistic (robust): 16.209
P-value:           0.0000
Distribution:       F(4,7695)

Parameter Estimates
=====
      Parameter  Std. Err.   T-stat   P-value   Lower CI   Upper CI
-----
const          6.66e-06   0.0317     0.0002   0.9998   -0.0622     0.0622
CO>=1%         -0.0314    0.0117    -2.6979   0.0070   -0.0543    -0.0086
Capex          -0.0153    0.0141    -1.0849   0.2780   -0.0429     0.0123
Opex           0.1397    0.0201     6.9391   0.0000    0.1002     0.1792
Turnover       0.0081    0.0088     0.9266   0.3542   -0.0091     0.0253
=====

```

Appendix 16: Coefficients of Common Ownership on ESG scores and change in ESG scores for different subsamples

	Dependant Variable: ESG Score											
	Independent Variables						Independent Variables					
	CO>=1%		CO>=5%		CO>=10%		CO>=1%		CO>=5%		CO>=10%	
	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects
Full Sample	-0,0084	-0,0314***	-0,0008	-0,0077	0,0258	0,0298	-0,0084	-0,0314***	-0,0008	-0,0077	0,0258	0,0298
US Firms	-0,0420	-0,0629***	-0,0103	-0,0256**	0,0422	0,0433	-0,0420	-0,0629***	-0,0103	-0,0256**	0,0422	0,0433
European Firms	0,0110	0,0053	0,0140	0,0137	0,0067	0,0111	0,0110	0,0053	0,0140	0,0137	0,0067	0,0111
Energy Sector	-0,0437	-0,0541	-0,0397	-0,0463*	0,0967	0,0992	-0,0437	-0,0541	-0,0397	-0,0463*	0,0967	0,0992
Industrials Sector	-0,0681**	-0,0929***	-0,0125	-0,0204	0,0517	0,0487	-0,0681**	-0,0929***	-0,0125	-0,0204	0,0517	0,0487
Materials Sector	0,0310	0,0116	-0,0116	-0,0122	-0,0461*	-0,0446	0,0310	0,0116	-0,0116	-0,0122	-0,0461*	-0,0446
Information Technology	0,1011*	0,0754***	0,0232	0,0203	0,0143	0,0261	0,1011*	0,0754***	0,0232	0,0203	0,0143	0,0261
Health Care	-0,0204	-0,0699	-0,0177	-0,0258	0,1443**	0,1473*	-0,0204	-0,0699	-0,0177	-0,0258	0,1443**	0,1473*
Communication Services	-0,0219	-0,0356	0,0612	0,0590*	0,0125	0,0134	-0,0219	-0,0356	0,0612	0,0590*	0,0125	0,0134

	Dependant Variable: Change in ESG Score											
	Independent Variables						Independent Variables					
	CO>=1%		CO>=5%		CO>=10%		CO>=1%		CO>=5%		CO>=10%	
	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects
Full Sample	0,0164	0,0422***	-0,0094	0,0122	-0,0050	-0,0605	0,0164	0,0422***	-0,0094	0,0122	-0,0050	-0,0605
US Firms	0,0550	0,0827***	-0,0236	0,0166	-0,0645	-0,1182*	0,0550	0,0827***	-0,0236	0,0166	-0,0645	-0,1182*
European Firms	-0,0039	-0,0182	0,0136	0,0072	0,0644	0,0087	-0,0039	-0,0182	0,0136	0,0072	0,0644	0,0087
Energy Sector	-0,1445	0,0414	-0,1619	-0,0362	-0,1145	-0,1610	-0,1445	0,0414	-0,1619	-0,0362	-0,1145	-0,1610
Industrials Sector	0,0412	0,0570**	0,0128	0,0243	0,1441	0,0307	0,0412	0,0570**	0,0128	0,0243	0,1441	0,0307
Materials Sector	0,1134	0,0223	0,0402	0,0432	-0,0396	-0,1277*	0,1134	0,0223	0,0402	0,0432	-0,0396	-0,1277*
Information Technology	0,0603	0,0150	-0,0261	-0,0016	-0,0349	-0,0426	0,0603	0,0150	-0,0261	-0,0016	-0,0349	-0,0426
Health Care	-0,0414	0,0751	0,0641	0,0326	0,2493	0,1212	-0,0414	0,0751	0,0641	0,0326	0,2493	0,1212
Communication Services	0,0198	0,0311	0,1121	0,0126	-0,1306	-0,1550	0,0198	0,0311	0,1121	0,0126	-0,1306	-0,1550

Appendix 17: Sample output for regression with lagged variables

```

=== Full Sample ESG Score ===

Fixed Effects Summary:
                        PanelOLS Estimation Summary
=====
Dep. Variable:          ESG Score      R-squared:              0.0032
Estimator:             PanelOLS       R-squared (Between):   0.0157
No. Observations:     5390          R-squared (Within):    0.0032
Date:                 Sun, May 26 2024  R-squared (Overall):   0.0143
Time:                 09:26:58       Log-likelihood         -1641.1
Cov. Estimator:      Clustered
Entities:             770
Avg Obs:              7.0000
Min Obs:              7.0000
Max Obs:              7.0000
Time periods:        7
Avg Obs:              770.00
Min Obs:              770.00
Max Obs:              770.00

F-statistic:          2.4905
P-value              0.0208
Distribution:         F(6,4614)

F-statistic (robust): 1.4277
P-value              0.1997
Distribution:         F(6,4614)

Parameter Estimates
=====
      Parameter  Std. Err.   T-stat   P-value   Lower CI   Upper CI
-----
const          1.863e-05  6.025e-06  3.0921   0.0020   6.818e-06  3.044e-05
C0>=1%_lag1   -0.0139    0.0204    -0.6838  0.4941   -0.0538    0.0260
C0>=1%_lag2   -0.0008    0.0141    -0.0565  0.9549   -0.0284    0.0268
C0>=1%_lag3    0.0290    0.0181    1.6020   0.1092   -0.0065    0.0645
Capex          -0.0107    0.0204    -0.5253  0.5994   -0.0508    0.0293
Opex           0.0920    0.0421    2.1880   0.0287   0.0096    0.1745
Turnover       0.0058    0.0112    0.5169   0.6053   -0.0162    0.0278
=====

F-test for Poolability: 45.499
P-value: 0.0000
Distribution: F(769,4614)

Included effects: Entity

Hausman Test:
Chi2 Statistic: 1.0701246392735217
P-value: 0.9828137327925777

VIF Results:
feature      VIF
const 1.000000
C0>=1%_lag1 5.380942
C0>=1%_lag2 8.044967
C0>=1%_lag3 5.228775
Capex 1.655243
Opex 1.559134
Turnover 1.360823

Durbin-Watson Statistic: 1.3463003492427765

```

Appendix 18: Coefficients of Lag1 Common Ownership on ESG scores and change in ESG scores for different subsamples

	Dependant Variable: ESG Score											
	Independent Variables						Independent Variables					
	CO>=1%_Lag1		CO>=5%_lag1		CO>=10%_lag1		CO>=1%_Lag1		CO>=5%_lag1		CO>=10%_lag1	
	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects
Full Sample	-0,0139	-0,0365**	-0,0215	-0,0275**	-0,0098	-0,0029	-0,0139	-0,0365**	-0,0215	-0,0275**	-0,0098	-0,0029
US Firms	-0,0237	-0,0465*	-0,0360	-0,0516***	0,0156	0,0172	-0,0237	-0,0465*	-0,0360	-0,0516***	0,0156	0,0172
European Firms	-0,0079	-0,0142	0,0015	0,0034	-0,0348	-0,0253	-0,0079	-0,0142	0,0015	0,0034	-0,0348	-0,0253
Energy Sector	-0,0531	-0,0621	-0,1000**	-0,1021***	-0,0808	-0,0720	-0,0531	-0,0621	-0,1000**	-0,1021***	-0,0808	-0,0720
Industrials Sector	-0,0222	-0,0446	-0,0347	-0,0437*	0,0226	0,209	-0,0222	-0,0446	-0,0347	-0,0437*	0,0226	0,209
Materials Sector	0,0220	0,0013	-0,0331	-0,0329	-0,0477*	-0,0460	0,0220	0,0013	-0,0331	-0,0329	-0,0477*	-0,0460
Information Technology	0,0267	0,0039	0,0107	0,0113	-0,0006	0,0182	0,0267	0,0039	0,0107	0,0113	-0,0006	0,0182
Health Care	-0,4480	-0,0880*	-0,0007	-0,0197	0,0619	0,0741	-0,4480	-0,0880*	-0,0007	-0,0197	0,0619	0,0741
Communication Services	-0,0014	-0,0227	0,0820**	0,0786**	-0,1127	-0,1155	-0,0014	-0,0227	0,0820**	0,0786**	-0,1127	-0,1155

	Dependant Variable: Change in ESG Score											
	Independent Variables						Independent Variables					
	CO>=1%_Lag1		CO>=5%_lag1		CO>=10%_lag1		CO>=1%_Lag1		CO>=5%_lag1		CO>=10%_lag1	
	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects
Full Sample	0,0033	0,0119	-0,0285	-0,0337	-0,0458	-0,0129	0,0033	0,0119	-0,0285	-0,0337	-0,0458	-0,0129
US Firms	0,0436	0,0287	-0,0165	-0,0349	-0,0673	-0,0102	0,0436	0,0287	-0,0165	-0,0349	-0,0673	-0,0102
European Firms	-0,0150	-0,0075	-0,0490	-0,0261	-0,0228	0,0088	-0,0150	-0,0075	-0,0490	-0,0261	-0,0228	0,0088
Energy Sector	0,1746	0,0724	0,0508	0,0062	-0,2562	-0,3341	0,1746	0,0724	0,0508	0,0062	-0,2562	-0,3341
Industrials Sector	0,0954	0,0990	-0,0411	-0,0561	0,0053	0,0096*	0,0954	0,0990	-0,0411	-0,0561	0,0053	0,0096*
Materials Sector	-0,0098	-0,0024	0,0081	-0,2740	-0,0264	-0,0374	-0,0098	-0,0024	0,0081	-0,2740	-0,0264	-0,0374
Information Technology	-0,2173**	-0,0385	-0,1371*	-0,0778	-0,0605	0,0241	-0,2173**	-0,0385	-0,1371*	-0,0778	-0,0605	0,0241
Health Care	-0,0482	-0,1812	-0,0060	-0,0419	-0,1799	0,0721	-0,0482	-0,1812	-0,0060	-0,0419	-0,1799	0,0721
Communication Services	0,1572	0,0909	0,0924	0,1140	0,2509	0,0829	0,1572	0,0909	0,0924	0,1140	0,2509	0,0829

Appendix 19: Coefficients of Lag2 Common Ownership on ESG scores and change in ESG scores for different subsamples

	Independent Variables							
	CO>=1%_Lag2		CO>=5%_lag2		CO>=10%_Lag2			
	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects
Full Sample	-0,0008	-0,0135	-0,0201	-0,0239**	-0,0183	-0,0158		
US Firms	0,0325	0,0173	0,0003	-0,0093	-0,0053	-0,0046		
European Firms	-0,0180	-0,0211	-0,0522**	-0,0518***	-0,0376	-0,0354		
Energy Sector	0,0282	0,0158	-0,0147	-0,0159	0,0226	0,0257		
Industrials Sector	-0,0061	-0,0174	-0,0491	-0,0532**	0,0455	0,0449		
Materials Sector	-0,0553	-0,0615	0,0265	-0,0269	-0,0288	-0,0280		
Information Technology	0,0812**	0,0689*	0,0150	0,0137	0,0132	0,0181		
Health Care	-0,0742	-0,1026**	-0,0120	-0,0221	-0,1508	-0,1453		
Communication Services	-0,0088	-0,0186	-0,0667	-0,0705	-0,0860	-0,0863		

	Independent Variables							
	CO>=1%_Lag2		CO>=5%_lag2		CO>=10%_Lag2			
	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects
Full Sample	-0,0088	0,0011	0,0042	0,0058	-0,0753	-0,0692		
US Firms	0,0717	0,0649	0,0575	0,0601	-0,1016	-0,0820		
European Firms	-0,0469	-0,0442	-0,0763	-0,0803	-0,0562	-0,0654		
Energy Sector	0,2192	0,1716	0,1067	0,1205	0,0919	0,0643		
Industrials Sector	-0,1546*	-0,1116	0,0792	-0,0865	-0,1119	-0,1265		
Materials Sector	-0,1056	-0,0975	0,0804	0,0671	-0,0392	-0,0563		
Information Technology	-0,0248	-0,0660	0,0576	0,0638	0,0499	0,0374		
Health Care	0,2393	0,1095	0,0643	0,0444	-0,8763***	-0,6209**		
Communication Services	-0,0900	-0,1180	-0,4496***	-0,4314***	0,1972	-0,0021		

Dependant Variable: Change in ESG Score

Dependant Variable: ESG Score

Appendix 20: Coefficients of Lag3 Common Ownership on ESG scores and change in ESG scores for different subsamples

	Dependant Variable: ESG Score																																																													
	CO>=1%_Lag3						CO>=5%_Lag3						CO>=10%_Lag3																																																	
	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects																																																		
Full Sample	0,0290	0,0079	0,0315**	0,0240**	-0,0402	-0,0365	US Firms	0,0288	0,0075	0,0411**	0,0250	-0,0560	0,0541	European Firms	0,0294	0,0245	0,0133	0,0133	-0,0142	-0,0096	Energy Sector	0,0747*	0,0575	0,0365	0,0297	-0,0377	-0,0354	Industrials Sector	0,0466	-0,0671**	0,0551**	0,0486**	0,1109**	0,1112*	Materials Sector	0,0604	0,0436	0,0481	0,0469	-0,1487***	-0,1457***	Information Technology	0,0248	0,0011	0,0033	-0,0031	-0,0228	-0,0187	Health Care	0,0794	0,0513	-0,0313	-0,0516	-0,1465	-0,1505	Communication Services	0,0756	0,0534	0,0804	0,0742*	0,0266	0,0290
	Dependant Variable: Change in ESG Score																																																													
	CO>=1%_Lag3						CO>=5%_Lag3						CO>=10%_Lag3																																																	
	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects																																														
Full Sample	0,0117	0,0374	0,0678*	0,0690	-0,0401	-0,0289	US Firms	0,0433	0,0238	0,0778*	0,0620	-0,0541	-0,0560	European Firms	-0,0077	0,0082	0,0560	0,0826*	-0,0300	0,0157	Energy Sector	-0,0471	-0,0743	0,0087	0,0513	-0,1030	-0,0871	Industrials Sector	-0,0299	0,0793	0,1815**	0,1674***	0,1601	0,0783	Materials Sector	0,0951	0,1126	0,0511	0,5450	-0,1375	-0,1231	Information Technology	-0,0893	-0,0505	-0,0314	-0,0034	-0,1238	0,1143	Health Care	0,2675	0,1349	0,0372	0,0106	-0,0893	0,1796	Communication Services	0,1457	0,0634	0,2810**	0,2595**	0,5746***	0,3132

Appendix 21: Sample Output for Linear Regression Models

```

Regression Results for Average CO>=1% 2014-2017:
Group: Full Sample
                                OLS Regression Results
=====
Dep. Variable:   ESG Score Improvement 2018-2023   R-squared:           0.018
Model:          OLS                               Adj. R-squared:      0.013
Method:         Least Squares                    F-statistic:         3.472
Date:           Sun, 26 May 2024                  Prob (F-statistic):  0.00802
Time:           12:14:22                          Log-Likelihood:      -1085.2
No. Observations: 770                             AIC:                 2180.
Df Residuals:   765                               BIC:                 2204.
Df Model:       4
Covariance Type: nonrobust
=====

```

	coef	std err	t	P> t	[0.025	0.975]
const	-0.0021	0.036	-0.059	0.953	-0.072	0.068
Average CO>=1% 2014-2017	0.1066	0.040	2.685	0.007	0.029	0.184
Average Opex 2014-2017	-0.0653	0.051	-1.276	0.202	-0.166	0.035
Average Capex 2014-2017	-0.0201	0.051	-0.391	0.696	-0.121	0.081
Average Turnover 2014-2017	-0.0095	0.036	-0.262	0.794	-0.081	0.062

```

=====
Omnibus:          44.771   Durbin-Watson:       1.886
Prob(Omnibus):   0.000   Jarque-Bera (JB):   151.203
Skew:            0.135   Prob(JB):           1.47e-33
Kurtosis:        5.154   Cond. No.           2.42
=====
Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
=====

```