

Is investment capital cheaper for green firms? Evidence from equity listings at Euronext – Oslo

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We investigate whether the sustainability profile of a firm affects the terms at which the firm list on a stock market. Given the evidence that sustainable firms have a lower cost of capital, we expect this to also be reflected in the issue terms at an IPO. The laboratory for our investigation is new issues at Euronext Oslo. The average underpricing in the sample is in the 3%-4% region. Surprisingly we find little evidence of differences linked to the environmental stance of the firm. An implication is that the (negative) premium on green stocks (greenium) is lower in magnitude than previously thought.

Keywords: IPO; Cost of Capital; ESG; Underpricing

JEL Codes: G30; G12; G24

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Introduction

Concerns about climate change lead to a drive for economic and social transition towards a zero-emission society. But the necessary changes, such as transforming energy systems from fossil fuels to renewables, comes with the need for substantial capital investments. Raising such large amounts of capital is a prime function of stock markets. Stock markets are also key when small, innovative firms want to scale up. Well functioning stock markets that can both provide capital for large infrastructure investments and provide risk capital for innovative green investments are therefore key to the success of a transition to a more sustainable society. To what degree this is the case is an empirical question.

In this paper we investigate to what extent the environmental stance (greenness) of a firm affects the terms at which firms list (the initial public offer – IPO) on a stock exchange. Our laboratory is recent listings at the Oslo Stock Exchange

Our motivation is the current asset pricing literature that links environmental, social and governance (ESG) issues and stock market returns.¹ This theoretical literature is driven by hypothesized investor preferences for “good” ESG companies (green firms), which in the theory is modeled as utility from holding companies that satisfy the investors’ ESG criteria, beyond the pure monetary return. This leads to an increased demand for high quality ESG companies. This increased demand translates to higher prices (and lower expected returns) for these high quality ESG firms.

Such demand effects will also be present in the new issue market. One reason to suspect that the effects may be even higher in this market is the degree to which the new issue market is dominated by institutional investors. The institutional market has seen a remarkable increase in funds marketed as “sustainable.” Such funds are

¹See Starks (2023) for a survey of this asset pricing literature.

constrained in what type of firms they invest in and will be particularly interested in capital issues from firms classifiable as environmentally friendly.

Our research investigates whether such considerations are reflected either in the terms of issue (underpricing) at the IPO, or the subsequent stock performance. Specifically, we are investigating a sample of IPOs at Euronext-Oslo (Norway). There are several reasons why the Euronext-Oslo case is well suited for this study. First, this period saw a marked increase in new listings in Oslo, partially due to an innovation at the exchange, which introduced new markets with reduced listing requirements. This resulted in many new listings, particularly of companies with sustainable goals.

Second, the Norwegian market is well suited to study sustainability, as the other parts of ESG, S and G, are not varying much in the Norwegian context, due to social coherence and strongly regulated governance (For example, Norway was the first country to introduce a gender quota for corporate boards.)

A third issue concerns the scope for measurement of environmental quality. The Norwegian setting allows us to implement a number of alternative methods for ranking of firms in the environmental dimension. Starting in 2019, all OSE listed firms must report various ESG related measures, such as greenhouse gas emissions. We use the measures most relevant for environmental quality. An alternative measure uses the listing prospectuses of the IPOs. Text analysis is used to estimate the degree to which the company's business plans are sustainable. Finally, we manually group firms into green/brown/neutral.

Our estimations look for differences in issue terms linked to measures of the environmental quality of the firm. First, we look at the usual measure of underpricing in the IPO, the market price change from the issue price to the closing price during the first day of trading. Is the amount of underpricing linked to the sustainability profile of the firm?? Second, we look at secondary trading at the IPO date. Do sustainable firms have higher trading interest? Finally, we investigate the post-IPO performance.

Overall, the picture that emerges is one in which the environmental stance does not make a big difference. While there are some differences in point estimates, we can not find significant differences between green firms and others. This is actually somewhat surprising. Most of the asset pricing literature suggest return differences linked to ESG, differences that should also be affecting primary markets. One possible difference is our concentration on the "E" part of ESG. But that is refuted by research showing return differences linked to climate exposure (Bolton and Kacperczyk, 2021).

Our results also contrast with other studies that look at IPO and ESG issues. For example, in a study of the US market that looks at gender issues (the "S" part of ESG) in IPOs, Rau, Sandvik, and Vermaelen (2023) finds that underpricing is linked

significantly to the degree to which company boards are gender diversified.

The main implication of our results concerns the hypothesized negative return premium for green investment. Our results indicate that it is lower in magnitude than the typical estimates in the literature (Chava, 2014; Pástor, Stambaugh, and Taylor, 2022; Berle, He, and Ødegaard, 2024). One possibility is that the implied cost of capital for these IPOs in the period 2019-23 represent a forward-looking estimate of “greenium.” As such our estimates are in line with the estimates of expected greenium in Eskildsen, Ibert, Jensen, and Pedersen (2024).

The structure of the paper is as follows. We start with a literature discussion and hypothesis development, before section 2 introducing the setting, the market(s) for Oslo-listed equities, and providing some descriptives. We also discuss ESG data. Section 3 contains the results. Section 4 offers a conclusion.

1 Literature

This work intersects several financial research fields. In the following, we attempt to summarize the two key subplots of particular relevance (ESG linked asset pricing and IPOs) before looking at the intersection of the two and develop the hypotheses to be tested.

1.1 ESG and asset pricing

Our research questions will concern whether differences in corporate environmental stance is linked to differences in IPO terms. A necessary condition for this is that stock returns vary with environmental issues, or more generally, ESG. Are there theoretical frameworks that allow us to make this case? To simplify the discussion, let us label stocks with high-quality ESG “green” and those with low-quality ESG “brown.” There are two theoretical approaches to generating a price (return) difference between brown and green stocks.

The first is a mispricing argument. With this view, current stock prices do not fully reflect the ESG consequences of firms’ choices, which could be due to brown stocks’ prices not endogenizing the future climate consequences, or because the stock market does not appreciate the potential higher future returns for green firms “preparing for the new circular economy.” A possible theoretical approach that generates such results is the classical short-termism argument of e.g. Stein (1989). While the short-termism argument is general, a prime source of disagreement in the context of ESG concerns future *regulation*. This is particularly the case for environmental issues. As

countries must adapt to international agreements such as the Paris Climate Accords, firms may face intrusive regulation of climate-related aspects of their operations. Disagreement about the degree of intrusion will translate into different views on future cash flow.

This first argument is framed in a traditional risk-return framework. The second type of theoretical argument moves beyond this by introducing non-pecuniary preferences, where the ESG component of a firm directly affects utility functions. The argument of e.g. Pástor, Stambaugh, and Taylor (2021) is that when a subset of investors gets utility from green stocks beyond their pure monetary return, green stocks can sustain lower returns.² There is, however, a trade-off. The higher expected returns for brown firms also translate to higher capital costs for these firms. Thus, when financing new investments, brown firms will face a steeper hurdle rate than green firms. These brown firms will then have an incentive to become greener to access cheaper capital. In equilibrium, this will be a true trade-off. We expect firms to be trading off the costs of improving ESG with the benefits of a lower cost of capital. In equilibrium, there will be a set of excluded firms where the costs of improving ESG outweigh the expected gains from a lower cost of capital.

There is a voluminous empirical literature that provides estimates of a green return premium with various assumptions as to what ESG aspect is relevant, and variations in asset choice. Hong and Shore (2023) summarizes much of this literature.³ Most studies find negative estimates of the green return premium. For example Chava (2014), using a sample of environmental firms, finds a premium in the range (−0.7% to −1.4%). Similarly, Bolton and Kacperczyk (2021) finds a premium in the range (−1.5% to −3.6%) related to Carbon, and Pástor et al. (2022) estimates a green premium of −1.4%. We conclude that the empirical evidence predominately is of a negative estimate of the green return premium. If we maintain the assumption of a negative “greenium,” what is the implication for new issues, IPOs? Let us now turn to the general issue of IPOs, before looking at how ESG issues can be linked to IPOs.

1.2 Initial Public offers

The IPO is one of the most important events in a firm’s life, where the company moves away from being closely held, usually raising further capital, and opening for future raising of capital through seasoned equity offers. A company’s way to an exchange listing is facilitated by investment banks that acts as underwriters. A company selects

²Models with similar results include Pedersen, Fitzgibbons, and Pomorski (2021) and Zerbib (2022).

³Other surveys of empirical studies of ESG and performance include Coqueret (2021), Whelan, Atz, and Clark (2021), and Atz, Van Holt, Liu, and Bruno (2023).

a lead underwriter.⁴ This underwriter manages the investment process. As part of the listing process a prospectus is filed with the Norwegian Financial Authority (Finanstilsynet). The prospectus is partly standardized, containing historical accounts, legal statements and so on. But the prospectus also details the business plan of the company.

The most important role of the lead underwrite is in promoting the listing among its institutional customers, and maintain a book of indications of interest among these. Based on this interest, the lead underwriter sets the issue price, and allocates the stocks according to the book. IPO's are often over-subscribed, and the interested customers face rationing.

During the first day of trading, stocks starts trading at the beginning of the day, with the issue price as a starting point. The price then evolves as all interested buyers are able to trade the stock during the day. If there is a large pent-up demand for the stock, this will be pushing up the price during trading the first day. The closing price at the first trading day is often viewed as an estimate of the "true" (efficient) price of the stock. The difference between these two prices is called underpricing. Underpricing represents a cost for the firm, because the firm's stock could theoretically have been issued at the "true" price and still not been under-subscribed. Note that for an issuing firm, underpricing is only part of the cost of listing. The firm will additionally be paying fixed fees to underwriters. There may also be other ways the underwriters are remunerated.

1.2.1 IPO theory

Historically underpricing has been substantial. For example, Lowry, Michaely, and Volkova (2017) finds an average of 17% first day return for US IPOs in the period 1973–2016. The research on the IPO process is therefore primarily concerned with the cause of underpricing.⁵ The focus is on asymmetric information models of underpricing in the setting of bookbuilt IPOs.

We will concentrate on theories that can link ESG and underpricing. We follow Rau et al. (2023) and consider two theoretical approaches to generate underpricing. The first, *partial adjustment*, builds on the model of Benveniste and Spindt (1989), where the potential investors have private information relevant for the valuation of the company. To encourage revelation of the information, underwriters will set an issue price that involves underpricing.

⁴For Nordic Issues, important underwriters include Carnegie, ABG Sundal collier, SEB, Nordea, Pareto Securities, DNB Markets, Danske Bank, Sparebank 1 Markets, Barclays and City.

⁵See Ritter (2011) and Lowry et al. (2017) for overviews of much of this literature.

Secondly, underwriters may not understand the degree to which ESG properties are valued by investor, or even whether ESG matters to investors. Rau et al. terms this the *neglected demand* hypothesis.

1.2.2 Trends in IPOs

IPO research focus has recently shifted to the dynamics of when firms list, and the method of listing,⁶ prompted by the apparent decline of the number of listed firms, particularly in the US (Doidge, Karolyi, and Stulz, 2013; Gao, Ritter, and Zhu, 2013). While some of the decline is due to mergers (Eckbo and Lithell, 2023) which increases the size of the typical firm, McDonald (2022) argues that most listed firms are later in their life cycle. A related trend is the increased interest among private equity (PE) companies in retaining control and the larger amounts of capital invested in PE (Ewens and Farre-Mensa, 2022). Firms remain private longer, and the size of private firms grows. This concern is also voiced by practitioners.⁷

These trends have led to political concerns that traditional listing and capital raising through IPOs and SEO are losing their important role in allowing innovative companies to realize their full growth potential. These trends have, however, also led to innovation in the listing sphere. A recent trend is the emergence of special purpose acquisition companies (SPACs), which are alternative ways for private companies to go public. More directly, the stock exchanges have promoted alternative listing methods, such as auctions and direct listings.

Finally, exchanges have tried to lower the costs of the traditional listing by creating lower-cost alternative listing choices by creating a menu of tiered markets within an exchange. These lower-cost alternatives also have lowered listing requirements, such as the amount of financial information necessary for listing and the number of distinct owners. OSE is an example of an exchange that has taken the step of creating a separate market with lower listing requirements, something we will return to.

Empirically, Kaserer and Trebel (2023) investigate the consequences of the simplified listings, specifically the EU growth prospectus, and find that simplified listing is less complex and streamline the listing process. However, they find no robust evidence that the simplified process caused an increase in IPO activity for small and medium companies.

⁶See Huang, Ritter, and Zhang (2023) and Huang and Zhang (2022) for surveys.

⁷See e.g. "Why the stockmarket is disappearing", *The Economist* 18 apr 2024.

1.3 Research on IPOs in Norway

Research on IPOs in the Norwegian context is limited. Fjesme (2016) and Fjesme (2019) uses OSE data for the period 1993–2007 to investigate price support in the post-IPO period. He finds an average underpricing of 10% for his sample.

Axenrod, Bienz, and Cornelli (2024) investigate an innovation in Nordic IPO markets, Cornerstone Investors, which are investors that pre-commit to invest. They also have a useful overview of the institutional environment of Nordic IPOs. Their analysis looks at the period 2014–2018, and their focus is on the dynamics of the price setting before the first date. They do however provide some statistics on underpricing, where their full sample (which also contains other Nordic IPOs) has a mean (median) underpricing of 8.3% (4.4%).

1.4 ESG and capital raising – empirical evidence

Several empirical studies link ESG to IPO outcomes. For example, in a cross-country study, Baker, Boulton, Braga-Alves, and Morey (2021) finds that underpricing tends to be lower in countries with more transparent financial disclosures and higher liability standards. Economidou, Gounopoulos, Konstantios, and Tsiritakis (2022) finds that disclosure of ESG information prior to an IPO increases the level of underpricing, increasing the cost of capital for companies revealing ESG performance. The study does not take into account the content of the ESG disclosure, just its existence. Similarly, but with the opposite conclusion, Ferri, Tron, Colantoni, and Savio (2023) find that ESG disclosure is related to lower IPO underpricing compared with companies that do not provide ESG disclosure.

Related to the issue of asymmetric information, ESG disclosure is found to reduce idiosyncratic volatility and downside tail risk. Reber, Gold, and Gold (2022) further find that higher ESG ratings have lower firm-specific volatility and downside tail risk the first year of trading after listing. Wang and Xu (2023) investigate IPOs for the Hong Kong stock market and find that ESG is a key driver for price stability.

Investigating US SEOs, the Feng, Chen, and Tseng (2018) find that firms with high corporate social responsibility (CSR) scores experience fewer adverse reactions to SEOs than firms with lower scores. Firms with high ethical scores decrease SEO underpricing through extensive information disclosure, decreasing information asymmetry. Further, they differentiate the types of CSR concerns and find that environmental concerns or improving the rights of minorities and women are the most effective in reducing negative announcement returns and underpricing.

1.5 Hypothesis development

Let us now quickly present the working hypotheses we will be investigating. The first is motivated by the two theoretical approaches we discussed earlier, partial adjustment and neglected demand. In the partial adjustment type of argument, suppose some potential investors are better at evaluating the environmental stance than the investment banker setting the price. Under an asset pricing model where good ESG can support a higher price (and lower return), this means these investors have private information about valuation. To elicit that information, the investment banker must give the “good ESG” case more in terms of price difference between the price set and the “true” price. With this argument underpricing will be higher the better the environmental ranking of the listing firm.

With the neglected demand type of argument, the investment banker is unaware of the (additional) value that investors puts on more environmentally sound firms. The ESG aspect is therefore not reflected in the issue price. The first day of trading will therefore induce a closing price increasing in environmental quality.

Thus, both these theories predict that underpricing will be increasing in environmental quality, which leads to our formulation of *Hypothesis 1*: The first day return (measure of underpricing) increases with the firm’s environmental quality.

If we only observe the first day of trading, it will be hard to empirically distinguish the two theories. Rau et al. (2023) gives a couple of methods that can be used to distinguish them. One concerns the pattern of price revisions leading up to the IPO. Unfortunately we do not have access to data from the book-building process, so we can not go in that direction. Another of their arguments does have some promise. Under the neglected demand argument the investment banker should be learning over time about the piece of the demand, and adjust pricing accordingly. One can therefore expect underpricing due to ESG issues to decline over time. But then we need a longer time period.

There is another possible way to distinguish the two hypotheses. The neglected demand hypothesis potentially requires more trading to move prices from the initial price to the closing price. We therefore investigate the first day of trading to evaluate *Hypothesis 2*. First day trading interest (which we measure as turnover) is increasing in the measure of environmental quality of the firm.

Suppose we assume that prices at the end of the first day of trading has settled on the efficient price. Then, if we have an asset pricing model with a negative greenium, the cross-sectional return will be decreasing in environmental quality. We can then introduce *Hypothesis 3*. The post-IPO expected return depends on the company’s environmental stance.

2 Economic Environment and Data

In this section, we discuss the economic setting of the study, discuss data sources, and give some descriptives.

2.1 The Oslo Stock Exchange (now Euronext Oslo)

We analyze stocks traded at the Oslo Stock Exchange (OSE), which was an independent market until 2020, when Euronext bought it. After the merger, trading of stocks listed at the OSE became gradually integrated with Euronext systems. For simplicity, we will use OSE to refer to both the earlier independent market and Euronext's trading of Oslo stocks.

Stocks traded at the OSE can be listed on the main list or a couple of alternative markets with somewhat lighter listing requirements, Euronext Expand (Earlier named Oslo Axess), or Euronext Growth (earlier named Merkur Markets). Oslo Axess was introduced in 2007, and Merkur Markets was introduced in 2016. For the companies, listing on the alternative marketplaces involves lower fees to the exchange, fewer requirements on accounts, free float, and less marketplace regulation.⁸ From the exchange's point of view, these new marketplaces are attempts to convince smaller companies that would otherwise stay private to list. The exchanges are interested in attracting new companies, as one of the loosened requirements concerns the number of years of accounts necessary before one can list. In the standard market, this is typically three, but the newer markets lower this threshold to two or one.

Figure 1 shows the relative proportions (in terms of the number of stocks) of the three marketplaces at the OSE. The overview is for the period of 2000 to 2023. All stocks were listed on the main board at the beginning of the period. In 2007, OSE introduced Access, its first attempt at a lower-cost marketplace. This marketplace attracted limited interest. Merkur markets were introduced in 2017 and attracted a large number of issuers. Figure 1 shows the annual *levels*. Of more interest to this paper is the *changes*, illustrated in Figure 2. At the top is the number of listings (IPOs) per year. We note the increase in 2020, particularly in the Merkur market. At the bottom is the number of cases where a firm moves between marketplaces. Initially, there were stocks dropping from Oslo Børs to Merkur when this market was introduced, but this has changed. Now, it is more a question of the successful firms "moving up" to the main board from Euronext Growth.

⁸Euronext Growth is regulated as a Multilateral Trading Facility.

Figure 1: Stocks traded at the Oslo Stock Exchange / Euronext Oslo

Active stocks at the OSE marketplaces. For each year, the figure shows the count of stocks with trading activity in the year, grouped by market places. Stocks at the main board (Oslo Børs) split into stocks in the OBX index (the 25 most liquid shares) (red) and others (blue). Stocks traded at the Axess Oslo / Euronext Expand in green, and stocks in Merkur Market / Euronext Growth in grey. Data sources: OSE data services, Yahoo Finance, and Euronext.

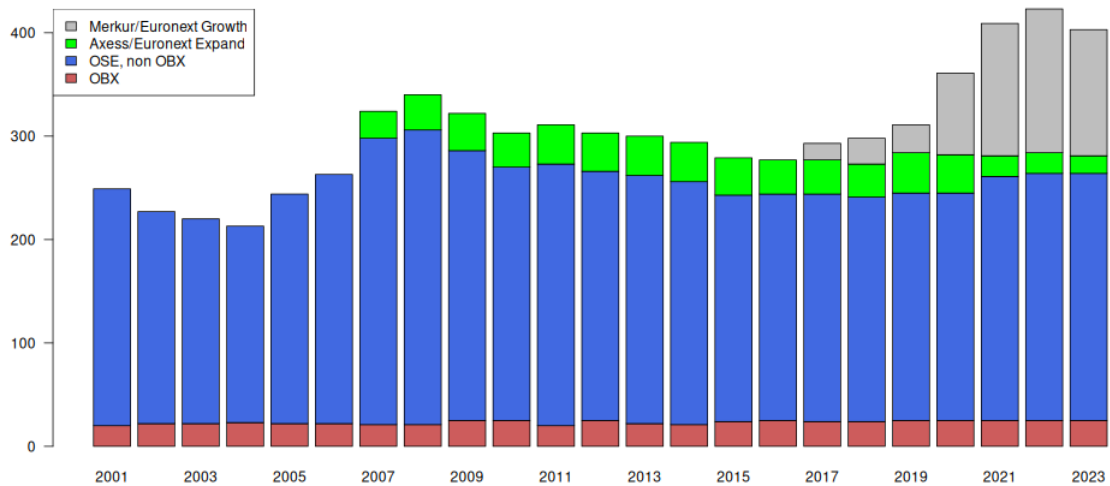
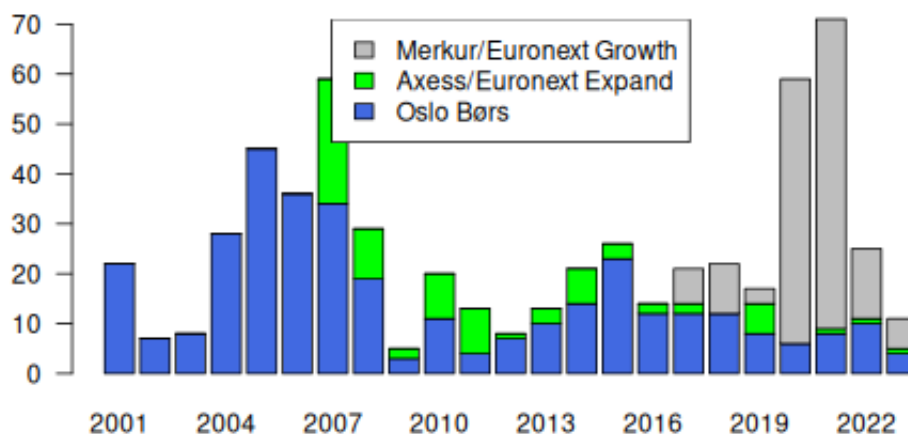


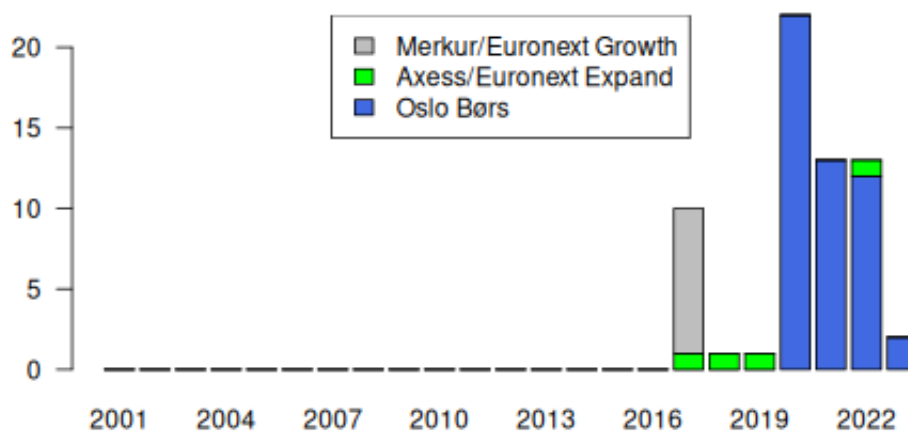
Figure 2: IPO/Listings and market switches by year, Oslo, 2001-2023

Panel A: The number of IPO transactions in each year, broken down by the listing market place (Oslo Børs – The main market, Axess/Euronext Expand, Merkur/Euronext Growth) Panel B: Switches between markets. Count the number switching *into* each of the marketplaces.

Panel A: IPO/Listings by market



Panel B: Which market is being switched into



Our analysis will not cover all of this period. The main limitation is the lack of the various ESG data for much of the period. We therefore start the analysis in 2018. Table 1 gives an overview of the number of listings in the period. We distinguish between traditional IPO's, where new stocks are issued in concert with the listing, or pure listings, where the stock starts trading on the exchange, without any stock issuance. This latter form of listing is one of the more recent innovations. Internationally, a well known example is Spotify, which went for a pure listing on the NYSE. In this Norwegian sample, IPOs are still the majority, but especially at Merkur pure listings are also common. For the cases with stock issuing at the same time as the listing, there are some differences in formality. Particularly for the cases at Merkur, most of these are done as a private placements not formally linked to the listing. For our purposes, we will not distinguish these. We apply the IPO label to any listing where new stock is issued.

Table 1: Number of listings in analysis period (2018–2024)

Sample. For each of the markets Oslo Børs (main list), Axess, and Merkur/Euronext Growth, number of new stocks on the exchange, split between traditional IPO's with an issue of stock accompanying the listing, or pure listings.

	IPO	Listing	Total
Oslo Bors(Main List)	27	6	33
Axess/Euronext Expand	3	0	3
Merkur/Euronext Growth	89	69	158
Total	119	75	194

2.2 Stock Market Data

Stock market data are sourced from various data providers. The OSE and Euronext reports provide information about stock listings and corporate events. Stock prices are from the OSE/Euronext data services, Yahoo Finance, and Refinitiv Eikon (earlier Datastream). We also gather accounting data from Refinitiv Eikon.

2.3 ESG data

Our research question concerns whether ESG properties of companies, such as their environmental stance, are reflected in issues such as IPO underpricing and post-IPO performance. In order to implement this analysis, we need proxies of company ESG properties. We will consider several methods for proxy construction. First, we use the ESG prospectus. Using text analysis, we measure the extent to which a company

describes itself in the ESG dimension(s). Second, we use granular reporting data. Following recent regulations, firms must report ESG properties, such as emissions, salary differences, etc. Finally, as a third categorization, we use the firms main business area to sort companies into three categories: green/neutral/brown, based on (rough) sustainability criteria.

2.3.1 Inferring ESG from prospectus

One way we attempt to classify the ESG properties of IPO companies involves the prospectus. We use natural language processing on the prospectus text to rank firms along the ESG dimensions. We are particularly measuring the environmental properties, as it is hard to distinguish the governance dimension from a standardized document like the prospectus, where much of the governance information is mandated. We construct two ESG measures, one for general environmental issues and one for "brown" issues. The latter captures known pollutants and terms used to describe non-renewable energy.

Let us give some detail on the construction procedure. IPO documents are collected as PDFs from the Oslo Stock Exchange, Euronext, or companies. The documents vary in length and structure. We are particularly interested in the information describing the business, risks, history, and prospects. We remove the appendixes, some containing historic audit statements, annual accounts, and ownership information, as they generally carry little information about the company's future strategy and sales pitch.

To extract the text features, we extend the ESG dictionary created by Baier, Berninger, and Kiesel (2020), complementing with terms from Uni (2023); Coley (2011), and synonyms obtained from Merriam Webster Dictionary.⁹ For some words and terms, we have included a wildcard (*) at the end of the term to allow us to find words with different endings, e.g. Labor right* – this will identify both singular and plural forms. In this way, we do not risk forgetting to specify all versions of the word. Wildcards should be used cautiously, so we do not include this for all words. For example, we search for the word "insider" specifically, as it has a particular meaning concerning transparency. We remove words with less than two characters and stopwords to ease processing.

After extracting the words from the IPO admission documents based on the dictionary, we evaluate the relative importance of a word in the IPO admission document in the context of the other IPO documents in the sample, using the Term Frequency -

⁹See Appendix Table 7 for details.

Inverse Document Frequency measurement (TF-IDF), where TF can be described as:

$$\text{TF}(t, d) = \frac{\text{Number of times term } t \text{ appears in document } d}{\text{Total number of terms in document } d}, \quad (1)$$

where t represent a specific dictionary term, d a admission document, and $TF_{t,d}$ the term frequency of term t in document d .

The IDF can be expressed as:

$$\text{IDF}(t, D) = \log \left(\frac{\text{Total number of documents in set } D}{\text{Number of documents containing term } t} \right), \quad (2)$$

where D represents the set of all admission documents. $IDF_{t,D}$ is the inverse document frequency of term t across all documents in D . The TF-IDF score is then estimated as:

$$\text{TF-IDF}(t, d, D) = \text{TF}(t, d) \times \text{IDF}(t, D) \quad (3)$$

This score reflects both the frequency of the term in a specific document and its uniqueness across all documents. Table 2 shows an overview of topics and frequencies for all documents. High TF-IDF scores indicate terms more relevant to a particular document in the context of a given corpus. In this context, low scores are interpreted as ubiquitous terms across all documents so that the IDF component (Equation 2) is close to zero. Terms that are common across all documents are less informative for distinguishing one document from another.

Panel A of Table 3 gives some descriptive statistics for the variables.

2.3.2 Mandated self-reported data

Norwegian firms are subject to regulation which mandates extensive reporting on ESG related information. We will in our analysis use three items. The first is related to the firm's reported greenhouse gas emissions, *Scope 1* defined as "Scope 1 emissions are direct greenhouse (GHG) emissions that occur from sources controlled or owned by an organization"¹⁰ The magnitude of the emissions are normalized by dividing the Scope 1 variable (measured in tCO₂), with the firm's enterprise value (EV). Similarly, the *Total GHG Emissions* is the sum of the firm's reported Scope 1, 2 and 3 emissions. These are also normalized by EV. We also use a dummy variable for whether a firm is in the fossil fuel sector. Panel A of Table 3 gives some descriptive statistics for the variables. Note that there is differences in the coverage, the emissions data in

¹⁰These data are sourced from the Stamdata database. The definitions are from Stamdata's documentation.

Table 2: Details about text analysis. Frequency Table

Feature corresponds to the dictionary category. Frequency shows the number of times each category appears in the corpus. A higher frequency indicates it is more common and corresponds to the rank. Doc. Frequency indicates the document frequency, the number of documents in the corpus in which the dictionary category appears at least once.

Feature	Frequency	Rank	Doc. Frequency
Non Renewable	909.45	1.00	104.00
Renewable Technology	764.05	2.00	70.00
Provisional	454.27	3.00	101.00
Waste Recycle	406.46	4.00	41.00
Ecosystem Service	232.90	5.00	90.00
Pollutants	192.73	6.00	58.00
Pollution control	163.99	7.00	102.00
Regulating	163.67	8.00	83.00
Bribery / Corruption	130.98	9.00	59.00
Product Opportunities	114.55	10.00	21.00
UN Global Compact Compliance	111.17	11.00	50.00
climate Change	88.27	12.00	48.00
Human Rights	87.30	13.00	36.00
Public Health	83.86	14.00	135.00
Abate	82.30	15.00	20.00
Charity	79.77	16.00	96.00
Society	75.96	17.00	81.00
Laborstandards	75.79	18.00	101.00
Business ethics	73.79	19.00	79.00
Environmental Management	72.78	20.00	42.00
Diversity	68.04	21.00	122.00
Community relations	66.06	22.00	63.00
Environmental Standards	60.73	23.00	14.00
Board Structure	54.66	24.00	102.00
Sustainability Management_reporting	53.58	25.00	72.00
Health Safety	53.15	26.00	133.00
Political Influence	46.47	27.00	114.00
Transparency	40.35	28.00	110.00
Pollution	40.13	29.00	126.00
Family	34.54	30.00	117.00
Diverse Board	26.02	31.00	26.00
Whistleblowing System	23.46	32.00	6.00
Environmental	23.34	33.00	140.00
Education	19.91	34.00	139.00
Labor Rights	19.69	35.00	10.00
Supply chain environmental standards	19.27	36.00	9.00
Social	15.02	37.00	141.00
Support	14.52	38.00	11.00
Security	11.44	39.00	143.00
Governance Sustainability_issues	8.28	40.00	6.00
Responsible Marketing	7.43	41.00	2.00
Responsible Sourcing	2.16	42.00	1.00

particular is only available for less than half of the sample.

2.3.3 Categorizing the firm's business plan

To complement the text analysis and reported data, we manually go into each firm's business plan, attempting to identify the firms that are clearly a sustainable category (green), or clearly a non-sustainable category (brown), such as oil and gas. Specifically, we put in the green category firms that work in areas like renewable energy, sustainability innovation, and circular economy. The brown category is chiefly oil and gas related firms. Firms that are not easily categorized, such as financials, are put in a neutral category. Panel B of Table 3 breaks down the firms in the sample by category.

Table 3: Describing the ESG categorization

The table describes the ESG data. Data for firms at the OSE having an IPO in the period 2018-2023. Panel A provides the mean, standard deviation, minimum, median and maximal observations for the variables: *ESG(Environment)* – *ESG(Brown)* – *Scope1/EV* – The firms reported Scope 1 emissions in the year of the IPO, divided by the firm's enterprise value. *Scope3/EV* – The firms reported Scope 3 emissions in the year of the IPO, divided by the firm's enterprise value. *ind(FossilFuel)* – indicator variable equal to 1 if the firm's main business is related to fossil fuels. *MktCap* – Market capitalization (in billions NOK). Panel B shows the number of firms in each the manual categories.

Panel A: Descriptive statistics

	mean	std	min	med	max	n
ESG(environment)	0.4	0.6	0.0	0.3	4.2	148
ESG(brown)	0.9	2.1	0.0	0.2	14.4	148
Scope1/EV	45.2	156.2	0.0	0.0	817.4	65
TotalGHGEmissions/EV	906.2	3749.1	0.0	18.1	22072.5	69
ind(FossilFuel)	0.11	0.32	0.00	0.00	1.00	157
MktCap(bill)	7	28	0	2	243	171

Panel B Manual Categorization

	No Obs
Green	87
Neutral	94
Brown	35

3 Results

In this section we investigate whether the proposed hypotheses are supported by the data.

3.1 IPO underpricing

We start by characterizing the IPO underpricing. Table 4 gives some descriptive statistics for the sample. For the typical IPO case, with issuance of stock, the underpricing is positive 3-4% for the Main list and the Merkur case. Only 3 companies listed on Axess, we will ignore these. For listings, on average prices fall on the first day of listing. But for listings it may take longer for prices to stabilize. For the cases where new stocks are issued, more information is released to the market, in particular the IPO price, which shows what price the market is willing to accept. For listings there may be less price relevant information, and the market takes longer to settle down to the efficient price. We therefore also investigate the price evolution during the first week of trading, measuring the return from the IPO price (or open) to the close one week later. These one week returns are described in Panel B. Here we see that the average return is positive, for the 67 Merkur stocks, the average first week return is a positive 7%.

Table 4: Underpricing and first week returns

Panel A shows measures of underpricing. For the IPO sample, measured as the difference between the closing price and the IPO price, relative to the closing price. For the listing sample, measured as the difference between the closing price and the opening price, relative to the closing price. Panel B shows the first week return. For the IPO sample this is measured as the difference between the closing price one week later and the IPO price, relative to the IPO price. For the listing sample, measured as the difference between the closing price one week later and the opening price, relative to the opening price. Numbers in percent.

Panel A: Opening day underpricing

	min	med	mean	sd	max	n
IPO Oslo Bors	-8.25	0.00	3.83	8.78	28.00	27
IPO Axess	-5.17	0.00	-1.72	2.98	0.00	3
IPO Merkur	-35.00	0.00	4.16	16.61	65.69	89
Listing Oslo Bors	-20.83	-3.64	-4.41	9.94	8.37	6
Listing Merkur	-129.06	-1.64	-3.64	20.72	40.97	69

Panel B: First week return

	min	med	mean	sd	max	n
IPO Oslo Bors	-19.09	2.40	4.94	13.53	58.73	27
IPO Axess	-21.67	-1.18	-7.72	12.09	-0.31	3
IPO Merkur	-30.31	-0.98	6.15	26.66	131.60	89
Listing Oslo Bors	-10.00	2.49	2.71	10.59	14.29	6
Listing Merkur	-33.50	-2.41	7.00	49.97	282.80	67

3.2 Is IPO underpricing influenced by ESG?

We start by investigating Hypothesis 1, which concerns the first-day premium, the typical measure of underpricing, and ask: Are ESG properties of the company influencing the magnitude of underpricing?

To formally investigate the hypothesis we rely on regressions of the form specified in equation (4):

$$\text{FirstDayReturn}_i = \alpha + \beta^{ESG} \text{ESG measures}_i + \beta^2 \text{Controls}_i + \varepsilon_i, \quad (4)$$

where the ESG measures include the three categories we discussed. The control variables include the size of the firm.

Table 5 provides a summary of the results for the various regressions. In Panel A we use the ESG measures inferred from the prospectus. Under our hypothesis we should have a positive coefficient on *ESG environment*, and a negative on *ESG Brown*. As we observe all of the coefficients on the ESG variables have the wrong sign, and the ones on *ESG environment* even significantly so. Using the reported emissions data (shown in Panel B) we are also unable to support the hypothesis. None of the coefficients are significant. The results in Panel C confirms the impression from the simple means table, green (brown) firms have lower (higher) underpricing than the neutral group, although it is not significant.

Our results are thus not supportive of our first hypothesis.

3.3 First day liquidity and ESG

Our second hypothesis concerns the trading interest the first day. We want to investigate whether liquidity is increasing in the sustainability quality. To investigate the link to ESG we employ a similar regression to our underpricing regression (4), replacing the first day return as dependent variable with a measure of liquidity. As liquidity proxy we use the turnover (trading volume divided by shares outstanding) during the first day of trading:

$$\text{Turnover}_i = \alpha + \beta^{ESG} \text{ESG measures}_i + \beta^2 \text{Controls}_i + \varepsilon_i, \quad (5)$$

The explanatory variables employed are the same as we used in the previous analysis.

Table 6 provides the results. Again, the results are not significant. So, our results do not support either of our first hypotheses. Given that the basis for our hypothesis is the assumption that green stocks have a lower expected return, our results may indicate that that assumption is not justified.

Table 5: Underpricing regressions

The tables report the results of regressions of the form $\text{FirstDayReturn}_i = \alpha + \beta^{ESG} \text{ESG measures}_i + \beta^2 \text{Controls}_i + \varepsilon_i$, where the dependent variable is the measure of underpricing – first-day return, measured as return difference from opening to the closing price on the IPO date. The primary control variable is $\ln(\text{MarketCap})$, log of the firm’s market capitalization. The ESG measures are Panel A: $\ln(\text{ESG Environment})$ – log of inferred Environmental stance from text analysis of prospectus. $\ln(\text{ESG Brown})$ – log of corresponding ESG Brown measure inferred from the prospectus. Panel B: *FossilFuel* indicator variable equal to one if the company is involved in fossil fuel extraction. *Scope1/EV* Company’s Scope1 CO₂ emissions, divided by the company enterprise value. *Total GHG / EV* Company’s total greenhouse gas emissions (the sum of the company’s reported Scope 1, Scope 2 and Scope 3, divided by company enterprise value). Panel C: Dummies for the green and brown categories. The first three columns ((1)–(3)) use all IPOs starting in 2018. The last three ((4)–(6)) only IPOs at Merkur/Euronext Growth. Significance levels indicated as *p<0.1; **p<0.05; ***p<0.01.

Panel A Regressing first day return on measures of ESG inferred from prospectus

	Dependent variable:		
	Underpricing		
	(1)	(2)	(3)
$\ln(\text{ESG Environment})$	-2.0*	-2.2**	
	(1.2)	(1.1)	
$\ln(\text{ESG Brown})$	-0.1		-0.5
	(0.5)		(0.5)
$\ln(\text{MktCap})$	1.3	1.3	1.2
	(1.2)	(1.1)	(1.2)
Constant	-26.0	-26.2	-20.9
	(24.9)	(24.7)	(24.9)
Observations	90	90	90
Adjusted R ²	0.02	0.03	0.003

Note: *p<0.1; **p<0.05; ***p<0.01

Panel B Regressing first-day return on reported emissions data.

	Dependent variable:		
	Underpricing		
	(1)	(2)	(3)
<i>FossilFuel</i>	-4.9		
	(6.3)		
<i>Scope1/EV</i>		-0.001	
		(0.02)	
<i>Tot GHG/EV</i>			-0.000
			(0.000)
$\ln(\text{MktCap})$	1.1	3.1	1.6
	(1.2)	(2.3)	(2.3)
Constant	-18.9	-64.0	-30.5
	(26.7)	(50.7)	(51.3)
Observations	96	41	45
Adjusted R ²	-0.01	-0.01	-0.03

Note: *p<0.1; **p<0.05; ***p<0.01

Panel C Regressing first-day return on green/brown manual categorization

	Dependent variable:		
	Underpricing		
	(1)	(2)	(3)
<i>Green</i>	-1.0	-2.3	
	(3.2)	(3.1)	
<i>Brown</i>	5.5		5.9
	(4.5)		(4.3)
$\ln(\text{MktCap})$	0.6	0.5	0.7
	(1.1)	(1.1)	(1.1)
Constant	-10.1	-5.1	-12.1
	(23.9)	(23.6)	(23.0)
Observations	111	111	111
Adjusted R ²	-0.01	-0.01	0.002

Note: *p<0.1; **p<0.05; ***p<0.01

Table 6: Liquidity regressions

The tables report the results of regressions of the form $\text{Turnover}_i = \alpha + \beta^{\text{ESG}} \text{ESG measures}_i + \beta^2 \text{Controls}_i + \varepsilon_i$, where the dependent variable is the measure of liquidity during the first day of trading – the trading volume divided by shares outstanding. The control variable is $\ln(\text{MarketCap})$, the log of the firm’s market capitalization. The ESG measures are Panel A: $\ln(\text{ESG Environment})$ – log of inferred Environmental stance from text analysis of prospectus. $\ln(\text{ESG Brown})$ log of corresponding ESG Brown measure inferred from the prospectus. Panel B: *FossilFuel* indicator variable equal to one if the company is involved in fossil fuel extraction. *Scope1/EV* Company’s Scope1 CO₂ emissions, divided by the company enterprise value. *Total GHG / EV* Company’s total greenhouse gas emissions (the sum of the company’s reported Scope 1, Scope 2 and Scope 3, divided by company enterprise value). Panel C: Dummies for the green and brown categories. The first three columns ((1)–(3)) use all IPOs starting in 2018. The last three ((4)–(6)) only IPOs at Merkur/Euronext Growth. Significance levels indicated as *p<0.1; **p<0.05; ***p<0.01.

Panel A Regressing turnover on measures of ESG inferred from prospectus

	Dependent variable:		
	Liq		
	(1)	(2)	(3)
$\ln(\text{ESG Environment})$	–0.000 (0.001)	–0.000 (0.001)	
$\ln(\text{ESG Brown})$	–0.000 (0.000)		–0.000 (0.000)
$\ln(\text{MktCap})$	–0.001 (0.001)	–0.001 (0.001)	–0.001 (0.001)
Constant	0.02* (0.01)	0.02* (0.01)	0.03* (0.01)
Observations	80	80	80
Adjusted R ²	0.01	0.02	0.01

Note: *p<0.1; **p<0.05; ***p<0.01

Panel B Regressing turnover on firm-level variables from Stamdata

	Dependent variable:		
	Liq		
	(1)	(2)	(3)
<i>FossilFuel</i>	–0.001 (0.002)		
<i>Scope1/EV</i>		–0.000 (0.000)	
<i>Total GHG Emissions/EV</i>			–0.000 (0.000)
$\ln(\text{MktCap})$	–0.001* (0.001)	–0.003*** (0.001)	–0.004*** (0.001)
Constant	0.03** (0.01)	0.1*** (0.02)	0.1*** (0.02)
Observations	86	34	38
Adjusted R ²	0.02	0.2	0.3

Note: *p<0.1; **p<0.05; ***p<0.01

Panel C Regressing turnover on green/brown manual categorization

	Dependent variable:		
	Liq		
	(1)	(2)	(3)
Green	–0.001 (0.003)	–0.000 (0.002)	
Brown	–0.001 (0.004)		–0.000 (0.003)
$\ln(\text{MktCap})$	–0.004*** (0.001)	–0.004*** (0.001)	–0.004*** (0.001)
Constant	0.1*** (0.02)	0.1*** (0.02)	0.1*** (0.02)
Observations	152	152	152
Adjusted R ²	0.1	0.1	0.1

Note: *p<0.1; **p<0.05; ***p<0.01

4 Conclusion

We ask whether the ESG properties of a firm affect the firm's cost of capital at the IPO point. For example, can green firms tap into capital at a lower cost of capital? Or, is the demand by green institutional investors, such as sustainable funds, high enough to affect the pricing at the IPO (and later)?

We ask these questions in the context of IPOs at the Oslo Stock Exchange (OSE). OSE is an interesting laboratory in market innovations, where the exchange has introduced the possibility of lower cost and lower requirement listings. We showed how this marketplace had increased in popularity with a peak in IPOs between the end of Covid restrictions and the Russian attack on Ukraine.

We start by an assumption of a negative "greenium." With this assumption we show that underpricing should be increasing in the environmental quality of the IPO firm. Our results do not support the assumed negative greenium. We construct several different measures of environmental quality of firms. One of the specifications, where we infer the environmental stance from the prospectus, imply that the underpricing is *lower* for better ESG firms. These coefficients are significant. The other specifications also has the "wrong" signs implying underpricing decreasing in ESG quality, but these are not statistically significant. We are therefore led to reject the maintained hypothesis of lower underpricing for environmental firms.

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A Appendix – Details of text analysis

Table 7: ESG Dictionary

Category	Terms
Governance	accountability, transparency, fairness, responsibility, risk management, integrity, participation, responsiveness, consensus oriented, inclusiveness, governance
Corporate Governance	compliance, conduct, conform, misconduct, surveil, fiscal policy, goodwill, contract, regulation, noncompliance, permit, license
Audit Control	approve, assess, audit, control, evaluate, examine, oversee, oversight, review, treadway
Board Structure	independence, qualification, skill, succession, tenure
Shareholder Rights	ballot, elect, nominate, plurality, quorum, vote, shareholder, ownership, dividend, voting power
Family	brother, family, grandchild, grandparent, nephew, niece, relative, sibling, sister, son, spouse, stepchildren, stepparent
Transparency	insider, inspector, interlock, transparent, collaborate, public feedback, feedback culture, openness, access to information
Diverse Board	female boardmember, women boardmember, diverse board, management structure, management composition, board structure, board composition, diverse management, diverse team, gender balance
Business Ethics	corporate, ethical, ethically, ethics, honesty, code of conduct
Bribery / Corruption of lines	bribe, corrupt, crime, embezzlement
Political Influence	grassroot, influence, lobbyist, lobby
Responsible Marketing	conscious consumption, responsible marketing, brand activists, corporate citizens
Whistle-blowing system	whistleblow, whistle blow, informer, informant, canary
Labor Rights	responsible business practice, labor right, labour right, trade union, collective bargain, wage development, TFEU, living condition, working condition, freedom of speech, employee right, child labor, child labour, discrimination, decent wage, freedom of association

Continue on next page

Continuation of ESG Dictionary

Category	Terms
Sustainability Management	fairly, integrity, liaison
Governance Issues	ecological citizen, globaliz, democracy, transbound
Marketing Certification	envirolink
Responsible Sourcing	recycle polymer, undyed fabric, spun fiber, recycled content, sustainably grown, life cycle assessment
UN GC Compliance	global compact, ungc, united nations, paris accord, paris agreement, ungp, carbon neutral, net zero
Environmental	clean, environment, epa, sustain, ecolog, ecosystem
Climate Change	Surface water, climate emergency, climate change, global warming, climate crises, climate breakdown, global heating, sea level rise, global average temperature
Climate Change Strategy	energywende, eu adaptation strateg, hydropower, Francis, Pelton, pump storage, Kaplan, geothermal energy, bioenergy, biofuel, tidal energy, photovoltaics, pv, shc, csp, tidal streams, barrages, tidal lagoons, thermal power, dry steam, flash steam, hydrothermal, geopressur, hot dry rock, magma, binary cycle, green energy, renewable energy, solar, wind turbine, wind energy, wind farm, wind power, solar power, solar energy, solar panels
Ecosystem Services	wetland, grassland, tundra, desert, forest, savanna, mountain, marine, terrestrial, freshwater ecosystem, ocean
Provisional	food, livestock, pastur, agricultur, cropland, fruit, vegetable, fish, timber, wood, freshwater, water
Regulating	carbon storage, climate regulat, weather, photosynthes, Phytoplankton, Eutrophication Benthic organism, benthos, biomass, pollinate
Support	Groundwater, nutrient cycling, provisioning service, habitat, decompos, creation of soil, water cycle
Environmental Management	Acute exposure, abatement, absorption, accident site, cleanup, contamination, monitoring, waste minimization, acid deposition, activated carbon, Activated sludge

Continue on next page

Continuation of ESG Dictionary

Category	Terms
Environmental Standards	EU taxonomy, NAAQS, EPA, California Air Resources Board, ISO 14001, EMAS, miljC8fyrtC%rn
Pollution Control	Pyrolysis, Monitoring well, Mitigation, geiger, Flowmeter, Electrostatic precipitator, Effluent limitation, biological protocol, Bioassay Biochemical, oxygen demand, biological control, air monitoring, carbon, nitrogen, pollution, superfund
Abatement	bar screen, activated carbon, activated sludge, reforestation, aerobic treatment, advanced water treatment, water treatment, adsorption, aeration, biological treatment, baghouse filter, biodegradable, abate
Product Opportunities	carbon capture, trickling filter, slow sand filtration, sanitary sewers, septic, sewer, wastewater treatment, drones, algae, biotechnology, flocculation, emission permit
Supply Chain Env. Standards	Food chain, iso14001, Fair Trade Certification, Carbon Disclosure Project, cpd, Greenhouse Gas Protocol, Leadership in Energy and Environmental Design, Global Reporting Initiative, The Responsible Business Alliance, SA8000 Standard
Waste Recycling	waste disposal, Rubbish, Irrigation, Incineration, biphenyls, hazardous, householding, pollutants, printing, recycling, toxic, waste, wastes, brackish water, re-cycle
Pollution	emission, Bioaccumulat, degradation, dilution, air pollution, Acute toxicity, Acute exposure, erosion, flood, biodiversity loss, biodiversity decrease
Pollutant	Toxicity, Trichloroethylene, Silt, Sludge, Pollutant, Polychlorinated biphenyls, Polyvinyl chloride, Phosphorus, Phosphates, Pesticide, Nitrate, Nitric oxide, Nitrification, Nitrogen dioxide, Nitrogen oxides, Methane, Insecticide, Hydrogen sulfide, Herbicide Fluorocarbon, Fly ash, Fluorides, Flue gas, acid deposition, acid rain, pesticide, pesticides, deforestation, cadmium, chlorinated solvent, chlorofluorocarbons, CFC, carbon dioxide, carbon monoxide, chlorinated, chlorinated hydrocarbons, hydrocarbons, airborne particles, agricultural pollution, air pollutant, air pollution

Continue on next page

Continuation of ESG Dictionary

Category	Terms
Social	citizen, citizens, corporate social responsibility csr, disabilities, disability, disabled, human, nations, social, un, veteran, vulnerable
Human Rights	dignity, discriminate, discriminated, discriminating, discrimination, equality, freedom, humanity, nondiscrimination
Community Relations	community, volunteer
Privacy Free Expression	free expression, free speech
Security	peace, security
Public Health	endowment, philanthropic, philanthropy, socially, societal, society, welfare
Labor Standards	bargain, eeo, fairness, harassment, injury, labor, labour, overtime, sick, wage, workplace
Diversity	bisexual, diversity, ethnic, female, gay, homosexual, immigration, immigrant, lesbian, lgbt, minorities, minority, race, religio, sex, transgender, women, diversity, lqtbq, diverseness, ethnic, cross culturalism, cultural diversity, multiracialism, pluralism
Health & Safety	safe, eicc
Society	endowment, endowments, people, philanthropic, philanthropy, socially, societal, society, welfare),
Charity	charitable, charities, charity, donat, donors, foundation, foundations, gift, gifts, nonprofit, poverty, pro bono
Education	course, educat, learning, mentoring, scholarship, teach, training, schooling
Employment	employ, headcount, hire, hiring, staffing, unemployment
End of Table	