

Changes in the Relationship between Corporate Social Performance and Cost of Equity: Insights from a Multi-Decade Analysis of Sin Stocks and ESG Laggards¹

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Abstract

Financial theory suggests that exclusionary investing increases divested firms' cost of equity. With the surge in sustainable investing, the divergence between the cost of equity of firms prone to be targeted by divestment campaigns relative to their counterparts is expected to grow. Using panel regression and propensity score matching on a dataset of 6,336 U.S. firms from 1990 to 2023, this study presents a more nuanced view. While firms in carbon-intensive industries exhibit a growing cost of equity premium, no consistent premium is found for traditional sin stocks (i.e., alcohol, tobacco, gambling and military, firearms). Furthermore, recent years have seen a shift in how ESG scores affect the cost of equity. The relationship between ESG scores and the cost of equity has shifted from being positive to negative, suggesting a changing market perception of ESG risks. These findings challenge the investor base channel and suggest that the perception of risks, rather than exclusionary practices, drives higher equity costs.

Keywords: corporate social performance; cost of equity; ESG; exclusionary investing; sin stocks.

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1 Introduction

The Norwegian Ministry of Finance has issued ethically motivated guidelines for observing and excluding investments in the Government Pension Fund Global—with a market value of more than USD 1.67 trillion as of June 30, 2024, the world's largest sovereign wealth fund. These guidelines contain criteria for excluding companies based on their products or their conduct. Specifically,

“The fund must not invest in companies which themselves, or through entities they control, manufacture weapons that violate fundamental humanitarian principles through their normal use, or sell weapons or military materiel to certain countries. Nor may it invest in companies that produce tobacco or cannabis for recreational use.” ... “Companies may also be excluded if there is an unacceptable risk of them contributing to or being responsible for particularly serious violations of fundamental ethical norms.” (NBIM, 2024)

This is just one example of the growing practice among institutional investors to integrate ethical and environmental considerations into their investment strategies. The increasing demand for sustainable investment approaches extends beyond institutional actors. Retail

investors, too, are increasingly seeking to allocate their resources towards companies that align with ethical and environmental standards. Generally, investors adopt exclusionary investing practices for a variety of reasons, reflecting both pecuniary and non-pecuniary motivations (Gutsche & Ziegler, 2019). One rationale is the belief that companies engaged in unethical or unsustainable practices carry risks that are not adequately reflected in their current pricing. These risks, which could arise, for example, from regulatory penalties, reputational damage, or operational challenges, may undermine long-term profitability. Investors seek to avoid these firms to improve their risk-adjusted returns, expecting that either the market will eventually price these risks appropriately or the risks will manifest, both resulting in return volatility and declining stock values. Another motivation stems from the desire to make a positive societal impact. Investors may aim to channel capital away from companies that contribute to harmful activities and towards those that align with broader ethical or environmental goals. By excluding companies with unsustainable practices from their portfolios, investors effectively shrink the investor base for these firms. The idea, rooted in economic theory (e.g., Heinkel, Kraus, & Zechner, 2001; Merton, 1987), is that a reduced investor base will lead to a cost of equity premium for unsustainable firms. This “investor-base channel” can be a mechanism through which investors hope to internalise the external costs associated with unsustainable corporate behaviour, thereby incentivising firms to adopt more responsible practices (Chava, 2014).

Empirical studies have sought to test the theoretical predictions regarding unethical firms’ increased equity cost by examining the performance of stocks operating in controversial industries, so-called sin stocks. Early papers such as Hong and Kacperczyk (2009) and Fabozzi, Ma, and Oliphant (2008) found evidence supporting the existence of a sin premium. These studies documented that firms operating in industries like alcohol, tobacco, and gambling tended to exhibit higher costs of equity and lower valuation ratios compared to non-sin firms. However, more recent studies have challenged these findings. Blitz and Fabozzi (2017), for instance, show that the outperformance of sin stocks can be explained by their exposure to the profitability and investment factor of the Fama-French five-factor model, casting doubt on the existence of a distinct sin premium.

One potential explanation for these mixed findings is that in earlier periods, the proportion of investors with exclusionary policies may have been too small to significantly affect the equity cost of sin stocks. Ethical investing has been a niche market for much of the 20th century. However, in recent years, the proportion of investors incorporating environmental, social, and governance (ESG) criteria into their decision-making has grown substantially (Derrien, Krüger, Landier, & Yao, 2021). This shift has been driven by a broader range of factors, including heightened awareness of climate risks and other critical issues such as diversity, equity and inclusion, ethical supply chains, labour practices, fair wages, etc. Regulatory developments, such as the EU’s Sustainable Finance Disclosure Regulation (SFDR), have further reinforced the focus on sustainability. As the emphasis on ESG investing and exclusionary practices has intensified, it stands to reason that the sin premium

should also increase over time. Furthermore, with the growing recognition that ESG risks affect established risk categories such as credit, market, liquidity, operational, strategic and reputation risk (Grüner & Lang, 2024), the strength of the relationship between firms' corporate social performance and their cost of equity has likely intensified. As ESG considerations increasingly factor into traditional risk assessments, the financial implications of a firm's social and environmental practices become more pronounced, potentially amplifying the impact on equity capital costs.

This paper seeks to contribute to the debate by addressing two key questions. First, has the disparity in the cost of equity between stocks that are likely to be targeted by exclusionary investing campaigns and their non-divested counterparts increased over time? Second, how has the relationship between corporate social performance and the cost of equity shifted through time? The novelty of this study lies in its longitudinal perspective, examining the evolution of these relationships using an extensive sample of US companies that spans several decades (1990–2023). The study employs a robust empirical design that combines panel regression and propensity score matching and provides a forward-looking perspective using the implied cost of equity capital rather than relying solely on historical stock returns. To identify firms likely to be excluded by a meaningful portion of investors, I consider two separate approaches: (i) firms that operate in controversial industries, so-called sin stocks, and (ii) firms that have very low ESG scores, so-called ESG laggards. Both groups are likely to be excluded or underweighted by sustainable investors.

The results reveal that the cost of equity premium for firms operating in carbon-intensive industries has indeed increased over time. This finding is consistent with the growing global awareness of environmental risks, particularly following the adoption of international agreements like the Paris Climate Accord, and previous findings regarding a carbon premium (e.g., Feldhütter, Halskov, & Krebbers, 2024; Hsu, Li, & Tsou, 2023; Li, Shan, Tang, & Yao, 2024; Pástor, Stambaugh, & Taylor, 2022; Sankar, Nag, Chakrabarty, & Basu, 2024). In contrast, neither companies operating in the so-called “triumvirate of sin”, namely alcohol, tobacco, and gambling, nor companies in the category military and firearms show consistent sin premiums, suggesting that generalisations across different sin categories are inappropriate. Additionally, I find evidence that the cost of equity premium for ESG laggards was negative for an extended period before only recently turning positive. Similarly, the relationship between corporate social performance, as measured by ESG scores from Refinitiv (formerly ASSET4), and the cost of equity was positive for a long time but has recently turned negative. This shift contributes to the mixed evidence in existing literature regarding the impact of corporate social performance on the cost of equity in the USA (see, for example, Breuer, Müller, Rosenbach, & Salzmann, 2018; Galluzzi & Segara, 2023).

In conclusion, this study presents evidence of a structural shift in the relationship between firms' ethical and sustainability profiles and their implied cost of equity capital. In particular, the main takeaways from this study are: (i) there is a carbon premium that has intensified over time, (ii) while being negative for an extensive period, a positive ESG lag-

gard premium has emerged in recent years, and (iii) the relationship between corporate social performance and the implied cost of equity capital has turned negative in recent years. On the other hand, while the result that firms operating in the sin categories alcohol/tobacco/gambling and military/firearms are not associated with a positive premium is consistent with the findings of Blitz and Fabozzi (2017), they contradict the theoretical predictions regarding a cost of equity premium for shunned firms according to the investor base hypothesis. Suppose the higher cost of equity for unsustainable firms is driven by risk factors such as environmental policy uncertainty, as suggested by Hsu et al. (2023), rather than by exclusionary practices, the implications for sustainable investors are significant. Rather than divesting firms, constructive engagement can lead to greater improvements in a firm's corporate social performance, making it a more effective strategy for fostering positive societal and environmental change (Blitz & Swinkels, 2020; Kölbel, Heeb, Paetzold, & Busch, 2020).

2 Theory, Literature, and Hypothesis Development

While traditional finance theory suggests that investors should be perfectly diversified (Markowitz, 1952), numerous studies indicate that they often fail to achieve adequate diversification (e.g., Coval & Moskowitz, 1999; Goetzmann & Kumar, 2008; Kelly, 1995). This lack of diversification results in varying investor bases across different firms. Merton (1987)'s theoretical model addresses this discrepancy and theorises that stocks of firms with smaller shareholder bases and, thus, lower risk-sharing opportunities should yield higher expected returns.

Heinkel et al. (2001) developed a similar model exploring the effects of varying investor bases. Caused by environmentally conscious investors divesting from polluting firms, neutral investors demand a higher expected return as compensation for holding more shares of polluting firms and, hence, being less diversified than would be optimal in a market free of boycotts. The decreased investor base of polluting firms and the corresponding lack of risk-sharing among non-green investors leads to lower share prices, thus raising their cost of equity. The model shows that the presence of green investors can incentivise firms to adopt environmentally friendly practices to broaden their investor base. In their model, firms can reform their technology to become clean. If, due to a significant fraction of green investors, the higher cost of equity overcomes the cost of reforming, polluting firms will become green as a result of exclusionary ethical investing.

More recent studies model the equilibrium considering investing that incorporates ESG scores. Pástor, Stambaugh, and Taylor (2021) show that investors with a strong preference for sustainability are willing to pay more for sustainable firms, thereby lowering the firms' cost of equity. High-ESG assets have negative CAPM alphas, whereas low-ESG assets have positive alphas, lowering (increasing) the expected return of investors with strong (weak) ESG preferences. Yet investors with high ESG preferences are not unhappy because they

derive utility from holding high-ESG assets (Pástor et al., 2021). Furthermore, traditional finance has been enhanced by modelling an ESG efficient frontier (Pedersen, Fitzgibbons, & Pomorski, 2020) and developing a sustainable capital asset pricing model (Zerbib, 2022). Both models imply an increased cost of equity for firms with low ESG scores.

Based on the theoretical consideration that firms with a narrower investor base face a higher expected return and cost of equity, various studies have investigated the hypothesis that the shareholder return of shunned firms should exceed the performance of otherwise similar non-shunned firms because, in the long run, the return on a stock should be equal to its cost of capital (Asness, 2017; Blitz & Swinkels, 2023). Generally, a sin premium can be interpreted as a measure of success, as it internalises external costs by increasing the cost of capital of unsustainable firms. On the other hand, it represents a lower expected return for sustainable investors and, *ceteris paribus*, a wealth transfer to unsustainable investors (Blitz & Swinkels, 2023). Until recently, it seemed that there was strong empirical support for the existence of such a sin premium. Studies such as Fabozzi et al. (2008), Hong and Kacperczyk (2009), Statman and Glushkov (2009), and Salaber (2009) report highly significant positive abnormal returns for sin stocks¹ after controlling for the classic asset pricing factors market, size, value, and momentum (Blitz & Swinkels, 2023). In line with these findings, the valuation ratios of sin stocks seemed significantly lower after controlling for various stock characteristics (Hong & Kacperczyk, 2009). Furthermore, studies showed that sin stocks and firms with environmental concerns have lower institutional ownership (Chava, 2014; Hong & Kacperczyk, 2009).

More recent studies challenge these findings. Eccles, Rajgopal, Kester, Byrnes, and Xie (2022) find that the difference in valuation and institutional ownership vanishes when looking at a propensity score matched sample of sin and non-sin stocks. Blitz and Fabozzi (2017) demonstrate that the outperformance of sin stocks can be fully explained by the two quality factors profitability and investment of the Fama-French five-factor model introduced by Fama and French (2015). Pedersen et al. (2020) neither find evidence for valuation differences between sin and non-sin stocks and confirm the findings of Blitz and Fabozzi (2017) of a non-significant sin premium when using five- or six-factor models.

Despite the theoretical arguments that sin stocks should have higher historical returns, there is no conclusive empirical evidence for such a sin premium (Blitz & Swinkels, 2023). A major problem in this context is that historical stock return data may not always be appropriate to test the above-mentioned theories. Pástor et al. (2021) introduce an ESG factor that captures unexpected changes in ESG concerns, which can be customers shifting their demands for goods of sustainable providers or investors changing their appreciation for sustainable holdings. High (low) ESG assets have positive (negative) ESG factor loadings (“ESG betas”). When ESG concerns strengthen, sustainable assets outperform un-

¹Fabozzi et al. (2008) operationalise sin stocks as publicly traded companies in the industries adult service, alcohol, tobacco, gaming, biotech, and defence; Hong and Kacperczyk (2009) and Salaber (2009) focus on the “triumvirate of sin” (alcohol, tobacco, and gaming companies); Statman and Glushkov (2009) focus on tobacco, alcohol, gambling, firearms, military, and nuclear operations).

sustainable assets despite having lower expected returns (Pástor et al., 2021, 2022). Hence, historical stock returns over such a period may be misleading. However, over the long run, the higher expected return of unsustainable firms should be observable in historical stock return data. So why then do Blitz and Fabozzi (2017) and Pedersen et al. (2020) find no evidence for a sin premium when investigating sin stocks over a very long period of 1963–2016?

A potential explanation is that exclusion in mainstream investment portfolios is a relatively young phenomenon. The proportion of sustainable investors has to be substantial enough to translate into empirically significant differences in asset valuations. While exclusionary investing has long been around, the proportion of investors incorporating sustainability factors into investment decisions has strongly increased over the past years (Deloitte & Fletcher, 2024). Furthermore, the scope of exclusion has broadened from firms with morally questionable business models (i.e., sin stocks) to stocks that score poorly on ESG criteria, the United Nations Sustainable Development Goals (UN SDGs), or their contribution to climate change (Blitz & Swinkels, 2023).

During a transition phase in which the proportion of exclusionary investors quickly increases, the share price of shunned stocks decreases relative to non-shunned stocks. It is this comparably lower realised return that leads to a higher expected return and cost of equity. Instead of looking at past returns to analyse the relationship between exclusionary investing and the cost of equity, a forward-looking approach of considering the implied cost of equity capital (ICC) can be an appealing alternative (Hmaittane, Salam, & Kais Bouslah, 2019; Pástor et al., 2022). ICC is derived by using analysts' earnings estimates and the firm's current share price. ICC can also be interpreted as a firm's ex-ante cost of equity. In a transition phase, where the proportion of sustainable investing increases significantly, ICC is a valid construct to analyse the relationship between exclusionary investing and a firm's cost of equity. Based on the theoretical arguments that exclusionary investing increases shunned firms' cost of equity relative to non-shunned firms and the recent growth in sustainable investing, I assert:

Hypothesis 1a: *The ex-ante cost of equity of companies that operate in industries often considered unethical or immoral (i.e., sin stocks) relative to their counterparts operating in “neutral” industries (i.e., non-sin stocks) has increased over time.*

Hypothesis 1b: *The ex-ante cost of equity of companies with a comparably low ESG score (i.e., ESG laggards) relative to companies with a comparably high ESG score (i.e., ESG leaders) has increased over time.*

Previous literature suggests that, in addition to the reduced investor base caused by exclusionary investing, investors may perceive firms acting unethical or unsustainable as riskier and thus demand a higher return (Chava, 2014; El Ghouli, Guedhami, Kwok, & Mishra, 2011). Superior corporate social responsibility disclosure and performance can reduce financial risk by increasing firm transparency, reducing information asymmetry

(Benlemlih, Shaukat, Qiu, & Trojanowski, 2018; Dhaliwal, Li, Tsang, & Yang, 2011) and offering insurance-like protection against stakeholder sanction (Godfrey, 2005; Godfrey, Merrill, & Hansen, 2009; Hong, Kubik, Liskovich, & Scheinkman, 2019; Kölbel, Busch, & Jancso, 2017). Hong and Kacperczyk (2009) further argue that sin stocks generally face higher litigation risks.

Empirical analyses consistently confirm the negative relationship between CSR disclosure and performance and financial risk (e.g., Benlemlih et al., 2018; Godfrey et al., 2009; Hong et al., 2019; Jo & Na, 2012; Monti, Pattitoni, Petracci, & Randl, 2022; Shafer & Szado, 2020; Utz, 2018). While Chava (2014) and Breuer et al. (2018) report that the investor base rather than the risk channel mediates the relationship between CSP and cost of equity, there is also evidence that—in addition to systematic risk and against modern portfolio theory that posits that idiosyncratic risk is eliminated in equilibrium through diversification and does not affect the cross-section of expected returns—CSP affects firm’s implied cost of equity through increased idiosyncratic risk (Brockman, Guo, Vivero, & Yu, 2022; Thuy, Khuong, Canh, & Liem, 2022).

With the growth in socially responsible investing and the increasing awareness of the necessity to combat climate change, the appreciation that ESG risks affect established risk categories such as credit, market, liquidity, operational, strategic and reputation risk has increased significantly. This is reflected not least in regulatory developments such as the EU’s “Sustainable Finance Action Plan”, which aims, among other things, to integrate the concept of “sustainability” into the risk management of credit institutions to limit financial risks arising from the climate crisis, resource scarcity and social problems, for example (Grüner & Lang, 2024). I argue that with the intensified focus on ESG risks and growth in sustainable investing, the ESG risk factor introduced by Pástor et al. (2021) has increased in importance and, hence, assert:

***Hypothesis 2:** The magnitude of the negative effect of ESG scores on cost of equity has increased over time.*

3 Research Design

3.1 Variable Construction

3.1.1 Cost of Equity

In line with prior research (e.g., Breuer et al., 2018; Breuer, Trauzettel, Müller, & Salzmann, 2024; Dhaliwal et al., 2011), I estimate the ex-ante cost of equity implied by stock prices and analyst earnings forecasts annually. I follow previous literature and derive it as the internal rate of return using different models. Specifically, I use the models of Claus and Thomas (2001), Easton (2004), and Ohlson and Juettner-Nauroth (2005)². In these models,

²I also calculated the ICC using the model of Gebhardt, Lee, and Swaminathan (2001). However, this approach resulted in numerous missing values (a key issue with the Gebhardt et al. (2001) model stemmed

the internal rate of return is set such that the present value of the expected future residual income, obtained from analyst consensus earnings forecasts, equals the firm's stock price (Breuer et al., 2018). While the models of Easton (2004) and Ohlson and Juettner-Nauroth (2005) can be solved analytically, the model of Claus and Thomas (2001) requires numerical methods to search for the solution. In line with previous research such as Chava (2014), Eugster (2020), and Hail (2002), I use analyst earnings forecasts and stock price data from the month of June to ensure that financial data are publicly available and incorporated in the forecast. The implied cost of equity capital used as the dependent variable in this study is defined as the average of the three models winsorised at the 1% level. For detailed information on the models, see appendix A.

3.1.2 Divested Companies

I identify divested companies using two distinct approaches. First, I examine companies operating in controversial industries. Second, I analyse companies that investors shun due to their poor ESG profile.

SIN Stocks: I follow previous research to assign firms to controversial industries. I start by including the industries collectively known as the “triumvirate of sin”, namely alcohol, tobacco, and gambling. These consumer product groups are viewed as sinful due to their addictive properties and undesirable social consequences when consumed excessively (Hong & Kacperczyk, 2009). Furthermore, I include companies operating in the sectors military and firearms as well as the carbon-intensive sectors cement, oil, coal, and gas. These sectors are viewed as controversial because of the externalities generated by the nature of their activities (Hmaittane et al., 2019). In particular, the divestment of carbon-intensive sectors is a more recent phenomenon that has gained momentum with an increasing number of institutional investors, such as banks and pension funds, tracking and trying to reduce the environmental footprint of their investments. In contrast to Hmaittane et al. (2019), I do not assign biotech companies as controversial, as this would include firms such as Pfizer, Johnson & Johnson, Roche or Novartis. These companies cannot be put on a par with socially despised industries such as weapons producers or high-emission oil or coal firms³. All SIC and NAICS codes used to identify relevant industries are reported in Table 1. Table 2 presents the sample breakdown by year and firm category. On average, sin stocks constitute approximately 5% of the total sample of companies.

ESG Laggards: A more recent phenomenon is divesting companies based on their environmental, social and governance profile. ESG scores allow investors to evaluate compa-

from its reliance on the industry mean return on equity as an input parameter; negative industry mean values posed challenges for solving the equation numerically, leading to inconsistencies). To avoid a reduction in the sample size, I decided to focus on the models of Claus and Thomas (2001), Easton (2004), and Ohlson and Juettner-Nauroth (2005). I acknowledge that an alternative approach would have been to include the model of Gebhardt et al. (2001) and require only three (or fewer) out of four ICC estimates per company-year to calculate the overall ICC. Focusing on three models with available ICC estimates enhances both consistency and comparability.

³Separate analyses show that overall, biotech companies do not show any cost of equity discount or premium over non-sin companies, cf. Figures 7 and 8 in the appendix.

nies relative to their peers rather than simply shunning whole industries. Hence, companies operating in non-sin industries with poor ESG performance compared to their peers within the same industries may also be divested by investors. This should incentivise all companies—also those operating in controversial industries—to improve their ESG profile to attract investors and increase their investor base. I use ESG scores from Refinitiv to identify ESG-divested firms in this study. Specifically, I sort all companies into five quintiles yearly based on their ESG score. Companies in the lowest quintile are flagged as “ESG laggards”, proxying a high probability of being divested. In contrast, companies in the highest quintile are flagged as “ESG leaders”, proxying a low probability of being divested.

3.1.3 Control Variables

Following previous studies such as El Ghouli et al. (2011), I control for various firm-specific characteristics: beta, estimated based on the market model by regressing companies’ daily stock return on the daily market return over the past 252 trading days; size, measured as the natural logarithm of total assets; market-to-book ratio, calculated as the logarithmic ratio of the market value of equity to book value of equity; leverage, defined as the ratio of total liabilities to total assets; profitability, measured as the return on equity; and Zscore, estimated as the modified Z’-score model (Altman, Iwanicz-Drozdzowska, Laitinen, & Suvas, 2017) with low values indicating high financial distress. Furthermore, I incorporate year and industry fixed effects using Fama–French 12 industry groups, resulting in a very stringent control set-up.

3.2 Empirical Methods

3.2.1 Baseline Regression Models

The baseline regression model for testing hypothesis 1 directly links the classification of companies as divested or not with their implied cost of equity capital as follows:

$$CoE_{i,t} = \alpha + \beta Divested_i + \sum_t^{T-1} \gamma_t Year_t + \sum_j^{J-1} \sigma_j Divested * Year_{i,t,j} + \sum_v^V \gamma_v Controls_{i,t,v} + \sum_f^{F-1} \omega_f Industry_f + \epsilon_{i,t} \quad (1)$$

$CoE_{i,t}$ represents company i ’s implied cost of equity capital in year t . I estimate empirical models separately for sin stocks and ESG laggards. $Divested_i$ is a dummy variable that takes the value of one if company i is assigned to a sin industry or flagged as an ESG laggard, depending on the empirical model, and zero otherwise. Interacting the time-invariant dummy variable $Divested_i$ with the time variable $Year_t$ allows observing whether the implied cost of equity capital for divested firms relative to non-divested firms

has increased over time, as predicted by hypothesis 1. I control for temporal trends that could influence the cost of equity by incorporating year dummies. In the regression model where divested companies are identified using ESG scores, I additionally include industry dummies to control for industry-specific effects. Due to collinearity issues, I do not incorporate industry fixed effects in the model where divested firms are identified using industry classifications (sin stocks). Separate analyses that include industry fixed effects in the sin stock regression nevertheless show very similar results. Furthermore, firm-specific control variables are incorporated to account for other factors that might affect the cost of equity, ensuring that these variables do not confound the estimated effect of divestment status.

To test hypothesis 2, I regress the companies' implied cost of equity capital on their ESG scores and the interaction term between ESG score and year as follows:

$$CoE_{i,t} = \alpha + \beta ESGScore_{i,t} + \sum_t^{T-1} \gamma_t Year_t + \sum_j^{J-1} \sigma_j ESGScore * Year_{i,t,j} + \sum_v^V \gamma_v Controls_{i,t,v} + \sum_f^{F-1} \omega_f Industry_f + \epsilon_{i,t} \quad (2)$$

This setup allows for the observation of whether the effect of the ESG score on the cost of equity has increased over time, as predicted by hypothesis 2. ESG scores are sourced from Refinitiv and range from 0 to 100. The regression model also includes industry- and year-dummies as well as the firm-specific control variables.

3.2.2 Propensity Score Matching

In addition to the multivariate regression analysis, I employ a second, alternative research approach to test my hypothesis: propensity score matching (PSM). This method allows the creation of a balanced comparison between sin stocks and their non-sin counterparts by matching firms with similar propensity scores, thereby controlling for confounding variables and reducing bias. By ensuring that sin and non-sin stocks are comparable across observed characteristics, PSM helps isolate the effect of being in a sin industry on the implied cost of equity capital, complementing the multivariate regression analysis and providing a more robust test of my hypothesis.

For each year in my sample period (1990–2023), I identify all sin stocks and implement a kernel-based propensity score matching to identify comparable non-sin stocks. Kernel-based matching offers several advantages over other matching methods. Unlike nearest neighbour matching, it uses multiple control observations, resulting in more efficient and smoother estimates with reduced bias (Heckman, Ichimura, & Todd, 1998). Compared to caliper matching, it avoids arbitrary thresholds and includes all treated units, maintaining sample size and enhancing power (Smith & Todd, 2005). Unlike stratification matching, it achieves finer balance and continuous adjustment across propensity scores, utilising the

entire sample for more precise and robust treatment effect estimates (Caliendo & Kopeinig, 2008). As recommended by Caliendo and Kopeinig (2008), the propensity scores are estimated using a probit model based on several key variables: the sin-dummy (indicating whether a stock belongs to a sin industry), beta, size, market-to-book ratio, return on equity, and Zscore. By restricting the matching to observations with common support, I ensure that the matched non-sin stocks are within the same range of propensity scores as the sin stocks, enhancing the comparability of the two groups.

This approach allows me to calculate the annual average implied cost of equity capital for both sin and non-sin stocks and subsequently examine the annual difference from 1990 to 2023. To test whether these annual differences are statistically significant, I employ bootstrapped standard errors with 1,000 repetitions, providing robust estimates of the variability of my results. Based on hypothesis 1a, I expect that the annual difference in cost of equity between sin and non-sin firms increased over time.

I furthermore combine propensity score matching with regression analysis using a one-to-one matching approach. Every year, each sin firm is paired with a directly comparable non-sin firm based on nearest neighbour matching, enabling a focused and precise evaluation of the impact of being a sin stock. I then conduct a regression analysis on these matched pairs to assess how being in a sin industry affects the implied cost of equity capital while controlling for firm-specific effects. This method ensures a clear comparison between sin and non-sin firms, reinforcing the robustness of the results obtained from the initial matching process and providing a thorough understanding of the differences in the cost of equity.

3.3 Sample Construction and Descriptive Statistics

I construct the sample by merging several databases. Consensus forecasts on company earnings required to compute the implied cost of equity capital come from I/B/E/S. Stock price data and fundamental financial and company information come from CRSP and Compustat, respectively. Federal Reserve Economic Data are used as estimates of historical expectations on US inflation. Aggregate US stock market returns to estimate firms' market beta stem from the Kenneth R. French data library. Corporate social performance is operationalised by using ESG scores from Refinitiv.

The sample used to test the hypotheses regarding differences between sin and non-sin stocks consists of 6,336 firms or 53,481 firm-year observations between 1990 and 2023. When merging the data with the ESG database, the sample is reduced to 1,802 firms or 14,004 firm-year observations between 2003 and 2023. The long time period of the samples allows for investigating differences over time. Table 3 and 4 provide descriptive statistics and correlations for the constructed variables. The mean cost of equity is 11 per cent with a standard deviation of 5 per cent, which closely aligns with the numbers of previous studies such as Dhaliwal et al. (2011), Breuer et al. (2018) or Breuer et al. (2024). The unexpected negative correlation between beta and the cost of equity in the descriptive statistics likely

reflects unobserved time effects. In a regression of cost of equity on beta without year fixed effects, a negative relationship is observed. However, after controlling for year fixed effects, the relationship turns positive.

4 Empirical Results

4.1 Cost of Equity Premium for Divested Firms

4.1.1 Sin Stocks

Figure 1 presents the annual cost of equity premium or discount for sin stocks relative to non-sin stocks. The bars represent the regression coefficient of the variable sin (i.e., β) plus the regression coefficients of the interaction term between the sin and year dummy (i.e., σ_j) in the year fixed model presented in equation 1 above. The significance of the annual differences is tested jointly for the coefficients of the sin dummy and the interaction term between the sin and year dummy. This setup effectively isolates the impact of operating in a controversial industry and allows for an analysis of how the effect has evolved over time. While Table 9 in the appendix provides detailed regression results, the graphical representation in Figure 1 offers a more comprehensible and interpretable view of the results.

In the 1990s, sin stocks exhibited no cost of equity premium nor discount, i.e., their cost of equity was very similar to non-sin stocks. From 2000 to the mid-2010s, a trend towards a sin premium is observable. Since the mid-2010s, an increasing premium for sin stocks has become apparent. The finding that sin stocks exhibited no cost of equity premium in the 1990s goes against the argumentation that divested firms show higher cost of equity due to a narrower investor base. On the other hand, the trend towards a positive cost of equity premium for sin stocks generally speaks in favour of hypothesis 1a.

To delve deeper, I examine the three sin groups “alcohol, tobacco, gambling”, “military, firearms”, and “CO₂” separately, as shown in Figure 2. The results indicate substantial differences between groups, suggesting that generalisations about the sin premium may not be appropriate. For the alcohol/tobacco/gambling group, I find no significant difference in the cost of equity compared to non-sin stocks for 30 out of the 34 years analysed. Similarly, firms operating in the sectors military and firearms show no significant sin premium, with generally no significant effects between 1990 and the mid-2010s. Since 2018, there has been a significant discount for sin stocks in this sector, although the small number of firms in this group may affect the reliability of this finding. In contrast, the companies in carbon-intensive industries present a very different picture. There was no significant effect in the 1990s, followed by a trend towards a premium. A high and significant premium resulted in seven out of the last eight years between 2016 and 2023. This trend may suggest a structural break, possibly linked to the Paris Climate Accord agreed upon in December 2015.

Figure 3 and Table 5 provide a decade-wise examination, reinforcing the conclusions

drawn from the annual analysis. The group alcohol, tobacco, and gambling shows no significant difference from non-sin stocks, the group military and firearms shows a discount in recent years, and the group CO₂ exhibits an increasing premium over time. Specifically, the regression analysis presented in Table 5 shows that firms operating in the cement, oil, coal and gas industry exhibit a cost of equity premium of 1.52%, 2.71% and 3.64% in the decade between 2000–2009, 2010–2019 and the period between 2020 and 2023, respectively. Using an ordinal year variable rather than year dummies in the interaction with sin also shows a significant positive trend for the sin category CO₂. The control variables are significant using robust standard errors and exhibit the expected sign: riskier firms (high beta, leverage; low Zscore) have a higher cost of equity; larger and more profitable firms (high size, market-to-book ratio, return on equity) have a lower cost of equity.

Figure 4 displays the results of the analysis using propensity score matching. Specifically, it shows the annual cost of equity premium or discount for sin stocks by sin category, measured as the difference in average cost of equity between sin and non-sin stocks calculated using annual kernel-based propensity score matching. Table 10 in the appendix details these results. The findings from the PSM analysis closely mirror those obtained from the regression analysis. This consistency across different methodological approaches reinforces the robustness of the observed trends in the cost of equity for sin stocks.

Finally, I combine the two statistical methods PSM and regression analysis. I match each sin stock of the respective sin category with one non-sin stock using the nearest neighbour method (i.e., one-to-one matching, cf. section 3.2.2). Then, I drop all non-matched firms and repeat the decade-wise regression analysis. Table 6 presents the results. The results obtained from the regression analysis and propensity score matching are confirmed. There is no sin premium observable for firms operating in the industries alcohol, tobacco, and gambling or military and firearms. The sin premium for firms operating in carbon-intensive industries has increased over time. The cost of equity of firms in the category cement/oil/coal/gas showed no significant difference in the 1990s. However, a statistically significant and economically substantial premium has emerged in subsequent decades, amounting to 1.10%, 1.60%, and 2.46% in the 2000s, 2010s, and 2020s, respectively.

4.1.2 ESG Laggards

I continue with the analysis in which firms are identified as potential targets for divestment based on their ESG scores rather than through controversial industry classification. Specifically, firms classified as ESG laggards are those falling within the bottom 20% of ESG scores each year. The analysis aims to investigate the relationship between ESG performance and the cost of equity by estimating a regression model that includes an ESG laggard dummy variable, a year dummy variable, their interaction term, and a set of control variables. To ensure a robust comparison, the model excludes firms with ESG scores between the 2nd and 5th deciles (i.e., between the 20th and 50th percentiles). This exclusion focuses the analysis on comparing the ESG laggards with firms less likely to be

divested, thereby enhancing the precision of the estimated effect of poor ESG performance on the cost of equity. In a parallel model assessing ESG leaders, I exclude firms in the 5th to 8th deciles (i.e., between the 50th and 80th percentiles), resulting in a sample composed of ESG leaders (top 20%) and firms with ESG scores in the bottom 50%. This approach ensures a comparison between ESG leaders and firms with a higher likelihood of being divested.

The results, summarised in Figure 5a, indicate that the joint coefficient of the ESG laggard dummy and the interaction term between the ESG laggard dummy and the year dummy reveals a notable trend over time. Between 2003 and 2017, ESG laggards experienced a negative premium, reflected in a cost of equity discount rather than the expected premium. This finding contradicts hypothesis 1b, which predicted a positive effect on the cost of equity for ESG laggards due to a reduced investor base. However, in the more recent period of 2018–2023, this trend reversed, with ESG laggards now facing a cost of equity premium, aligning more closely with the original hypothesis. Figure 5b illustrates the mirrored effect for ESG leaders. From 2003 to 2017, ESG leaders enjoyed a significant cost of equity premium, which is inconsistent with the hypothesis that firms with low ESG scores would suffer from divestment. Notably, from 2018 to 2023, this premium dissipated, with no significant difference in cost of equity observed between ESG leaders and other firms. Table 11 in the appendix exhibits the detailed regression results.

These findings suggest that the relationship between ESG performance and the cost of equity has evolved. While there was a longstanding discount (premium) for ESG laggards (leaders), recent years have shown a shift in this dynamic. This change indicates that the anticipated effects of ESG-driven divestment on the cost of equity, as outlined in Hypothesis 1b, may only have recently begun to manifest in the U.S. market.

4.2 The Effect of ESG Score on Cost of Equity

Shifting the focus to hypothesis 2, I analyse the relationship between a firm's corporate social performance, proxied using ESG scores from Refinitiv, and its implied cost of equity capital. Before examining whether the effect of ESG performance has changed over time, I explore the general effect by employing a regression model in which the cost of equity is regressed on the numerical ESG score, alongside year and industry fixed effects and a set of firm-specific control variables. The underlying assumption of this model is that higher ESG performance should be associated with a lower cost of equity, reflecting an enhanced investor base and/or reduced perceived risk.

The results presented in model 1 of Table 7 deviate from this expectation. Contrary to the hypothesised negative relationship, the analysis reveals a positive association between the ESG score and the cost of equity. Empirical evidence remains inconclusive regarding the relationship between ESG performance and cost of equity, particularly for the US market. For example, El Ghouli et al. (2011) find a negative relationship between CSP and the implied cost of equity based on a sample of 2,809 US firms between 1992 and 2007 and us-

ing KLD STATS to operationalise firms' corporate social performance. On the other hand, my findings align with Breuer et al. (2018), who find, i.a., that investor protection moderates the direction of the relationship. Managers in countries with low investor protection may not engage in CSR out of a genuine desire to be socially and environmentally responsible but instead extract private benefits through CSR spending (Breuer et al., 2018). In countries with weak investor protection—in their sample, among others, the USA—, they find a positive relationship between CSP, operationalised by ESG scores from Refinitiv, and the implied cost of equity capital between 2002–2015. These inconsistencies highlight the complexities and challenges inherent in measuring ESG performance, as the impact of ESG scores on financial outcomes appears to be sensitive to the specific methodologies employed. Berg, Kölbel, and Rigobon (2022) have also addressed this issue, emphasising the variability in results depending on how corporate social performance is assessed.

With the growing recognition among market participants that ESG factors can influence established firm risk categories, coupled with the expansion of divestment campaigns based on ESG scores and the increasing regulation and standardisation of firms' sustainability reporting—which reduces the risk of managers misallocating CSR spending—, I argue that today, the ESG factor exerts a negative effect on the cost of equity, even in countries with comparably slightly lower levels of investor protection such as the USA. To test this thesis, I extend the analysis by incorporating an interaction term between the ESG score and the year dummies to examine whether the previously positive effect has changed in recent years. The results of this extended model, presented in model 2 of Table 7 and Figure 6, indicate a significant temporal shift in the relationship. While the ESG score initially exhibited a significant positive effect on the cost of equity, this effect has steadily decreased over time, turning negative in 2018. Although the relationship was not significantly different from zero between 2019 and 2021, a significant negative effect can be observed in 2022 and 2023. This shift suggests a growing market recognition of the materiality of ESG performance, with investors increasingly associating higher ESG scores with a lower cost of equity.

4.3 Supplementary Analyses and Robustness Checks

To test the robustness of the overall positive association between ESG score and the cost of equity, I introduce a fixed effects model with clustered standard errors at the firm level that controls for all unobserved, time-invariant firm characteristics. Model 1 of Table 8 presents the results. Compared to the model with industry and year fixed effects (model 1, Table 7), the coefficient of ESG score remains very similar (0.90 vs. 0.95) and highly significant, confirming the robustness of the results. Furthermore, using the fixed effects model, I test whether the relationship between ESG score and cost of equity differs between different periods. I split the sample into two periods, 2003–2013 and 2014–2023, and separately estimated the fixed effects model. While the ESG score coefficient is significant for 2003–2013, the effect size decreases, and the significance vanishes for 2014–2023. This further

demonstrates that there has been a shift in the association between ESG scores and the cost of equity over time.

Next, I separately assess the relationship between environmental, social, and governance pillar scores and cost of equity, again by applying a fixed effects model. Models 4–6 of Table 8 present the results. Over the entire sample period, only the social and governance pillars show a statistically significant effect on the cost of equity, while the effect of the environmental score is insignificant.

5 Discussion and Conclusion

This study contributes to the literature on the financial implications of social values by investigating temporal changes in the relationship between firms' corporate social performance and the cost of equity.

First, the paper enhances the understanding of the sin stock premium. According to financial theory, the reduced investor base induced by investors' exclusionary investment practices leads to an increased cost of equity (Heinkel et al., 2001; Merton, 1987). Under the assumption that the portion of investors incorporating exclusionary investing has increased over time, the divergence between sin and non-sin stocks' cost of equity should have widened, too. The results presented in this article show a more nuanced picture. While firms in carbon-intensive industries, such as cement, oil, coal, and gas, have indeed experienced a growing cost of equity premium in recent years, no systematic premium has been found for firms in traditional sin industries like alcohol, tobacco, gambling, military, and firearms, suggesting that the market perceives the environmental profile as a material risk that is being priced in, rather than the reduced investor base causing a premium. The carbon premium is in line with recently published work. Using stock-level environmental scores based on MSCI ESG ratings data, Pástor et al. (2022) find a negative and widening cost of equity greenium measured as the difference between the implied cost of equity of green and brown stocks. Using a novel firm-level climate risk measure that is based on a textual analysis of earnings call transcript data, Li et al. (2024) find that firms with higher transition risk are valued at a discount in the equity market. Furthermore, based on firm-level toxic emission intensity, Hsu et al. (2023) find a pollution premium and propose a new systematic risk related to environmental policy uncertainty. The extension of the carbon premium could be a manifestation of increasing environmental policy uncertainty caused by governments' intensified efforts to combat climate change. By analysing firms in carbon-intensive industries, this study extends prior firm-specific research by demonstrating that the carbon premium is also evident at the industry level.

Second, I find evidence for temporal changes in how ESG scores are priced. One key finding is that in the past few years, ESG laggards, i.e., firms with particularly bad ESG profiles, show a cost of equity premium. On the other hand, ESG leaders show no significantly different cost of equity. Interestingly, over an extensive period, ESG laggards

(leaders) showed a negative (positive) cost of equity premium. Additionally, the association between ESG score and cost of equity has significantly shifted: While the relationship was consistently positive in the period 2003–2017, in recent years, a negative relationship has emerged. While the larger investor base, lower perceived risk level, and reduced information asymmetry of firms with better CSP theoretically lead to a lower cost of equity, Breuer et al. (2018, 2024) and Wang, Kartika, Wang, and Luo (2021) show that the reverse effect may occur if investors believe that corporate insiders can opportunistically exploit CSR activities to serve their interests. Findings from this study suggest that in the USA, the former three effects causing a lower cost of equity for firms with better CSP have taken precedence in recent years, possibly due to more sophisticated CSP measurement practices and regulatory interventions that diminish the risk of exploitative CSR activities. The findings are in line with Galluzzi and Segara (2023), who find changing ESG-cost of equity dynamics for U.S. firms after the Paris Agreement.

The evidence for temporal shifts in the financial implications of CSP should be carefully considered in future empirical research by utilising more recent data or explicitly testing for changes over time, thereby mitigating the risk of historical, potentially outdated patterns distorting results. Generally, while this paper presents evidence of temporal shifts, further research is needed to explore the underlying causes. Future studies could investigate the investor base and risk channel in more detail. Under the premise that the proportion of investors excluding firms operating in industries such as alcohol, tobacco, and gambling has increased, the absence of a sin premium presented in this article challenges the validity of the investor base channel. In addition to analysing sin stocks, this study utilises ESG data from Refinitiv to identify ESG laggards, which are likely to be divested by a significant portion of sustainable investors. The use of ESG ratings raises concerns regarding the divergence among different ESG rating agencies (Berg et al., 2022). However, this issue is mitigated here, as the identification focuses on the worst performers. While the overall correlation between ESG ratings from different providers is modest, the divergence is likely not so substantial that a firm deemed as laggard by one agency would be categorised as a high performer by another (cf. Fig. 1 in Berg et al., 2022). Nevertheless, future research could conceive a method to more precisely and explicitly identify shunned firms, allowing a more robust investigation of the investor base channel. For example, drawing on ESG data from different providers and identifying divested firms as the cross-section of ESG laggards is a promising strategy to ensure a robust identification of firms subject to exclusionary practices. Another approach could involve analysing the portfolios of major sustainable investment funds to identify firms that are systematically excluded from their investments.

This study contributes to the literature on the effectiveness of exclusion with implications for sustainable investors. There is no conclusive empirical evidence confirming the theoretical argument that a narrower investor base is causing a higher cost of equity. In conjunction with the large body of literature demonstrating a significant negative relation-

ship between corporate social performance and firm risk, it seems likely that the higher cost of equity seen in unethical and unsustainable firms is instead driven by perceived risk. In addition, even if exclusion were to result in an increased cost of equity, there is currently no evidence that such changes in asset prices have translated into changes in ESG practices (Kölbel et al., 2020). Blitz and Swinkels (2020) even argue that if the objective is to make firms more sustainable, exclusion might actually signal a failure. By excluding a firm, investors acknowledge that their view is in the minority and have given up efforts to gain majority support to push for improved corporate social performance or to replace the executive board with one that aligns with shareholder demands. The impact of shareholder engagement is well supported in the literature (Kölbel et al., 2020). However, engagement demands significant effort, and investors often face pressure to enhance their sustainability profiles quickly. As a result, exclusion can be a more convenient, quick-fix solution, even though engagement may be more effective in driving changes in corporate practices and, in turn, positively impacting society and the environment.

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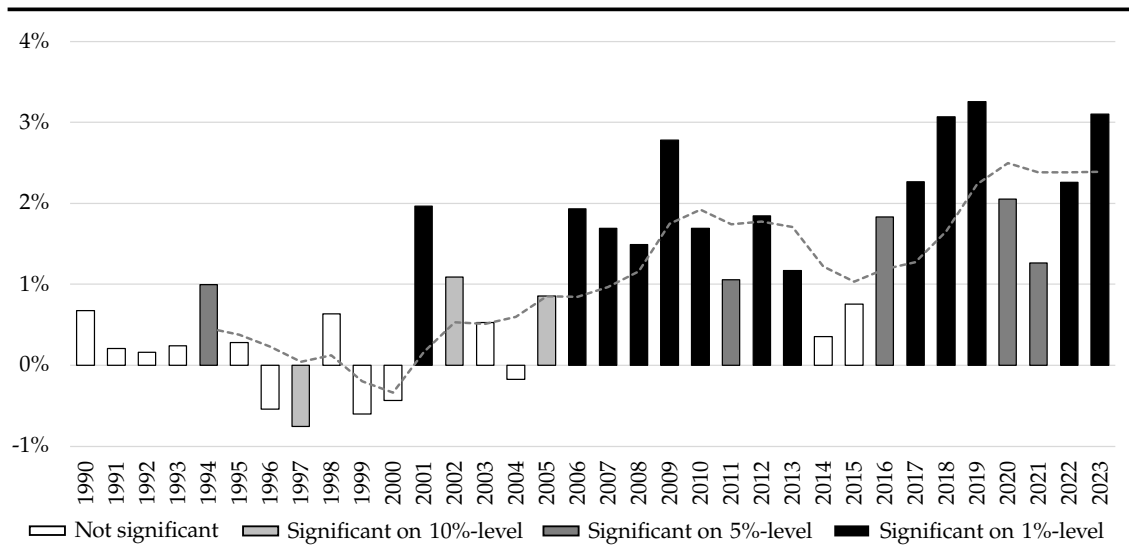


Figure 1: Temporal change in sin premium

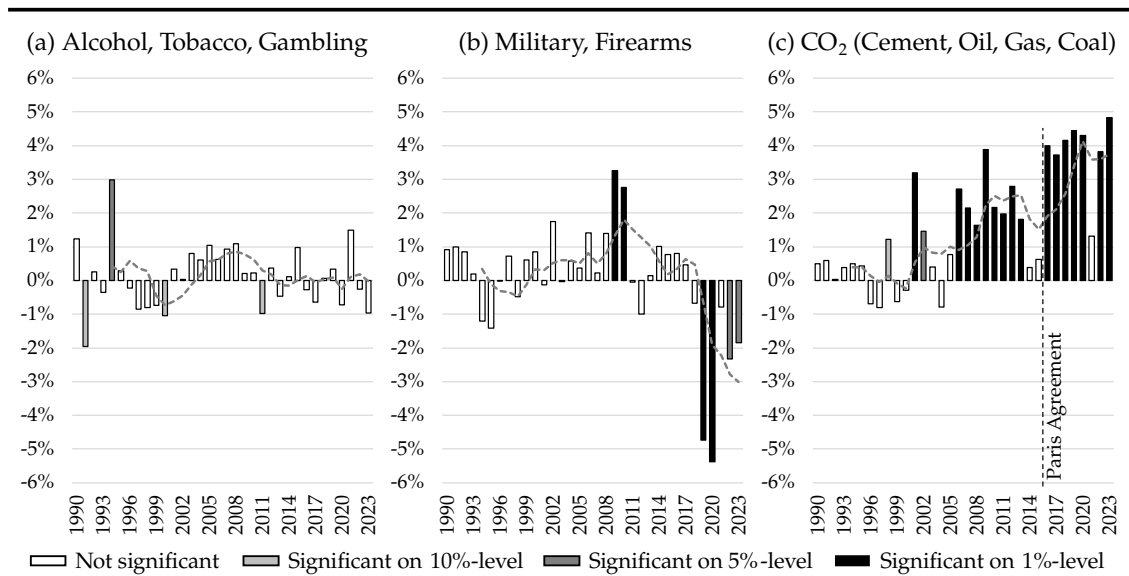
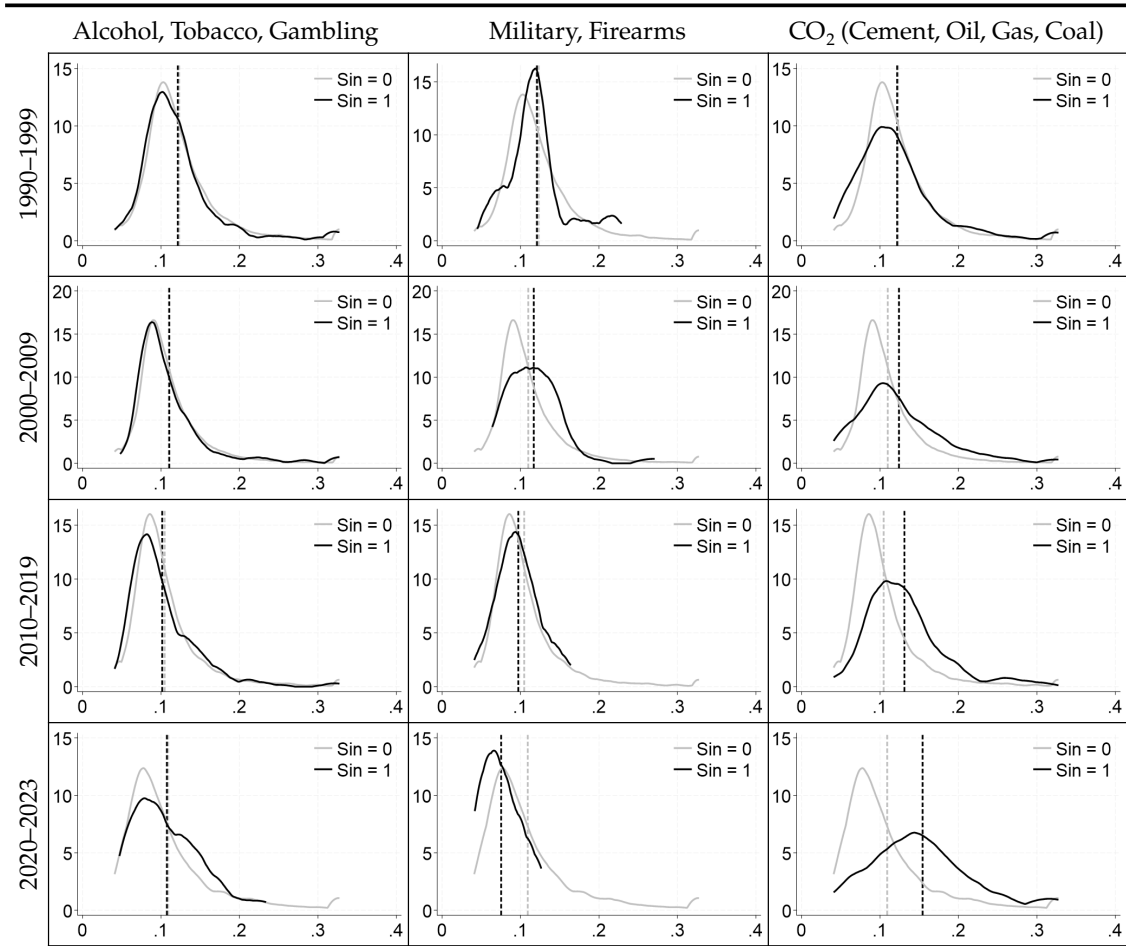
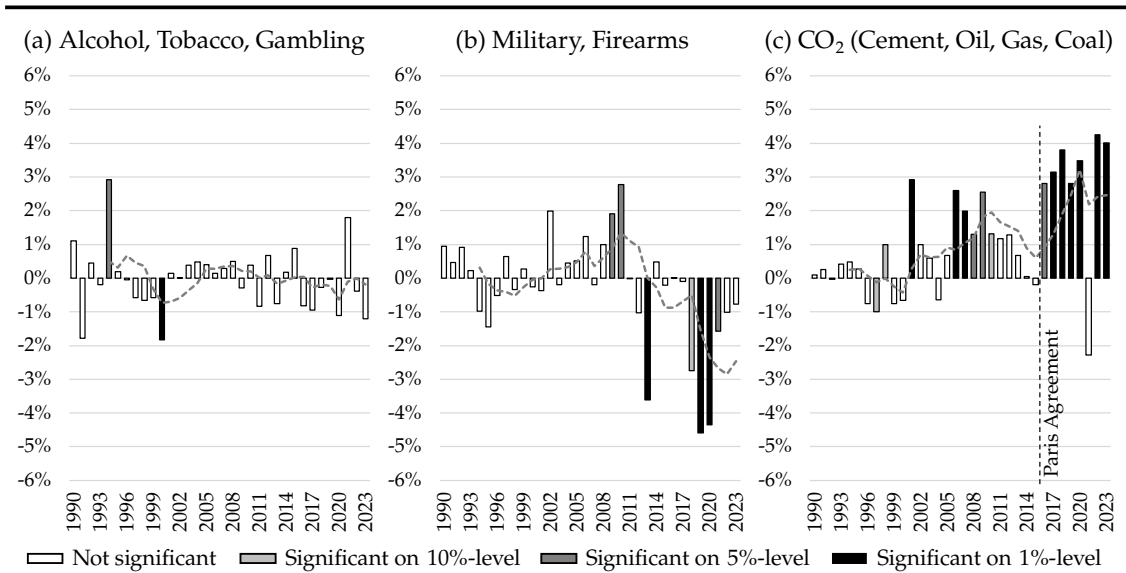


Figure 2: Temporal change in sin premium by sin group



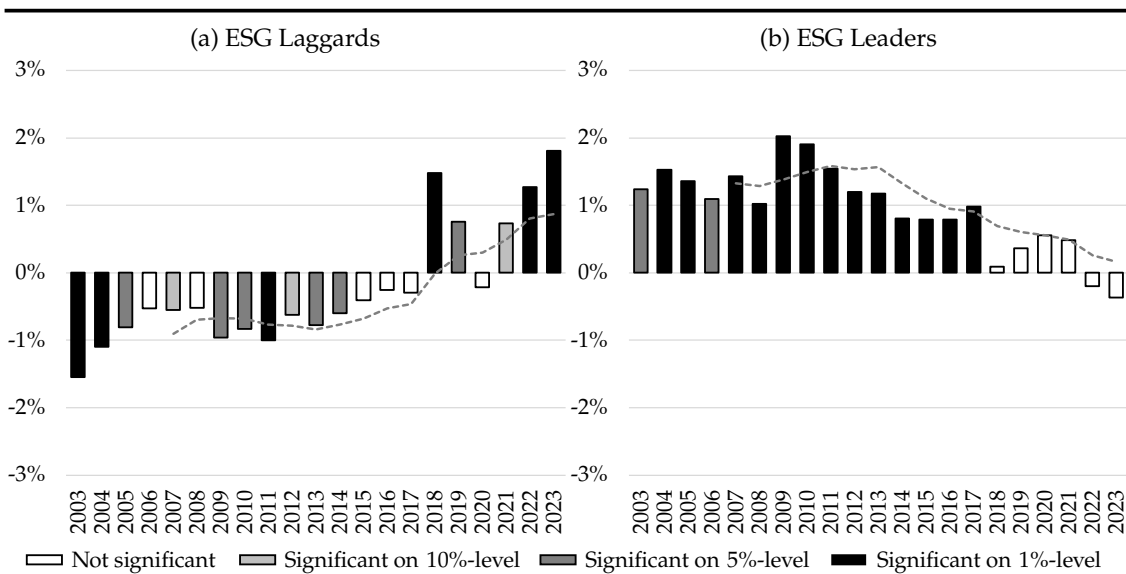
Kernel density estimates (solid lines) and mean values (dashed lines) of the implied cost of equity capital, grouped by firms operating in the industries alcohol/tobacco/gambling, military/firearms, or oil/coal/gas/cement (Sin = 1) and non-sin industries (Sin = 0), across each decade. The y-axis represents the kernel density. The x-axis represents the implied cost of equity capital.

Figure 3: Kernel density estimates and mean values by sin group and decade



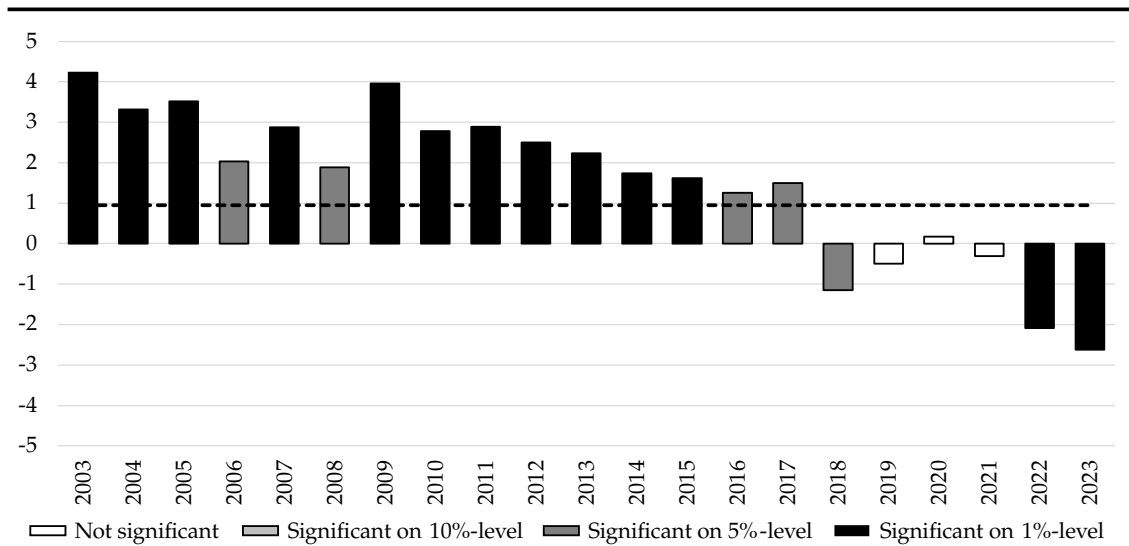
Annual cost of equity premium/discount of sin stocks by sin group measured as the difference in average cost of equity between sin and non-sin stocks calculated using annual kernel-based propensity score matching. Propensity scores estimated based on a probit model using the variables sin-dummy, beta, size, market-to-book ratio, return on equity and Zscore. Restricted to observations with common support. Significance based on bootstrapped standard errors using 1,000 repetitions. The dotted line shows the five-year average premium/discount.

Figure 4: Temporal change in sin premium by sin group (propensity score matching)



Annual cost of equity premium/discount of ESG laggards (left panel) / leaders (right panel) measured as the coefficient of the interaction term laggard/leader-dummy $\times$ year in the industry and year fixed panel regression with cost of equity as dependent and beta, size, market-to-book ratio, leverage, return on equity and Zscore as control variables. Significance is tested jointly for ESG-dummy + ESG-dummy $\times$ year. The dotted line shows the five-year average premium/discount.

Figure 5: Temporal change in ESG laggards (leaders) premium



Annual effect of ESG score on cost of equity measured as the joint coefficient of ESG score + ESG score x year in the industry and year fixed panel regression with cost of equity as dependent and beta, size, market-to-book ratio, leverage, return on equity and Zscore as control variables. Significance is tested jointly for ESG score + ESG score x year. The dotted line shows the effect of ESG score on cost of equity over the whole sample period (i.e., in the regression model without the interaction term ESG score x year). The effect size is given in basis points.

Figure 6: Temporal change in the relationship between ESG score and cost of equity

Industry	SIC	NAICS
Alcohol	2081-2085	325193, 4248, 42481, 424810, 42482, 424820, 7224, 72241, 722410
Tobacco	2100-2199	424940, 453991, 11191, 111910, 312, 3122, 31221, 312210, 31222, 312221, 312229, 312230
Gambling	-	7132, 71312, 713120, 713210, 71329, 713290, 72112, 721120
Military	3760–3769, 3795, 3480-3489	336992
Firearms	-	332992-332994
Cement	3240-3241	-
Oil, Coal, Gas	1300, 1310-1339, 1370-1382, 1389, 2900-2912, 2990–2999	-
(Biotech	3240-3241)	

The list of SIC/NAICS for different SIN categories.

Table 1: List of SIC and NAICS codes for controversial industry sectors

Year	SIN			Non-SIN	Total
	Alcohol, Tobacco, Gambling	Military, Firearms	CO ₂ (Cement, Oil, Coal, Gas)		
1990	12	5	43	1,074	1,134
1991	11	7	48	1,162	1,228
1992	12	7	49	1,270	1,338
1993	15	7	65	1,476	1,563
1994	25	6	72	1,649	1,752
1995	30	7	74	1,875	1,986
1996	31	7	90	1,955	2,083
1997	35	6	106	2,160	2,307
1998	32	7	93	2,230	2,362
1999	31	5	69	2,145	2,250
2000	29	5	69	1,888	1,991
2001	27	4	42	1,524	1,597
2002	30	5	77	1,505	1,617
2003	29	5	42	1,565	1,641
2004	33	5	50	1,774	1,862
2005	34	4	50	1,698	1,786
2006	32	5	57	1,712	1,806
2007	25	5	58	1,663	1,751
2008	22	6	66	1,503	1,597
2009	19	3	44	1,221	1,287
2010	22	5	59	1,413	1,499
2011	21	5	53	1,395	1,474
2012	22	4	47	1,392	1,465
2013	20	3	56	1,356	1,435
2014	21	6	55	1,333	1,415
2015	18	4	29	1,338	1,389
2016	19	3	20	1,276	1,318
2017	21	4	47	1,229	1,301
2018	18	3	60	1,239	1,320
2019	18	2	58	1,205	1,283
2020	10	2	19	979	1,010
2021	16	3	36	1,105	1,160
2022	20	2	38	1,131	1,191
2023	17	4	52	1,210	1,283

Sample breakdown by year and firm category.

Table 2: Sample distribution

Variables	N	Mean	S. D.	Min	P25	P50	P75	Max
Cost of Equity (w)	53,481	0.11	0.05	0.04	0.08	0.10	0.13	0.33
Beta (w)	53,481	0.97	0.51	-0.08	0.61	0.93	1.28	2.45
Size (ln)	53,481	6.81	1.97	0.02	5.37	6.70	8.13	13.24
Market-to-Book Ratio (ln)	53,481	0.91	0.79	-3.03	0.37	0.83	1.34	9.87
Leverage	53,481	0.49	0.20	0.00	0.33	0.50	0.64	1.72
Return on Equity (w)	53,481	0.11	0.20	-0.80	0.05	0.12	0.18	0.94
Zscore (w)	53,481	6.33	2.81	-2.45	4.76	5.87	7.49	16.90
ESG Score	14'004	43.00	19.87	0.63	26.96	40.38	57.99	95.16

Firm-year observations, mean, standard deviation, minimum, first quartile, median, third quartile, and maximum of cost of equity and control variables. "w" stands for winsorised at the 1%-level. "ln" stands for logarithmic.

Table 3: Summary statistics

Correlation	1	2	3	4	5	6	7	8
1 Cost of Equity	1.00							
2 Beta	-0.02	1.00						
3 Size	-0.22	0.07	1.00					
4 Market-to-Book Ratio	-0.24	0.20	0.00	1.00				
5 Leverage	0.06	-0.13	0.43	0.06	1.00			
6 Return on Equity	-0.18	-0.06	0.13	0.34	0.08	1.00		
7 Zscore	-0.15	0.03	-0.18	0.07	-0.68	0.24	1.00	
8 ESG Score	-0.04	-0.16	0.53	0.07	0.20	0.12	-0.03	1.00

Table 4: Correlation matrix

Dependent Variable	Cost of Equity					
	Alcohol, Tobacco, Gambling		Military, Firearms		CO ₂ (Cement, Oil, Coal, Gas)	
SIN category						
SIN	0.0009 (0.12)	-0.0008 (-0.14)	0.0075 (0.56)	0.0011 (0.10)	-0.0071* (-1.79)	0.0007 (0.23)
Year	-0.0003*** (-5.49)		-0.0003*** (-5.46)		-0.0003*** (-5.26)	
SIN x Year	0.0000 (-0.07)		-0.0004 (-0.53)		0.0014*** (7.18)	
SIN + SIN x 2000s		0.0039 (0.26)		0.0090* (3.20)		0.0152*** (19.19)
SIN + SIN x 2010s		-0.0007 (0.02)		0.0030 (0.12)		0.0271*** (74.36)
SIN + SIN x 2020s		-0.0001 (0.00)		-0.0243*** (9.52)		0.0364*** (39.76)
Beta	0.0071*** (11.12)	0.0076*** (11.89)	0.0071*** (11.07)	0.0076*** (11.82)	0.0070*** (11.11)	0.0076*** (11.97)
Size	-0.0069*** (-24.02)	-0.0070*** (-24.65)	-0.0069*** (-24.23)	-0.0070*** (-24.83)	-0.0070*** (-25.24)	-0.0071*** (-25.78)
Market-to-Book Ratio	-0.0136*** (-27.33)	-0.0142*** (-28.60)	-0.0137*** (-27.34)	-0.0143*** (-28.60)	-0.0139*** (-27.99)	-0.0145*** (-29.20)
Leverage	0.0432*** (14.17)	0.0423*** (13.78)	0.0432*** (14.05)	0.0424*** (13.66)	0.0419*** (13.80)	0.0410*** (13.39)
Return on Equity	-0.0148*** (-8.69)	-0.0140*** (-8.15)	-0.0153*** (-8.92)	-0.0145*** (-8.40)	-0.0143*** (-8.48)	-0.0134*** (-7.95)
Zscore	-0.0009*** (-5.05)	-0.0009*** (-4.90)	-0.0009*** (-5.10)	-0.0009*** (-4.95)	-0.0010*** (-5.40)	-0.0010*** (-5.27)
Constant	0.1563*** (61.17)	0.1569*** (59.80)	0.1565*** (60.99)	0.1572*** (59.61)	0.1580*** (62.34)	0.1586*** (60.99)
Control for Decade	No	Yes	No	Yes	No	Yes
Adjusted R ²	0.16	0.16	0.16	0.16	0.16	0.16
Observations	51,427	51,427	50,811	50,811	52,543	52,543

Regression of cost of equity on control variables and the variables sin-dummy, year/decade and the interaction sin-dummy x year/decade. Year is an ordinal variable starting at 1 (1990) and ending at 34 (2023). Decade is a categorical variable. t/f-values in parentheses, clustered at firm level. Significance levels: *10%, **5%, ***1%.

Table 5: Decade-wise examination of sin premium

SIN cat.	Alcohol, Tobacco, Gambling				Military, Firearms				CO ₂ (Cement, Oil, Coal, Gas)			
Decade	1990s	2000s	2010s	2020s	1990s	2000s	2010s	2020s	1990s	2000s	2010s	2020s
SIN	-0.0012 (-0.30)	0.0006 (0.17)	-0.0022 (-0.58)	0.0022 (0.33)	0.0012 (0.13)	0.0055 (0.69)	-0.0040 (-0.39)	-0.0501*** (-3.56)	0.0023 (0.93)	0.0110*** (3.72)	0.0160*** (4.99)	0.0246*** (3.27)
Beta	-0.0056 (-0.72)	0.0185 (1.31)	0.0097 (0.85)	0.0420*** (4.42)	0.0065 (0.31)	0.0016 (0.09)	0.0025 (0.15)	-0.2080*** (-3.55)	0.0197*** (3.22)	0.0052 (0.79)	0.0034 (0.34)	0.0027 (0.20)
Size	-0.0112*** (-4.97)	-0.0034* (-1.73)	-0.0084*** (-4.71)	-0.0091*** (-3.39)	-0.0122*** (-2.85)	-0.0062 (-1.40)	-0.0094** (-2.22)	-0.0531*** (-3.39)	-0.0137*** (-6.47)	-0.0064*** (-4.28)	-0.0092*** (-3.12)	-0.0076** (-2.51)
MB	-0.0055 (-0.95)	-0.0108*** (-2.79)	-0.0282*** (-3.96)	-0.0257*** (-5.31)	0.0008 (0.08)	-0.0124 (-1.05)	-0.0094 (-0.87)	0.0026 (0.21)	-0.0085*** (-2.57)	-0.0044 (-1.21)	-0.0094*** (-2.95)	-0.0224*** (-2.34)
Leverage	0.0487 (1.47)	-0.0320 (-0.84)	0.0669** (2.33)	0.0507 (0.81)	0.1366*** (2.69)	0.0923 (1.25)	-0.0409 (-0.70)	0.2676* (2.12)	-0.0087 (-0.37)	0.0107 (0.57)	0.0693*** (2.98)	0.0805** (2.20)
ROA	-0.0327 (-1.39)	-0.0103 (-0.86)	0.0370** (1.98)	-0.0250 (-1.32)	-0.0573 (-1.05)	-0.0947 (-1.49)	0.0666 (0.92)	-0.1068* (-1.84)	0.0221 (1.52)	-0.0234 (-1.55)	0.0173 (1.21)	-0.0058 (-0.22)
Zscore	0.0009 (0.38)	-0.0023 (-1.02)	0.0012 (0.66)	-0.0022 (-0.54)	0.0045 (1.09)	0.0036 (0.84)	-0.0078*** (-2.85)	0.0160** (2.25)	-0.0052** (-2.44)	-0.0016 (-0.96)	0.0011 (0.69)	-0.0008 (-0.22)
Constant	0.1748*** (5.67)	0.1678*** (5.80)	0.1374*** (5.48)	0.1586** (2.55)	0.1013 (1.48)	0.1082** (2.07)	0.2376*** (5.70)	0.4845*** (5.55)	0.2370*** (12.57)	0.1661*** (8.35)	0.1558*** (4.44)	0.1635*** (3.42)
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	467	552	398	124	128	93	78	22	1,369	1,069	893	272

Regression of cost of equity on a sin dummy and the control variables. Separated by sin group and decade. t-values in parentheses, clustered at the matched pair level. Significance levels: *10%, **5%, ***1%. The samples used in the regressions consist only of sin stocks of the respective sin group and one-to-one matched non-sin stocks based on nearest neighbour matching.

Table 6: Decade-wise examination of sin premium (propensity score matched sample)

Dependent Variable	Cost of Equity	
Model	(1)	(2)
ESG Score	0.95*** (2.80)	4.22*** (3.15)
Beta	165.30*** (11.31)	167.39*** (11.46)
Size	-42.36*** (-7.39)	-37.73*** (-6.47)
Market-to-Book Ratio	-155.42*** (-19.95)	-153.64*** (-19.77)
Leverage	496.41*** (10.66)	502.41*** (10.71)
Return on Equity	19.12 (1.16)	20.53 (1.24)
Zscore	-1.17 (-0.36)	-0.04 (-0.01)
ESG Score + ESG Score x year2004		3.31***
ESG Score + ESG Score x year2005		3.51***
ESG Score + ESG Score x year2006		2.03**
ESG Score + ESG Score x year2007		2.87***
ESG Score + ESG Score x year2008		1.89**
ESG Score + ESG Score x year2009		3.95***
ESG Score + ESG Score x year2010		2.78***
ESG Score + ESG Score x year2011		2.89***
ESG Score + ESG Score x year2012		2.50***
ESG Score + ESG Score x year2013		2.24***
ESG Score + ESG Score x year2014		1.73***
ESG Score + ESG Score x year2015		1.62***
ESG Score + ESG Score x year2016		1.26**
ESG Score + ESG Score x year2017		1.50**
ESG Score + ESG Score x year2018		-1.15**
ESG Score + ESG Score x year2019		-0.49
ESG Score + ESG Score x year2020		0.18
ESG Score + ESG Score x year2021		-0.31
ESG Score + ESG Score x year2022		-2.09***
ESG Score + ESG Score x year2023		-2.62***
Constant	1017.14***	869.65***
Industry & Year Fixed Effects	Yes	Yes
Adjusted R ²	0.23	0.24
Observations	14'004	14'004

Model (1): Regression of cost of equity on ESG score and control variables with industry and year fixed effects. Model (2): Regression of cost of equity on the control variables and the variables ESG score, year and the interaction ESG score x year. The table reports the joint coefficient and significance of ESG score + ESG score x year (cf. separate bar plot). The effect size is given in basis points. t-values in parentheses, clustered at firm level. Significance levels: *10%, **5%, ***1%.

Table 7: Temporal change in the relationship between ESG score and cost of equity

Dependent Variable	Cost of Equity					
	(1)	(2)	(3)	(4)	(5)	(6)
Sample Period	2003-2023	2003-2013	2014-2023	2003-2023	2003-2023	2003-2023
ESG Score	0.90*** (2.73)	0.89** (2.11)	0.33 (0.68)			
Environmental Score				0.34 (1.28)		
Social Score					0.57*** (2.82)	
Governance Score						0.63** (2.20)
Beta	76.66*** (5.87)	59.47*** (3.78)	92.84*** (5.70)	76.74*** (5.86)	76.74*** (5.87)	76.35*** (5.84)
Size	25.83 (1.59)	50.48** (2.00)	-36.70** (-2.05)	26.64 (1.62)	27.59* (1.70)	26.06 (1.62)
Market-to-Book Ratio	-80.09*** (-8.92)	-14.30 (-0.95)	-104.26*** (-9.27)	-79.70*** (-8.84)	-79.19*** (-8.78)	-80.07*** (-8.92)
Leverage	526.06*** (9.02)	189.61** (2.08)	598.67*** (8.05)	526.26*** (9.01)	524.45*** (8.99)	525.40*** (9.02)
Return on Equity	-58.72*** (-4.48)	-73.36** (-2.52)	-60.25*** (-3.69)	-58.70*** (-4.47)	-59.32*** (-4.52)	-58.79*** (-4.49)
Zscore	6.98* (1.65)	-4.47 (-0.77)	9.34* (1.65)	7.07* (1.67)	6.96* (1.65)	6.99* (1.65)
Constant	451.39*** (3.67)	397.20** (2.00)	866.96*** (5.63)	460.40*** (3.71)	429.74*** (3.47)	454.71*** (3.71)
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R ²	0.56	0.61	0.59	0.56	0.56	0.56
Observations	13,832	4,970	8,812	13,832	13,832	13,832

Regression of cost of equity on ESG score (model 1-3) and E/S/G score (model 4/5/6) and control variables with firm and year fixed effects. The effect size is given in basis points. t -values in parentheses, clustered at firm level.
Significance levels: *10%, **5%, ***1%.

Table 8: Supplementary analysis and robustness checks

Appendix

A – Implied Cost of Equity Capital Models

P_t is the firm's stock price at time t . DPS_t is the last actual dividend per share. B_t is the last actual book value per share. EPS_t is the last actual earnings per share. $EPS_{t+\delta}$ is the analysts' expected EPS for year δ from I/B/E/S. The long-term growth rate LTG_t is set to the expected inflation rate at time t . The dividend payout ratio DPR_t is set to DPS_t/EPS_t . If unavailable, the dividend payout ratio is replaced by the industry-average dividend payout ratio in the respective year. $Growth_{IBES}$ is the analysts' expected long-term growth rate for EPS from I/B/E/S. If unavailable, $Growth_{IBES}$ is replaced by $(EPS_{t+2} - EPS_{t+1})/EPS_{t+1}$. The ICC is calculated in the month of June for each year. While the models of Ohlson and Juettner-Nauroth (2005) and Easton (2004) have closed-form solutions, in the model of Claus and Thomas (2001), the ICC is calculated using the generalised reduced gradient method to equate the right and left hand sides of the valuation equation.

Model of Ohlson and Juettner-Nauroth (2005):

$$ICC_{OJ} = A + \sqrt{A^2 + \frac{EPS_{t+1}}{P_t} * (STG_t - LTG_t)}$$

where

$$A = \frac{1}{2} * \left(LTG_t + \frac{DPR_t * EPS_{t+1}}{P_t} \right)$$

$$STG_t = ShortTermGrowth_t = \frac{1}{2} * \left(\frac{EPS_{t+2} - EPS_{t+1}}{EPS_{t+1}} + Growth_{IBES} \right)$$

Model of Claus and Thomas (2001):

$$P_t = B_t + \sum_{\delta=1}^5 \frac{EPS_{t+\delta} - ICC_{CT} * B_{t+\delta-1}}{(1 + ICC_{CT})^\delta} + \frac{(EPS_{t+5} - ICC_{CT} * B_{t+5-1})(1 + LTG_t)}{(ICC_{CT} - LTG_t)(1 + ICC_{CT})^5}$$

where

$$B_{t+\delta} = B_{t+\delta-1} + EPS_{t+\delta} * (1 - DPR) \text{ for } \delta = 1 \text{ to } 5 \text{ (clean surplus accounting)}$$

$$EPS_{t+\delta} = EPS_{t+\delta-1} * (1 + Growth_{IBES}) \text{ for } \delta = 3 \text{ to } 5 \text{ if } EPS_{t+\delta} \text{ is unavailable}$$

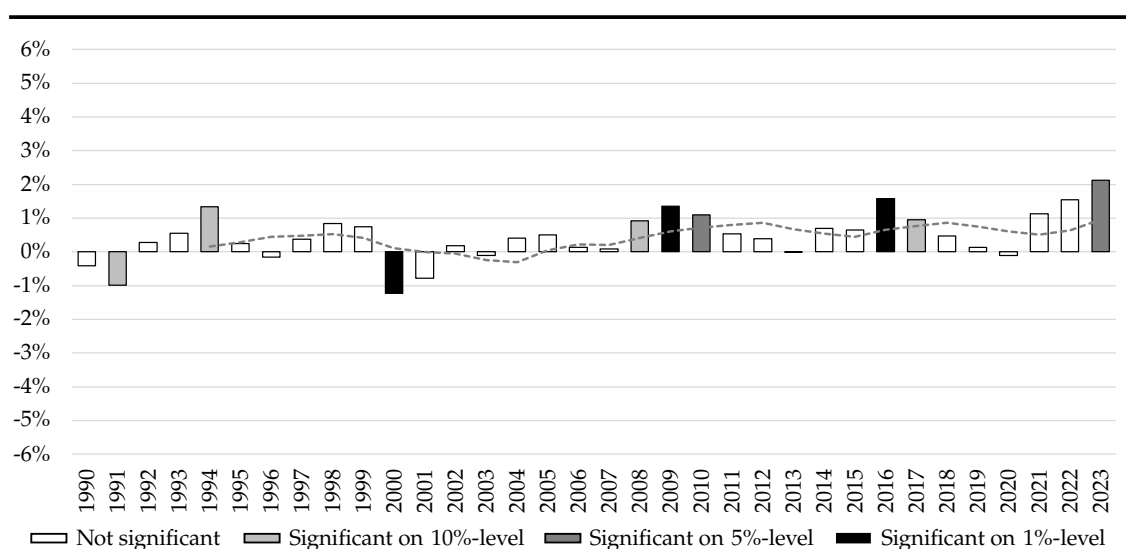
Model of Easton (2004):

$$ICC_E = A + \sqrt{A^2 + \frac{EPS_{t+2} - EPS_{t+1}}{P_t}}$$

where

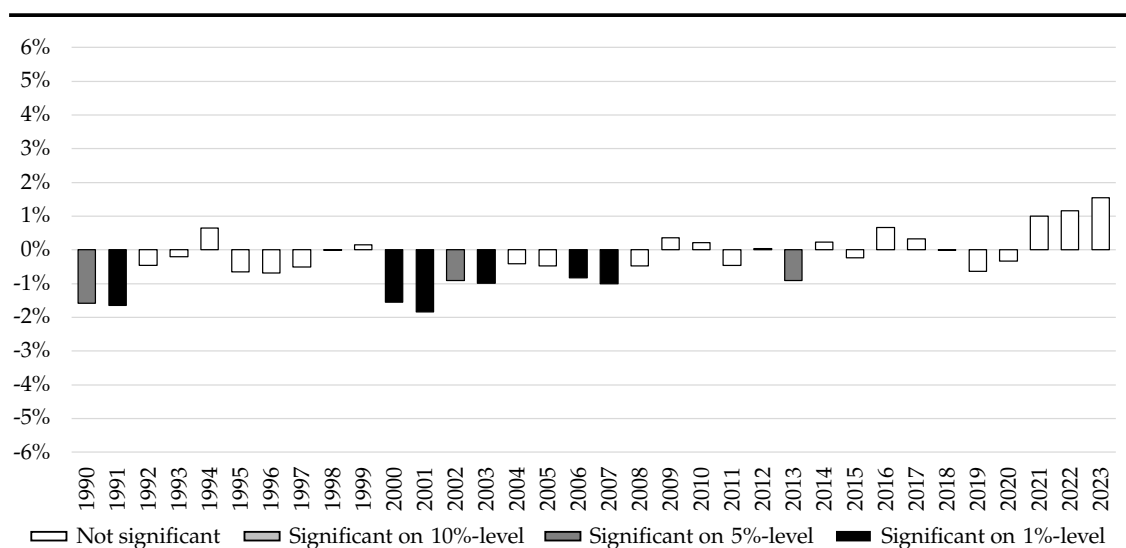
$$A = \frac{DPS_t}{2P_t}$$

B – Cost of Equity Premium of Biotech Companies



Annual cost of equity premium/discount of biotech stocks measured as the coefficient of the interaction term biotech-dummy x year in the year fixed panel regression with cost of equity as dependent and beta, size, market-to-book ratio, leverage, return on equity and Zscore as control variables. Significance is tested jointly for biotech-dummy + biotech-dummy x year. The dotted line shows the five-year average premium/discount.

Figure 7: Cost of equity premium of biotech companies



Annual cost of equity premium/discount of biotech stocks measured as the difference in cost of equity between biotech and non-biotech stocks calculated using annual kernel-based propensity score matching. Propensity scores estimated based on a probit model using the variables sin-dummy, beta, size, market-to-book ratio, return on equity and Zscore. Restricted to observations with common support. Significance based on bootstrapped standard errors using 1,000 repetitions.

Figure 8: Cost of equity premium of biotech companies (propensity score matching)

C – Regression Output

Dependent Variable	Cost of Equity			
SIN category	Overall	Alcohol, Tob - acco, Gambling	Military, Firearms	CO ₂ (Cement, Oil, Coal, Gas)
Beta	0.0088*** (13.25)	0.0087*** (12.98)	0.0088*** (13.02)	0.0087*** (12.97)
Size	-0.0068*** (-24.49)	-0.0067*** (-23.50)	-0.0068*** (-23.69)	-0.0068*** (-24.61)
Market-to-Book Ratio	-0.0141*** (-27.78)	-0.0139*** (-27.07)	-0.0139*** (-27.05)	-0.0140*** (-27.56)
Leverage	0.0400*** (13.20)	0.0414*** (13.48)	0.0414*** (13.39)	0.0402*** (13.16)
Return on Equity	-0.0143*** (-8.56)	-0.0151*** (-8.83)	-0.0156*** (-9.14)	-0.0150*** (-8.89)
Zscore	-0.0011*** (-5.76)	-0.0010*** (-5.38)	-0.0010*** (-5.40)	-0.0010*** (-5.69)
SIN	0.0067	0.0124	0.0091	0.0049
SIN + SIN x year1991	0.0021	-0.0196	0.0099	0.0059
SIN + SIN x year1992	0.0016	0.0026	0.0085	0.0004
SIN + SIN x year1993	0.0024	-0.0036	0.0020	0.0038
SIN + SIN x year1994	0.0100**	0.0298**	-0.0121	0.0049
SIN + SIN x year1995	0.0028	0.0029	-0.0142	0.0044
SIN + SIN x year1996	-0.0054	-0.0023	-0.0002	-0.0070
SIN + SIN x year1997	-0.0076*	-0.0086	0.0072	-0.0081
SIN + SIN x year1998	0.0063	-0.0080	-0.0048	0.0122**
SIN + SIN x year1999	-0.0060	-0.0074	0.0060	-0.0063
SIN + SIN x year2000	-0.0043	-0.0104*	0.0085	-0.0028
SIN + SIN x year2001	0.0197***	0.0034	-0.0013	0.0319***
SIN + SIN x year2002	0.0109*	0.0003	0.0174	0.0146**
SIN + SIN x year2003	0.0053	0.0080	-0.0004	0.0040
SIN + SIN x year2004	-0.0018	0.0060	0.0057	-0.0078
SIN + SIN x year2005	0.0086*	0.0103	0.0036	0.0076
SIN + SIN x year2006	0.0193***	0.0062	0.0140	0.0271***
SIN + SIN x year2007	0.0169***	0.0093	0.0022	0.0215***
SIN + SIN x year2008	0.0149***	0.0109	0.0140	0.0164***
SIN + SIN x year2009	0.0278***	0.0021	0.0325***	0.0388***
SIN + SIN x year2010	0.0169***	0.0022	0.0275***	0.0216***
SIN + SIN x year2011	0.0106**	-0.0098*	-0.0004	0.0198***
SIN + SIN x year2012	0.0184***	0.0037	-0.0100	0.0278***
SIN + SIN x year2013	0.0117***	-0.0047	0.0015	0.0182***
SIN + SIN x year2014	0.0035	0.0011	0.0100	0.0038
SIN + SIN x year2015	0.0075	0.0097	0.0078	0.0063
SIN + SIN x year2016	0.0183**	-0.0028	0.0081	0.0400***
SIN + SIN x year2017	0.0227***	-0.0065	0.0046	0.0372***
SIN + SIN x year2018	0.0307***	0.0007	-0.0067	0.0416***
SIN + SIN x year2019	0.0326***	0.0033	-0.0474***	0.0445***
SIN + SIN x year2020	0.0205**	-0.0072	-0.0538***	0.0429***
SIN + SIN x year2021	0.0126**	0.0149	-0.0079	0.0131
SIN + SIN x year2022	0.0226***	-0.0026	-0.0233**	0.0382***
SIN + SIN x year2023	0.0310***	-0.0096	-0.0184**	0.0483***
Constant	0.1619***	0.1606***	0.1608***	0.1623***
Year Fixed Effects	Yes	Yes	Yes	Yes
Adjusted R ²	0.18	0.18	0.18	0.18
Observations	53,481	51,427	50,811	52,543

Regression of cost of equity on control variables and the variables sin-dummy, year and the interaction sin-dummy x year. The table reports the joint coefficient and significance of sin-dummy + sin-dummy x year (cf. separate bar plot). t-values in parentheses, clustered at firm level. Significance levels: *10%, **5%, ***1%.

Table 9: Temporal change in sin premium

SIN category	Difference in Cost of Equity between SIN and non -SIN stocks based on PSM							
	Overall		Alcohol, Tobacco, Gambling		Military, Firearms		CO ₂ (Cement, Oil, Coal, Gas)	
	Diff.	t-stat.	Diff.	t-stat.	Diff.	t-stat.	Diff.	t-stat.
1990	0.49%	0.60	1.11%	0.56	0.95%	0.43	0.09%	0.09
1991	-0.16%	-0.24	-1.79%	-1.46	0.47%	0.35	0.25%	0.28
1992	0.08%	0.10	0.45%	0.24	0.91%	0.62	-0.04%	-0.04
1993	0.22%	0.38	-0.19%	-0.30	0.22%	0.11	0.42%	0.59
1994	0.95%	1.82	2.92%	2.35	-0.98%	-0.64	0.47%	0.86
1995	0.08%	0.16	0.20%	0.19	-1.45%	-0.73	0.27%	0.46
1996	-0.55%	-1.18	-0.04%	-0.05	-0.52%	-0.27	-0.75%	-1.34
1997	-0.90%	-2.02	-0.58%	-0.72	0.65%	0.42	-0.99%	-1.87
1998	0.52%	1.15	-0.66%	-0.78	-0.33%	-0.29	0.99%	1.77
1999	-0.53%	-1.02	-0.57%	-0.63	0.28%	0.25	-0.75%	-1.14
2000	-0.87%	-1.52	-1.82%	-2.75	-0.27%	-0.19	-0.66%	-0.87
2001	1.65%	2.22	0.15%	0.13	-0.36%	-0.27	2.91%	3.02
2002	0.85%	1.47	0.01%	0.02	1.98%	0.63	1.00%	1.32
2003	0.49%	0.84	0.39%	0.37	-0.19%	-0.11	0.59%	0.74
2004	-0.21%	-0.41	0.48%	0.52	0.45%	0.61	-0.64%	-0.94
2005	0.58%	1.15	0.39%	0.44	0.51%	0.66	0.67%	1.04
2006	1.73%	3.44	0.15%	0.18	1.24%	0.67	2.61%	4.14
2007	1.36%	2.63	0.30%	0.34	-0.19%	-0.20	1.99%	2.99
2008	1.02%	1.90	0.49%	0.41	0.99%	0.81	1.30%	2.14
2009	2.26%	3.02	-0.29%	-0.40	1.91%	2.20	2.55%	2.31
2010	1.38%	2.44	0.38%	0.45	2.77%	2.45	1.32%	1.73
2011	0.80%	1.67	-0.84%	-1.40	0.00%	0.00	1.16%	1.58
2012	1.56%	2.64	0.67%	0.61	-1.03%	-0.96	1.29%	1.51
2013	0.74%	1.46	-0.76%	-0.89	-3.61%	-3.48	0.67%	0.93
2014	0.26%	0.51	0.18%	0.12	0.47%	0.43	0.04%	0.07
2015	0.38%	0.62	0.89%	0.60	-0.21%	-0.23	-0.19%	-0.31
2016	1.49%	1.97	-0.81%	-1.08	0.02%	0.05	2.80%	2.48
2017	2.15%	4.31	-0.94%	-1.51	-0.10%	-0.17	3.15%	4.97
2018	2.93%	4.65	-0.27%	-0.41	-2.75%	-1.96	3.81%	4.92
2019	2.10%	3.10	-0.04%	-0.04	-4.59%	-3.58	2.81%	3.11
2020	1.86%	1.89	-1.12%	-1.14	-4.34%	-8.92	3.48%	2.78
2021	0.73%	0.89	1.80%	1.44	-1.57%	-2.28	-2.28%	-1.17
2022	3.04%	3.29	-0.39%	-0.43	-1.01%	-1.07	4.25%	3.16
2023	2.71%	3.45	-1.21%	-1.05	-0.78%	-0.63	4.02%	4.39

Annual cost of equity premium/discount of sin stocks measured as the difference in average cost of equity between sin and non-sin stocks calculated using annual kernel-based propensity score matching. Propensity scores estimated based on a probit model using the variables sin-dummy, beta, size, market-to-book ratio, return on equity and Zscore. Restricted to observations with common support. Significance based on bootstrapped standard errors using 1,000 repetitions.

Table 10: Temporal change in sin premium (propensity score matching)

Dependent Variable	Cost of Equity	
	ESG Laggards (divested firms)	ESG Leaders (invested firms)
Beta	0.0168*** (9.68)	0.0150*** (9.24)
Size	-0.0028*** (-4.98)	-0.0047*** (-7.60)
Market-to-Book Ratio	-0.0149*** (-16.34)	-0.0160*** (-18.13)
Leverage	0.0519*** (9.46)	0.0462*** (9.25)
Return on Equity	0.0013 (0.65)	0.0026 (1.33)
Zscore	0.0002 (0.42)	-0.0003 (-0.91)
ESG-Laggard/Leader	-0.0155***	0.0124**
ESG-Lag./Lead. + ESG -Lag./Lead. x year2004	-0.0110***	0.0153***
ESG-Lag./Lead. + ESG -Lag./Lead. x year2005	-0.0080**	0.0136***
ESG-Lag./Lead. + ESG -Lag./Lead. x year2006	-0.0053	0.0109**
ESG-Lag./Lead. + ESG -Lag./Lead. x year2007	-0.0055*	0.0143***
ESG-Lag./Lead. + ESG -Lag./Lead. x year2008	-0.0052	0.0102***
ESG-Lag./Lead. + ESG -Lag./Lead. x year2009	-0.0096**	0.0203***
ESG-Lag./Lead. + ESG -Lag./Lead. x year2010	-0.0083**	0.0190***
ESG-Lag./Lead. + ESG -Lag./Lead. x year2011	-0.0100***	0.0154***
ESG-Lag./Lead. + ESG -Lag./Lead. x year2012	-0.0062*	0.0120***
ESG-Lag./Lead. + ESG -Lag./Lead. x year2013	-0.0077**	0.0117***
ESG-Lag./Lead. + ESG -Lag./Lead. x year2014	-0.0060**	0.0080***
ESG-Lag./Lead. + ESG -Lag./Lead. x year2015	-0.0041	0.0079***
ESG-Lag./Lead. + ESG -Lag./Lead. x year2016	-0.0025	0.0079***
ESG-Lag./Lead. + ESG -Lag./Lead. x year2017	-0.0029	0.0098***
ESG-Lag./Lead. + ESG -Lag./Lead. x year2018	0.0148***	0.0009
ESG-Lag./Lead. + ESG -Lag./Lead. x year2019	0.0076**	0.0036
ESG-Lag./Lead. + ESG -Lag./Lead. x year2020	-0.0021	0.0056
ESG-Lag./Lead. + ESG -Lag./Lead. x year2021	0.0073*	0.0048
ESG-Lag./Lead. + ESG -Lag./Lead. x year2022	0.0127***	-0.0020
ESG-Lag./Lead. + ESG -Lag./Lead. x year2023	0.0180***	-0.0037
Constant	0.0927***	0.1080***
Industry & Year Fixed Effects	Yes	Yes
Adjusted R ²	0.24	0.24
Observations	9,805	9,801

Regression of cost of equity on control variables and the variables ESG-laggard/leader-dummy, year and the interaction ESG-laggard/leader-dummy x year. The table reports the joint coefficient and significance of ESG-laggard/leader-dummy + ESG-laggard/leader-dummy x year (cf. separate bar plot). t-values in parentheses, clustered at firm level. Significance levels: *10%, **5%, ***1%.

Table 11: Temporal change in ESG laggards (leaders) premium