Systematic Common Components in ESG Ratings across Legal Origins*

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Abstract

This study investigates the systematic components of ESG ratings by applying a multilevel factor model using the GCC approach. Leveraging ESG data from MSCI and Refinitiv across countries grouped by legal origin (English, French, German, and Scandinavian), we identify a single global factor consistently present across aggregate ESG scores and individual E/S/G pillars, reflecting the globalisation of ESG standards. However, the number and influence of local factors vary across legal origins and data providers. Notably, Refinitiv ratings are dominated by global factors, while MSCI ratings exhibit stronger local factor influence. These findings reveal rater-specific divergences and mixed evidence on the role of legal origin in shaping ESG performance. We argue that enhancing the relative importance of global factors—through harmonised ESG disclosure standards—can improve the consistency and predictive power of ESG ratings. Policy implications include the need for global mandatory reporting frameworks.

Keywords: Multilevel Factor Model, Generalised Canonical Correlation Analysis, Systematic Common Components of ESG Ratings, Legal Origin Theory, Global Mandatory Reporting Standards.

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1 Introduction

Following the United Nations' "Who Cares Wins" report (2004), scholarly interest in sustainable finance has grown substantially. Despite the absence of a universally accepted definition, the field has evolved under various conceptual labels, including Environmental, Social, and Governance (ESG) indicators, socially responsible investing (SRI), sustainable investing, and corporate social responsibility (CSR). A substantial body of research has emerged, primarily focusing on the intersection of ESG and financial markets. Three key strands of literature are particularly relevant. First, asset pricing models have been extended to incorporate ESG preferences among investors (Kashyap et al. 2021, Broccardo et al. 2022). Second, studies have examined the relationship between ESG performance and stock returns, yielding mixed results: some find that strong ESG performers achieve higher returns (Lins et al. 2017, Albuquerque et al. 2019), while others report negative or neutral effects (Chava 2014, Bolton & Marcin 2020). Third, a growing literature addresses ESG rating divergence and uncertainty (Christensen et al. 2022*a*, Avramov et al. 2022, Berg et al. 2024), suggesting that inconsistencies across rating agencies complicate efforts to isolate the true impact of ESG performance on financial outcomes.

Against this backdrop, our study aims to contribute to the ESG literature by identifying and analysing the systematic global and local factors, as well as noise components, in aggregate ESG ratings and their three individual pillars (Environmental, Social, and Governance) across four legal origin groups: English, French, German, and Scandinavian. To achieve this, we employ the Generalised Canonical Correlation (GCC) approach, as advanced by Choi et al. (2023) and Lin & Shin (2024). This method represents a significant advancement over traditional single-level factor models, which typically assume cross-country homogeneity and overlook institutional heterogeneity. The GCC framework is data-driven and capable of estimating a multilevel factor structure. Specifically, it decomposes ESG data into global factors shared across all countries, local factors specific to legal origin groups, and idiosyncratic noise components capturing country- or firm-level variation. This multilevel decomposition enables a more nuanced understanding of ESG dynamics by distinguishing systematic signals from statistical noise. Furthermore, our study introduces a novel institutional lens by classifying countries according to their legal origins, rather than by geography or income level, as is common in existing literature. Legal origin reflects deep-rooted differences in regulatory frameworks, corporate governance structures, and investor protections—factors that are likely to influence ESG practices and disclosure standards. By integrating legal origin into the GCC model, we uncover systematic variations in ESG factor structures that are not captured by conventional approaches. This methodological innovation enhances both the analytical depth and institutional relevance of ESG research, offering new insights into the structural determinants of ESG ratings across jurisdictions.

A wide range of micro- and macro-level factors influence ESG performance. At the firm level, financial characteristics such as firm size (Drempetic et al. 2020) and financial constraints (Hong et al. 2012) have been shown to affect ESG outcomes. Non-financial attributes, including board structure and

diversity, also play a significant role in shaping ESG practices (Beji et al. 2021, Shy 2024). Industry-level dynamics further contribute to ESG variation, with factors such as competitive intensity (Flammer 2015), regulatory constraints, and government-imposed sanctions influencing corporate sustainability efforts (Aragon-Correa et al. 2019). ESG encompasses multiple dimensions of firm behaviour and reflects a firm's efforts to address various externalities. However, not all determinants of ESG performance are within the control of individual firms. Broader institutional and regulatory environments—such as national governance structures, legal systems, and societal preferences—play a critical role in shaping ESG outcomes (Ferrell et al. 2016). Country-level factors, including differences in government policies and cultural norms, have been found to exert a stronger influence on corporate social performance than firm-specific characteristics (Kitzmueller & Shimshack 2012, Graham 2022). Supporting this view, Cai et al. (2016) demonstrate that country-level institutional arrangements are more strongly associated with corporate social performance than firm-level variables.

ESG data is inherently noisy due to a range of factors including data quality, coverage gaps, inconsistent metrics, time lags, varying industry and country-level regulations, and aggregation methodologies. Berg et al. (2022) highlight that disagreement surrounding ESG ratings is fundamentally driven by divergence in measurement scope and weighting schemes, stemming from the absence of a standardised ESG rating framework. This lack of consistency complicates efforts to assess ESG performance reliably across firms and jurisdictions. Tsang et al. (2024) emphasise the potential monitoring role of ESG rating agencies, suggesting that they can incentivise firms to reduce ESG violations. Beck et al. (2022) provide a succinct overview of the broader landscape of green and ethical finance, further illustrating the complexity of ESG evaluation. Due to these inconsistencies, existing studies often fail to reach a consensus on the impact of ESG on financial, social, and environmental outcomes. As Billio et al. (2021) note, discrepancies in ESG ratings can lead to divergent performance assessments, making it difficult for investors and policymakers to make informed decisions. Moreover, ESG regulations are multifaceted and vary significantly across regions, often shaped by their legal origins. Navigating these complexities while striving for alignment with emerging global standards presents a significant challenge for firms, regulators, and rating agencies alike.

Given the intricate regulatory landscape surrounding ESG issues, it is essential to examine how legal origin theory influences corporate sustainability practices. Legal origin theory posits that a country's legal framework—shaped by its historical legal tradition—serves as a foundational determinant of its business environment, governance structures, and corporate behaviour. The first generation of legal origin theory primarily focused on the relationship between legal systems and economic outcomes, often arguing for the superiority of common law systems over civil law systems in promoting governance efficiency and economic growth (Mahoney 2001, La Porta et al. 2002, 2008). However, this perspective has been criticised for overlooking environmental and social dimensions of corporate performance (Collison et al. 2012). The second generation of legal origin theory has expanded its scope to include sustainability-related outcomes, recognising that legal systems also shape corporate responsibilities beyond shareholder value. In

general, countries with English common law traditions tend to adopt more flexible and market-oriented legal frameworks, prioritising shareholder profit maximisation. This often results in more voluntary and heterogeneous ESG practices. In contrast, civil law countries—including those with French, German, or Scandinavian legal origins—typically embrace a stakeholder-oriented approach, mandating broader social responsibilities and more stringent ESG disclosure requirements. Empirical evidence supports these institutional distinctions. Kim et al. (2017) find that civil law firms exhibit significantly higher levels of corporate environmental responsibility, driven by stakeholder value maximisation and stronger environmental governance. Kock & Min (2016) show that common law countries tend to perform worse in terms of CO2 emissions, while Liang & Renneboog (2017) report that firms in civil law jurisdictions generally achieve higher ESG scores than their common law counterparts. Overall, the second generation of legal origin theory suggests that civil law countries tend to outperform common law countries on environmental and social metrics, largely due to higher levels of state intervention and regulatory enforcement.

We address the aforementioned challenges by aligning our analysis with the differing ESG disclosure standards between common and civil law systems. To identify the systematic and noisy components of ESG ratings, we apply the Generalised Canonical Correlation (GCC) approach to a multilevel factor model using two datasets: the MSCI dataset, which contains monthly observations of IVA ratings and their E/S/G pillars for 3,911 companies from January 2014 to December 2023; and the Refinitiv/LSEG dataset, which includes annual ESG ratings and their components for 2,306 companies from 2002 to 2023.

The estimation results reveal both similarities and differences across datasets. First, we identify a single global factor in both MSCI and Refinitiv data, confirming the presence of a global ESG trend. The time-varying patterns of these global components closely mirror the raw ESG data, with firms from Scandinavian legal origins consistently emerging as top performers. However, the number of local factors varies, and their time-varying patterns exhibit significant heterogeneity across legal origins and ESG sub-components. This suggests that multiple local institutional drivers—rooted in cultural, economic, environmental, and political differences—shape ESG practices across jurisdictions. Second, while the global components of both datasets show qualitative similarities, we observe a divergence in factor dominance: global factors dominate in Refinitiv, whereas local factors are more influential in MSCI. This may reflect methodological differences, with Refinitiv prioritising universal ESG standards and international benchmarks, while MSCI places greater emphasis on local regulations and cultural norms.

The global and local components extracted through GCC capture systematic ESG shocks shared across firms, distinguishing them from idiosyncratic firm-level practices. Their importance lies in three key areas: (i) investor decision-making: understanding whether ESG ratings are driven by global standards or localised risks is critical for regional asset allocation and portfolio construction; (ii) policy implications: regulators can use these insights to target global versus local ESG drivers, for example, harmonising carbon disclosure globally while adapting labour norms to local contexts (Kotsantonis & Serafeim 2019); (iii) corporate strategy: multinational firms must balance adherence to global ESG norms (e.g., GHG reporting) with responsiveness to local expectations (e.g., community engagement in emerging markets).

Next, we examine the association between ESG ratings—along with their global and local common components and a set of country-specific macroeconomic and firm-level variables, including GDP growth, inflation, company size, return on equity (ROE), and leverage, following the "doing well by doing good" literature (Martiny et al. 2024). We also incorporate legal origin dummies and a COVID-19 pandemic indicator. Although the estimation results differ qualitatively between the MSCI and Refinitiv datasets, for example, GDP growth and inflation show mostly positive effects in MSCI but negative effects in Refinitiv; the signs and significance of these determinants for the systematic components (global and local) largely mirror those observed in the raw ESG data. Firm-level variables such as company size and ROE exhibit consistently positive and significant associations with ESG performance across both datasets. In contrast, leverage shows a significantly negative effect only in the MSCI data. Importantly, the COVID-19 dummy remains positive and significant in both datasets, suggesting that the pandemic acted as a catalyst for ESG engagement, consistent with the flight-to-quality hypothesis (Urbonavicius & Chirita 2023). This implies that during periods of heightened uncertainty, firms and investors may place greater emphasis on sustainability and governance. We also find that global common components of ESG ratings are more predictable using macro and firm-level determinants, whereas local components and raw ESG scores are harder to explain. This, combined with the higher relative importance of idiosyncratic components in the MSCI data, suggests that MSCI ratings may be subject to greater noise and uncertainty in ESG disclosure practices. Finally, our analysis reveals mixed evidence on the impact of legal origin. The MSCI results show inconsistencies with prior studies (Liang & Renneboog 2017, Kim et al. 2017), while the Refinitiv results align more closely with the second generation of legal origin theory, which posits that civil law countries tend to exhibit stronger ESG performance due to higher regulatory intervention and stakeholder orientation.

As the GCC-based approach is data-driven, the differing findings between MSCI and Refinitiv datasets underscore the issue of ESG rating divergence, as widely documented in the literature (Avramov et al. 2022, Christensen et al. 2022*a*, Berg et al. 2024). These discrepancies highlight the ongoing complexity in uncovering the fundamental relationships between ESG ratings and firm characteristics, macroeconomic variables, and institutional factors such as legal origin. To improve the predictive power and reliability of ESG assessments, we suggest that the relative importance of global factors should be strengthened in comparison to local and idiosyncratic components. This would help align ESG ratings more closely with universal sustainability benchmarks and reduce noise stemming from inconsistent disclosure practices. Given the substantial differences in ESG reporting standards between civil and common law countries, achieving this goal requires the enforcement of global mandatory reporting standards. As Christensen et al. (2021) note, the effectiveness of such mandates depends critically on the quality and consistency of the standards themselves. In line with the growing momentum toward global harmonisation of sustainability reporting (Threlfall et al. 2020), we encourage policymakers to adopt frameworks such as those proposed by the International Sustainability Standards Board (ISSB) as global benchmarks. Additionally, the implementation of international ESG training programs—such as the United Nations Principles

for Responsible Investment Academy and the International Finance Corporation ESG Training Program—can facilitate cross-border collaboration and help synchronise ESG disclosures. These efforts are essential for improving transparency, reducing rating divergence, and fostering a more coherent global ESG ecosystem.

We acknowledge that ESG ratings are shaped by a range of broader contextual factors, including political systems, cultural norms, and industry composition. For example, regulatory enforcement of ESG standards often varies with political governance structures: countries with stronger state intervention (e.g., China) tend to prioritise governance factors aligned with political objectives (Marquis & Qian 2014), whereas liberal market economies (e.g., U.S.) emphasise investor-driven ESG metrics (Khan et al. 2016). Similarly, societal values (such as individualism versus collectivism) can influence corporate priorities in E/S/G components (Liang & Renneboog 2017). Industry composition also plays a role; resource-dependent economies (e.g., Australia) are subject to heightened environmental scrutiny, while service-dominated economies (e.g., Switzerland) place greater emphasis on governance and data privacy (Khan et al. 2016, Christensen et al. 2022*b*). While these factors are analytically relevant, our multilevel factor model focuses on systematic components shared across firms within legal origins, as these frameworks provide the foundational institutional "filter" through which other contextual factors (such as politics, culture, and industry) are mediated. This approach allows us to isolate and analyse the structural underpinnings of ESG variation across jurisdictions. See also Kurbus & Rant (2025) for a dicussion on legal origins as moderators of ESG outcomes.

The paper is organised as follows: Section 2 describes the multilevel factor model and the GCC estimation algorithms. Section 3 presents the main empirical results using the MSCI as well as the Refinitive/LSEG ESG dataset. The robustness analysis using sub-indicators of E, S and G pillars is presented in section 4. Section 5 offers concluding remarks. The data descriptions and additional estimation results are relegated to the Online Appendix.

2 The Model and Methodology

To identify systematic global and local common components of ESG ratings across groups, we employ the following three-dimensional panel data model with the multilevel factors for ESG ratings:

$$ESG_{ijt} = \boldsymbol{\gamma}_{ij}'\boldsymbol{G}_t + \boldsymbol{\lambda}_{ij}'\boldsymbol{F}_{it} + u_{ijt},\ i = 1, ..., R,\ j = 1, ..., N_i,\ t = 1, ..., T, \tag{1}$$

where ESG_{ijt} represents the ESG ratings by firm j in group i at time t, $\boldsymbol{G}_t = [G_t^1, ..., G_t^{r_0}]'$ is the $r_0 \times 1$ vector of latent global factors which influence all firms' ESG activities (e.g., climate change and global regulations/standards), $\boldsymbol{F}_{it} = [F_{it}^1, ..., F_{it}^{r_i}]'$ is the $r_i \times 1$ vector of latent local factors in the group i, that affects ESG performance of firms in the group i only, capturing the common trend within the group (e.g., cultural norms, local stakeholder pressure and regional economic conditions). $\boldsymbol{\gamma}_{ij}$ and $\boldsymbol{\lambda}_{ij}$ are the

corresponding heterogeneous factor loadings measuring the sensitivity of individual firms to the global and local factors, respectively. u_{ijt} is the idiosyncratic error.

Following the seminal paper by Kose et al. (2003), there has been a growing literature on the multi-level factor models. To deal with the primary issue of identifying the global and local factors separately, a number of alternative methods have been developed, because the principal component (PC) estimation, a popular method in the single-level factor model, fails to separately identify the global and local factors. Breitung & Eickmeier (2023) and Choi et al. (2018) propose the use of the canonical correlation analysis (CCA). Andreou et al. (2019) develop a CCA-based asymptotic theory for the estimated factors and loadings, though their approach can be applied to the case with the two groups only. Choi et al. (2023) develop consistent selection criteria for the number of global and local factors based on the average canonical correlations among all group pairs. Recently, Lin & Shin (2024) propose the generalised canonical correlation analysis (GCC) by conducting the simultaneous analysis of the factor spaces of all groups along with a GCC-based selection criteria for identifying the number of the global/local factors, and establish the superior performance of the GCC estimator over the alternative estimators.

2.1 The GCC Estimation Algorithm

Let $y_{ijt} = ESG_{ijt}$. Stacking (1) over time periods, we can write the model as

$$\boldsymbol{Y}_{ij} = \boldsymbol{G}\boldsymbol{\gamma}_{ij} + \boldsymbol{F}_i\boldsymbol{\lambda}_{ij} + \boldsymbol{e}_{ij} = \boldsymbol{K}_i\boldsymbol{\theta}_{ij} + \boldsymbol{e}_{ij} \tag{2}$$

where $\underset{T\times 1}{\boldsymbol{Y}_{ij}} = [y_{ij1}, ..., y_{ijT}]'$, $\underset{T\times 1}{\boldsymbol{e}_{ij}} = [e_{ij1}, ..., e_{ijT}]'$, $\underset{T\times r_0}{\boldsymbol{G}} = [\boldsymbol{G}_1, ..., \boldsymbol{G}_T]'$, $\underset{T\times r_i}{\boldsymbol{F}_i} = [\boldsymbol{F}_{i1}, ..., \boldsymbol{F}_{iT}]'$, $\boldsymbol{\theta}_{ij} = \left[\boldsymbol{\gamma}_{ij}', \boldsymbol{\lambda}_{ij}'\right]'$ and $\boldsymbol{K}_i = [\boldsymbol{G}, \boldsymbol{F}_i]$. For each group i we have:

$$\boldsymbol{Y}_i = \boldsymbol{G}\boldsymbol{\gamma}_i' + \boldsymbol{F}_i\boldsymbol{\lambda}_i' + \boldsymbol{e}_i = \boldsymbol{K}_i\boldsymbol{\theta}_i' + \boldsymbol{e}_i,\ i = 1, ..., R \tag{3}$$

where $\underset{T\times N_i}{\boldsymbol{Y}_i} = [\boldsymbol{Y}_{i1}, \boldsymbol{Y}_{i2}, \ldots, \boldsymbol{Y}_{iN_i}]$, $\boldsymbol{e}_i = [\boldsymbol{e}_{i1}, \boldsymbol{e}_{i2}, \ldots, \boldsymbol{e}_{iN_i}]$ and $\underset{N_i\times(r_0+r_i)}{\boldsymbol{\theta}_i} = [\boldsymbol{\gamma}_i, \boldsymbol{\lambda}_i]$. Notice that the existing CCA approach (e.g. Choi et al. (2023)) does not always identify the global factors in the presence of common local/regional factors. To address this important issue, Lin & Shin (2024) propose the GCC approach based on the following $T(R-1)R/2 \times \sum_{l=1}^{R}(r_0 + r_l)$ system-wide matrix:

$$\boldsymbol{\Phi} = \begin{bmatrix} \boldsymbol{K}_1 & -\boldsymbol{K}_2 & \boldsymbol{0} & \boldsymbol{0} & \ldots & \boldsymbol{0} & \boldsymbol{0} \\ \boldsymbol{K}_1 & \boldsymbol{0} & -\boldsymbol{K}_3 & \boldsymbol{0} & \ldots & \boldsymbol{0} & \boldsymbol{0} \\ & & & & \vdots & & \\ \boldsymbol{0} & \boldsymbol{0} & \boldsymbol{0} & \boldsymbol{0} & \ldots & \boldsymbol{K}_{R-1} & -\boldsymbol{K}_R \end{bmatrix} \tag{4}$$

Estimation of global factors and loadings We first obtain the PC estimate of $\boldsymbol{K}_i$ for each group i, denoted $\widehat{\boldsymbol{K}}_i$, by $\sqrt{T}$ times the $r_{\max}$ eigenvectors of $\boldsymbol{Y}_i\boldsymbol{Y}_i'$ corresponding to the $r_{\max}$ largest eigenvalues,

where $r_{\max} \geq \max_{i=1,\ldots,R}\{r_0+r_i\}$. We construct the $TR(R-1)/2 \times Rr_{\max}$ matrix, $\widehat{\mathbf{\Phi}}$ by replacing $\boldsymbol{K}_i$ with $\widehat{\boldsymbol{K}}_i$ in (4), and evaluate the singular value decomposition (SVD) of $\widehat{\mathbf{\Phi}}$ given by $\widehat{\mathbf{\Phi}} = \widehat{\boldsymbol{P}}\widehat{\mathbf{\Delta}}\widehat{\boldsymbol{Q}}'$, where $\widehat{\boldsymbol{P}}$ and $\widehat{\boldsymbol{Q}}$ are the $TR(R-1)/2 \times Rr_{\max}$ and $Rr_{\max} \times Rr_{\max}$ orthonormal matrices, and $\widehat{\mathbf{\Delta}}$ is the $Rr_{\max} \times Rr_{\max}$ diagonal matrix consisting of the singular values in *ascending order*. Next, we construct the $T \times Rr_0$ matrix, $\widehat{\mathbf{\Psi}} = \left[\widehat{\boldsymbol{K}}_1\widehat{\boldsymbol{Q}}_1^{r_0}, \ldots, \widehat{\boldsymbol{K}}_R\widehat{\boldsymbol{Q}}_R^{r_0}\right]$, where $\widehat{\boldsymbol{Q}}^{r_0} = \left[\widehat{\boldsymbol{Q}}_1^{r_0\prime}, \ldots, \widehat{\boldsymbol{Q}}_R^{r_0\prime}\right]'$ is the first r_0 columns of $\widehat{\boldsymbol{Q}}$. We consider the eigen-decomposition, $T^{-1}\widehat{\mathbf{\Psi}}\widehat{\mathbf{\Psi}}' = \widehat{\boldsymbol{L}}\widehat{\mathbf{\Xi}}\widehat{\boldsymbol{L}}'$ where $\widehat{\boldsymbol{L}}$ is a $T \times T$ orthonormal matrix and $\widehat{\mathbf{\Xi}}$ is a $T \times T$ diagonal matrix consisting of the eigenvalues in *descending order*. The consistent estimator of the global factors can be obtained as $\sqrt{T}$ times the r_0 vectors of $\widehat{\boldsymbol{L}}$ corresponding to the r_0 largest eigenvalues given by $\widehat{\boldsymbol{G}} = \frac{1}{\sqrt{T}}\widehat{\mathbf{\Psi}}\widehat{\mathbf{\Psi}}'\widehat{\boldsymbol{J}}^{r_0} = \frac{1}{\sqrt{T}}\left(\sum_{i=1}^{R}\widehat{\boldsymbol{K}}_i\widehat{\boldsymbol{Q}}_i^{r_0}\widehat{\boldsymbol{Q}}_i^{r_0\prime}\widehat{\boldsymbol{K}}_i'\right)\widehat{\boldsymbol{J}}^{r_0}$ where $\widehat{\boldsymbol{J}}^{r_0} = \widehat{\boldsymbol{L}}^{r_0}\left(\widehat{\mathbf{\Xi}}^{r_0}\right)^{-1}$, $\widehat{\boldsymbol{L}}^{r_0}$ collects the first r_0 columns of $\widehat{\boldsymbol{L}}$ and $\widehat{\mathbf{\Xi}}^{r_0}$ is an $r_0 \times r_0$ diagonal matrix consisting of the r_0 largest eigenvalues of $T^{-1}\widehat{\mathbf{\Psi}}\widehat{\mathbf{\Psi}}'$ in *descending order*. The global factor loadings can then be estimated by $\widehat{\mathbf{\Gamma}}_i = T^{-1}\boldsymbol{Y}_i'\widehat{\boldsymbol{G}}$.

Estimation of local factors and loadings For each group $i = 1, ..., R$, the local factors can be consistently estimated by $\sqrt{T}$ times the r_i eigenvectors of $\widehat{\boldsymbol{Y}}_i\widehat{\boldsymbol{Y}}_i'$ corresponding to the r_i largest eigenvalues, denoted $\widehat{\boldsymbol{F}}_i$, where $\widehat{\boldsymbol{Y}}_i = \boldsymbol{Y}_i - \widehat{\boldsymbol{G}}\widehat{\mathbf{\Gamma}}_i'$. The local factor loadings can be estimated by $\widehat{\mathbf{\Lambda}}_i = T^{-1}\widehat{\boldsymbol{Y}}_i'\widehat{\boldsymbol{F}}_i$.

The GCC criterion for identifying the number of global/local factors Using the diagonal matrix, $\widehat{\mathbf{\Delta}}$ from the SVD of $\widehat{\mathbf{\Phi}}$ ($\widehat{\mathbf{\Phi}} = \widehat{\boldsymbol{P}}\widehat{\mathbf{\Delta}}\widehat{\boldsymbol{Q}}'$), we estimate the number of global factors consistently by

$$\hat{r}_{0,GCC} = \underset{k=0,\ldots,r_{\max}}{\operatorname{argmax}} \frac{\hat{\delta}_{k+1}^2}{\hat{\delta}_k^2} \tag{5}$$

where $\hat{\delta}_1, \ldots, \hat{\delta}_{Rr_{\max}}$ are the diagonal elements of $\widehat{\mathbf{\Delta}}$ in *ascending order*. To handle the case with $r_0 = 0$, we set the mock singular value as $\hat{\delta}_0^2 = \left(C_{\underline{NT}}Rr_{\max}\right)^{-1}\sum_{k=1}^{Rr_{\max}}\hat{\delta}_k^2$. Given $\hat{r}_0$, we can consistently estimate global factors and loadings, denoted $\widehat{\boldsymbol{G}}$ and $\widehat{\mathbf{\Gamma}}_i$. Then, the number of local factors, r_i can be consistently estimated by applying the existing approximate factor model to $\widehat{\boldsymbol{Y}}_i = \boldsymbol{Y}_i - \widehat{\boldsymbol{G}}\widehat{\mathbf{\Gamma}}_i'$ for $i = 1, ..., R$, e.g., Bai & Ng (2002) and Ahn & Horenstein (2013).

Lin & Shin (2024) establish the consistency of the estimated factors and loadings based on a matrix perturbation theory. Although consistency can be achieved irrespective of whether the number of blocks, R is finite or tends to infinity, we focus on a more practical but challenging case with a finite R, and derive the asymptotic normal distributions for the global/local factors and loadings under fairly standard assumptions.

3 The Empirical Application

To identify systematic and noisy components of ESG ratings, we apply the GCC approach to the MSCI dataset containing monthly observations of IVA rating and its E/S/G pillars for $3,911$ companies over

January 2014–December 2023 as well as the Refinitiv/LSEG dataset containing annual observations of ESG rating and its three pillars for 2,306 companies over 2002–2023.

3.1 The MSCI ESG dataset

3.1.1 The data

Our data are collected from several sources. We collect the aggregate ESG as well as the individual environmental, social, and governance pillars from MSCI and Refinitiv databases. We collect the firm-specific fundamentals from Compustat, and macroeconomic controls such as country-level GDP growth and CPI-based inflation rates from the IMF database. See Table 1.

Table 1 about here

We use the intangible value assessment (IVA) as the aggregate rating, and the three components: the environmental, social and the governance scores from January 2014 to December 2023 (see Appendix A for data details).[1] We group the firms according to the four legal origins: English common legal origin and French/German/Scandinavian civil legal origins,[2] and apply the GCC approach to identifying the global and local common components of ESG ratings using the multilevel factor model, (1).

The descriptive statistics for MSCI based on legal origin grouping are presented in Table 2, showing that the Scandinavian legal origin tops in IVA as well as in E/S/G pillars. However, the ranking among English, French and German legal origins is not monotonic. For IVA and E/S pillars, French legal origin has a higher score than German and English counterparts. On the other hand English legal origin presents a higher score than German and French counterparts for the G pillar. The variability is relatively higher for the E pillar while Scandinavian legal origin displays the smallest variations except social score.[3]

Table 2 about here

Figure 1 displays the time-varying patterns of the raw ESG data, measured as the cross-section averages within each legal origin. IVA displays a smooth trend. Scandinavian legal origin tops the list, followed by French legal origin. Initially, English legal origin lagged behind, but outperformed German legal origin from 2018, and French legal origin from 2023. Scandinavian legal origin exhibits a relatively stable pattern but sustains a decline after the mid 2022. Three other legal origins experience two major

[1] We select the companies that satisfy the two criteria: (i) balanced monthly data covering the whole sample period and (ii) the data with variance larger than zero to apply the GCC regression.

[2] Socialist legal tradition began in the Soviet Union and spread to Eastern Europe and China, reverting to pre-revolutionary French or German civil law systems after the Berlin Wall fell. Following the litrature, we ignore socialist legal origin.

[3] Using a paired t-test involving means of the different indicators we find a significant difference between English, French, German and Scandinavian legal origins for IVA as well as E/S/G ratings. For the E pillar such differences exist between English vs Scandinavian, for the S pillar between English vs Scandinavian, English vs French, French vs Scandinavian and for the G pillar English vs Scandinavian, English vs French, French vs Scandinavian and German vs Scandinavian. Overall, 11 out of 24 correlations turn out to be significant at the 10% level. These results are available upon request.

declines in IVA during the Russian crisis (2014M12-2015M1) and the COVID pandemic peak (2020M12-2021M1). The first decline is mainly attributed to the sharp fall in the G pillar while the second is attributed to the drop in both S and G pillars. E scores continue to gradually increase across legal origins (with the ranking of Scandinavian, French, German and English legal origins), reflecting the impacts of various factors such as the UN Sustainable Development Goals, more emphasis on ESG considerations in investment decisions by institutional investors and stakeholders and rise in consumers' awareness of the environmental and social impacts of products and services. Despite two main declines, S scores continue to rise, though Scandinavian legal origin recently sustained a sharp decline and lost its leading position, surpassed by French legal origin.[4] Post-pandemic growth of IVA follows mainly due to the strong recovery in E and S pillars. G pillar shows higher volatilities than other pillars. Initially, English legal origin dominated. Following the Russian crisis, only Scandinavian legal origin did not suffer from decline, although the other three legal origins were faced with a sharp fall. This shifts the ranking to Scandinavian, English, French and German legal origins.

In sum, companies belonging to civil law origin have the higher ESG ratings since they are subject to higher state interventions and regulations, which is in line with the existing studies (e.g., Liang & Renneboog (2017), although the performance gap between English and French/German legal origins becomes negligible for IVA.

Figure 1 about here

3.1.2 Global and local common components of ESG ratings across legal origins

We apply the GCC criterion developed by Lin & Shin (2024) to the multilevel ESG model, (1), estimate the number of global factors, and use the ER criterion by Ahn & Horenstein (2013) to the de-factored data in each legal origin $i = 1, ..., 4$ to estimate the number of local factors. We also report the relative importance ratios of the factors for each legal origin, measuring the strength of both global and local factors relative to idiosyncratic components in explaining ESG variance.[5]

Table 2 shows presence of one global factor irrespective of IVA ratings or its three components. The number of local factors is 2 for social scores and ranges between 1 and 2 for IVA and environmental/governance scores, respectively. Given the global concerns regarding the climate change, human rights, corruption and the interconnectedness of the global economy, we would expect that these issues require synchronised action across countries irrespective of their legal origins, thereby resulting in single global factor in overall ESG as well as in its three components. Local factors, however, are subject to

[4] This may be due to the French Duty of Vigilance Law in 2017, which mandates that French multinational companies publish annual reports on their social and environmental impacts, including labour conditions and human rights risks.

[5] The relative importance ratios are evaluated using the variance decomposition based on the estimated ESG regression given by $ESG_{ijt} = \hat{\boldsymbol{\gamma}}_{ij}'\hat{\boldsymbol{G}}_t + \hat{\boldsymbol{\lambda}}_{ij}'\hat{\boldsymbol{F}}_{it} + \hat{u}_{ijt}$, where $\hat{\boldsymbol{G}}_t$ and $\hat{\gamma}_{ij}$ ($\hat{\boldsymbol{F}}_{it}$ and $\hat{\boldsymbol{\lambda}}_{ij}$) are the GCC estimates of global (local) factors and loadings from the multilevel ESG factor model, (1), and $\hat{u}_{ijt}$ are the residuals. Then, we obtain: $RI_G = Var(\hat{\boldsymbol{\gamma}}_{ij}'\hat{\boldsymbol{G}}_t)/Var(ESG_{ijt})$, $RI_F = Var(\hat{\boldsymbol{\lambda}}_{ij}'\hat{\boldsymbol{F}}_{it})/Var(ESG_{ijt})$ and $RI_u = Var(\hat{u}_{ijt})/Var(ESG_{ijt})$. By construction, $RI_G + RI_F + RI_u = 1$.

different goals and challenges due to varying cultures, economies, environments, and political systems. Here, 'one size fits all' would not apply, and companies including multinationals need to tailor their ESG strategies keeping in mind the diverse needs of companies. For example, one multinational may adopt global sustainability practice, but also address labour rights in one region or local governance in another. This would lead to presence of multiple local factors driving the ESG practices across legal origins.

We find the dominance of local factors in explaining the variance of ESG, and this dominance is more pronounced in E/S/G pillars. Scandinavian origin has a higher relative importance (RI) ratio of global factor (25.8%), although the influence of the global factor remains non-negligible for the other legal origins (18.7%–20.4%). Regarding the RI ratios of local factors in IVA, German legal origin (45.4%) is ranked at the top. Moreover, idiosyncratic components are more important in explaining the IVA variations in English and French legal origins, reflecting substantial uncertainties related to their ESG disclosure.

Turning to the three E/S/G components, local factors exhibit substantially higher RI ratios than the global factor for all legal origins. This dominance is prominent especially for S and G pillars, where the average RIs of global and local common components are 8.7% and 49% for S pillar and 6% and 50.9% for G pillar, respectively. This suggests that local factors provide a more comprehensive explanation behind ESG transitions. Notice that RIs of the global factor are significantly higher in the E pillar than in S/G pillars. This is mainly because environmental issues, such as climate change, pollution and biodiversity loss, have received more attention and indicators included in the E pillar are more tangible than those measured in S and G pillars. This finding is in line with studies that highlight the increasing emphasis on environmental issues in the overall ESG score due to global climate change concerns (Environment 2020), overshadowing S and G pillars. The primary focus of MSCI is financial materiality, evaluating the long-term resilience of companies that could impact their financial performance (LLC 2024). Research by MSCI highlights the different impacts of ESG components on financial performance, with environmental factors often having a more pronounced effect (Ankit & Bentley 2020).

Finally, the RI ratios of the idiosyncratic components range between 41.6% and 43.2% while they are more prominent for IVA and S scores of English legal origin and for E and G scores of Scandinavian legal origin. We also note that the nature of ESG disclosure reporting is quite different between common and civil law systems without the standardised mandatory reporting. This, combined with the specific local factors in which companies function (e.g., supply chain disruptions, labour rights violations, political instability and corruption), would have a more immediate impact on ESG compared to the global factors. Overall, these results confirm the substantial noises and uncertainties related to ESG disclosures.

Figure 2 displays the time-varying patterns of (average) global common components ($\overline{\hat{\boldsymbol{\gamma}}}_i'\hat{\boldsymbol{G}}_t = N_i^{-1}\sum_{j=1}^{N_i}\hat{\boldsymbol{\gamma}}_{ij}'\hat{\boldsymbol{G}}_t$, $i = 1, ...4$) of IVA rating as well as the three components along with global events for each legal origin, where $\hat{\boldsymbol{G}}_t$ and $\hat{\boldsymbol{\gamma}}_{ij}$ are the GCC estimates of global factor and loadings. The global common components of IVA exhibits an upward trend across legal origins, closely resembling the raw data shown in Figure 1, with Scandinavian legal origin as the top performer and German legal origin at the bottom except for E and S pillars (English legal origin at the bottom). Initially, following a noticeable

awareness and adoption of ESG principles among firms and investors,[6] there was a gradual increase in the global common component. The sudden drop in 2015 has been mainly due to the Russian crisis, that led to a reevaluation of environmental risks associated with energy production and supply chains.[7] The upward trend continues especially following the Paris agreement on the Climate Summit in 2016, also reflecting the lagged impact of sustainable investing policy on ESG metrics. Scandinavian legal origin outperforms in the three individual pillars. French legal origin dominates German and English counterparts in E and S pillars, whereas English legal origin outperforms the other two in G pillar, thus reinforcing the role of shareholder-focused mechanism. During the Covid pandemic sharp falls in global common components of IVA as well as S and G pillars are observed though those of E pillar continue to rise. This may suggest that S and G scores are more tangible metrics of firm resilience in times of crisis, because they reflect a combination of a leaner production process and good governance. Although the S component started showing upward trend immediately after the pandemic, firms may still struggle to increase the G scores given the resource constraints due to the pandemic.[8]

Figure 2 about here

Figure 3 portrays the time-varying patterns of (average) local common components ($\overline{\hat{\boldsymbol{\lambda}}}_i'\hat{\boldsymbol{F}}_{it} = N_i^{-1}\sum_{j=1}^{N_i}\hat{\boldsymbol{\lambda}}_{ij}'\hat{\boldsymbol{F}}_{it}$) for each legal origin $i = 1, ..., 4$, where $\hat{\boldsymbol{F}}_{it}$ and $\hat{\boldsymbol{\lambda}}_{ij}$ are the GCC estimates of local factors and loadings. Several observations can be made: significant heterogeneity gets reflected across legal origins, irrespective of aggregate or the three components. Time-varying patterns of local common components of IVA consist of three groups. First, local common components of IVA for English legal origin show an increasing trend (even more during the pandemic). Next, German legal origin exhibits almost an U-shape whilst companies in Scandinavian and French legal origins sustained significant falls in IVA ratings.

The local common components of the E pillar continue to grow and even jump during the pandemic, showing sustained commitments to environmental policies and climate change mitigation. Interestingly, the local E performance of French legal origin eventually tops the list though its initial position started from the bottom. The post-pandemic changes in the local common components of the S pillar of French legal origin are contrasted by those of German and Scandinavian legal origins. The pandemic disrupted

[6] Governments and regulatory bodies increasingly focused on sustainability and responsible business practices. International agreements and initiatives encouraged firms to enhance their performance. As consumers are becoming more conscious of the environmental and social impacts of products and services, companies responding to consumer preferences for sustainable and socially responsible options can enhance their ESG performance.

[7] This crisis caused severe global supply chains disruption, including labour practices and product responsibility. Companies with less-than-average management performance on ESG issues, such as carbon emission and climate change, see their scores largely driven down. Baid & Jayaraman (2022) highlight the importance of social responsibility in supply chain finance and management in promoting the S pillar in ESG investing.

[8] Despite the substantial declines in G scores, the aggregate ESG score tends to follow the growth of E and S pillars due to lockdown. The pandemic not only posed challenges in social responsibility fulfilment but also built up their resilience and adaptability to shocks by accelerating ESG integration into supply chains. During the period of zero-COVID policy, more rigorous lockdown policies were adopted and companies with robust supply chains were better positioned to respond effectively to the crisis. Thus, the increasing scores in E and S pillars contribute to the improvement in IVA.

global supply chains, trade and business operations. In response, many large businesses and enterprises in the former group stepped up their CSR initiatives to support local economies, displaying an upward trend.[9] The pandemic also highlighted the importance of building genuine relationships with community members, rather than relying on green-washing or advertising slogans as in the Forbes report (Payson 2021). The local common components of the G pillar plunged after the early oil price shock and stayed at the lower level, though some increases are observed after the pandemic except for French legal origin.

Figure 3 about here

3.1.3 Determinants of ESG ratings and systematic components

Given the heterogeneous time varying patterns of global and local common components of ESG ratings, we examine their associations with individual firm characteristics, country-specific macro-variables, the global event and the legal origin dummies, using the following panel data regression model with fixed effects (FE):

$$y_{ijt} = \boldsymbol{\beta}_c' \boldsymbol{x}_{ct-1} + \boldsymbol{\beta}_f' \boldsymbol{x}_{ij,t-1} + \beta_d d_t + \boldsymbol{\beta}_\ell' \boldsymbol{\ell}_i + e_{ijt},\ i = 1, ..., R,\ j = 1, ..., N_i,\ t = 1, ..., T, \tag{6}$$

where $\boldsymbol{x}_{ct}$ is a $k_c \times 1$ vector of country-specific macroeconomic regressors for $c = 1, ..., C$, $\boldsymbol{x}_{ijt}$ is a $k_f \times 1$ vector of firm-specific regressors, d_t is a dummy regressor for the Covid pandemic, $\boldsymbol{\ell}_i$ is a $k_\ell \times 1$ vector dummy regressors for legal origins and $e_{ijt} = \alpha_i + u_{ijt}$ is the one-way error component. We employ ESG_{ijt}, $\widehat{ESG}^G_{ijt} = \hat{\gamma}_{ij}' \hat{G}_t$, $\widehat{ESG}^F_{ijt} = \hat{\lambda}_{ij}' \hat{F}_{it}$ as a respective dependent variable, y_{ijt}, and consider covariates given by $\boldsymbol{x}_{c,t-1} = (g_{c,t-1}, \pi_{c,t-1})$ and $\boldsymbol{x}_{ij,t-1} = (size_{ij,t-1}, ROE_{ij,t-1}, leverage_{ij,t-1})$, where g is the seasonally adjusted quarterly real GDP growth rate π is the CPI inflation rate (with the base year 2015) collected from IMF, *size* is the company size measured by the logarithm of total assets, *ROE* is the return on equity measured by the ratio of net income to shareholder equity, and *leverage* is the ratio of long-term debt to shareholder equity, collected from Compustat. We construct the COVID pandemic dummy, d_t, taking the unity during 2019Q4–2023Q2 and zero otherwise, and legal origin dummies $\boldsymbol{\ell}_i = (French, German, Scandinavian)$. We then apply the fixed effects (FE) estimator to (6) using the dataset containing quarterly observations of 3,892 companies over 2014Q1–2023Q4.[10] See the definitions of the regressors in Table 1.

[9] Although English and German legal systems in general offer more flexibility and adaptability in response to economic shocks, France adopted a more targeted government support measures to adapt the existing rules for active workers, the unemployed and those suffering from Covid-19, which got reflected in sustained S scores during and beyond the pandemic.

[10] The quarterly data is employed to match data frequency of macro covariates. As GDP is unavailable for 2 countries (Bermuda in English legal origin and Panama in French legal origin), we remove 19 out of 3,911 companies. To avoid any contemporaneous endogeneity, we use the lagged values of firm and macro covariates as regressors. The coefficients on legal origin dummies are estimated by the 2-step procedure: we first construct the residuals from (6) by $\hat{e}_{ijt} = y_{ijt} - \hat{\boldsymbol{\beta}}_c' \boldsymbol{x}_{ct-1} - \hat{\boldsymbol{\beta}}_f' \boldsymbol{x}_{ij,t-1} - \hat{\beta}_d d_t$, where $\hat{\boldsymbol{\beta}}_c, \hat{\boldsymbol{\beta}}_f and \hat{\beta}_d$ are the FE estimates. Next, we run the between regression of $\hat{e}_{ijt} = a + \boldsymbol{\beta}_\ell' \boldsymbol{\ell}_i + error_{ijt}$ to estimate $\hat{\boldsymbol{\beta}}_\ell$.

Table 3 reports the regression results. First, we observe that the sign and significance associated with the coefficients of GDP growth and inflation for the systematic global and local common components of ESG match in almost all cases with those of raw data except for local common components in the E pillar and global common components in the G pillar. Both GDP growth and inflation enhance ESG activities for IVA and E/S/G pillars, implying that GDP growth enables investments in sustainable practices, green technologies and regulatory compliance while inflation enhances the profitability of firms and hence motivates firms to improve innovation & infrastructure and employ renewable energy resources, thus explaining the positive association between inflation and ESG or its global common components. However, the impact of GDP growth on local common components is negative and insignificant in the E pillar whereas both growth and inflation exert negative impacts on local common components in the G pillar.

Second, the impacts of company size are mostly positive and significant for the raw data and global/local common components except for the G pillar, in line with the stakeholder theory that higher ESG performance is expected in larger firms because of their richer resources and strategy to cope with higher pressure from the public and regulatory bodies (Drempetic et al. 2020). ROE and leverage ratio exert positive and negative impacts on ESG scores and global common components, respectively, whilst their impacts become insignificant for local common components. The positive effect of profitability (ROE) on ESG supports the legitimacy and stakeholder theories documenting that profitable companies, monitored by diverse stakeholders, tend to improve ESG practices as a contribution to the value and well-being of stakeholders and the society (Muttakin & Khan 2014). The negative effect of financial leverage aligns with existing studies showing that highly leveraged companies have limited resources to invest in ESG activities (Lourenço & Branco 2013).

Third, the impacts of the Covid dummy remain positive and significant for the IVA and E/S pillars. As awareness of sustainability risk is likely to increase in the long run, the COVID crisis can act as a positive catalyst for ESG, aligning with flight-to-quality hypothesis (Urbonavicius & Chirita 2023). Given the widespread lockdowns and less industrial activities caused by the pandemic, the external environment with less pollution and emission contributes to higher E scores for companies (Al Amosh & Khatib 2023). Moreover, the pandemic underscored the important engagement with diverse stakeholders through initiatives such as safety and health measures and remote work, improving S scores (Obrenovic et al. 2020). But, we have mixed results for the G pillar. Although some companies exhibit higher resilience with strong ESG ratings, this unprecedented crisis led to challenges in corporate governance, such as risk management, effective oversight and decision-making.

Fourth, taking the English common legal origin as a benchmark, the positive (negative) dummy coefficients imply that the civil legal origin can produce a higher (lower) ESG performance than the English counterpart. For the raw ESG data Scandinavian legal origin is the only one that dominates English legal origin except the G pillar, though the difference is significant only for IVA. However, the coefficients on the French and German legal origin dummies become significantly negative except the E

pillar, implying that the English common law counties can achieve higher performance than French and German counterparts in S and G pillars. Our results are not in line with Liang & Renneboog (2017), who document the positive coefficients on all three civil legal origins across E/S pillars. This difference may be due to the use of different samples and time periods. Notice that our data covers more recent period including both voluntary and mandatory reporting periods. Furthermore, the civil legal origin dummy coefficients are mostly negative for both global and local common components of IVA and E/S/G pillars, indicating that the systematic component of ESG ratings are weaker for civil law system than for common law system. Taken together, these results do not provide support for the second generation of legal origin theory (Liang & Renneboog 2017, Kim et al. 2017).

Finally, the adjusted R^2s for global common components are substantially higher than those for the raw data and local common components in all cases. In particular, R^2s for the raw data, global and local common components in IVA are 7.4%, 50.6% and 1.1%, respectively. This implies that systematic global common components can be well predicted by company/macro/legal origin determinants while the raw data and local common components are harder to predict.

Table 3 about here

In sum, our findings show the presence of single global factor across legal origins in overall ESG and its three components, thereby reflecting the ESG trend/globalisation. The single global factor signals for integration of ESG in investment strategies where ESG principles can turn out to be another dimension of risk-return diversification. High R^2 in explaining global factors using macroeconomic and firm-specific variables along with legal origins dummies imply 'doing well doing good' works well here, in contrast to raw data and local factors. The presence of multiple local factors portrays volatile components of ESG due to region-specific environmental, social, and governance factors that are formed by local culture, laws, development and institutional norms, thereby demanding for region specific strategies and resolutions. The higher relative importance ratios of local factors and idiosyncratic components combined with low R^2s in regression analysis reflects noises and uncertainties of the ESG disclosure and data.

Using extended data covering both voluntary and mandatory reporting periods, our findings are generally inconsistent with the earlier studies, e.g., Liang & Renneboog (2017). This may suggest that an extended legal origin theory perhaps work better, along with a call for political and adaptability mechanism as postulated by Graff (2008). If firms belonging to a certain legal origin country already attains a certain level of corporate sustainability, its importance appears to decrease. Investing in corporate sustainability in less sustainable countries turns out to be advantageous, though this relationship may not be valid in more sustainable countries since firms have already exploited many of the existing opportunities, thus leading to over-investment in corporate sustainability.[11] Adaptations in local legal and

[11] Common law system is shown to exhibit the stronger positive reaction of environmental performance in response to international agreements, e.g., Kyoto protocol (Eberlein & Matten 2009, Kock & Min 2016). This reflects that civil law countries have already incorporated stakeholders' environmental demands into their institutional logic, with limited scope for changing the policy.

cultural factors could lead to diverse approaches to ESG implementation, potentially undermining a universal approach. This suggests that the global mandate reporting standards would be a more important determinant of ESG performance and focus on global factor can improve (future) ESG disclosure.

3.2 The Refinitiv/LSEG dataset

3.2.1 The data

Next, we consider the Refinitiv dataset containing annual observation of 2,306 companies from 60 countries over the period 2002 to 2023. We use the ESG aggregate rating and the three components constituting the ESG: the environmental, social and the governance scores (see Appendix A for data details).[12]

The descriptive statistics for Refinitiv ESG data reported in Table 4, show that the Scandinavian legal origin ranks the first in ESG and individual E/S pillars while the ranking among English, French and German legal origins is not monotonic. For ESG and S pillar, French legal origin has a higher score than German and English counterparts. For E pillar, German legal origin shows a higher score than French and English counterparts. English legal origin records a top score for the G pillar, followed by French, Scandinavian and German legal origins. Overall, the civil legal origins tend to outperform the common legal origin in terms of ESG and E/S scores whilst the reverse holds for the G pillar.

Table 4 about here

3.2.2 Global and local common components of ESG ratings across legal origins

Table 4 also shows presence of one global factor irrespective of ESG ratings or its three components. The number of local factors is 1 for ESG and 2 for E scores, and mostly ranges between 1 and 2 for S and G scores, respectively. We now notice the dominance of global factors in explaining the ESG variances. For example, RI ratios of global common components in aggregate ESG are well over 55.5%. Turning to the E/S pillars, global common components still exhibit higher RI ratios than the local counterparts for all legal origins, except for S pillar in German legal origin. This suggests that global common components provide a more comprehensive explanation behind ESG transitions. The G pillar displays an opposite pattern, showing higher RI ratios for local components than global ones across legal origins. Finally, we observe that the average RI ratios of idiosyncratic components range between 16.6% and 33.8% in three individual pillars while RI ratios in aggregate ESG are smaller than 14% across legal origins. Overall, the current results are quite different from those obtained for MSCI ESG data. Combining significantly higher RIs of the global common components and relatively negligible RIs of idiosyncratic components, we conjecture that the Refinitiv ESG data is likely to be subject to less noises and uncertainties related to ESG disclosures than MSCI ESG data.

[12] Annual Refinitiv data covers longer periods while covering different firms.

Figure 4 displays the time-varying patterns of the raw ESG data, displaying a smooth upward trend for all legal origins. Scandinavian legal origin tops the list, followed by French legal origin. English legal origin began to outperform German legal origin since 2009. After the Covid pandemic, Scandinavian legal origin sustains a mild decline, but three other legal origins stay relatively stable. E scores continue to gradually increase, with English legal origin at the bottom. Prior to the global financial crisis (GFC), German and French legal origins outperformed. Then, Scandinavian legal origin gained an edge until 2020, after which it is overtaken by French legal origin. The time varying patterns of S scores look similar to those of E scores with the main difference that German legal origin remains at the bottom. Scandinavian origin began to outperform during GFC, but its leading position was surpassed by French legal origin after the pandemic. G pillar shows substantially higher volatilities especially for Scandinavian legal origin. Since GFC, English legal origin remained on top, but Scandinavian legal origin experienced a rapid rise from mid 2017 and became the top performer since 2019. We note two stylised findings: first, Scandinavian legal origin maintains the best performance. Next, civil law countries outperform common law countries in ESG and E/S pillars, while English common legal origin achieves higher scores than French and German counterparts for the G pillar. Overall, these results are qualitatively similar to those obtained for the MSCI dataset.

Figure 4 about here

Figure 5 displays the time-varying patterns of (average) global common components. The global common components of ESG exhibits a smooth upward trend across legal origins, closely resembling the raw data in Figure 4, with Scandinavian legal origin as the top performer and English/German legal origins at the bottom. Initially, there was a gradual increase in the global common component, followed by a significant increase during GFC. Although this crisis destroyed public trust in the financial industry, it still underscored the importance of integrating non-financial factors into investment decisions to implement stricter corporate regulations and oversight. The upward trend continues, especially following the Paris Climate Summit in 2016. Scandinavian legal origin outperforms in ESG and E/S pillars whereas English legal origin dominates in G pillar. During the Covid pandemic global common components of S and G pillars started to decline while those of E pillar continued to rise. As a result, global common components of the aggregate ESG remained unchanged. Recently, slow-downs of global common components have been observed across legal origins in both datasets, indicating that ESG measurement and framework tend to be more standardised, following recent mandatory reporting initiatives. This can improve the quality and coherence of ESG datasets between raters (Ioannou & Serafeim 2019).

Figure 5 about here

Figure 6 portrays the time-varying patterns of (average) local common components. Significant heterogeneities are observed across legal origins. Time-varying patterns of local common components of ESG consist of three groups. The local common components of ESG for English and French legal origins

display an increasing trend while German legal origin stays relatively stable. Scandinavian legal origin exhibits a declining trend mainly caused by G pillar and to some extent by E pillar after the pandemic. Following the pandemic shocks, companies in Scandinavian origin sustained a further fall in ESG and E ratings. The local common components of the E pillar continue to grow gradually for the three legal origins, except Scandinavian legal origin that exhibits an inverse U-shape, with an initial upward trend (even a jump during GFC) and a downward trend starting from the Russian crisis. Interestingly, the local E performance of English and French legal origins eventually tops the list. During the GFC period the local common components of the S pillar in Scandinavian legal origin continued to rise while those of the other legal origins sustained falls. German legal origin experienced a rapid rise from 2015 and began to outperform the other three legal origins since 2018. The local common components of the G pillar plunged during GFC, except English legal origin. They continued to decline though only Scandinavian legal origin started to bounce back. Overall, time-varying patterns of local common components become significantly different between Refinitiv and MSCI datasets, indicating that there are substantial heterogeneities in local factors.

Figure 6 about here

3.2.3 Determinants of ESG ratings and systematic components

We examine the associations of Refinitiv ESG datasets and their global and local common components with macro factors, firm-specific characteristics, the COVID dummy and the legal origin dummies containing annual observations of $2,211$ companies during 2002 and 2023.[13] Table 5 reports the regression results. First, we also observe that the sign and significance of the coefficients on GDP growth and inflation for the systematic global and local common components of ESG match in almost all cases with those of raw data except for local common components in ESG and G pillar. Unlike in MSCI data, however, the impacts of both GDP growth and inflation are mostly negative for ESG and E/S/G pillars.

Second, the impacts of firm characteristics share some similarities and differences to those from MSCI data. The impacts of company size and ROE are mostly positive and significant for the raw data and global/local common components. On the contrary, the impacts of leverage ratio become mostly insignificant.

Third, the COVID pandemic exerts a significantly positive effect on ESG data and their global/local common components. This is in line with the previous results for MSCI dataset.

Fourth, turning to the legal origin dummies, we find that Scandinavian and French legal origins significantly outperform English legal origin for ESG scores and global common components except G pillar whilst the German legal origin is outperformed by English legal origin except E pillar. These results provide some support for existing studies (e.g., Liang & Renneboog (2017)), documenting that

[13] All the variables are measured in annual frequency. As GDP and CPI data are unavailable for 5 countries (Bermuda, Jersey and Cayman Island in English legal origin, Puerto Rico in French legal origin, and Taiwan in German legal origin), we remove 95 out of $2,306$ companies.

ESG performance tends to be stronger in civil law countries. Next, unlike in MSCI dataset, the dummy coefficients are mostly positive for both global and local common components in the civil law system except G pillar, implying that their systematic ESG activities can be stronger than those in common law system.

Finally, R^2s for global common components are significantly higher than those for the raw data and local common components in all cases. For instance, R^2s for the raw data, global and local common components in ESG are 23.2%, 32.1% and 0.1%, respectively, also confirming that systematic global common components can be better predicted by company, macro and legal origin determinants.

Table 5 about here

3.3 Comparative Insights from MSCI and Refinitiv ESG Data

This section compares ESG outcomes derived from the MSCI and Refinitiv datasets, focusing on legal origin hierarchies, factor structures, and methodological divergence. Despite differences in data construction and frequency, both datasets consistently show that civil law systems—particularly those with Scandinavian legal origins—demonstrate superior ESG performance, especially in the Environmental (E) and Social (S) pillars. These findings align with legal origin theory, which links civil law traditions to stronger regulatory environments and enhanced investor protection.

However, meaningful divergences emerge between the two datasets. The MSCI data exhibits higher event sensitivity, capturing sharp fluctuations in ESG scores around major geopolitical disruptions such as the Global Financial Crisis, the COVID-19 pandemic, and the Russia–Ukraine conflict. These fluctuations are particularly pronounced in the Social and Governance pillars, reflecting MSCI's emphasis on financial materiality and risk-adjusted exposure (Christensen et al. 2022*a*). In contrast, Refinitiv data smooths through such shocks, placing greater emphasis on long-term structural trends tied to macroeconomic cycles. For instance, while MSCI identifies a post-2018 inflection point in ESG performance for English legal origin countries, Refinitiv attributes this shift to as early as 2009. Additionally, Governance scores for Scandinavian legal origin countries show greater volatility in Refinitiv, suggesting differences in how each rater captures institutional dynamics and disclosure practices. These contrasts underscore the importance of understanding methodological differences across ESG rating agencies, particularly when interpreting cross-country ESG performance and legal origin effects.

Both datasets identify a strong global ESG factor, consistent with emerging evidence of international ESG convergence (Berg et al. 2022). However, the composition of ESG variance differs notably between MSCI and Refinitiv. MSCI attributes a larger share of ESG variance to local and idiosyncratic factors, particularly within the Social and Governance pillars. This suggests greater sensitivity to national regulatory environments, firm-level practices, and disclosure inconsistencies. In contrast, Refinitiv places greater emphasis on global comparability, producing smoother temporal trends and exhibiting lower idiosyncratic volatility. This divergence in signal composition reflects distinct philosophical approaches to

ESG assessment. MSCI's dual exposure-management model tailors ESG scores to sector-specific risks and long-term resilience, prioritising financial materiality. Refinitiv, on the other hand, emphasises data coverage, breadth of indicators, and transparency, aiming for consistency across jurisdictions (Avramov et al. 2022).

Regression analyses further underscore the methodological distinctions between MSCI and Refinitiv. In the MSCI dataset, macroeconomic indicators such as inflation and GDP growth show positive associations with global ESG components, suggesting that firms demonstrating resilience under challenging economic conditions are rewarded with higher ESG scores. This aligns with MSCI's emphasis on financial materiality and dynamic risk exposure. In contrast, Refinitiv reports negative relationships between these indicators and ESG scores, likely reflecting the influence of backward-looking, self-reported metrics that tend to deteriorate during periods of economic strain.

Legal origin effects also diverge across the two datasets. MSCI supports the superiority of common law systems in the Governance (G) pillar, while Refinitiv attributes ESG leadership to civil law jurisdictions, particularly in the Environmental (E) and Social (S) pillars. Moreover, the legal origin dummies exert stronger influence on the global common components in Refinitiv's ratings—not because Refinitiv captures local variation directly, but because legal origin may indirectly shape how firms align with global ESG benchmarks. In other words, firms from different legal traditions may systematically differ in their conformity to internationally standardised ESG expectations, which Refinitiv prioritises. Conversely, in MSCI, legal origin dummies have a stronger impact on local components, consistent with its institution-sensitive, locally grounded rating methodology. This finding aligns with Berg et al. (2024), who argue that ESG scores depend as much on rating methodology as on firm behaviour, reinforcing the importance of understanding how institutional and methodological factors jointly shape ESG assessments.

These findings reinforce the growing literature on ESG rating divergence, which highlights inconsistencies in scope, weighting, and measurement practices across rating providers (Chatterji et al. 2016, Berg et al. 2022). While the average correlation between MSCI and Refinitiv ESG scores in our study is higher than the 0.5 benchmark reported in prior research—likely due to our use of cross-sectional averages (Billio et al. 2021)—substantial divergence remains, particularly across legal systems and within the Governance pillar. Importantly, the choice of dataset has direct implications for both empirical research and policy formulation. MSCI may be more appropriate for studies focused on market-specific risks, institutional heterogeneity, and event-driven ESG dynamics, given its sensitivity to geopolitical disruptions and emphasis on financial materiality.[14] In contrast, Refinitiv is better suited for examining global ESG harmonisation, regulatory convergence, and long-term structural trends, due to its broader indicator coverage and smoother signal composition.

In conclusion, our comparative analysis confirms that while both datasets recognise the presence of global ESG trends, they diverge in terms of attribution, volatility, and interaction with legal origin.

[14] MSCI adjusts scores based on relevance and timing of industry-specific factors, though the MSCI's scoring methodology is not always unveiled.

These differences reflect underlying methodological choices and underscore the complexity of measuring ESG performance consistently across jurisdictions. They also highlight the need for greater transparency and standardisation in ESG rating practices—while preserving enough flexibility to account for local institutional realities and regulatory diversity.

4 Robustness Analysis using Sub-indicators

We now conduct robustness exercises using key sub-indicators of both MSCI and Refinitiv ESG dataset to examine whether the findings from the previous section are consistent.[15] For the MSCI dataset, we use sub-indicators such as climate change score for the E pillar, human capital theme score for the S pillar, and corporate governance score for the G pillar. Regarding key sub-indicators of Refinitiv dataset, we choose carbon emissions score for the E pillar, human rights score for the S pillar, and management score for the G pillar. [16]

The descriptive statistics based on legal origin grouping, presented in Tables 6 and 7, reveal similarities and differences between the MSCI and Refinitiv sub-indicators. In both datasets, Scandinavian-origin countries consistently perform well, particularly in environmental (E) and governance (G) dimensions. For instance, Scandinavian countries lead in corporate governance theme (G) in MSCI and management (G) in Refinitiv, reinforcing their strong institutional frameworks. Additionally, both show that French-origin countries also excel in E/S/G metrics. We also find that Scandinavian legal origin displays the smallest variability, except in the human right (S) in Refinitiv. The non-monotonic ranking between English and German origins in MSCI further contrasts with Refinitiv's distinction (especially in S and G pillars), indicating potential methodological or definitional differences in pillar construction. Scandinavian legal countries consistently lead, though the relative performance of other legal origins varies depending on the dataset and specific sub-indicator. Overall, these results are more or less consistent with those obtained for the aggregate indicators.

Tables 6 and 7 about here

Both MSCI and Refinitiv sub-indicators confirm the presence of a single global factor across all E, S, and G pillars, but they differ in the dominance of local versus global influences. In MSCI, local factors explain more variance, particularly in S and G pillars, with German origin showing higher sensitivity to local shocks in the G pillar. In contrast, Refinitiv exhibits stronger global factor dominance, except in the G sub-indicator, where Scandinavian origin is more responsive to global shocks. While MSCI

[15] We are thankful to an anonymous referee for this suggestion.

[16] In selecting sub-indicators, we should deal with two hurdles associated with the respective methodologies of MSCI and Refinitiv data providers. First, the weights assigned to sub-indicators change over time, which renders a full alignment with the aggregated ESG scores unachievable, even if the sub-indicators are connected to their respective pillars. This may introduce a layer of analytical noises that cannot be easily filtered out. Next, the missing data across the sub-indicators limits the scope of analysis. Thus, the sample size for these sub-indicators is smaller than that the aggregate indicators.

highlights the importance of idiosyncratic components in S and G pillars across legal origins, Refinitiv emphasises Scandinavian origin's higher reliance on local factors (except in human right). Overall, MSCI underscores localised ESG dynamics, whereas Refinitiv suggests a more globally driven structure, though both acknowledge substantial disclosure uncertainties in S and G pillars.

In the Online Appendix C we present figures of the raw data and global/local common components of MSCI/Refinitiv ESG sub-indicators across 4 legal origins (Figures 7 to 12) as well as regression results for determinants of ESG sub-indicators (Tables 11 and 12). A careful reading of these results further unveils the distinctions between datasets. For instance, legal origin dummies significantly influence local common components in the G pillar of MSCI, whilst it presents stronger effects on the global component in E, S and G pillars of Refinitiv. It confirms that MSCI relies more on domestic institutional environments, especially in the G pillar, while Refinitiv puts more emphasis on the consistency of firm behaviour with global standards. Moreover, MSCI shows positive relationships between macroeconomic indicators like GDP growth and inflation and human capital (S) and corporate governance (G) scores. In contrast, Refinitiv reports negative associations. Additionally, in both dataset, the superiority of common law systems in governance (G) is supported (except for Scandinavian legal origin and local component in MSCI), while the leading position of civil law jurisdictions is observed in the E pillars (except for local component).

In sum, these findings using sub-indicators explicitly unveil the distinctions between datasets in E, S and G pillars, further reinforcing the literature on ESG rating divergence across rating providers.

5 Concluding Remarks

ESG is a framework that incorporates non-financial factors—environmental, social, and governance—that influence a company's long-term sustainability and success. While ESG initially focused on environmental concerns, it has evolved to encompass broader social and governance dimensions. However, the existing literature has yet to reach a consensus on ESG performance, largely due to the noisy and uncertain nature of ESG data. This noise arises from inconsistencies in data quality, metric definitions, aggregation methods, and varying industry and country-level regulations. Navigating these complexities is particularly challenging given the divergent ESG disclosure standards between common law and civil law systems. To address this issue, our study identifies and analyses the systematic and noisy components of ESG ratings by employing a multilevel factor model and applying the data-driven GCC approach. This methodology allows us to disentangle global, local, and idiosyncratic influences on ESG ratings, offering a more nuanced understanding of how institutional structures shape sustainability assessments.

We first conduct the GCC analysis using the MSCI dataset containing $3,911$ companies monthly observations of IVA ratings and its E/S/G components over January 2014–December 2023, and find one systematic global factors across the four legal origins (English, French, German and Scandinavian) for IVA ratings and its three components, reflecting ESG trend/globalisation. The number of local factors

varies across legal origins and sub-components of ESG. We find the dominance of local factors and the large relative importance ratios of the idiosyncratic components in explaining the ESG variance.

We next utilise the Refinitiv/LSEG dataset, which comprises annual ESG ratings and their three components for 2,306 companies over the period 2002–2023. Our analysis identifies a single global factor, alongside varying numbers of local factors across legal origins. Notably, we observe the dominance of global factors and minimal idiosyncratic influence in explaining ESG variance. This suggests that, under a universal mandatory reporting regime, the explanatory power (RIs) of global factors would significantly outweigh that of local factors and idiosyncratic components. In this context, we conjecture that the MSCI ESG data may be subject to greater noise and uncertainty in ESG disclosures compared to the Refinitiv dataset.

We examine the relationship between ESG data and their global and local common components with country-level macroeconomic and firm-specific variables, as well as COVID-19 and legal origin indicators. While the estimation results differ between the MSCI and Refinitiv datasets, the signs and significance of the determinants for the systematic components of ESG largely align with those observed in the raw data. Moreover, global systematic components are more reliably predicted by these variables, whereas the raw data and local components exhibit lower predictive power. Importantly, we find mixed evidence regarding the influence of legal origin on ESG performance. The MSCI results diverge from prior studies, which consistently report stronger ESG performance in civil law countries compared to common law countries (Kock & Min 2016, Liang & Renneboog 2017, Kim et al. 2017). In contrast, the Refinitiv data support the second-generation legal origin theory. Given the data-driven nature of the GCC-based approach, these contrasting findings underscore the divergence and uncertainty among ESG ratings, as highlighted in recent literature (Avramov et al. 2022, Christensen et al. 2022*a*, Berg et al. 2024).

Our findings confirm that uncovering the relationships between ESG factors and firm characteristics, macroeconomic variables, and legal origins remains a complex and multifaceted challenge. The divergence in ESG signal composition across rating agencies, combined with institutional and regulatory heterogeneity, complicates efforts to establish consistent empirical relationships. To improve the predictive power and reliability of ESG assessments, we recommend increasing the relative importance of global factors in ESG models, relative to local and idiosyncratic components. This adjustment would enhance the comparability of ESG scores across jurisdictions and better reflect universal sustainability benchmarks. Given the substantial differences in ESG disclosure standards between civil and common law countries, this goal can be achieved through the enforcement of global mandatory reporting standards.[17] The adoption of consistent frameworks plays a critical role in making ESG information more comparable, reliable, and decision-useful for investors and regulators.[18] Following the growing momen-

[17]While various standards were developed for different reporting purposes, ESG disclosure mandates are expanding. The EU's Corporate Sustainability Reporting Directive went into force in January 2023, requiring estimated 50,000 companies to file annual reports on business risks and opportunities related to social and environmental issues. Moreover, the Corporate Sustainability Due Diligence Directive, starting in 2027, will require qualifying companies to act on adverse human rights and environmental impacts in their own operations as well as their supply chains, see Craig (2024).

[18]Between 2000 and 2019 there was a 92% increase in mandatory and voluntary ESG disclosure frameworks. We are

tum toward global harmonisation of sustainability reporting (Threlfall et al., 2020), policymakers are encouraged to adopt international standards—such as those proposed by the International Sustainability Standards Board (ISSB)—as benchmarks. In addition, market-driven mechanisms in common law countries could be leveraged to incentivise firms to adopt more standardised ESG metrics. Conversely, government-led implementation may be more effective in civil law systems, where rule-based governance structures support regulatory enforcement.

As ESG continues to reshape financial markets and corporate behaviour, the challenge of achieving consistency across rating systems and jurisdictions remains. Our study opens several avenues for future research. Methodologically, there is scope to extend our multilevel factor model to incorporate spatial and network dependencies in ESG performance, capturing inter-firm and cross-country linkages. Empirically, our results motivate further investigation into the commonality of ESG scores across rating agencies, as well as network analyses linking ESG metrics to Sustainable Development Goals (SDGs) across legal origins.

still some way from a global consensus on reporting standards. See six steps to improve your ESG performance by Mark Carney, Former Governor of The Bank of England, via the link https://simplysustainable.com/insights/six-steps-to-improve-your-esg-performance.

Table 1: Variable Descriptions

Variable Name	**Description**	**Source**
IVA rating (MSCI ESG)	The overall ESG score assigned by MSCI, reflecting a firm's aggregate performance across environmental, social, and governance dimensions based on the Intangible Value Assessment (IVA) methodology.	MSCI ESG
Environmental score (E)	The environmental pillar score, measuring a firm's exposure to and management of environmental risks and opportunities, including carbon emissions, resource use, and climate strategy.	MSCI ESG
Social score (S)	The social pillar score, capturing a firm's performance and disclosure on social issues, such as labor practices, employee relations, health and safety, community engagement, and human rights.	MSCI ESG
Governance score (G)	The governance pillar score, assessing a firm's corporate governance structures, including board independence, shareholder rights, executive compensation, and transparency.	MSCI ESG
ESG score (Refinitiv)	The overall ESG score provided by Refinitiv, summarizing a firm's ESG performance based on a set of environmental, social, and governance indicators.	Refinitiv ESG
Company size	The logarithm of total assets, used as a proxy for firm size.	Compustat
ROE	Return on Equity, defined as net income divided by shareholders' equity; a measure of firm profitability.	Compustat
Leverage ratio	The ratio of long-term debt to shareholders' equity.	Compustat
GDP growth	The seasonally adjusted quarterly growth rate of real Gross Domestic Product (GDP) at the country level.	IMF database
Inflation	The annual percentage change in the Consumer Price Index (CPI).	IMF database
COVID	A dummy variable equal to one for quarters within the COVID-19 pandemic period (2019Q4–2023Q2) and zero otherwise.	
French law	A dummy variable equal to one if a firm's home country follows the French civil law tradition; zero otherwise.	
German law	A dummy variable equal to one if a firm's home country follows the German civil law tradition.	
Scandinavian law	A dummy variable equal to one if a firm's home country follows the Scandinavian civil law tradition.	
English law	A dummy variable equal to one if a firm's home country follows the English common law tradition.	

Table 2: Main empirical results for 4 legal origins using MSCI ESG data

Variable	Legal origin	N_c	N_i	Mean	Std	$\hat{r}_i$	RI_G	RI_F	RI_E
IVA rating	English	16	2718	4.883	1.053	1	0.187	0.337	0.475
	French	25	445	5.086	1.177	1	0.193	0.349	0.458
	German	9	643	4.828	1.030	2	0.204	0.454	0.342
	Scandinavian	4	105	5.674	0.873	1	0.258	0.353	0.389
	Sum/Average	54	3911	4.919	1.070		0.211	0.373	0.416
Environmental score	English	16	2718	5.184	2.328	2	0.110	0.515	0.375
	French	25	445	5.949	2.382	1	0.207	0.341	0.452
	German	9	643	5.409	2.054	2	0.124	0.489	0.387
	Scandinavian	4	105	6.183	1.902	1	0.128	0.357	0.515
	Sum/Average	54	3911	5.335	2.298		0.142	0.426	0.432
Social score	English	16	2718	4.538	1.608	2	0.069	0.496	0.435
	French	25	445	5.09	1.596	2	0.091	0.484	0.424
	German	9	643	4.755	1.580	2	0.090	0.483	0.427
	Scandinavian	4	105	5.341	1.621	2	0.097	0.498	0.405
	Sum/Average	54	3911	4.658	1.617		0.087	0.490	0.423
Governance score	English	16	2718	5.599	1.773	2	0.059	0.546	0.395
	French	25	445	4.864	1.831	2	0.046	0.523	0.431
	German	9	643	4.774	1.806	2	0.046	0.576	0.378
	Scandinavian	4	105	6.332	1.564	1	0.090	0.390	0.519
	Sum/Average	54	3911	5.400	1.821		0.060	0.509	0.431

We report the GCC estimation results for (1) using the monthly data for 3,911 companies over Jan. 2014–Dec. 2023 from the MSCI Database. N_c and N_i are the numbers of countries and firms in each legal origin, respectively. Mean and Std represent the mean and standard deviation of ESG scores, respectively. $\hat{r}_i$ is the number of local factors estimated from the model (1) by the ER criteria after projecting out one global factor selected by the GCC criterion. RI_G, RI_F and RI_u are the relative importance ratios of global, local and idiosyncratic components measuring the contribution of each component to the explained variance of ESG metrics, respectively (see also footnote 2).

Table 3: Determinants of MSCI ESG and systematic components

Y / X	IVA	IVA_G	IVA_F	E	E_G	E_F
GDP growth	2.128***	0.704**	0.058	1.292*	1.915***	-0.262
	(0.745)	(0.354)	(0.459)	(0.778)	(0.400)	(0.698)
Inflation	12.29***	9.013***	1.920	10.027***	11.28***	5.003**
	(3.712)	(2.295)	(1.241)	(2.175)	(2.889)	(2.124)
Company size	0.253***	0.193***	0.061***	0.318***	0.170***	0.107***
	(0.035)	(0.019)	(0.023)	(0.059)	(0.017)	(0.042)
ROE	0.003***	0.001*	-0.001	-0.005*	0.001**	-0.002
	(0.001)	(0.001)	(0.001)	(0.003)	(0.001)	(0.003)
Leverage ratio	-1.78E-04***	-6.11E-05*	6.17E-05	1.58E-04	-5.22E-05*	1.03E-04
	(6.62E-05)	(3.17E-05)	(7.07E-05)	(1.27E-04)	(3.03E-05)	(1.81E-04)
COVID	0.257***	0.205***	0.060***	0.202***	0.162***	0.122***
	(0.012)	(0.005)	(0.010)	(0.018)	(0.006)	(0.018)
French law	-0.097**	-1.116***	-1.357***	0.013	-1.160***	-1.273***
	(0.039)	(0.094)	(0.124)	(0.09)	(0.099)	(0.113)
German law	-0.322***	-1.726***	-2.282***	-0.756***	-1.822***	-2.085***
	(0.033)	(0.081)	(0.106)	(0.077)	(0.085)	(0.097)
Scandinavian law	0.398***	-0.045	-0.226	0.251	-0.075	-0.162
	(0.075)	(0.183)	(0.241)	(0.174)	(0.193)	(0.220)
First-stage R^2	7.38%	50.57%	1.11%	2.52%	36.99%	0.99%
Second-stage R^2	3.24%	11.98%	11.68%	2.53%	11.95%	11.82%
Observations	92561	92561	92561	92561	92561	92561

Y / X	S	S_G	S_F	G	G_G	G_F
GDP growth	2.079***	0.391	0.976*	0.216	-2.731***	1.704*
	(0.767)	(0.413)	(0.513)	(1.372)	(0.261)	(0.968)
Inflation	7.526***	9.655***	2.002	14.16***	-4.419***	13.21***
	(2.667)	(2.591)	(1.387)	(4.502)	(1.040)	(4.638)
Company size	0.135***	0.111***	0.056	-0.062	-0.031***	0.133***
	(0.049)	(0.011)	(0.039)	(0.052)	(0.004)	(0.042)
ROE	0.004**	0.001*	0.003	0.004**	-0.001*	-0.001
	(0.002)	(3.53E-04)	(0.002)	(0.002)	(3.06E-04)	(0.004)
Leverage ratio	-1.67E-04*	-4.09E-05**	-1.10E-04	-3.42E-04***	3.74E-06	1.01E-04
	(9.27E-05)	(1.85E-05)	(1.24E-04)	(1.10E-04)	(1.69E-05)	(2.14E-04)
COVID	0.327***	0.209***	0.069***	0.003	-0.139***	0.249***
	(0.018)	(0.005)	(0.016)	(0.019)	(0.002)	(0.019)
French law	-0.350***	-1.259***	-1.366***	-1.573***	-1.535***	-1.217***
	(0.089)	(0.112)	(0.125)	(0.152)	(0.147)	(0.106)
German law	-1.374***	-2.050***	-2.302***	-2.757***	-2.690***	-1.952***
	(0.077)	(0.096)	(0.107)	(0.130)	(0.126)	(0.091)
Scandinavian law	0.039	-0.149	-0.232	-0.376	-0.360	-0.116
	(0.174)	(0.217)	(0.243)	(0.295)	(0.286)	(0.206)
First-stage R^2	1.37%	55.21%	0.35%	0.29%	12.92%	0.38%
Second-stage R^2	7.66%	11.81%	11.66%	11.27%	11.4%	11.86%
Observations	92561	92561	92561	92561	92561	92561

Note: We report the FE estimation results for (6) using the quarterly data for 3,892 companies over 2014Q1–2023Q4. IVA, IVA_G and IVA_F refer to the aggregate ESG score, the global common component and the local common components, respectively. Similarly for E, S and G pillars. First-stage R^2s refer to the variances of ESG scores explained by the macro and firm-specific variables and COVID dummy. Second-stage R^2s refer to the variances of ESG scores explained by legal origin dummies. Robust standard errors are included in parentheses. ***, ** and * indicate the significance of the coefficient at the 1%, 5% and 10% level, respectively.

Figure 1: Cross-section averages of MSCI IVA, E, S and G scores across 4 legal origins

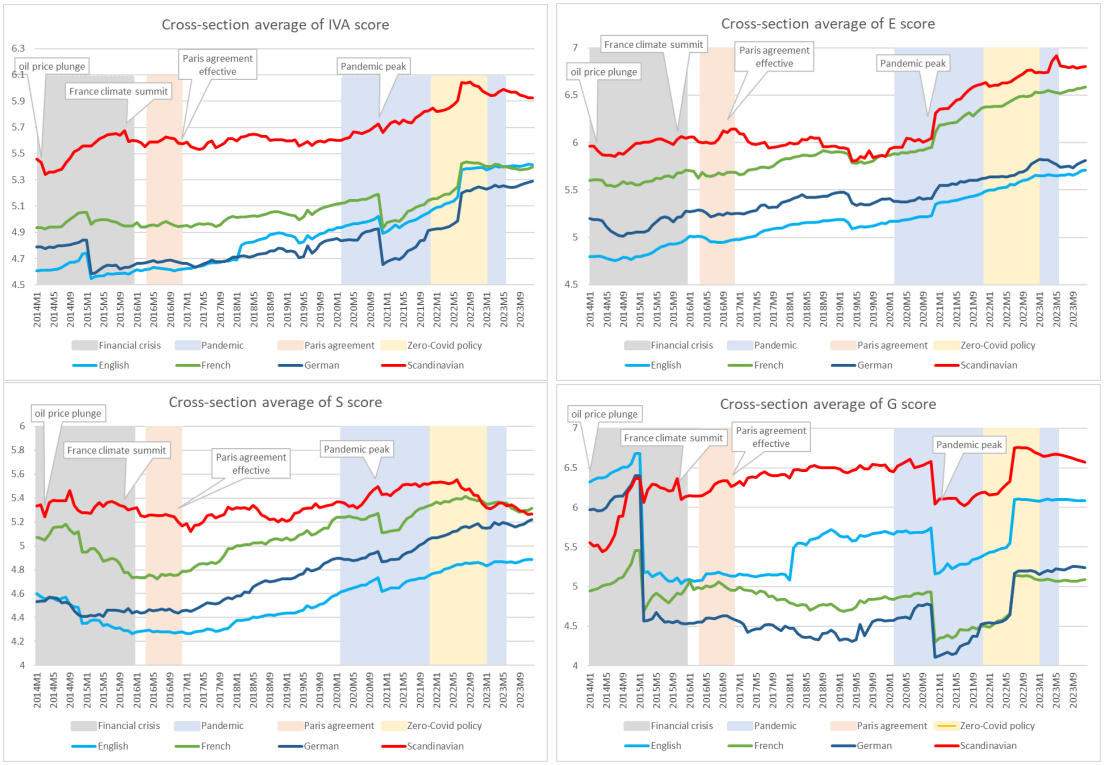

Figure 2: Global common components of MSCI IVA, E, S and G scores across 4 legal origins

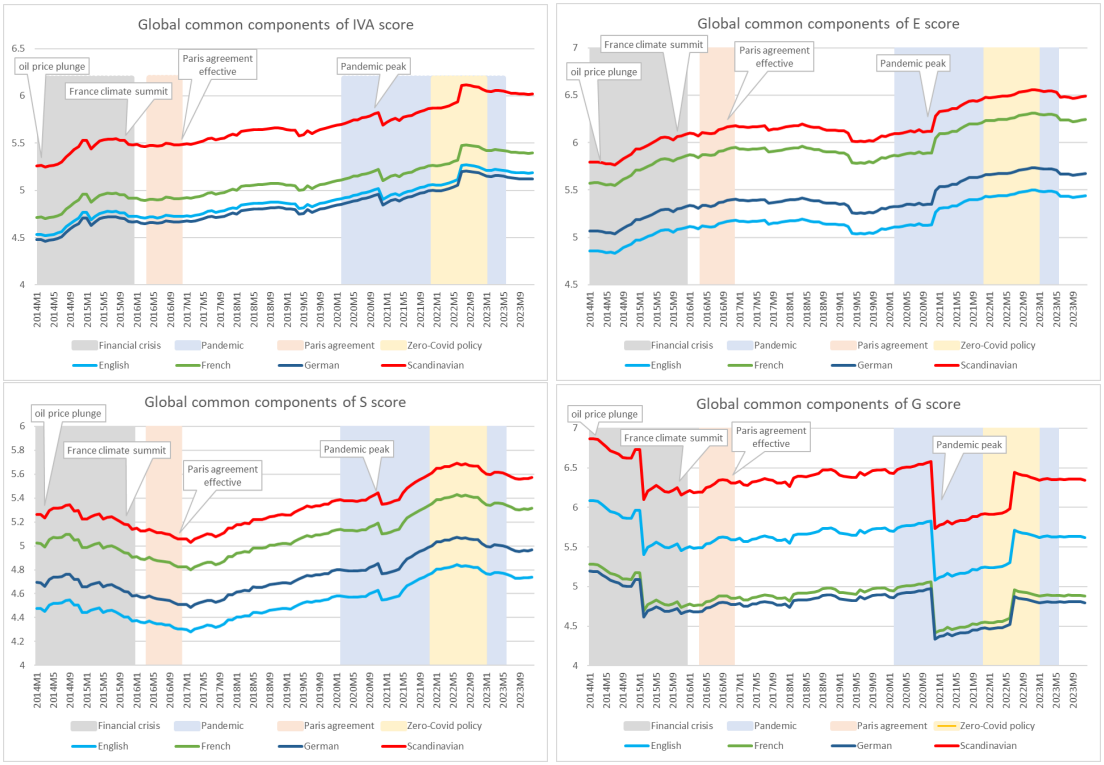

Figure 3: Local common components of MSCI IVA, E, S and G scores across 4 legal origins

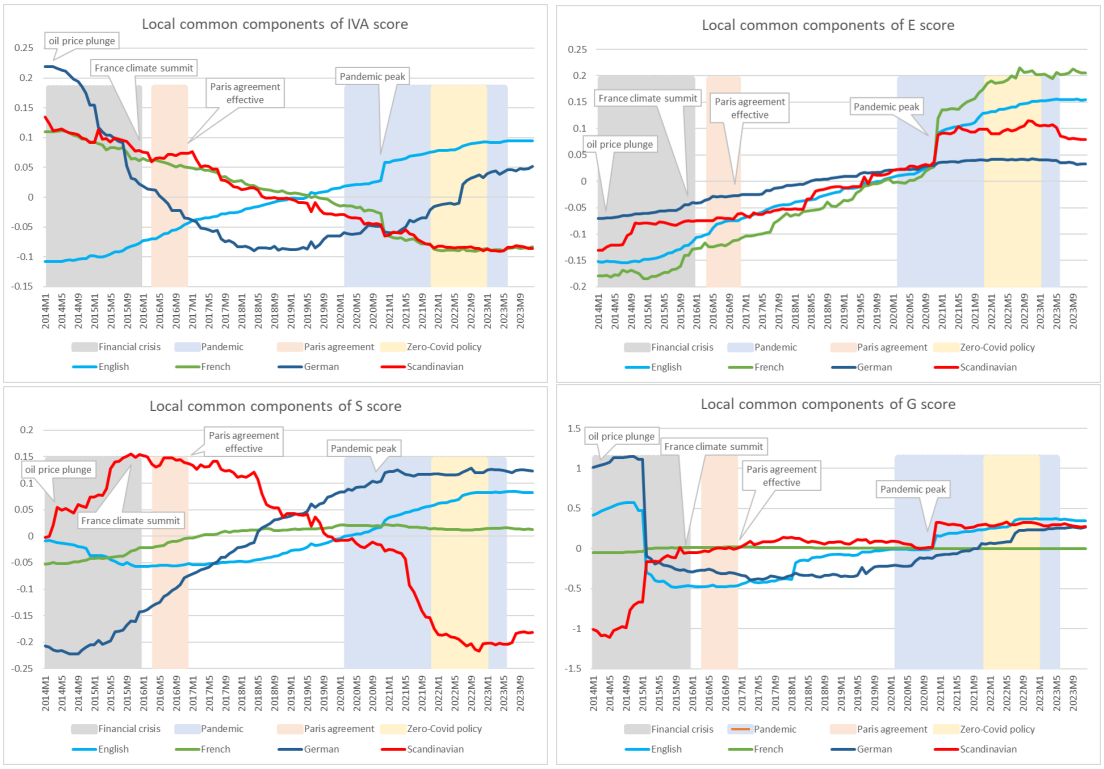

Table 4: Main empirical results for 4 legal origins using Refinitiv ESG data

Variable	Legal origin	N_c	N_i	Mean	Std	$\hat{r}_i$	RI_G	RI_F	RI_E
ESG score	English	18	1210	45.496	21.870	1	0.559	0.325	0.116
	French	31	420	48.035	23.507	1	0.555	0.329	0.116
	German	7	576	45.301	22.934	1	0.567	0.292	0.142
	Scandinavian	4	100	52.152	21.190	1	0.641	0.233	0.126
	Sum/Average	60	2306	46.199	22.473		0.580	0.295	0.125
Environmental score	English	18	1210	42.786	26.501	2	0.411	0.408	0.181
	French	31	420	49.871	27.770	2	0.474	0.370	0.156
	German	7	576	49.965	26.789	2	0.464	0.379	0.157
	Scandinavian	4	100	53.386	26.944	2	0.460	0.370	0.170
	Sum/Average	60	2306	46.329	27.092		0.452	0.382	0.166
Social score	English	18	1210	48.428	22.916	2	0.485	0.384	0.131
	French	31	420	51.477	26.344	1	0.487	0.266	0.247
	German	7	576	43.706	26.057	2	0.416	0.419	0.166
	Scandinavian	4	100	54.924	24.185	2	0.506	0.309	0.184
	Sum/Average	60	2306	48.086	24.614		0.473	0.345	0.182
Governance score	English	18	1210	53.894	22.111	2	0.272	0.401	0.328
	French	31	420	52.930	21.860	1	0.312	0.320	0.369
	German	7	576	51.098	22.961	1	0.269	0.336	0.395
	Scandinavian	4	100	52.921	22.431	3	0.290	0.450	0.260
	Sum/Average	60	2306	52.978	22.324		0.286	0.377	0.338

We report the GCC estimation results for (1) using the annual data for 2,306 companies over 2002–2023 from the Refinitiv Database. N_c and N_i are the numbers of countries and firms in each legal origin, respectively. Mean and Std represent the mean and standard deviation of ESG scores, respectively. $\hat{r}_i$ is the number of local factors estimated from the model (1) by the ER criteria after projecting out one global factor selected by the GCC criterion. RI_G, RI_F and RI_u are the relative importance ratios of global, local and idiosyncratic components measuring the contribution of each component to the explained variance of ESG metrics, respectively (see also footnote 2).

Figure 4: Cross-section averages of Refinitiv ESG, E, S and G scores across 4 legal origins

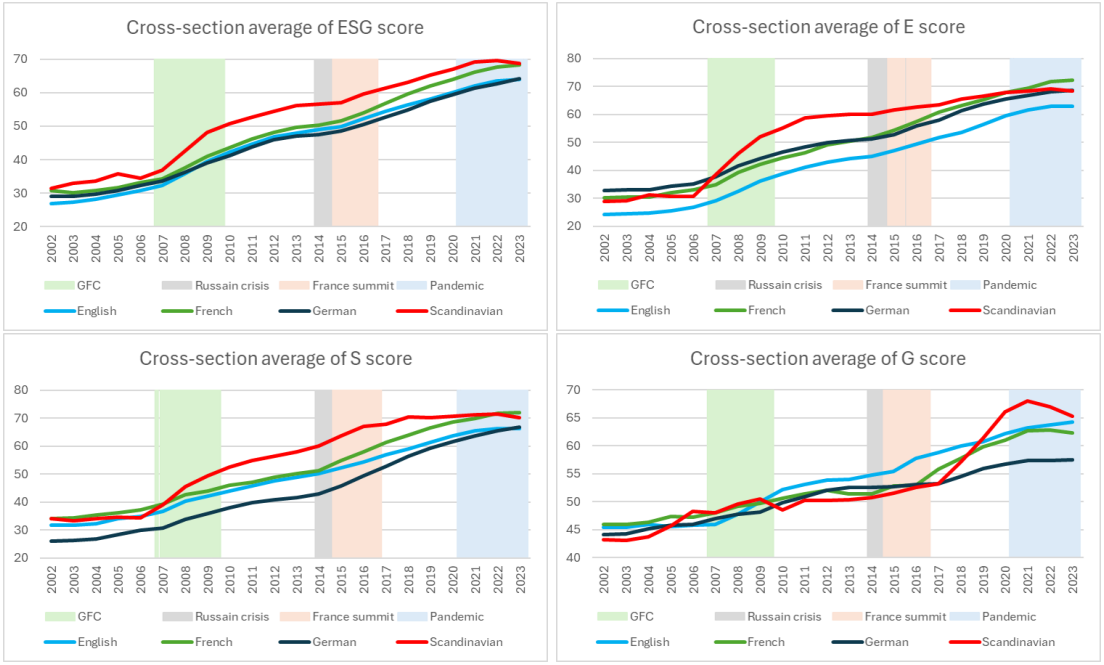

Figure 5: Global common components of Refinitiv ESG, E, S and G scores across 4 legal origins

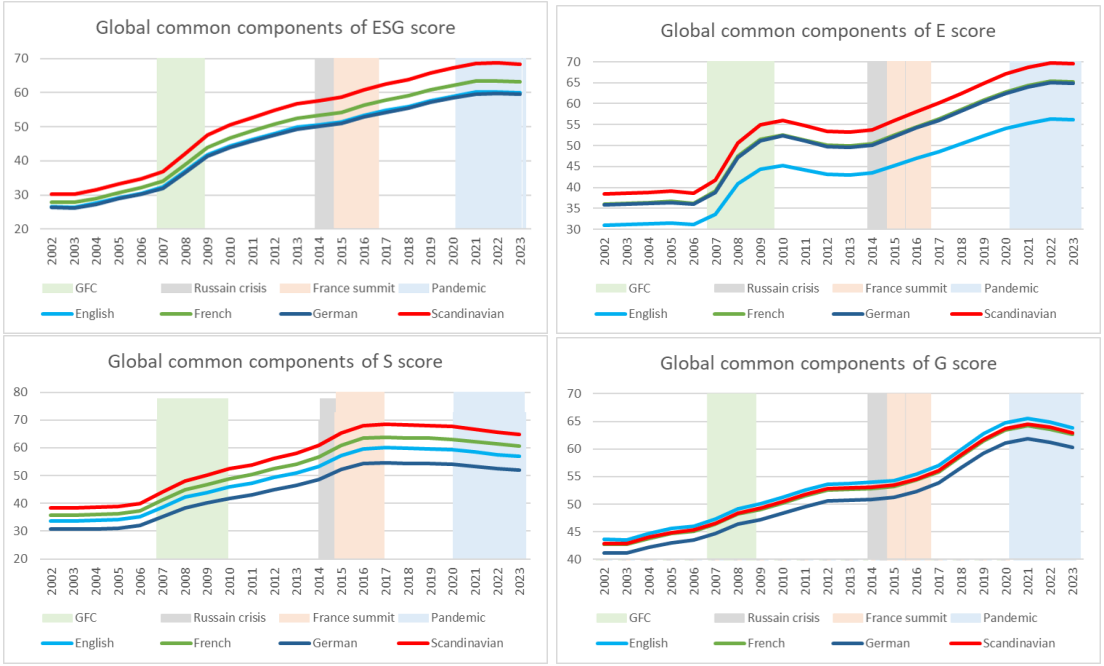

Figure 6: Local common components of Refinitiv ESG, E, S and G scores across 4 legal origins

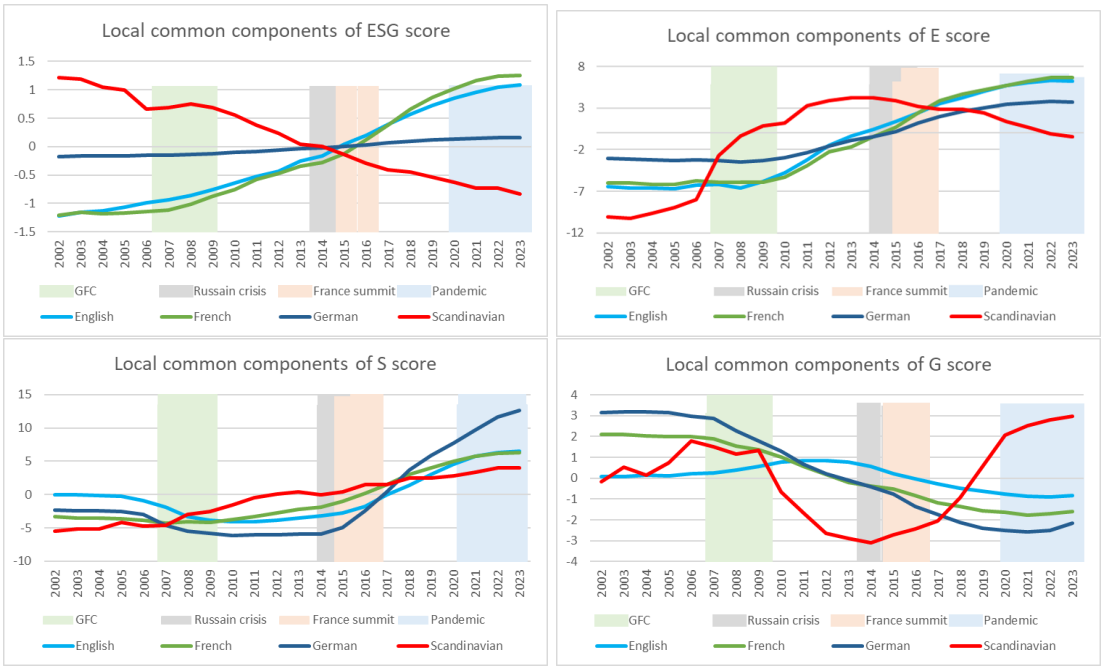

Table 5: Determinants of Refinitiv ESG and systematic components

Y / X	ESG	ESG_G	ESG_F	E	E_G	E_F
GDP growth	-74.19***	-89.72***	4.370***	-85.89***	-58.48***	-27.81***
	(1.902)	(1.456)	(1.173)	(2.372)	(1.104)	(1.725)
Inflation	-111.6***	-130.8***	9.840**	-125.5***	-59.87***	-68.13**
	(8.048)	(6.162)	(4.963)	(10.04)	(4.671)	(7.298)
Company size	0.701***	0.731***	0.219***	0.149	0.284***	-0.195
	(0.102)	(0.078)	(0.063)	(0.127)	(0.059)	(0.093)
ROE	0.085*	0.133***	-0.040	0.035	0.100***	0.016
	(0.046)	(0.035)	(0.028)	(0.057)	(0.027)	(0.042)
Leverage ratio	0.001	0.009	-0.006	0.007	0.006	-0.004
	(0.007)	(0.006)	(0.004)	(0.009)	(0.004)	(0.007)
COVID	18.57***	16.31***	-0.042	20.37***	14.87***	5.628***
	(0.176)	(0.135)	(0.109)	(0.219)	(0.102)	(0.160)
French law	3.014***	3.234***	-0.422***	8.663***	8.211***	0.446
	(0.277)	(0.242)	(0.110)	(0.343)	(0.274)	(0.159)
German law	-3.937***	-4.619***	-0.365***	5.669***	5.297***	0.578
	(0.249)	(0.218)	(0.099)	(0.309)	(0.247)	(0.144)
Scandinavian law	6.060***	5.649***	0.241	10.395***	10.145***	0.264
	(0.477)	(0.418)	(0.190)	(0.592)	(0.472)	(0.275)
First-stage R^2	23.16%	32.13%	0.09%	18.43%	38.57%	4.38%
Second-stage R^2	1.72%	2.65%	0.06%	2.28%	3.21%	0.04%
Observations	39799	39799	39799	39799	39799	39799

Y / X	S	S_G	S_F	G	G_G	G_F
GDP growth	-77.04***	-85.12***	-1.302	-28.21***	-31.79***	7.474***
	(2.130)	(1.308)	(1.389)	(2.242)	(0.723)	(1.508)
Inflation	-126.6***	-174.2***	-23.47***	-56.52***	-63.33***	1.025
	(9.015)	(5.534)	(5.878)	(9.488)	(3.060)	(6.383)
Company size	0.533***	0.659***	0.056	0.416***	0.257***	0.176**
	(0.114)	(0.070)	(0.075)	(0.120)	(0.039)	(0.081)
ROE	0.046	0.115***	-0.047	0.134**	0.051***	0.056
	(0.051)	(0.031)	(0.033)	(0.054)	(0.017)	(0.036)
Leverage ratio	0.002	0.005	-0.007	-0.005	0.008***	-0.010*
	(0.008)	(0.005)	(0.005)	(0.009)	(0.003)	(0.006)
COVID	20.01***	10.40***	7.881***	10.09***	12.60***	-1.900***
	(0.197)	(0.121)	(0.129)	(0.207)	(0.067)	(0.140)
French law	4.143***	4.442***	-0.270***	-1.347***	-1.014***	-0.306**
	(0.308)	(0.261)	(0.128)	(0.297)	(0.222)	(0.139)
German law	-8.406***	-9.062***	-0.573**	-5.240***	-4.885***	-0.479***
	(0.278)	(0.235)	(0.115)	(0.268)	(0.200)	(0.125)
Scandinavian law	6.075***	6.048***	-0.156	-1.570***	-1.338***	-0.298
	(0.532)	(0.450)	(0.221)	(0.513)	(0.383)	(0.240)
First-stage R^2	21.31%	22.16%	4.15%	1.40%	49.35%	0.68%
Second-stage R^2	3.97%	6.19%	0.06%	0.95%	1.49%	0.03%
Observations	39799	39799	39799	39799	39799	39799

Note: We report the FE estimation results for ESG scores on legal origin dummies using the annual data for $2,211$ companies over 2002–2023 from the Refinitiv Database. ESG, ESG_G and ESG_F refer to the aggregate ESG score, the global common component and the local common components, respectively. Similarly for E, S and G pillars. First-stage R^2s refer to the variances of ESG scores explained by the macro and firm-specific variables and COVID dummy. Second-stage R^2s refer to the variances of ESG scores explained by legal origin dummies. Robust standard errors are included in parentheses. ***, ** and * indicate the significance of the coefficient at the 1%, 5% and 10% level, respectively.

Table 6: Main empirical results for 4 legal origins using MSCI ESG sub-indicators

Pillar	Variable	Origin	N_i	Mean	Std	r_i	RI_G	RI_F	RI_u
E	climate change score	English	2292	6.380	2.746	2	0.348	0.470	0.182
		French	347	7.289	2.554	2	0.296	0.438	0.267
		German	553	6.986	2.631	2	0.284	0.456	0.260
		Scandinavian	89	7.617	2.216	2	0.489	0.438	0.073
		Average/Sum	3281	6.612	2.719		0.354	0.451	0.195
S	human capital theme score	English	2625	4.631	1.966	2	0.031	0.484	0.485
		French	423	5.196	1.963	2	0.039	0.472	0.489
		German	603	4.831	1.936	2	0.034	0.504	0.462
		Scandinavian	96	5.741	1.922	2	0.064	0.476	0.460
		Average/Sum	3747	4.755	1.975		0.042	0.484	0.474
G	corporate governance score	English	2593	6.209	1.866	2	0.077	0.566	0.358
		French	426	5.621	2.019	2	0.061	0.526	0.412
		German	621	5.442	2.003	2	0.055	0.619	0.326
		Scandinavian	100	7.066	1.657	1	0.131	0.345	0.524
		Average/Sum	3740	6.038	1.935		0.081	0.514	0.405

We report the GCC estimation results for (1) using the monthly data for 3281 (E pillar), 3747 (S pillar) and 3740 (G pillar) companies over Jan. 2014–Dec. 2023 from the MSCI Database, respectively. N_i is the number of firms in each legal origin. Mean and Std represent the mean and standard deviation of ESG scores, respectively. $\hat{r}_i$ is the number of local factors estimated from the model (1) by the ER criteria after projecting out one global factor selected by the GCC criterion. RI_G, RI_F and RI_u are the relative importance ratios of global, local and idiosyncratic components measuring the contribution of each component to the explained variance of ESG metrics, respectively (see also footnote 2).

Table 7: Main empirical results for 4 legal origins using Refinitiv ESG sub-indicators

Pillar	Variable	Origin	N_i	Mean	Std	r_i	RI_G	RI_F	RI_u
E	carbon emission score	English	1359	37.25	34.96	2	0.379	0.404	0.217
		French	368	48.65	37.34	2	0.458	0.366	0.177
		German	715	42.67	36.93	2	0.364	0.381	0.255
		Scandinavian	100	53.27	33.56	3	0.431	0.424	0.145
		Average/Sum	2542	41.06	36.14		0.408	0.394	0.198
S	human right score	English	1290	26.98	34.13	1	0.409	0.240	0.351
		French	362	36.96	37.41	1	0.492	0.202	0.306
		German	689	24.69	32.23	1	0.371	0.277	0.353
		Scandinavian	100	49.31	38.56	1	0.614	0.129	0.256
		Average/Sum	2441	28.73	34.80		0.471	0.212	0.317
G	management score	English	1373	47.167	33.574	1	0.248	0.243	0.509
		French	371	45.403	34.030	1	0.310	0.302	0.388
		German	720	42.417	33.443	1	0.263	0.267	0.470
		Scandinavian	100	51.423	31.476	3	0.312	0.442	0.246
		Average/Sum	2564	45.744	33.605		0.283	0.314	0.403

We report the GCC estimation results for (1) using the annual data for 2542 (E pillar), 2441 (S pillar) and 2564 (G pillar) companies over 2002–2023 from the Refinitiv Database, respectively. N_i is the number of firms in each legal origin. Mean and Std represent the mean and standard deviation of ESG scores, respectively. $\hat{r}_i$ is the number of local factors estimated from the model (1) by the ER criteria after projecting out one global factor selected by the GCC criterion. RI_G, RI_F and RI_u are the relative importance ratios of global, local and idiosyncratic components measuring the contribution of each component to the explained variance of ESG metrics, respectively (see also footnote 2).

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Appendix A The Data Construction

The MSCI ESG dataset consists of monthly data for 3,911 firms across 54 countries, covering the period from January 2014 to December 2023. This dataset contains firm-level ESG ratings (IVA score), as well as separate Environmental (E), Social (S) and Governance (G) pillar scores. Descriptive statistics are presented in Table 8. We also collect firm-level fundamentals from Compustat, and country-level GDP growth and CPI inflation rates from the World Bank.

IVA score analyses each firm's risk exposure, measuring the extent to which its core business is at risk of incurring unanticipated losses. The data are normalised by the most relevant and available factors such as sales or production levels. The environmental score of IVA rates the companies based on the following issues: carbon emissions, product carbon footprint, energy efficiency, insurance against climate change risk, water stress, biodiversity and land use, raw material sourcing, financing environmental impact, toxic emissions and waste, packaging material and waste, electronic waste, opportunities in clean tech, opportunities in green building, opportunities in renewable energy, etc. Labour management, human capital development, health and safety, supply-chain labour standards, controversial sourcing, product safety and quality, chemical safety, privacy and data security, responsible investing, insuring health and demographic risk, opportunities in health and nutrition, access to communications, access to healthcare, etc. are evaluated in the social score. The government score is based on the sum of deductions derived from Key Metrics included in the Corporate Governance (including Board, Pay, Ownership & Control, and Accounting) and Corporate Behaviour (including Business Ethics and Tax Transparency) themes.

The IVA score are then converted to a relative rating by assigning the company with the best performance in a given category an AAA (6) rating while giving the company with the worst performance a CCC (0) rating. The categorical scores are converted to the weighted average scores between 0 and 10, where the weights are given by the leader companies with AAA (8.571-10) and AA (7.143-8.571), the average firms with A (5.714-7.143), BBB (4.286-5.714) and BB (2.857-4.286), and the laggard companies with B (1.429-2.857) and CCC (0-1.429).

Next, we collect the annual ESG data for 2,306 companies across 57 countries, covering the period 2002–2023, from the Refinitiv ESG database. The dataset includes over 870 metrics sourced from publicly available disclosures and is organised into ten categories aggregated into the three ESG pillars. The overall score is a composite of three pillar scores: Environmental (including resource use, emissions, and innovation), Social (including workforce, human rights, community, and product responsibility), and Governance (including management structure, shareholder rights, and CSR strategy). The weighting of the Environmental and Social pillars is industry-specific to reflect the most material issues within each sector. Additionally, the final score is also adjusted by an separate "ESG Controversies" score. This metric tracks negative events concerning the company from global media sources, and controversies a company has been involved. The controversies score acts as a discount on the overall ESG rating.

The Refinitiv ESG database reports a quantitative company score derived from publicly disclosed

corporate data. Each company is evaluated on a continuous scale from 0 to 100. On this scale, higher values signify better overall ESG performance. For easier interpretation, the database segments these scores into four distinct quartiles. Each quartile corresponds to a specific performance ranking. Scores within the 0-25 range are designated as 'poor'. The 26-50 range indicates 'satisfactory'. A score between 51 and 75 is classified as 'good'. Finally, scores from 76 to 100 are considered 'excellent'. Table 9 reports the summary statistics.

Table 8: The summary of IVA, E, S and G scores of 3911 companies over Jan. 2014–Dec. 2023 from the MSCI Database

		IVA			E			S			G		
Country	N	Mean	Std	Mid	Mean	Std	Mid	Mean	Std	Mid	Mean	Std	Mid
Argentina	4	4.88	0.65	4.85	6.34	1.45	6.40	4.48	1.45	4.20	4.87	1.82	5.00
Australia	146	5.24	1.08	5.20	5.43	2.46	5.10	5.05	1.64	4.90	6.43	1.76	6.70
Austria	18	5.33	0.77	5.20	5.78	1.94	5.40	5.22	1.24	5.00	5.79	1.36	6.00
Belgium	18	5.20	0.80	5.20	6.36	2.07	6.00	4.95	1.04	5.10	5.48	1.72	5.60
Bermuda	18	4.44	0.92	4.50	3.57	2.13	3.50	4.07	1.43	3.90	6.17	1.66	6.30
Brazil	45	4.70	1.22	4.70	5.83	2.23	6.00	4.80	1.53	4.90	3.99	1.42	3.90
Canada	171	4.96	0.98	5.00	4.95	2.15	4.70	4.65	1.72	4.80	5.94	1.64	6.00
Chile	22	4.92	0.84	4.90	4.85	1.85	4.90	5.23	1.30	5.10	4.74	1.25	4.80
China	69	3.80	1.05	3.90	4.14	2.07	4.10	3.56	1.53	3.70	4.48	1.79	4.30
Colombia	6	5.02	0.77	5.20	4.97	1.68	5.40	5.52	1.21	5.40	4.31	1.22	4.30
Costa Rica	1	5.96	0.49	5.95	6.90	1.16	6.30	5.88	0.78	5.70	5.85	0.73	5.75
Czechia	7	5.56	0.89	5.40	6.22	1.96	5.90	5.50	1.05	5.20	5.31	1.29	5.50
Denmark	23	5.57	0.79	5.70	5.50	1.82	5.10	5.29	1.57	5.40	6.56	1.25	6.50
Egypt	1	4.81	0.32	4.80	2.90	1.94	2.40	4.78	0.74	4.50	5.59	0.71	5.70
Finland	18	5.92	0.93	5.80	5.88	1.61	5.60	5.33	1.86	5.20	7.05	1.39	7.20
France	85	5.59	0.90	5.50	6.74	1.79	6.60	5.35	1.52	5.30	5.60	1.75	5.70
Germany	61	5.25	1.03	5.40	6.45	2.06	6.20	4.62	1.67	4.60	5.37	2.02	5.70
Greece	3	4.65	0.90	4.70	7.04	2.15	7.10	4.99	1.41	4.80	3.89	1.40	3.80
Hong Kong	89	4.58	1.17	4.70	5.27	1.93	5.20	4.53	1.76	4.50	4.46	1.80	4.30
Hungary	4	5.13	0.64	4.90	5.21	1.75	4.80	5.55	1.14	5.40	4.62	0.96	4.90
India	55	4.15	1.14	4.30	4.85	2.00	4.80	3.93	1.60	4.00	4.33	1.94	4.30
Indonesia	22	4.24	0.97	4.30	3.68	2.22	3.50	4.93	1.61	5.10	3.88	1.60	3.80
Ireland	27	5.54	1.06	5.60	5.73	2.07	6.00	4.95	1.54	4.90	6.61	1.63	6.70
Israel	8	4.82	0.94	5.00	4.22	1.77	4.00	4.47	1.29	4.80	5.95	1.54	6.20
Italy	25	5.16	1.03	5.00	6.02	2.43	6.40	4.93	1.37	4.70	4.99	1.56	5.10
Japan	312	4.92	0.88	4.90	5.54	1.91	5.50	5.06	1.51	5.10	4.48	1.68	4.30
Korea	115	4.51	0.91	4.60	4.91	1.91	4.90	4.47	1.46	4.50	4.44	1.67	4.40
Luxembourg	25	5.18	0.80	5.10	6.77	2.25	6.40	5.05	1.41	4.90	5.24	1.63	5.20
Macao	5	4.41	0.74	4.30	4.91	1.37	5.20	4.31	0.79	4.40	4.22	1.20	4.40
Malaysia	49	4.69	0.96	4.90	4.66	2.48	4.60	4.56	1.55	4.70	5.13	1.79	5.40
Mexico	35	4.34	1.43	4.30	5.10	2.42	5.20	4.61	1.81	4.50	3.48	1.80	3.30
Morocco	2	5.09	0.72	4.90	8.02	1.43	8.40	5.65	0.66	5.60	3.67	1.55	3.20
Namibia	2	5.58	0.46	5.50	7.45	2.01	7.20	4.78	0.68	4.80	6.55	0.95	6.40
Netherlands	58	5.50	1.21	5.40	6.90	2.06	7.00	5.14	1.93	5.00	5.34	1.93	5.50
New Zealand	12	5.64	0.92	5.60	7.43	1.75	7.60	4.91	1.23	5.10	6.26	1.78	6.40
Nigeria	1	5.17	0.76	5.20	3.86	1.91	3.50	5.35	0.60	5.30	4.93	1.56	5.50
Norway	19	5.68	0.78	5.60	6.67	1.86	6.70	5.18	1.44	5.00	6.72	1.27	6.90
Panama	1	5.21	0.26	5.20	4.69	1.57	4.00	5.19	0.38	5.10	5.41	0.89	5.40
Paraguay	1	5.95	0.46	5.90	9.89	0.24	10.00	5.49	0.68	5.70	6.16	0.49	6.10
Peru	5	4.71	0.92	4.70	3.36	2.14	2.30	5.28	1.11	5.20	4.71	1.40	4.60
Philippines	12	4.01	0.83	4.00	4.40	2.24	4.50	4.47	1.46	4.60	3.24	1.74	3.10

		IVA			E			S			G		
Country	N	Mean	Std	Mid	Mean	Std	Mid	Mean	Std	Mid	Mean	Std	Mid
Poland	16	4.64	0.80	4.80	4.51	2.38	4.05	4.37	1.60	4.30	5.54	1.49	5.60
Portugal	5	5.91	1.29	5.40	6.71	1.92	6.80	5.64	1.43	5.10	5.59	1.50	5.60
Romania	1	5.16	0.46	5.20	4.99	1.94	4.30	4.79	0.39	4.70	5.85	0.88	6.05
Singapore	34	5.16	1.02	5.10	5.51	2.23	5.30	5.13	1.73	5.10	5.35	1.72	5.30
Slovakia	2	5.34	0.52	5.40	5.75	1.70	5.60	5.39	0.78	5.20	5.09	1.26	5.40
South Africa	64	5.08	0.86	5.10	5.61	2.39	5.00	4.64	1.39	4.70	6.27	1.46	6.30
Spain	32	5.90	1.25	5.70	7.12	2.19	7.40	5.92	1.54	5.70	5.73	1.58	5.80
Sweden	45	5.62	0.91	5.70	6.45	1.95	6.00	5.44	1.61	5.30	5.76	1.68	6.10
Switzerland	55	5.48	1.02	5.40	5.89	2.17	6.00	4.92	1.52	4.90	6.45	1.55	6.60
Thailand	23	4.82	0.78	4.80	5.11	2.04	5.00	5.81	1.95	5.70	3.93	1.52	3.90
Turkey	15	4.32	0.81	4.30	4.15	2.55	3.70	5.36	1.58	5.00	3.75	1.51	3.70
UK	264	5.50	1.10	5.40	6.25	2.30	6.30	4.89	1.60	4.80	6.37	1.92	6.70
USA	1755	4.77	1.00	4.70	5.02	2.31	5.00	4.41	1.56	4.40	5.47	1.67	5.50

We report the statistics summary of monthly IVA, E, S and G scores of 3,911 companies over Jan. 2014-Dec. 2023 from the MSCI Database by country. N is the number of firms in each country. Mean, Std and Mid represent the mean, standard deviation and median of ESG scores, respectively.

Table 9: The summary of ESG, E, S and G scores of 2306 companies over 2002–2023 from the Refinitiv Database

		ESG			E			S			G		
Country	N	Mean	Std	Mid	Mean	Std	Mid	Mean	Std	Mid	Mean	Std	Mid
Australia	110	43.81	22.30	41.48	37.76	25.99	33.17	43.75	23.67	39.96	55.56	22.21	56.13
Austria	13	49.07	18.00	49.83	51.56	24.80	57.34	50.81	20.70	48.03	53.95	20.78	54.91
Belgium	17	46.55	20.17	48.86	51.19	25.47	51.12	48.11	23.74	46.24	50.74	23.04	51.31
Bermuda	13	39.76	17.84	38.46	33.00	17.74	26.99	37.66	17.31	31.37	59.57	21.82	63.11
Brazil	39	52.97	20.61	56.48	52.80	21.53	52.66	59.20	22.00	62.91	53.73	20.77	56.44
Canada	97	43.61	21.86	42.62	41.92	27.89	38.85	44.61	23.25	41.77	53.75	21.71	54.94
Cayman Island	1	32.60	17.43	30.38	13.59	14.98	8.09	35.30	20.38	36.04	67.37	13.01	71.25
Chile	14	37.15	24.72	34.20	39.69	27.79	36.15	42.08	25.19	42.24	46.72	22.18	47.44
China	75	33.15	19.32	31.28	36.79	25.67	32.21	30.57	19.17	27.59	50.89	20.67	52.13
Colombia	5	45.34	23.45	50.38	41.43	26.39	40.96	55.10	19.81	58.46	51.89	19.94	54.44
Czechia	2	40.62	14.04	38.12	57.18	13.78	49.01	46.35	15.27	45.67	48.91	14.92	50.00
Denmark	22	44.33	21.14	45.52	45.42	24.77	48.02	45.02	24.73	46.50	49.15	22.38	50.72
Egypt	5	27.90	18.12	24.56	22.88	21.58	16.68	26.55	15.79	23.30	43.66	21.51	44.34
Finland	23	54.65	21.26	59.66	60.87	25.67	68.70	55.47	22.87	57.46	52.67	22.89	52.50
France	68	58.10	21.20	62.26	63.32	25.23	69.97	62.43	23.45	66.44	54.56	22.10	56.97
Germany	63	53.00	24.49	54.37	54.16	28.55	58.08	56.30	26.05	59.12	53.96	23.00	54.79
Greece	11	49.46	20.95	47.85	52.47	25.93	52.31	51.31	25.89	48.80	53.35	20.46	55.74
Hong Kong	62	35.59	21.91	32.58	36.95	26.82	30.01	38.69	22.77	36.21	48.43	20.98	49.65
Hungary	4	53.85	22.60	59.10	59.19	22.16	68.70	61.02	21.39	67.42	54.24	20.71	54.17
India	62	46.14	21.97	46.97	44.24	24.95	44.48	52.75	21.72	50.72	48.08	24.41	46.78
Indonesia	23	48.22	21.33	51.13	42.47	24.41	35.30	55.34	21.95	55.43	54.92	21.82	59.84
Ireland	20	47.18	20.17	47.60	44.54	25.72	41.19	50.79	22.03	49.26	54.24	21.19	56.30
Israel	7	44.55	21.91	40.18	48.40	26.58	57.57	51.83	25.59	46.70	46.47	20.56	43.33
Italy	20	55.97	24.53	58.85	56.97	28.99	61.62	60.90	26.26	68.74	56.27	24.81	59.52
Japan	290	42.98	21.45	43.90	49.41	26.59	51.95	37.88	24.03	35.37	49.80	23.11	49.42
Jersey	2	34.35	23.40	31.58	41.90	19.38	38.67	41.94	19.35	39.03	48.06	23.79	46.93
Jordan	1	47.12	13.33	49.42	56.73	15.36	58.32	48.99	11.87	52.60	52.06	11.35	50.00
Korea	63	49.82	23.10	55.51	54.75	25.95	63.26	50.75	25.62	54.70	51.13	23.11	51.16
Kuwait	4	32.20	17.68	29.82	29.13	18.27	23.37	28.34	22.13	19.66	54.89	20.63	56.91
Luxembourg	6	50.48	22.30	51.35	50.52	24.32	45.04	54.35	25.60	49.09	51.08	23.65	46.11
Macau	3	32.93	24.31	25.33	34.65	31.18	28.72	31.76	27.77	13.13	65.43	9.67	67.19
Malaysia	30	38.73	21.89	39.95	36.29	23.73	34.98	41.83	23.43	37.85	54.20	20.22	54.40
Mexico	17	48.23	22.78	51.02	46.54	28.21	45.40	50.53	25.83	54.06	51.41	23.35	52.20
Morocco	2	44.67	16.05	50.38	37.17	20.86	27.27	45.07	16.21	47.25	59.29	16.35	59.93
Netherlands	24	58.58	20.49	62.47	56.61	26.11	60.01	65.07	22.88	70.30	54.42	22.83	57.82
New Zealand	9	45.86	18.94	45.26	37.36	25.73	36.29	43.88	20.26	42.14	60.70	20.68	64.65
Nigeria	1	29.14	5.57	29.76	21.17	6.84	16.60	28.38	8.46	27.50	42.84	5.27	43.33
Norway	17	50.69	21.57	54.67	49.27	26.70	51.97	53.83	24.48	56.53	53.27	22.73	53.01
Oman	1	32.67	17.83	31.73	49.91	12.20	45.59	29.75	23.19	38.32	56.19	17.10	50.00
Panama	1	20.40	1.28	20.14	7.55	0.94	7.61	31.29	3.18	31.70	25.09	4.12	21.67
Peru	1	40.87	25.07	42.13	59.88	17.64	64.12	42.08	18.31	34.74	59.17	16.82	71.67
Philippines	17	39.23	22.54	39.06	36.71	24.14	33.85	41.24	24.50	39.20	53.37	22.99	56.17

		ESG			E			S			G		
Country	N	Mean	Std	Mid	Mean	Std	Mid	Mean	Std	Mid	Mean	Std	Mid
Poland	16	38.49	21.28	38.02	40.05	25.60	34.50	40.37	23.64	38.67	54.81	20.87	58.15
Portugal	7	56.67	21.66	61.22	55.97	28.79	66.65	59.79	25.30	64.25	51.71	23.75	51.97
Puerto Rico	1	35.02	6.85	34.84	26.95	14.82	18.18	38.70	9.63	38.79	42.95	6.04	43.33
Qatar	1	35.49	22.56	31.50	33.91	25.60	18.18	35.10	21.94	20.70	66.89	8.07	61.67
Russia	1	33.79	22.30	36.49	39.46	23.17	41.30	47.84	20.01	55.45	28.08	21.56	18.30
Saudi Arabia	3	30.54	17.86	29.04	34.36	24.75	20.80	27.55	18.64	22.58	46.02	16.16	46.45
Singapore	26	39.39	21.76	36.84	37.72	26.64	32.70	41.35	22.86	39.71	51.66	23.22	52.12
South Africa	48	52.08	18.41	53.85	50.23	22.92	50.84	57.01	19.33	58.92	53.58	20.84	52.97
Spain	28	62.12	21.42	67.42	67.25	24.46	73.23	69.53	24.81	77.96	54.26	22.87	56.63
Sweden	38	55.82	19.73	57.83	55.31	27.53	61.50	60.82	22.59	67.09	55.10	21.78	56.49
Switzerland	53	49.22	23.59	49.70	51.58	26.58	52.39	52.39	25.99	52.21	52.93	22.79	53.61
Taiwan	78	42.19	24.89	42.32	45.45	26.01	44.50	43.11	28.09	39.92	51.09	22.73	51.79
Thailand	16	47.49	22.18	51.78	49.80	25.72	53.61	56.30	24.91	58.80	52.27	19.62	54.90
Turkey	20	48.47	23.57	52.75	53.81	29.26	59.50	55.92	24.23	55.16	53.39	19.38	55.99
Ukraine	1	29.38	20.07	27.46	18.76	24.38	2.91	26.47	31.20	13.98	48.74	7.31	50.00
The Emirates	1	26.70	20.01	24.52	33.18	12.51	26.73	32.17	18.82	24.01	32.98	21.62	20.83
UK	175	51.37	20.19	52.34	50.09	25.67	49.75	52.83	22.07	53.39	57.67	21.33	59.86
USA	528	45.64	22.00	45.37	42.12	26.73	39.33	49.41	22.50	47.89	53.77	22.25	55.56

We report the statistics summary of annual ESG, E, S and G scores of 2,306 companies over 2002–2023 from the Refinitiv Database by country. N is the number of firms in each country. Mean, Std and Mid represent the mean, standard deviation and median of ESG scores, respectively.

Appendix B An additional Table for Section 3

Table 10: The correlation matrix between MSCI and Refinitiv CSA data

Legal origin	Variable	R_ESG	R_E	R_S	R_G	M_IVA	M_E	M_S	M_G
English	R_ESG	1							
	R_E	0.997	1						
	R_S	0.995	0.997	1					
	R_G	0.995	0.993	0.995	1				
	M_IVA	0.926	0.909	0.889	0.898	1			
	M_E	0.964	0.952	0.941	0.953	0.958	1		
	M_S	0.823	0.816	0.782	0.774	0.920	0.830	1	
	M_G	0.117	0.082	0.051	0.053	0.397	0.143	0.568	1
French	R_ESG	1							
	R_E	0.996	1						
	R_S	0.991	0.997	1					
	R_G	0.990	0.983	0.985	1				
	M_IVA	0.816	0.805	0.767	0.757	1			
	M_E	0.918	0.908	0.876	0.876	0.907	1		
	M_S	0.809	0.764	0.736	0.813	0.822	0.815	1	
	M_G	-0.416	-0.411	-0.452	-0.509	0.111	-0.244	-0.204	1
German	R_ESG	1							
	R_E	0.991	1						
	R_S	0.993	0.999	1					
	R_G	0.982	0.975	0.968	1				
	M_IVA	0.755	0.687	0.698	0.719	1			
	M_E	0.956	0.935	0.947	0.899	0.803	1		
	M_S	0.967	0.936	0.935	0.966	0.867	0.932	1	
	M_G	-0.272	-0.361	-0.365	-0.239	0.352	-0.226	-0.038	1
Scandinavian	R_ESG	1							
	R_E	0.992	1						
	R_S	0.894	0.914	1					
	R_G	0.973	0.973	0.817	1				
	M_IVA	0.809	0.811	0.667	0.768	1			
	M_E	0.713	0.681	0.489	0.677	0.947	1		
	M_S	0.577	0.570	0.290	0.699	0.512	0.553	1	
	M_G	0.611	0.663	0.770	0.506	0.593	0.342	-0.138	1

Note: We convert the monthly MSCI data to annual frequency by taking the 12-month moving-average. Then we estimate the correlation coefficients between the cross-section averages (CSA) of ESG and E/S/G data from MSCI (M) and Refinitiv (R) across legal origins over 2014–2023.

Appendix C Additional Figures and Tables for Section 4

Here we provide figures of the raw data and global/local common components of MSCI/Refinitiv ESG sub-indicators across 4 legal origins as well as regression results for determinants of ESG sub-indicators.

Figure 7: Cross-section averages of MSCI ESG sub-indicators across 4 legal origins

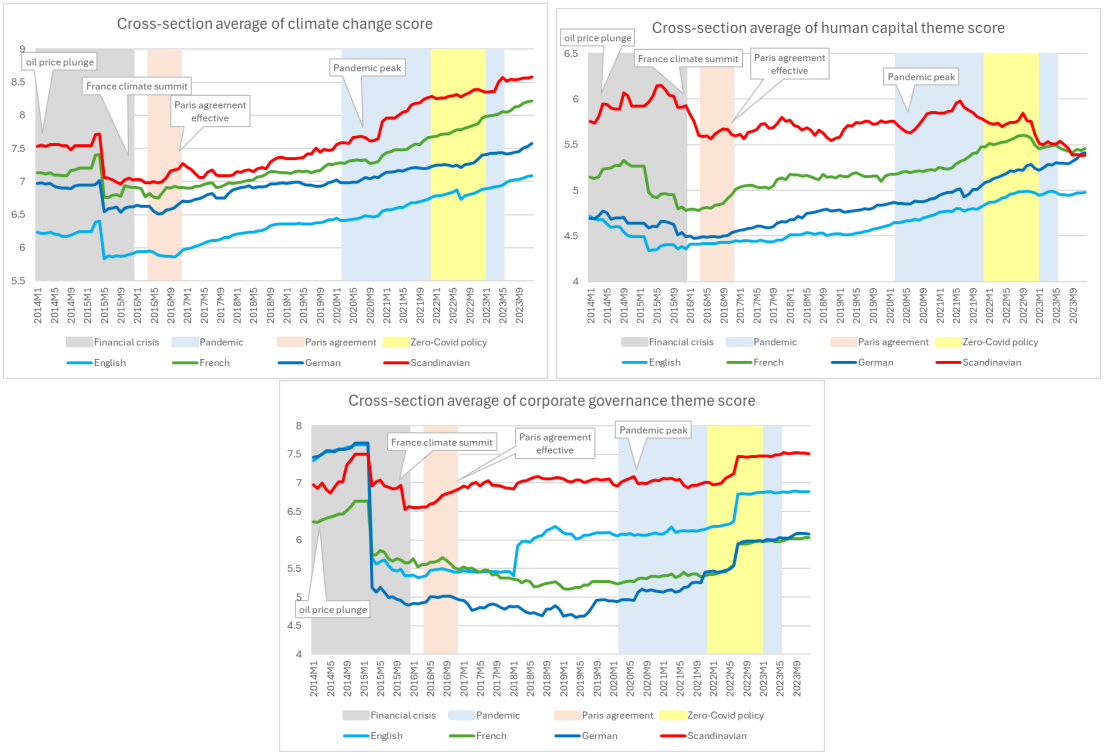

Figure 8: Global common components of MSCI ESG sub-indicators across 4 legal origins

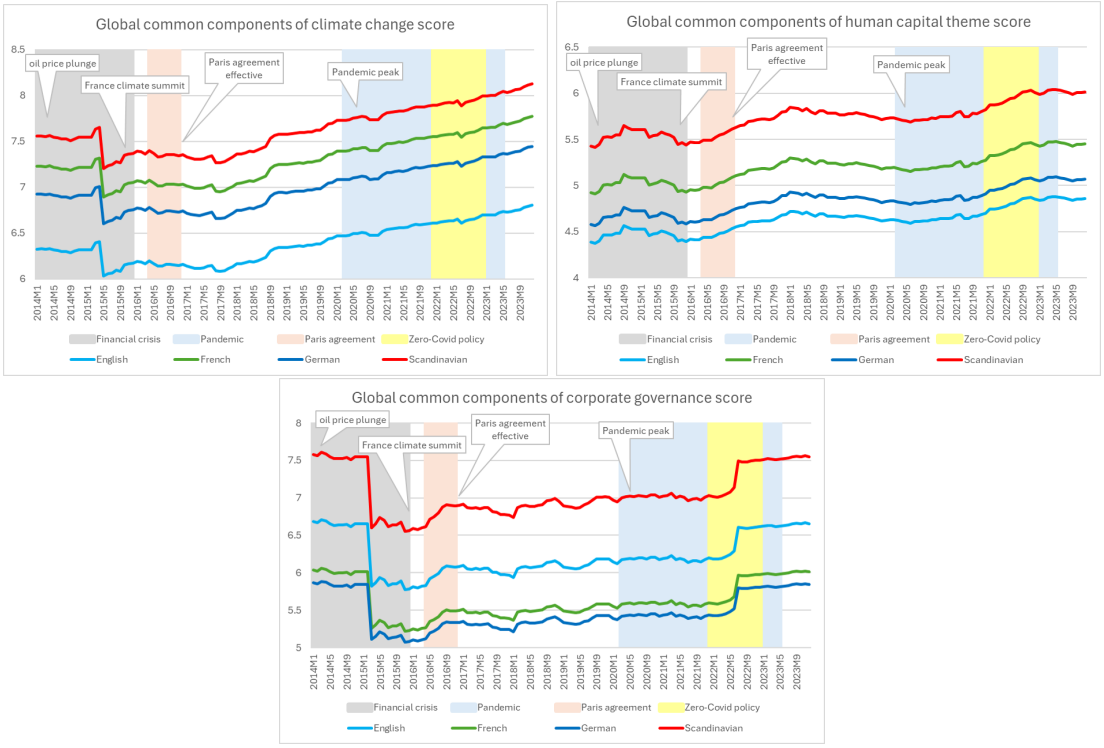

Figure 9: Local common components of MSCI ESG sub-indicators across 4 legal origins

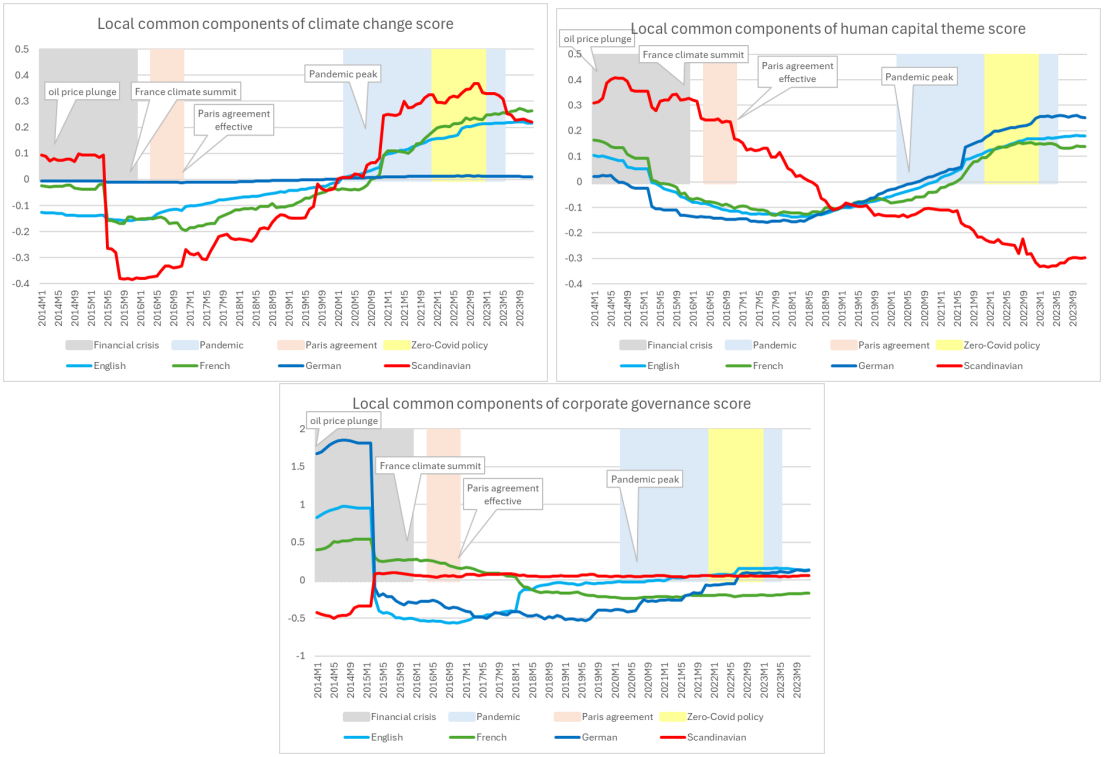

Figure 10: Cross-section averages of Refinitiv ESG sub-indicators across 4 legal origins

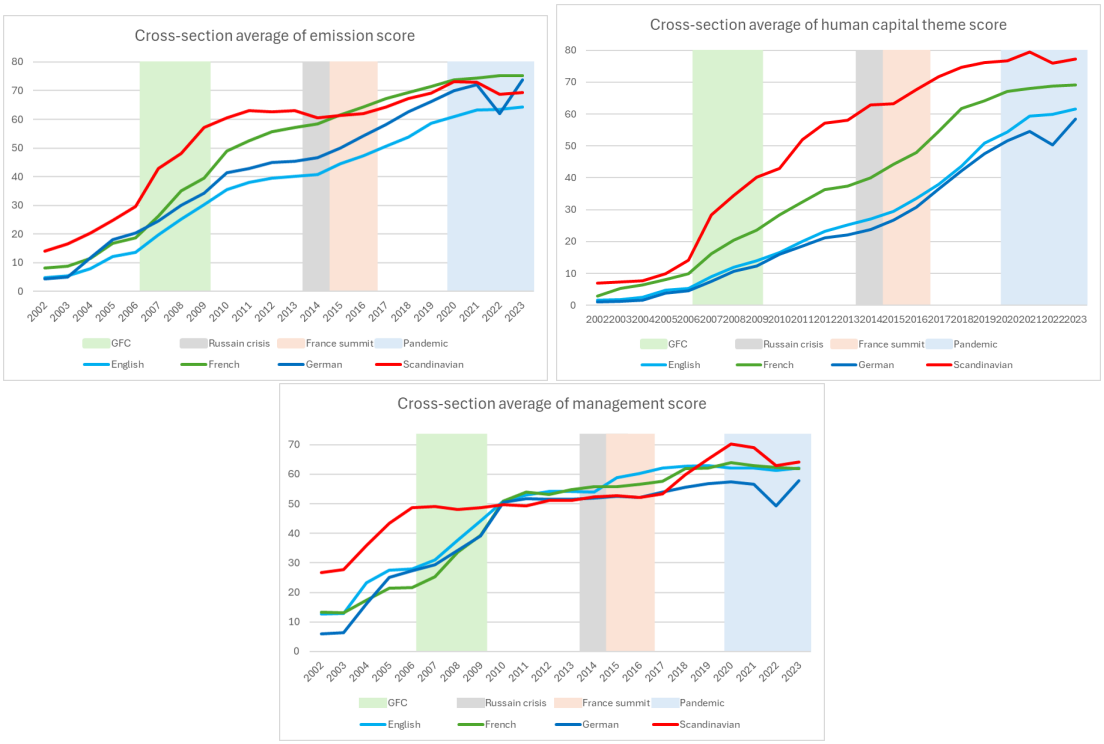

Figure 11: Global common components of Refinitiv ESG sub-indicators across 4 legal origins

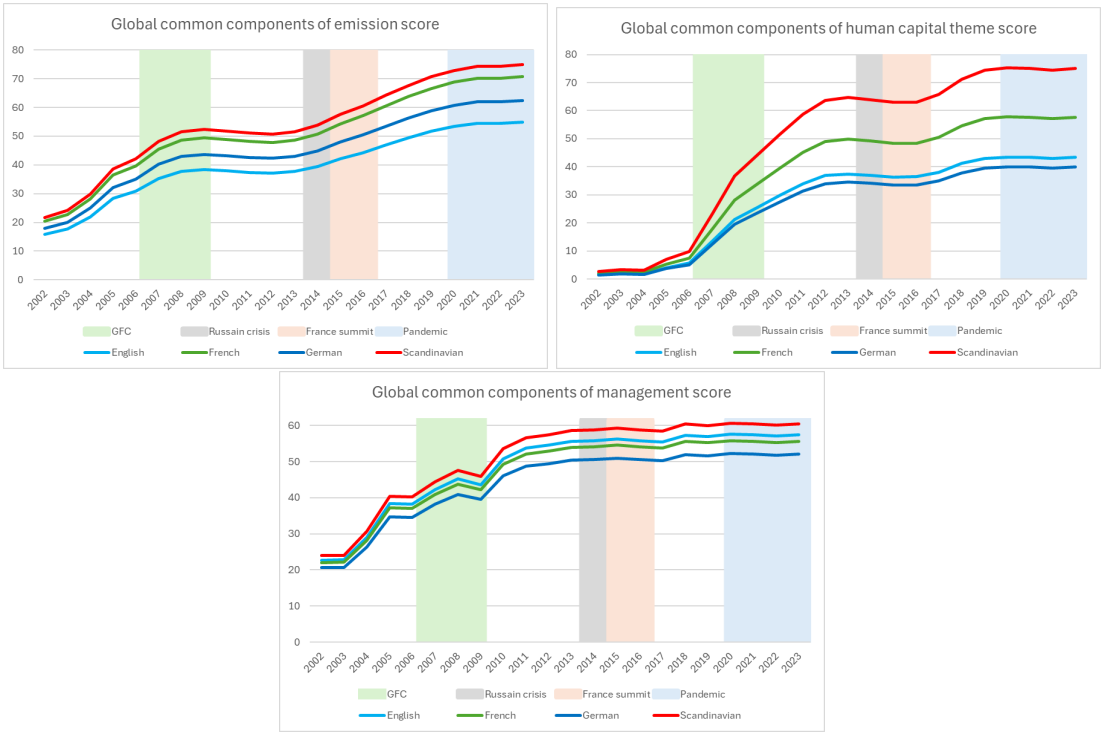

Figure 12: Local common components of Refinitiv ESG sub-indicators across 4 legal origins

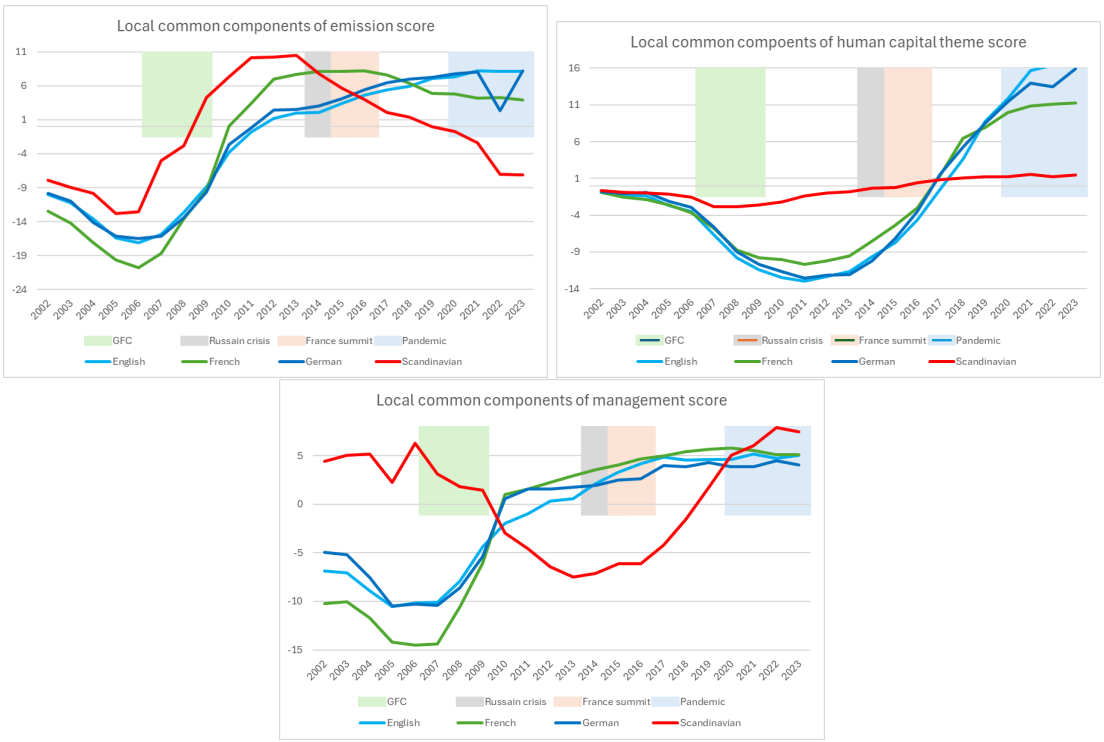

Table 11: Determinants of MSCI ESG sub-indicators and systematic components

	climate	$climate_G$	$climate_F$	*capital*	$capital_G$	$capital_F$
GDP growth	0.732	0.016	1.100	1.703*	1.145***	1.751**
	(1.112)	(0.144)	(0.886)	(0.983)	(0.101)	(0.761)
Inflation	8.620***	4.309***	2.677***	3.736***	6.853***	1.981***
	(1.045)	(0.135)	(0.832)	(0.925)	(0.095)	(0.717)
Company size	0.367***	0.130***	0.205***	0.096***	0.122***	1.54E-03
	(0.023)	(3.04E-03)	(0.019)	(0.020)	(2.10E-03)	(0.016)
ROE	0.006	1.48E-03***	0.003	1.63E-03	5.93E-04***	9.57E-04
	(0.004)	(5.18E-04)	(3.18E-03)	(2.05E-03)	(2.10E-04)	(1.59E-03)
Leverage ratio	-3.33E-04*	-8.58E-05***	-2.31E-04	-5.76E-05	-3.42E-05***	-1.75E-05
	(1.86E-04)	(2.41E-05)	(1.48E-04)	(1.03E-04)	(1.06E-05)	(7.98E-05)
COVID	0.456***	0.315***	0.192***	0.327***	0.108***	0.156***
	(0.010)	(1.24E-03)	(0.008)	(8.32E-03)	(8.54E-04)	(6.44E-03)
French law	0.685***	0.862***	-0.152***	0.575***	0.547***	-0.001
	(0.033)	(0.030)	(0.011)	(0.022)	(0.018)	(0.010)
German law	0.278	0.595***	-0.275***	-0.397***	-0.436***	0.002
	(0.036)	(0.033)	(0.013)	(0.025)	(0.020)	(0.011)
Scandinavian law	1.486***	1.618***	-0.117***	1.299***	1.301***	-0.015
	(0.060)	(0.054)	(0.021)	(0.040)	(0.033)	(0.017)
First-stage R^2	2.48%	54.75%	1.57%	2.51%	31.97%	0.90%
Second-stage R^2	1.26%	2.28%	0.77%	2.24%	3.23%	9.17E-06
Observations	79202	79202	79202	88369	88369	88369
	governance	$governance_G$	$governance_F$			
GDP growth	2.266**	0.854***	2.558***			
	(1.146)	(0.217)	(0.891)			
Inflation	20.536***	9.236***	10.591***			
	(1.072)	(0.203)	(0.834)			
Company size	-0.232***	0.058***	-0.284***			
	(0.024)	(0.005)	(0.019)			
ROE	0.003	5.14E-04	-1.38E-03			
	(0.002)	(4.50E-04)	(1.85E-03)			
Leverage ratio	-2.27E-04*	-5.99E-05**	-1.41E-07			
	(1.20E-04)	(2.27E-05)	(9.30E-05)			
COVID	0.232***	0.155***	0.096***			
	(0.010)	(0.002)	(7.52E-03)			
French law	-0.425***	-0.673***	0.245***			
	(0.020)	(0.015)	(0.011)			
German law	0.014	-0.451***	0.449***			
	(0.022)	(0.016)	(0.012)			
Scandinavian law	1.221***	1.004***	0.219***			
	(0.036)	(0.026)	(0.021)			
First-stage R^2	1.46%	0.13%	0.60%			
Second-stage R^2	1.87%	0.05%	1.86%			
Observations	89022	89022	89022			

Note: We report the FE estimation results for (6) using the quarterly data for 3,892 companies over 2014Q1–2023Q4. *climate*, $climate_G$ and $climate_F$ refer to the climate change score, the global common component and the local common components, respectively. Similarly for the rest of variables. *capital* and *governance* refer to human capital theme score and corporate governance theme score, respectively. First-stage R^2s refer to the variances of sub-indicators explained by the macro and firm-specific variables and COVID dummy. Second-stage R^2s refer to the variances of sub-indicators explained by legal origin dummies. Robust standard errors are included in parentheses. ***, ** and * indicate the significance of the coefficient at the 1%, 5% and 10% level, respectively.

Table 12: Determinants of Refinitiv ESG sub-indicators and systematic components

	$emission$	$emission_G$	$emission_F$	$right$	$right_G$	$right_F$
GDP growth	-160.6***	-69.55***	-91.63***	-122.4***	-141.5***	6.155***
	(3.586)	(1.562)	(2.489)	(3.628)	(2.574)	(1.899)
Inflation	-217.1***	-80.03***	-181.0***	-170.8***	-173.6***	-17.36**
	(15.18)	(6.610)	(10.53)	(15.27)	(10.84)	(7.995)
Company size	1.172***	0.329***	0.926***	0.075	0.670***	-0.321***
	(0.193)	(0.084)	(0.134)	(0.195)	(0.138)	(0.102)
ROE	0.015	0.157***	-0.016	0.180**	0.211***	-0.014
	(0.086)	(0.038)	(0.060)	(0.086)	(0.061)	(0.045)
Leverage ratio	0.016	8.29E-03	-1.05E-03	0.027**	1.48E-03	0.018***
	(0.014)	(5.92E-03)	(9.44E-03)	(0.014)	(9.74E-03)	(7.19E-03)
COVID	24.962***	19.878***	4.118***	33.994***	18.336***	16.320***
	(0.332)	(1.45E-01)	(0.230)	(0.336)	(0.239)	(0.176)
French law	8.004***	8.532***	-0.544**	7.664***	5.650***	1.194***
	(0.442)	(0.317)	(0.233)	(0.438)	(0.353)	(0.176)
German law	2.042***	5.805***	-4.392***	-3.546***	-6.312***	1.630***
	(0.398)	(0.286)	(0.209)	(0.400)	(0.322)	(0.161)
Scandinavian law	11.95***	11.28***	0.516	21.17***	18.82***	1.808***
	(0.762)	(0.547)	(0.401)	(0.751)	(0.604)	(0.302)
First-stage R^2	14.26%	34.93%	5.15%	21.73%	17.68%	15.30%
Second-stage R^2	1.24%	2.76%	1.17%	3.28%	4.87%	3.41E-03
Observations	39698	39698	39698	38339	38339	38339
	$management$	$management_G$	$management_F$			
GDP growth	-0.338	-75.36***	-47.75***			
	(3.376)	(1.447)	(1.976)			
Inflation	-10.32	-115.5***	-109.6***			
	(14.61)	(6.122)	(8.362)			
Company size	-0.067	0.765***	1.118***			
	(0.189)	(0.078)	(0.106)			
ROE	0.242***	0.127***	4.57E-03			
	(0.074)	(0.035)	(0.048)			
Leverage ratio	0.016	9.57E-03*	2.63E-03			
	(0.012)	(5.49E-03)	(7.50E-03)			
COVID	2.114***	9.173***	3.976***			
	(0.295)	(0.134)	(0.183)			
French law	-2.893***	-3.356***	-1.104***			
	(0.420)	(0.287)	(0.186)			
German law	-1.501***	-7.823***	-4.680***			
	(0.373)	(0.258)	(0.168)			
Scandinavian law	-4.912***	0.338	0.359			
	(0.689)	(0.494)	(0.321)			
First-stage R^2	0.21%	13.88%	3.49%			
Second-stage R^2	0.24%	2.36%	1.99%			
Observations	34392	34392	34392			

Note: We report the FE estimation results for ESG scores on legal origin dummies using the annual data for 2,211 companies over 2002–2023 from the Refinitiv Database. $emission$, $emission_G$ and $emission_F$ refer to the aggregate carbon emission score, the global common component and the local common components, respectively. Similarly for the rest of variables. $right$ and $management$ refer to human right core and management score, respectively. First-stage R^2s refer to the variances of sub-indicators explained by the macro and firm-specific variables and COVID dummy. Second-stage R^2s refer to the variances of sub-indicators explained by legal origin dummies. Robust standard errors are included in parentheses. ***, ** and * indicate the significance of the coefficient at the 1%, 5% and 10% level, respectively.