The fading green glow in the stock market. Evidence from IPOs and asset prices in the Nordics.

Erika Berle, Kjell Jørgensen and Bernt Arne Ødegaard*

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Abstract

After an initial optimism for the role of the stock market in the transition to the Green Economy following the Paris Climate Accords, with corresponding focus on sustainability and ESG issues by institutional investors, the ESG agenda has had some recent knocks. The war in Ukraine and the "war on woke" by the US republican party are the most obvious examples. In this paper we investigate these issues. We use data from the Nordic Stock Markets. We first investigate stock market listings (IPOs), and find that high quality ESG (green) firms are issued at better terms. However, coinciding with the onset of the Ukrainian war, IPOs dry up. To investigate whether this can be due to less willingness to fund green investments, we look at the cost of capital for existing firms. Here we find that in the period from 2018 to the onset of the war in Ukraine, green firms have lower cost of capital, but this subsidy of green firms disappears in the same time frame as the war.

Keywords: IPO; Cost of Capital; ESG; Underpricing
JEL Codes: G12; G24; G30

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 a need for substantial capital investments. Raising 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

*Berle and Ødegaard are at the University of Stavanger Business School (HHUiS). Jørgensen is at the Norwegian Business School BI. Corresponding author: Bernt Arne Ødegaard: bernt.a.odegaard@uis.no We are grateful for comments from Knut Nygaard and Cody Hyman, seminar participants at OsloMet, Sacred Heart University, and University of Stavanger, as well as discussants and participants at the 2024 Massey Sustainable Finance Conference in Auckland, the Infinti conference in Edinburgh, and the 2026 EFMA Meetings in Kristiansand.

investments and provide risk capital for innovative green investments are therefore key to the success of a transition to a more sustainable society.

Following the Paris Climate Accord, the world's capital markets started a transformation in this direction. ESG issues became central in financial institutions, and issues of corporate social responsibility were at the front of policy discussions. A large academic literature builds and test theories where ESG issues matter for stock pricing (i.e. firms cost of capital).[1] The empirical ESG literature primarily asks whether ESG is priced in the crossection. In this paper we first add to this literature by investigating *listings* (IPOs). The point at which a firm *list* is when it typically raises substantial amounts of *new* capital. There is therefore "real money" changing hands. The IPO experience can therefore potentially identify ESG effects distinct from those implied in the trading in the secondary market.

We view the Nordic (Denmark, Finland, Iceland, Norway and Sweden) and Baltic (Estonia, Latvia, and Lithuania) stock markets as a good laboratory for investigating these issues. These are relatively homogeneous societies which agreed on the need to combat climate change following the Paris agreement. They are also close to Ukraine, and therefore particularly exposed to consequences of that war. The Nordic markets are also well suited to study environmental issues (E), as the other parts of ESG, S and G, are not varying much in the Nordic context, due to social coherence and strongly regulated governance.

There are also some potentially useful crossectional differences. For example, Norway is a large oil and gas producer. Following the Paris Climate Agreement Norway saw the need to transit the economy away from oil and gas, and introduced substantial incentives for companies to develop in alternative, more sustainable directions. However, following the Ukraine war, Norway has focused on replacing Russian oil and gas to the European market. The other Nordic countries have much lesser roles in energy production.

We find that in the post-Paris agreement period, starting in 2018, we see a flurry of IPOs activity, with lots of green stocks listing. However, following the onset of the Ukrainian war, there is a drop in listing activity, including green listing. A possible reason behind this is the political backlash against ESG. As pointed out by Bolton, LaFrance, and di Mauro (2026), various events indicate that the ESG momentum is losing steam. In the US, the Republican Party's "war on woke" for example targeted ESG-based investment criteria.[2] In Europe, Russia's attack on Ukraine has shifted focus to defense and energy security issues, possibly crowding out climate concerns.

In the context of our study of IPOs, we can not use data on properties of IPO firms to address this issue, as the number of IPOs, in particular green IPOs, is so low in the later part of the sample. We therefore turn to the more traditional method, asking whether ESG is priced in the Nordic cross-section. Estimating a cross-sectional asset pricing model of the effect of ESG on the Nordic

[1] Starks (2023) and Hong and Shore (2023) summarizes much of this literature.

[2] For example, Garrett and Ivanov (2022) show how the state of Texas (which was dominated by republicans) target use of ESG as a financial criterion. Williams (2026) gives an overview of the US anti-ESG agenda.

cross-section we find that for the whole sample period, the market had a significant negative ESG "premium." Investigating how this premium behaves over time, we find that it moves from negative to positive around the start of the Ukraine war, consistent with a view that the market has stopped viewing green investment favorably.

The object of main interest in IPOs is the difference in the price at which the stock list (either the issue price or the opening price), and the equilibrium price after some trading, typically the close price on the first day, but alternatively for example the close price after the first week of trading. This difference is the *underpricing* associated with an IPO. Typically, this underpricing is substantial, stocks issue at a price way below the later close price. The common theories used for motivating substantial underpricing are based on information asymmetries between the IPO company, underwriters, and potential investors. These theories can be adjusted to bring in ESG issues, by for example assuming uncertainty about the willingness to subsidize green investments. As we will show, these types of theories involve more underpricing to elicit revelation of this information.

However, we also argue that the traditional IPO theories based on informational asymmetries may not be the most relevant in the context of ESG. Many ESG properties are observable. The environmental properties of a wind farm are obvious. There may therefore be agreement about how ESG should affect the cost of capital, in which case IPO underpricing is not linked to ESG through the cost of capital. Instead, we argue that there are potential issues with supply and demand: Following the Paris Accords, the financial management industry saw a large growth in interest in mutual funds labeled as green/environmentally friendly. These firms need to find investable equities that match their green criteria. If there is an under-supply of such stocks, institutions will be looking hard at green IPOs, potentially overbidding in the pre-issue auctions to secure their slice of the pie. In terms of the IPO literature this is a specific example of the *timing* issue.

Our results are in fact supportive of this second type of theory. We actually estimate that green IPOs in this period are slightly *overpriced*, consistent with an under-supply explanation. Additional support for under-supply is provided by the post-IPO trading. The green stocks have lower turnover (i.e. are traded less) the first day and week, potentially due to more of these stocks locked into institutional "climate friendly" portfolios.

As mentioned, we turn to the crossection of existing firms (i.e. firms active in the whole period 2018-2026, not firms that do IPOs in the period) to supplement the IPO evidence, and evaluate whether there are ESG effects in the cost of capital implied by the continuous trading in the secondary market. We do this two ways. One is an estimation in a system, in a formulation that builds on Gibbons (1982). This formulation will maximize the econometric efficiency of the estimation. It is with this formulation we find a that ESG properties are priced in the Nordic cross-section in the period 2018–2026. As a second econometric formulation we consider a variation on the classical Fama and MacBeth (1973) "rolling beta" estimation. While this method is less econometric efficient, it allows us to investigate time series variation in the ESG relationship, as the estimation is done on one cross-

section at a time. Here we find the ESG effect in the cost of capital is only negative in the early part of the sample period. It is remarkable how this effect disappears immediately upon the onset of the Ukrainian war.

We can summarize our contributions as two: First, looking at IPOs, in the aftermath of the Paris Agreement green IPOs seem highly sought after, with issues overpriced. Data from the primary market thus confirms extant evidence that ESG matters for stock prices in the crossection. Second, evidence that the political noise around ESG is reflected in actual market behavior, suggested both by the drying up of the green IPO market, and the fact that the cost of capital no longer subsidizes green projects in the later part of the sample period.

The structure of the paper is as follows. Section 1 summarizes literature and develops hypotheses. Section 2 describes the market and provides some summary statistics. Section 3 investigates whether the terms of issue of Nordic IPOs seem linked to ESG properties of the listing firms. Section 4 looks at environmental effects in the Nordic crossection. We finally offer a conclusion.

1 Literature and hypothesis development

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 concern whether differences in corporate environmental stance are linked to differences in IPO outcomes. A possible channel for such a link is that firm's cost of capital varies 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. If the short-term view does not fully incorporate future

negative climate consequences, long term returns will be higher for green firms.

This first theoretical 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.[3] 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, where greener firms can sustain lower costs 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.[4] 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, Stambaugh, and Taylor (2022) estimates a green premium of −1.4%. We conclude that the empirical evidence predominately points to a negative estimate of the green return premium.

Within the asset pricing literature there is however a lack of clarity in how to measure ESG. The most common method for ranking companies in the ESG dimension is to use an ESG index. It is well documented that different index providers will rank companies differently (Berg, Kölbel, & Rigobon, 2022). Individual investors may need to expend more effort than simply looking at an index if they want to find the superior companies wrg. e.g. climate. Such efforts are made harder by the tendency of companies to make unsupported claims about their green credentials (greenwashing).

1.2 Stock Market Listings

The Initial Public Offer (IPO) is one of the most important events in a firm's life, where the company moves away from being closely held to a wide ownership of liquid equity. In a traditional IPO, the firm raises new capital as part of the listing process. The issue price is typically the outcome of a bargaining process. Recently, we have seen the various stock markets innovating with the form of the IPO. Some companies choose to list without raising new capital (pure listing). Others combines a pure listing with a private placement (i.e. with a less formal bargaining process leading up to the setting of an issue price). These innovations are attempts by stock exchanges to make the listing process easier, presumably as a reaction to the decline in listed firms, particularly in the US (Doidge, Karolyi, &

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

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

Stulz, 2013; Gao, Ritter, & Zhu, 2013). [5]

Exchanges have also lowered the cost of the traditional listing by introducing lower-cost listing possibilities, creating a menu of tiered markets within an exchange. The lower-cost alternatives ease listing requirements, such as the amount of financial information necessary for listing, and the minimum number of distinct owners. Both Euronext and Nasdaq have taken the step of creating separate markets with lower listing requirements.[6]

A company's way to an exchange listing is facilitated by investment banks that acts as underwriters. As part of the listing process a prospectus is filed with the relevant financial authority. The prospectus is partly standardized, containing historical accounts, legal statements and so on. But the prospectus also details the business plan of the company.

During the first day of trading, stocks starts trading at the beginning of the day, either from the issue price, or set in an opening auction. The price then evolves as 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 the first day of trading. 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 (first day) underpricing. This 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 fees to underwriters. There may also be other ways the underwriters are remunerated.

Historically underpricing has been substantial. For example, Lowry, Michaely, and Volkova (2017) find an average of 17% first day return for US IPOs in the period 1973–2016. The theory-based research on the IPO process is therefore primarily concerned with the cause of underpricing.[7] The focus is on asymmetric information models of underpricing in the setting of book-built IPOs.

In addition to underpricing there is considerable interest in the fact that there is substantial time variation in IPOs.[8] There are clear cycles where "hot" markets are followed by slumps. The literature suggests both irrational effects (investor sentiment) and more business cycle based (need for capital) explanations, but the causes of these cycles are still an open issue.

1.2.1 ESG and capital raising – empirical evidence

Several empirical studies link ESG to IPO outcomes. For example, in cross-country studies, Baker, Boulton, Braga-Alves, and Morey (2021) and Boulton (2024) find that underpricing tends to be lower in countries with more transparent financial disclosures and higher liability standards. Economidou,

[5] See R. Huang, Ritter, and Zhang (2023) and R. Huang and Zhang (2022) for surveys.

[6] Nasdaq markets their market place "First North." Euronext markets "Euronext Access" and "Euronext Growth." Empirically, Kaserer and Trebel (2023) investigate the consequences of the simplified listings, specifically the EU growth prospectus, and do 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.

[7] See Ritter (2011) and Lowry, Michaely, and Volkova (2017) for overviews of much of this literature.

[8] See Lowry, Michaely, and Volkova (2017, Section 8) for a summary of this literature.

Gounopoulos, Konstantios, and Tsiritakis (2022) find 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 in their sample of European stocks ESG disclosure is related to lower IPO underpricing compared with companies that do not provide ESG disclosure. Chen, Khoo, and Peng (2023) find that climate change disclosures are associated with lower IPO underpricing. The study which is closest to our paper, Fenili and Raimondo (2021), also use text analysis of the prospectuses and links it to underpricing, finding that the amount of ESG disclosures is negatively associate with IPO underpricing.

Where our analysis differ from the above analysis is the theoretical starting point. Our analysis starts with the cost of capital consequences of ESG. The literature discussed above generally views disclosure as a general reduction in information asymmetry, without linking it to the raising of capital for green investment. (See e.g. Zazzaro, Oliviero, and Rondinella (2024) for a discussion of availability for capital to green investment.)

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, 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.

1.2.2 Prior work on Nordic listings

There is limited academic work on IPOs specifically in the Nordic context. International investigations of IPOs typically include Nordic companies. For example Banerjee, Dai, and Shrestha (2011) investigates IPOs in the period 2000 to 2006, and show that the Scandinavian markets typically have low underpricing. For example, Norway has the lowest underpricing (4.33%) in their sample of 36 countries.

Axenrod, Bienz, and Cornelli (2024) does look specifically at the Nordics, and investigate an innovation in Nordic IPO markets, Cornerstone Investors, which are investors that pre-commit to invest. 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

has a mean (median) underpricing of 8.3% (4.4%).[9]

1.3 The prospectus – Environmental disclosure and language

The IPO prospectus create a narrative to persuade and influence IPO pricing. Hanley and Hoberg (2010) show that prospectuses with more informative, less standardized content have a more accurate pricing and lower underpricing. Loughran and McDonald (2013) find that more uncertain language in the prospectus is associated with higher first-day returns. We build on this insight, but focus on the environmental content of the prospectus.

Using text-based climate and environmental measures in asset pricing is now quite established. Engle, Giglio, Kelly, Lee, and Stroebel (2020) construct climate news indices from newspaper text to hedge climate risk, and Sautner, van Lent, Vilkov, and Zhang (2023) measure firm-level climate change exposure from earnings call transcripts. These studies use text from listed firms or the media. We apply similar methods to the prospectus and information documents available to investors at the time of the listing.

Corporate ESG reporting, outside of the EU, is mostly voluntary. Corporate environmental discussion therefore does not need to reflect substance. Using ClimateBERT, Bingler, Kraus, Leippold, and Webersinke (2022) find that firms' support for the TCFD recommendations is mostly cheap talk, with selective reporting of non-material climate risks. Bingler, Kraus, Leippold, and Webersinke (2024) show that voluntary climate disclosure is associated with more cheap talk, and that cheap talk correlates with higher emissions growth and more negative news coverage. If investors discount vague commitments, environmental discussion should affect IPO pricing only to the extent that it is substantive. We therefore distinguish between the amount of environmental discussion in the prospectus and the share of non-specific climate commitments.

1.4 Hypothesis development

1.4.1 IPO related hypotheses

We are concerned with the stock pricing at the IPO stage. We are asking whether ESG properties of the firm will matter. One possible channel for ESG to matter is the cost of capital. All else equal, the lower the cost of capital, the higher the issue price can be. Under a theory where ESG matters for the cost of capital, understanding of ESG properties for a company that is considering listing will then be important for setting the correct price.

In IPO theory it is common to assume information differentials involving the investment bank setting the price and the potential buyers of stocks in the IPO. We therefore start by the two common

[9] A couple of investigations of Norwegian IPOS are Fjesme (2016) and Fjesme (2019). He 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.

theoretical approaches in the IPO literature, partial adjustment and neglected demand. We follow Rau, Sandvik, and Vermaelen (2024), and adjust these theories to accommodate ESG issues.

In the partial adjustment type of argument,[10] 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 environmental stance 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" case more in terms of price difference between the price set and the "true" price. With this argument (first-day) 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 of the cost of capital is therefore not reflected in the issue price, which is too low, and the first day of trading will induce a price increasing in environmental quality.

Both these theories predict that underpricing will be increasing in the firm's environmental quality, which leads to our formulation of:

Hypothesis 1 *Measures of underpricing increases with the firm's environmental quality.*

Both the above theories rely on an assumption of asymmetric information about the effect of ESG on the firm's cost of capital. It is however questionable if this is a good assumption. Most ESG properties are observable, which means that the investment banker setting the price will have the same opinion about the value of ESG as the potential buyers. There is an alternative approach that can explain ESG-linked differences in the IPO: under-supply of green stocks. In the period we are investigating, the financial industry saw a tremendous growth in "environmentally friendly" funds. These funds would either overweight "good ESG," or be limited to just invest in stocks with high environmental credentials. Then IPOs of "good ESG" firms will see a high demand, in a situation where there (as yet) are few firms able to fit into a "green" portfolio. While this under-supply may be short lived, this theoretical argument still leads to:[11]

Hypothesis 2 *Measures of underpricing decreases with the firm's environmental quality.*

As a corollary to Hypothesis 2 we note that if IPOs are oversubscribed because of demand by institutions, this has implications for the trading volumes after the IPO. These institutions need to keep the green stocks in their portfolios, and will not be selling them. We may therefore expect the trading interest lower for these stocks, which lead to:

Hypothesis 3 *Post-IPO trading volume decreases with the firm's environmental policy.*

[10] This line of argument follows Benveniste and Spindt (1989).

[11] This argument is a special case of the more general discussion of causes of "hot" IPO periods, with ESG investments replacing more general macroeconomic sources of demand for capital. See Lowry (2003) for the general case.

1.4.2 Cost of capital hypotheses

For our analysis, the degree to which the IPO *price* is affected by ESG (in addition to the *underpricing*) is interesting. For some of the hypotheses we assume that the cost of capital is affected by ESG properties. If so, this is likely a property that is also relevant for other stocks on the exchange, not just the IPO stocks. We therefore complement our analysis of IPOs with a separate crossectional estimation of the costs of capital, estimated on non-IPO shares.

To keep things simple, we add an ESG terms to the CAPM, that is, the maintained asset pricing model is this extended CAPM specified in (1):

$$E[r_i^e] = \beta_i E[r_m^e] + \gamma ESG_i, \tag{1}$$

where e_i^e is the excess return $r_i^e = r_i - r_f$ of stock i, and $r_{m,t}^e = r_m - r_{f,t}$ the excess return on a market portfolio. ESG_i is a measure of ESG quality of asset i.[12] This leads to

Hypothesis 4 *If ESG matter for cost of capital, the estimate of γ is different from zero.*

Note that γ can be estimated for periods shorter than the full period, and allow investigation of time series variation in the market's view of ESG.

1.4.3 Greenwashing hypotheses

We have mentioned the tendency by companies to obfuscate their climate contribution in their external communications. Companies may also include such "greenwashing" in their IPO prospectus. An interesting issue is to what degree investors, such as potential IPO bidders, "see through" greenwashing. We will in our text analysis of prospectuses measure to what degree the prospectus has greenwashing elements. The question is then whether the IPO underpricing is affected by greenwashing.

We therefore include

Hypothesis 5 *Investors see through greenwashing.*

2 Economic Environment and Data

We use data from the Nordic (Denmark, Finland, Iceland, Norway and Sweden) and Baltic (Estonia, Latvia and Lithuania) exchanges. Of these, all but Norway have national exchanges as part of NASDAQ. Norway had an independent exchange till 2020, before it was bought by Euronext. The IPO sample is provided by Federation of European Securities Exchanges (FESE).[13] For each firm we gather data on issue prices, stock prices and other company specific information from Euronext,

[12] In estimations we use the ESG ranking provided by LSE workspace.

[13] The statistics section at fese.eu provide detailed lists of all listings at European Exchanges.

LSEG Workspace, Yahoo Finance, and other data providers. We also collect the IPO prospectuses from various public databases. In most cases we will normalize measures across exchanges by converting to US dollars (USD). Exchange rates are collected from Yahoo finance.

2.1 Listing Sample

Table 1 describes the sample, a total of just above 600 listings. Sweden has the largest number of listings, followed by Norway and Finland, which reflect the relative sizes of these economies. The remaining countries have more limited numbers of listings. The table also breaks the sample down by industry, using the ICB categorization common among stock exchanges. Industrials (50) has the most listings, followed by Technology (10).

Table 1: The distribution of the sample of listings on the Nordic Stock Exchanges

Panel A: Country distribution

	2018	2019	2020	2021	2022	2023	2024	2025	2026	All years
Norway	16	11	52	67	16	6	12	7	13	200
Sweden	27	23	28	112	24	4	20	20	3	261
Denmark	10	4	14	24	2	1	1	0	0	56
Finland	12	6	4	26	6	0	3	5	0	62
Iceland	2	0	0	4	2	1	2	1	0	12
Baltics	2	1	2	9	6	3	2	1	0	26
Total	69	45	100	242	56	15	40	34	16	617

Panel B: Industry distribution

	2018	2019	2020	2021	2022	2023	2024	2025	2026	All Years
10 Technology	11	10	18	47	8	1	2	2	0	99
15 Telecommunications	1	0	2	7	2	0	0	1	0	13
20 Healthcare	12	4	15	21	6	1	4	3	0	66
30 Financials	6	3	4	22	4	1	5	6	1	52
35 Real Estate	4	3	3	11	2	0	5	0	2	30
40 Consumer Discretionary	8	10	9	40	6	1	3	5	2	84
45 Consumer Staples	3	1	11	16	2	3	5	2	0	43
50 Industrials	16	10	20	44	14	5	6	10	7	132
55 Basic Materials	2	2	3	9	4	0	2	3	2	27
60 Energy	5	2	9	12	7	3	7	2	2	49
65 Utilities	1	0	6	13	1	0	1	0	0	22
Total	69	45	100	242	56	15	40	34	16	617

The sample of listings on the Nordic Stock Exchange in the period 2018–2026:04. Data source: Federation of European Securities Exchanges (FESE). Listings on Nasdaq Nordic (Denmark, Finland, Iceland, Sweden, Nasdaq Baltics (Estonia, Latvia and Lithuania) as well as the Norwegian listings on the Oslo Stock Exchange (2018-2020) and Euronext/Oslo (2020-2026). Panel A shows a breakdown by country. Panel B shows a breakdown by the ICB industry classification.

There are some further institutional issues. First, this is a period where these Nordic exchanges attempted to garner interest in listing for smaller companies, by introducing lower tiered market places,

with easier listing requirements. Nasdaq introduced their market place "First North." Euronext introduced "Euronext Access" and "Euronext Growth." All of these are lower tiered alternatives to their main markets. Columns 4 and 5 in Table 2 shows where companies in our sample list. The clear majority of firms actually list in the lower tiered markets. The more successful firms will typically later move up to the main list.[14]

Table 2: Characteristics of listing sample

		Listing method		Listing Market		Market Cap (mill USD)	
	Total	IPO	Listing	Main	Growth	mean	median
Denmark	56	52	4	9	47	100.1	30.4
Finland	62	58	4	17	45	178.8	107.9
Iceland	12	8	4	2	10	361.7	185.4
Norway	200	121	79	44	156	477.5	151.9
Sweden	261	229	32	59	202	141.5	49.2
Baltics	26	24	2	0	26	75.3	18.4
All	617	492	125	131	486	256.7	77.4

The table summarizes various characteristics of the IPOs in the sample, by country, and for the whole sample. Column "Total" counts the total listings. The two Listing methods distinguishes between IPO, which involves raising new capital, either just before, or as part of the listing process, or pure listings, where no new capital is raised. The Listing Market distinguishes between the Main board, and the lower tiered Growth boards. For the Nasdaq markets, the Growth category is firms listing in the "First North" markets. For Oslo, it is firms listing in either "Axess" or "Merkur." After Oslo was taken over by Euronext, these change names to "Euronext Access" or "Euronext Growth." The market capitalization (Market Cap is the average (median) of market capitalization at the IPO date, translated to million US dollars (USD).

The second institutional issue concerns the method for getting onto the market. The traditional IPO involve bookbuilding for an issue of new capital, with changing prices reflecting the interest in the bookbuilding process, before the issue price is set just before the listing. We see that for our sample, there are a number of alternatives. One is to just list, without issuing new capital. Another involves new capital, but which is formally done by raising capital as private equity, just before the stocks list. In our analysis we will view this as equivalent to a traditional IPO, where the stock price in the private offering is treated as equivalent to an IPO issue price. In columns 3 and 4 of table 2 we show the split between IPOs (raising capital, either just before, or as part of the listing), and pure listing. Norway is the country with the largest fractions of pure listings, but it is also done in the Nasdaq markets.

For some perspective on the magnitude of the firms listing on these exchanges, columns 6 and 7 in table 2 summarizes the market capitalization (in millions USD) of the firm at the listing point.

[14] We do not include the cases where a stock moves from one market to another in the sample.

2.2 Underpricing

Let us now turn to the object of main interest in analyses of listings: The initial underpricing, measured as the difference between the first price (P_{pre}) and the market price after some trading (P_{post}), such as the close the first day, or the close after a week of trading. As P_{pre} we use either the issue price (from either a public bookbuilding process or a private placement), or the opening prices, which on these exchanges are set in an opening auction.

Table 3: Characterizing underpricing

						Listing market			
	Daily Underpricing			Weekly Underpricing		Daily Underpricing		Weekly Underpricing	
						Main mkt	Growth mkt	Main mkt	Growth mkt
	mean	med	*n*	mean	med	mean	mean	mean	mean
Denmark	3.7	0.0	56	1.4	-0.0	5.8	3.4	5.2	0.8
Finland	3.7	2.1	62	5.7	6.2	1.7	7.9	0.4	6.1
Iceland	6.8	10.9	12	5.2	6.6	4.1	3.6	9.2	4.2
Norway	-1.6	-1.6	200	-4.2	-3.0	-0.6	-1.9	0.2	-5.4
Sweden	1.8	1.1	261	1.0	0.4	10.5	-0.9	8.8	-1.5
Baltics	7.6	3.0	26	11.9	5.5		7.6		11.9
All	1.4	0.0	617	0.3	-0.2	5.5	0.2	5.6	-1.3

Describing underpricing for the sample of listings at Nordic stock exchanges in the period 2018–2026. Underpricing for stock i is measured as: $\text{Underpricing}_i = (P_{i,post} - P_{i,pre})/P_{i,post}$, where $P_{i,pre}$ is the initial price (either the issue price in the IPO, or the opening price), and $P_{i,post}$ is a close price. For the daily underpricing it is the close price on the first day of trading. For the weekly underpricing it is the close after a week of trading. We also group the estimates by whether the Listing Market is the Main market, or one of the lower tier Growth markets. (Nasdaq: First North, Euronext: Access or Growth). The weekly underpricing is measured in USD. Numbers in percent.

Table 3 gives some summary statistics for these two estimates of underpricing, broken down by country. Let us first look at the whole sample, in columns 2 and 3, which show a mean (median) underpricing the first day of 1.4% (0%). These numbers may look strange to readers familiar with the US markets, where for example R. Huang, Ritter, and Zhang (2023) report an average (first-day) underpricing of 41.6% for all IPOs in the US in 2020. A median of 0 implies that about half the listings have negative estimates of underpricing (i.e. overpricing). While there are also cases of negative first day returns in US markets,[15] this seem to be exceptionally low compared to the US.

There are a number of issues. First, the typical IPO underpricing in the Nordic markets are substantially lower than the US, as already mentioned, Scandinavian markets have typical underpricing in the 4-5% region. Second, some of these cases are pure *listings*, where we look at the difference between the open and close prices, not the difference between the price paid at the IPO and the closing price. Thirdly, this average masks another difference with the US case, that many of these are listings in the

[15] Rossovski, Lucey, and Helbing (2025) reports that 20% of US IPOs have negative first day returns in the period 2000 to 2020.

lower tier, less regulated markets. To show how the market place influences the underpricing, the last four columns of Table 3 breaks the underpricing estimates into those for listings at the main market, or for listings at the growth market. Here we see that for listings on the main market, the average first day underpricing is 5.5%, a number close to earlier estimates for Nordic IPOs. It is the listings of the growth market, many of which are pure listings, that generates the low average underpricing.

2.3 Liquidity

Another object of interest for listings concerns the trading in the after-market. To measure that we calculate the turnover, the fraction of the company's shares outstanding traded, either the first day, or the first week. Table 4 provides some descriptive statistics, also calculated separately for the main board and the new markets. The listings on the main board clearly have more first day (week) trading, even if they are much larger.

Table 4: Characterizing Initial Turnover

						Listing market			
	Daily Turnover			Weekly Turnover		Daily Turnover		Weekly Turnover	
						Main mkt	Growth mkt	Main mkt	Growth mkt
	mean	med	*n*	mean	med	mean	mean	mean	mean
Denmark	9.5	5.6	56	13.5	8.6	27.6	6.8	25.1	10.9
Finland	14.5	8.3	62	16.5	9.7		1.7		3.3
Iceland	1.7	1.5	12	3.3	2.8	37.8	7.1	42.0	8.4
Norway	4.5	1.7	200	7.4	3.6	9.8	3.0	13.2	5.7
Sweden	9.4	4.4	261	13.9	6.7	17.8	7.6	23.6	11.9
Baltics	1.2	0.6	26	2.1	1.4		1.2		2.1
All	7.6	3.2	617	10.9	5.4	17.1	5.4	21.1	8.5

The tables show descriptive statistics for Turnover for the sample of Nordic listings in the period 2018–2026:04. Turnover is measured as: (Quantity traded in period)/(Shares outstanding). Numbers in percent.

2.4 Non-IPO sample

In addition to IPO's we will also use data for trading in the secondary markets for non-IPO stocks in the same markets. For this sample we use the largest stocks on these exchanges, and restrict the sample to stocks continuously traded in the period 2016-2026:04. Since all these stocks were traded at the beginning of 2018, they are therefore distinct from our sample of firms listing in 2018 or later. The total sample is 303 stocks.[16]

[16] We rely on Bjørnsgaard and Angell-Olsen (2026) for the sample of listed stocks.

3 Environmental effects in listings

We now turn to the analysis of listings and ESG, where we want to link listing outcomes. (underpricing, trading) with ESG properties. The first challenge, then, is measuring ESG.

3.1 Measuring the greenness of the firms listing

At the IPO stage, firms usually do not have an ESG rating provided by rating agencies. We want to characterize ESG in ways that would have been possible for market participants at the time. The information available is primarily what is in the prospectus. We therefore use the prospectus to construct two proxies for a firm's ESG properties.

3.1.1 Grouping by greenness categories

First, we use a rough grouping into three caterogies, green, neutral or brown. To make the categorization we look at the business model of each firm. We manually go into each firm's business plan, attempting to identify firms that are clearly in a sustainable category (green), or clearly in 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. Figure 1 breaks down the firms in the IPO sample using this rough categorization. We see that in absolute terms, the majority of green IPOs are in the period 2020-2021. In Panel B of the same figure we show the fraction of IPOs in a given year that are in the green category.

3.1.2 Inferring environmental properties from prospectus

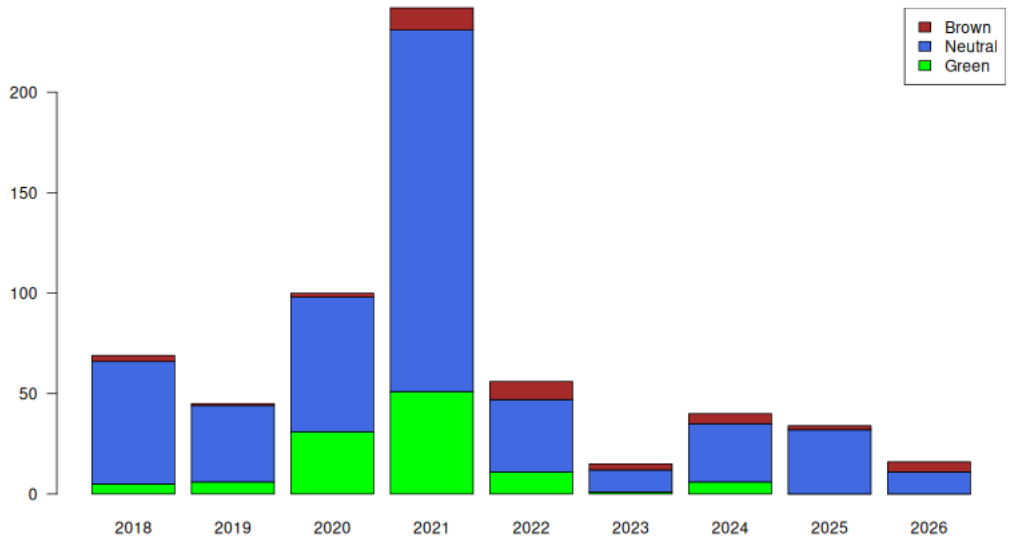
Our second method for classifying the environmental properties of companies tries to create a finer categorization in the ESG dimension using natural language processing. Suppose we want to capture the extent to which a given company prospectus is concerned with environmental issues. Can we rank the degree to which each prospectus talks about environmental issues? To estimate such a ranking, we use two different approaches, one using transformer-based deep learning models, and another using a dictionary-based approach.

We first extract the text of each prospectus, admission document, or company description, converting PDF to text. Information documents related to an IPO commonly contain an excessive amount of information, and to capture the narrative body and reduce noise, we remove appendices such as financial statements and other back matter. The idea is that ESG language appearing only as a note in the annual report, or in an appendix, is not part of the key narrative that form the audience's perception.

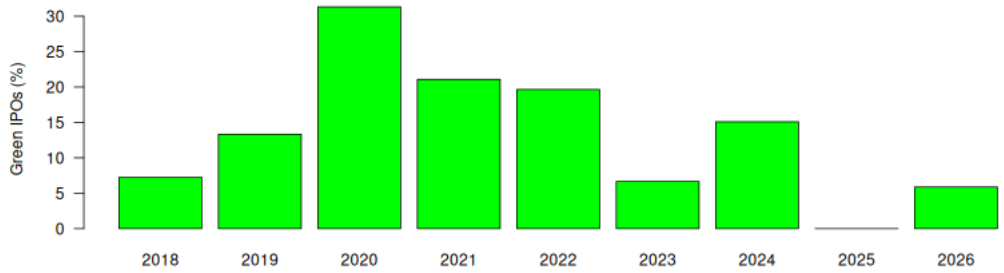
We use two different methods within language modelling. The first method use language transformer-based models specific to finance and climate. The second method is a more traditional dictionary

Figure 1: The number of listings categorized as Green, Neutral, and Brown

Panel A: Number of IPOs per year



Panel B: Fraction of green IPOs per year



Number of listings by whether the company's business can be classified as Green, Neutral, or Brown in our rough categorization: Green – Renewable Energy, Sustainability Innovation, and Circular Economy. Brown – Oil and Gas. Neutral – The rest.

approach. For the transformer-based approach, we use pre-trained deep learning models from the finance and climate litterature to classify each sentence of the prospectus.[17] A sentence needs to contain 40-1000 characters, 5 whitespace-delimited words, and 60% alphabetic characters. Headings, table of contents, headings, and index rows are thereby removed. The languages of the prospectus differ. The majority of the documents are written in English, but regional languages are represented. Since the large language classifiers (the BERT models) are trained on English text, we machine translate the non-English documents (approximately 45%)[18] We label each sentence to one of the ESG categories using FinBERT (A. H. Huang, Wang, & Yang, 2023). In total, we identify 221,722 ESG-tagged sentences, where the majority is social (121,627), followed by governance (55,414) and environmental (44,681). We use the ClimateBERT model from Hugging Face (Webersinke, Kraus, Bingler, & Leippold, 2021) to classify whether there is a specific commitment in the environmental sentences, and whether the commitment is specific or not. We identified 9,979 climate commitments, of which 3,377 are classified as non-specific.

From the classified sentences, we construct the following measurements. First, *env_share* is estimated as the share of prospectus sentences classified as environmental. A higher score suggests that the document discusses environmental issues more. We recognize that companies can discuss environmental issues at length without committing to anything concrete. Following Bingler, Kraus, Leippold, and Webersinke (2024) we measure how much unsubstantiated climate talk (measured in sentences) per unit of text (sentences) (*vague_per1000*). A high value suggests that environmental language is used more for presentation than to inform; firms making no vague claims have a zero score. An issue is thereby that a firm that makes 100 substantiated claims, and no vague ones, and a firm that makes no claims, are scored the same.

In addition to the large language approach, we use a dictionary approach based on the UN Good Governance Framework and the UN Human Development Approach, organized into the ESG pillars. There are some terms that apply regardless of language, highlighting European and international laws and regulations, such as the Corporate Sustainability Reporting Directive (CSRD) and EU taxonomy; these are applied to every document regardless of language, since the naming appear in non-English text. A separate language-tier dictionary regroups a subset of the dictionary terms by rhetorical type: Regulatory and Framework (tier 1), Substantive and Action (tier 2), and Rhetorical and Aspirational (tier 3). We use the R package *quanteda* to conduct the analysis in the following sequence: We first tokenise with punctuation and numbers removed, lowercase, and remove stop-

[17] The identification of sentences is rule-based, where punctuation is followed by whitespace and a capital letter or digit, and we ignore abbreviations such as No.m Inc., Ltd, etc. Hyphenated line breaks are re-joined, and soft-wrapped lines are collapsed.

[18] Language is translated sentence by sentence to English using Helsinki-NLP OPUS-MT. Language is assigned per document by cld2. The same detection is reused by the dictionary pipeline so that both measurement blocks rest on one language assignment rather than two that might disagree. The final language distribution is: English–389, Swedish–227, Finnish–53, Danish–20, Norwegian–10, Estonian–6 and Icelandic–3. In total 430,447 sentences were translated.

words relevant for each language.[19] We also remove tokens shorter than two characters. Since we operate with different languages and language families, we do not stem or lemmatise as this will likely increase noise rather than lower it. Category counts are aggregated into the ESG pillars by prefix and normalised per 1000 tokens. We translate the dictionary to all the relevant corpus languages using Claude, so, in contrast to the BERT models, the original documents are kept as they are, and the dictionary is translated to the relevant language before the estimation. The methods, dictionary, and large language model are different, but can be used to capture similar elements, based on words rather than sentences.

From the dictionary analysis, we construct two variables. First, *esg_environmental_norm*, which is the aggregated pillar for Environment, including 14 sub-categories. The count of terms is normalised against the number of tokens in the document per 1000 tokens. This is similar to the *env_share*, but the large language models are based on sentences, while the dictionary is based on words. The second variable is the *Tier3_share*, which is a dictionary equivalent to *gwm_ratio*. This is based on the Tier 1, Tier 2, and Tier 3 dictionaries. Tier 1 captures references to regulatory standards, directives, and certification (compliance with regulatory obligations). Tier 2 captures substantive action words and phrases that signal specific practices or measurable targets. Tier 3 captures forward-looking and value-based terms with low measurable anchoring:

$$\text{Tier3 share} = \frac{\text{Tier 3}}{\text{Tier 1} + \text{Tier 2} + \text{Tier 3}}. \tag{2}$$

Tier3_share measures how much aspirational and rhetorical words and phrases are used compared to more substantive ones, and can be used as a signal for greenwashing.

The dictionary and transformer measures are methodologically independent. The first reads native-language text against a defined list of terms; the other classifies translated text with fine-tuned models. The rank correlation between *env_share* and *esg_environmental_norm* is 65.5% overall, and 81.2% among the English-language documents. The discrepancy for the non-English text is due to the dictionary approach that identifies less environmental language in non-English prospectuses. This could reflect term coverage in the non-English list; although we have tried to make the lists as similar as possible, there might be other words more frequently used that we do not cover. We therefore use the transformer-based variables as the primary measurement and the dictionary ones as a robustness checks.

3.2 Does greenness affect underpricing?

With these two methods for ranking firms in ESG dimensions on hand, we are now ready to ask whether underpricing *is* linked to ESG properties.

[19] Estonian and Icelandic have no stopword list, so the stopword removal is incomplete

3.3 Green, Neutral and Brown categorization

We start with the rough categorization into the three buckets: Green, Neutral, and Brown. Table 5 shows averages of underpricing for the three groups. The Green stocks clearly are those with the lowest underpricing. It is actually negative; these stocks are issued at prices *overpriced* relative to the closing price.

Table 5: Average Underpricing by Green, Neutral and Brown categorizations

	First day Underpricing			First Week Underpricing		
	Green	Neutral	Brown	Green	Neutral	Brown
Denmark	5.9	3.3		6.0	0.5	
Finland	-5.6	4.9		2.5	5.9	
Iceland		5.2	22.8		3.3	25.9
Norway	-3.9	-0.2	-1.3	-7.0	-2.2	-4.1
Sweden	-4.8	2.5	5.4	-1.0	1.1	6.4
Baltics	9.3	7.6	2.6	10.2	11.8	20.1
All	-3.1	2.6	-0.1	-3.9	1.4	-1.9

Underpricing for stock i is measured as: Underpricing$_i = (P_{i,post} - P_{i,pre})/P_{i,post}$, where $P_{i,pre}$ is the initial price (Either the issue price in the IPO, or the opening price), and $P_{i,post}$ is a close price. For the daily underpricing it is the close price on the first day of trading. For the weekly underpricing it is the close after a week of trading. The weekly underpricing is measured in USD. Numbers in percent.

To more formally establish the results, we embed the estimation of underpricing in a regression model. We formulate a regression model with indicators for the green and brown categorizations. The coefficient on the Green indicator measures whether the underpricing is different for green listings,

Table 6 presents results of regressions. The estimates in column (1) is done without any additional controls. We see that the coefficient on the Green listings is negative and highly significant, indicating that the green listings have significantly *lower* underpricing, consistent with Hypothesis 2 (and rejecting Hypothesis 1). To build confidence in the estimation we then, in column (2), add the market capitalization. This is positive, and highly significant, which implies that the underpricing is less negative (i.e. less overpriced) for larger IPOs. This is a result we have seen already, where we saw that the larger listings (which were done at the main board, not the growth markets), had larger underpricing.[20] But for our purposes, the interesting question concerns the coefficient for Green firms. This retains the sign and magnitude, and remains highly significant. We then proceed to add fixed country and industry effects. Here too, the coefficient on Green remains negative and significant. These results are matched when we look at the first week of underpricing (in Panel B).

[20] In an Internet appendix we present results of corresponding regressions to those presented here, where we add indicator variables for whether the firm is an IPO, and whether it is listing on the main market. We also perform the analysis removing the pure listings. These analyses do not change the conclusions using this simpler specification.

Table 6: Determinants of underpricing using green, neutral and brown categorization

Panel A: First day underpricing

	(1)	(2)	(3)	(4)	(5)
(Intercept)	2.6***	−44.0***	−49.9***	−42.1***	−47.4***
	(0.8)	(9.0)	(9.3)	(9.3)	(9.6)
Green	−5.7***	−6.0***	−3.9**	−5.9***	−4.1**
	(1.9)	(1.9)	(1.9)	(2.0)	(2.1)
Brown	−2.7	−4.3	−1.0	−2.7	0.0
	(2.9)	(2.9)	(3.0)	(3.3)	(3.4)
ln(MktCap)		2.5***	3.2***	2.5***	3.1***
		(0.5)	(0.5)	(0.5)	(0.5)
Fixed country effects	N	N	Y	N	Y
Fixed industry effects	N	N	N	Y	Y
Adj. R^2	0.0	0.1	0.1	0.1	0.1
Num. obs.	599	570	570	570	570

$^{***}p < 0.025$; $^{**}p < 0.05$; $^{*}p < 0.1$

Panel B: First week underpricing

	(1)	(2)	(3)	(4)	(5)
(Intercept)	1.4	−44.9***	−53.6***	−41.9***	−49.4***
	(0.9)	(10.4)	(10.7)	(10.8)	(11.0)
Green	−5.3***	−5.7***	−2.1	−5.9***	−2.8
	(2.1)	(2.2)	(2.3)	(2.3)	(2.4)
Brown	−3.4	−5.0	0.2	−4.2	0.1
	(3.3)	(3.3)	(3.4)	(3.8)	(3.8)
ln(MktCap)		2.5***	3.3***	2.4***	3.2***
		(0.6)	(0.6)	(0.6)	(0.6)
Fixed country effects	N	N	Y	N	Y
Fixed industry effects	N	N	N	Y	Y
Adj. R^2	0.0	0.0	0.1	0.0	0.1
Num. obs.	587	558	558	558	558

$^{***}p < 0.025$; $^{**}p < 0.05$; $^{*}p < 0.1$

The tables report regressions of the form Underpricing $= a_0 + a_{green}1_{green} + a_{brown}1_{brown}$ + additional controls, where 1_{green} is an indicator variable equal to one if the firm is in the green group, and 1_{brown} is an indicator variable equal to one if the firm is in the brown group. The potentially additional controls include the logarithm of the stocks market capitalization (in USD), and fixed effects for selected countries and industries. Underpricing for stock i is measured as: Underpricing$_i = (P_{i,post} - P_{i,pre})/P_{i,post}$, where $P_{i,pre}$ is the initial price (Either the issue price in the IPO, or the opening price), and $P_{i,post}$ is a close price. For the daily underpricing it is the close price on the first day of trading. For the weekly underpricing it is the close after a week of trading. The weekly underpricing is measured in USD. Underpricing is measures in percent.

3.3.1 Text analysis – and greenwashing

We next consider the alternative ESG measure that capture the degree to which the prospectus discusses ESG issues. In Table 7 we present results using two such measures of the environmental focus in the prospective: **env-share** (the share of discussion in prospectus about environmental issues), and **esm-pooled**, (the quantity of environmental keywords). Both these measures increases with ESG. For consistency with the previous results using the rought Green/Neutral/Brown characterization, the coefficients on these variable should be negative. That is what we find, for both specifications the coefficients are negative and significant in all specifications, implying that firms that discusses such issues more in the prospectus (presumably firms concerned with these issues) have lower underpricing.

In this estimation we also bring in analysis of Hypothesis 5, greenwashing. We supplement the measures **env-share** and **esm-pooled** with **gwm-ratio**, a measure increasing with greenwashing (low substance in the discussion). Under the hypothesis that investors see through greenwashing, **gwm-ratio** should have opposite sign to the coefficients on **env-share** and **esm-pooled**. That is what we find, but the coefficient on the greenwashing measure is never significant. There are a couple of possibilities that can explain the lack of significance. First, the firms may be successful in managing to hide their lack of actual green content, and investors do not completely see through greenwashing. Second, it may be that the investors merely need stocks that "look green" to fulfill their obligations. Either of these possibilities would result in the investors not completely taking aboard the actual amount of greenwashing in the prospectus.

3.4 Is greenness related to trading interest?

The underpricing result show that Green firms are less underpriced, which is consistent with Hypothesis 2, under-supply of green stocks. Given that, we can proceed to Hypothesis 3, lower trading interest for green firm. If the overpricing of green listings is due to under-supply, those that participated in the IPO to make sure they got stocks needed for their portfolio will not want to sell them on immediately after the listing. As a result the trading volume post-listing will be lower for the stocks in high demand. We test this prediction by investigating the trading volume on the first day (week) of trading, in the form of turnover.

We proceed in the same manner as when investigating underpricing, and first calculate averages for the three buckets Green, Neutral and Brown. Table 8 shows average turnover for the three buckets. The green stocks have lower turnover than the neutral ones, consistent with a high demand/low supply hypothesis. The average turnover for the few brown listings is however even lower. But this could be due to low demand, as these are companies likely to be excluded from environmentally friendly portfolios.

To more formally estimate this relationship we run similar regression to those used for underpricing, shown in Table 9. The results show that the green categorization has significantly lower turnover.

Table 7: Determinants of first day underpricing using text-based ESG environment measures

Panel A. env_share

	(1)	(2)	(3)	(4)	(5)	(6)
(Intercept)	2.5***	3.3***	−31.0***	−41.7***	−31.0***	−38.8***
	(1.0)	(1.1)	(10.1)	(10.4)	(10.5)	(10.6)
env_share	−28.0**	−30.4**	−24.5*	−25.3*	−21.5	−27.8*
	(13.0)	(13.9)	(14.2)	(13.9)	(14.9)	(14.7)
gwm_ratio		0.8	0.8	0.3	0.7	0.4
		(0.8)	(0.8)	(0.8)	(0.9)	(0.8)
ln(MktCap)			1.8***	2.8***	1.8***	2.6***
			(0.5)	(0.6)	(0.6)	(0.6)
Fixed country effects	N	N	N	Y	N	Y
Fixed industry effects	N	N	N	N	Y	Y
Adj. R^2	0.0	0.0	0.0	0.1	0.0	0.1
Num. obs.	581	465	441	441	441	441

$^{***}p < 0.025$; $^{**}p < 0.05$; $^{*}p < 0.1$

Panel B. esm_pooled

	(1)	(2)	(3)	(4)	(5)	(6)
(Intercept)	1.2*	1.9***	−33.3***	−43.9***	−32.8***	−41.2***
	(0.7)	(0.8)	(10.0)	(10.3)	(10.3)	(10.5)
esm_pooled	−1.5**	−1.7**	−1.6*	−1.4*	−1.4*	−1.6**
	(0.7)	(0.8)	(0.8)	(0.8)	(0.8)	(0.8)
gwm_ratio		0.9	0.8	0.4	0.7	0.4
		(0.8)	(0.8)	(0.8)	(0.8)	(0.8)
ln(MktCap)			1.9***	2.8***	1.9***	2.7***
			(0.5)	(0.6)	(0.6)	(0.6)
Fixed country effects	N	N	N	Y	N	Y
Fixed industry effects	N	N	N	N	Y	Y
Adj. R^2	0.0	0.0	0.0	0.1	0.0	0.1
Num. obs.	581	465	441	441	441	441

$^{***}p < 0.025$; $^{**}p < 0.05$; $^{*}p < 0.1$

The tables report regressions of the form: Underpricing = a_0 + a_{esg}ESG environment measure + additional controls, where *ESG Environment measure* is the variable that measures how much environmental issues is discussed in the prospectus, The potentially additional controls include the logarithm of the stocks market capitalization (in USD), and fixed effects for selected countries and industries. Underpricing for stock i is measured as: $\text{Underpricing}_i = (P_{i,post} - P_{i,pre})/P_{i,post}$, where $P_{i,pre}$ is the initial price (Either the issue price in the IPO, or the opening price), and $P_{i,post}$ is a close price. For the daily underpricing it is the close price on the first day of trading. **env-share**: Share of discussion in prospectus about environmental issues. **esm-pooled** – Quantity environmental keywords **gwm-ratio** – measure of greenwashing.

Table 8: Describing turnover for Green, Neutral and Brown categories

	First day turnover			First week turnover		
	Green	Neutral	Brown	Green	Neutral	Brown
Denmark	6.7	10.1		10.6	15.0	
Finland	6.9	15.3		8.2	17.4	
Iceland		1.7			3.5	
Norway	3.3	5.9	2.9	6.8	8.3	6.2
Sweden	6.4	9.7	2.7	9.9	14.3	3.4
Baltics	2.3	1.1	0.8	3.0	2.1	2.3
All	4.1	8.9	2.8	7.5	12.4	5.9

The tables show averages of turnover for Nordic listings in the period 2018–2026:04. Turnover is measured as: Quantity traded in period/Shares outstanding. Numbers in percent. Grouped into the three baskets: Green, Neutral and Brown.

These regressions thus confirms the picture told by the table with mean turnovers.

Table 9: Determinants of turnover, Green, Neutral Brown categorization

Panel A: First day turnover

	(1)	(2)	(3)	(4)	(5)
(Intercept)	0.089***	0.180*	0.144	0.209**	0.176*
	(0.009)	(0.098)	(0.103)	(0.102)	(0.106)
Green	−0.048***	−0.046***	−0.030	−0.053***	−0.038*
	(0.020)	(0.020)	(0.022)	(0.022)	(0.023)
Brown	−0.061**	−0.056*	−0.034	−0.064*	−0.044
	(0.030)	(0.031)	(0.032)	(0.036)	(0.037)
ln(MktCap)		−0.005	−0.005	−0.006	−0.006
		(0.005)	(0.006)	(0.005)	(0.006)
Fixed country effects	N	N	Y	N	Y
Fixed industry effects	N	N	N	Y	Y
Adj. R^2	0.013	0.013	0.029	0.012	0.027
Num. obs.	482	482	482	482	482

$^{***}p < 0.025$; $^{**}p < 0.05$; $^{*}p < 0.1$

Panel B: First week turnover

	(1)	(2)	(3)	(4)	(5)
(Intercept)	0.123***	0.354***	0.297**	0.383***	0.329***
	(0.012)	(0.127)	(0.132)	(0.131)	(0.136)
Green	−0.048*	−0.044*	−0.027	−0.051*	−0.035
	(0.026)	(0.026)	(0.028)	(0.028)	(0.030)
Brown	−0.065*	−0.054	−0.030	−0.065	−0.043
	(0.039)	(0.039)	(0.041)	(0.046)	(0.047)
ln(MktCap)		−0.013*	−0.012	−0.014**	−0.013*
		(0.007)	(0.007)	(0.007)	(0.007)
Fixed country effects	N	N	Y	N	Y
Fixed industry effects	N	N	N	Y	Y
Adj. R^2	0.007	0.012	0.020	0.008	0.015
Num. obs.	488	488	488	488	488

$^{***}p < 0.025$; $^{**}p < 0.05$; $^{*}p < 0.1$

Panel A report regressions of the form: Turnover $= a_0 + a_{green}1_{green} + a_{brown}1_{brown}$ + Potentially additional controls, where 1_{green} is an indicator variable equal to one if the firm is in the green group, and 1_{brown} is an indicator variable equal to one if the firm is in the brown group. The potentially additional controls include the logarithm of the stocks market capitalization (in USD), and fixed effects for selected countries and industries. Turnover is measured as: Quantity traded in period/Shares outstanding. Numbers in percent.

4 Cost of Capital – is there an ESG effect?

Let us next turn to the non-IPO sample, and ask whether the cost of capital seem affected by ESG, by estimating the model specified in (1).

We consider two asset pricing formulations. First, since our sample of non-IPO firms has been present the whole period 2018-2026, we can use a system formulation that maximizes the econometric power by estimating all coefficients simultaneously. Second, we can use a Fama and MacBeth (1973) type of "rolling beta" estimation that allows for a time-varying estimate of whether ESG matter. This is useful to look for timing of changes.

4.1 Estimation as system

Let us remind the reader of the maintained asset pricing model: $E[r_i^e] = \beta_i E[r_m^e] + \gamma ESG_i$. Note that the beta coefficient varies with the assets, as the market return r_m^e is constant for all i, but γ is constant across companies, as the ESG measure (ESG_i) varies with companies. The object of interest is γ, the coefficient on the ESG measure.

The method for building a system for joint estimation of β and γ builds on Gibbons (1982). We give the details in an appendix on how to create the matrices $\mathbf{X}$, $\mathbf{R}_m^e$, and $\mathbf{ESG}$ in the estimation of the system:

$$\mathbf{R}^e = \beta \mathbf{X} \mathbf{R}_m^e + \gamma \mathbf{ESG} + \varepsilon.$$

We estimate the system above on the selected Nordic equities. Stock returns are translated to monthly US dollar returns.[21] We use the ESG quality measure from LSEG (earlier Datastream), which varies from 0 to 100 (the best ESG). The coefficient γ measures how returns vary with ESG quality. Since the ESG measure is increasing in ESG quality, a negative γ means that expected returns are decreasing in ESG quality.

The regression results are shown in Table 10. Of main interest is the coefficient γ on the ESG measure. As we see, the coefficient is (marginally) significantly negative, although small in absolute value. A negative coefficient has the interpretation that the expected returns (cost of capital) is decreasing in ESG quality, a result which is consistent with most extant empirics.

4.2 Rolling regressions

To allow for the relationship to change over time, we use a Fama and MacBeth (1973) type of "rolling beta" estimation. The estimation proceeds in steps. We first use three years of prior returns to estimate $\beta_{i,T}$, from the market model regression

$$r_{it}^e = \widehat{a}_{i,T} + \widehat{\beta}_{i,T} r_{mt}^e + \varepsilon_{it}, \quad t = T - 37, \cdots, T - 1$$

[21] As the market portfolio and risk free rate we use those provided by Ken French as part of his European factors.

Table 10: Estimate of ESG coefficient

	Dependent variable: R_i^e
γ	-0.00003^{*}
	(0.00002)
Market betas included	yes
Observations	10,234
Adjusted R^2	0.273

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

Estimates of γ in the regression: $\mathbf{R}^e = \beta \mathbf{XR}_m^e + \gamma \mathbf{ESG} + \varepsilon$. Data for large Nordic companies 2016-2025. All returns in USD. Stock returns from Yahoo. Risk free rate and market returns from Ken French European factor returns.

where r_{it}^e is the monthly excess return (in USD) for stock i, and r_{mt}^e the corresponding monthly excess return for the market.

Given this estimate of $\widehat{\beta}_{i,T}$ we run the crossectional regression

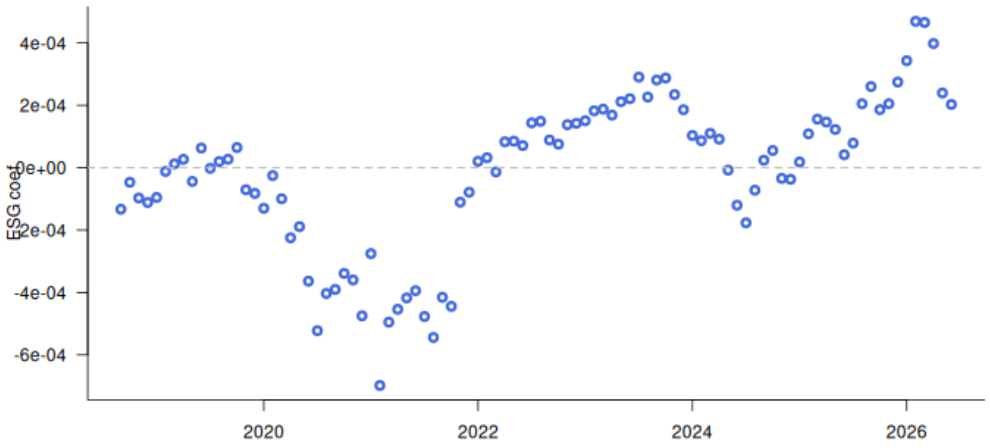
$$r_{i,T}^e = a_{0,T} + b_{m,T}\widehat{\beta}_{i,T} + \gamma_T ESG_i + \varepsilon_{i,T}$$

where ESG_i is same measure of ESG quality for company i as used in the previous estimation.

Figure 2 plots moving averages of estimates of γ_T. First, for the period 2019–2021, the coefficient estimate of γ is negative, A negative coefficient implies that the return (cost of capital) is *decreasing* in the ESG quality measure. Thus, for the period with the large number of green IPOs, where we estimated low underpricing, this negative estimate of γ indicates that the cost of capital is *lower* for green stocks. Second, note the the behaviour of γ at the onset of the Ukraine War. It immediately jumps to close to zero, but positive, at the beginning of 2022, and remains away from negative territory for most of the remaining period. This time series behavior implies that it becomes more expensive to finance green projects starting at the beginning of 2022, which is also the period where we observe a drying up of IPOs. Arguably, that the time series show this clear a break is evidence that the green glow in stock pricing has been gone since 2022.

To more formally show this, table 11 report averages of the coefficient estimates underlying the plot in Figure 2, for the whole period, and for the two subperiods. For the period 2018-2002:02, the coefficient is negative, with a p-value of 7.4%, and for the period after 2022:03, the coefficient is positive, with a p-value of 2.6%. Thus, we find a (marginally) significantly negative estimate in the period when

Figure 2: Time series plot of ESG coefficients



The figure illustrates the time series evaluation of estimates of γ_t estimated from $r^e_{i,T} = a_T + b_T\widehat{\beta}_{i,T} + \gamma_T ESG_i + e_{i,T}$ for the period 2018 to 2026. $\widehat{\beta}$ is estimated using a market model on three years of prior data. The returns data thus starts in 2015. The plots show a nine-month moving average of the estimate of γ_T. Data for large companies on the Nordic Stock Exchanges continuously listed 2018-2025. All returns in USD. Market and risk free returns from Ken French's European data factors.

Table 11: Fama Macbeth statistics

Panel A. Whole Period

	(Constant)	b	γ (ESG)	n
Average	0.004	0.005	-0.00003	96
P-value	0.565	0.182	0.666	

Panel B. Subperiods

	2018–2022:02				2022:03–2025			
	(Constant)	b	γ	n	(Constant)	b	γ	n
Average	0.013	0.007	-0.0002	50	-0.006	0.002	0.0001	46
P-value	0.259	0.121	0.074		0.369	0.744	0.026	

The tables report averages of estimates of a_T, b_T and γ_T, in $r^e_{i,T} = a_T + b_T\widehat{\beta}_t + \gamma_T ESG_i + e_{i,T}$. $widehat\beta_{i,T}$ is estimated using three years of prior data, starting in 2018. The return series thus starts in 2015. Panel A contains averages for the whole period. Panel B contains averages for the subperiods 2018:01–2022:03 and 2022:03–2026:04. Data for large companies on the Nordic Stock Exchanges continuously listed 2018-2025. All returns in USD. Market and risk free returns from Ken French's European data factors.

5 Conclusion

We use the Nordic stock markets as a laboratory to investigate the current state of the link between ESG and the stock market, using data for the period 2018–2026.

The sample period cover the rise and fall of ESG investing. An anecdotal example is Blackrock's announcement in January 2020 that it would address climate change through its investments, and in 2021 more than 450 financial institutions had joined the Glasgow Financial Alliance to reach net zero (Gelles, 2026). The reversal is visible from 2022. US ESG funds had four consecutive quarters of outflows through the third quarter 2023, and US managers closed more ESG funds than they opened (Sorkin, Mattu, Warner, et al., 2023). After the re-election of Trump in 2024, nearly all banks left the Glasgow Alliance (Gelles, 2026). Similar behavior is found among the young investors, the share who considered it very important that funds use their influence on environmental issues fell from 44% in 2022 to 11% in 2024, similarly the share willing to substitute 10% of their retirements savings for environmental improvement fell from 33% to 10% (Gelfand, 2025). Faced with higher inflation and raising interest rate, ESG is described as a luxury that investors set aside when in hard times.

This is the background for our analysis. Our main innovation relative to existing literature is to start with the question of how ESG affects the *raising of new capital* from the stock market, by analysing listings (IPOs). Theoretical and empirical work on asset pricing suggests that the cost of capital is lower for green stocks. But how a hypotetical lower capital affects the terms in an IPO is not straightforward.

We propose two theoretical channels: (1) Asymmetric information between price setter in IPO and investors about how ESG affects the cost of capital leading to higher IPO underpricing for more green stocks, or (2) How ESG affects the cost of capital is common knowledge, but there is low supply/high demand of green stocks, leading to excess demand (and lower IPO underpricing) for green stocks. Note that with this explanation the *IPO underpricing* is unrelated to how ESG affects the cost of capital. The issue price is set to a level that correctly reflects ESG. However, IPO underpricing can still be substantial if there are other sources of asymmetric information, or demand/supply effects relevant for the IPO stock.

We find that for the Nordic markets investigated here, green stocks are sought after in listings, even to the extent that early investors seem willing to overpay to secure allocations, which is supportive of a rationing explanation. Observing that green stocks are traded less in the post-listing market strenghtens this conclusion. We also observe a tapering off of IPOs after 2021, particularly of green IPOs.

Our results on IPOs can not be used to pin down the magnitude with which ESG affects the cost of capital. We therefore turn to the second thread of analysis, more standard crossectional estimation of asset pricing models, adding an ESG measure to the model, asking by how much measured ESG pushes returns down (which is the typical result in the literature), and whether this relationship

changes over time. Applying this to a sample of non-IPO firms in the secondary market on the same exchanges, we find evidence that the market view of ESG has shifted. During the period with most green IPOs, the cost of capital was lower for green stocks, but this shifted at the same time as the start of the Ukranian war. In the current market the cost of capital no longer seem subsidized for green companies.

But what effect these changes to cost of capital have on IPOs are unclear. If our cost-of-capital estimates from the secondary markets are also applicable to IPOs, the "ungreening" of cost of capital will presumably lead to lower IPO *issue* prices, but whether (and how) it affects IPO appetite (and underpricing) is an open question. We argued that our evidence on the low underpricing of IPOs could be due to a low supply of green stocks (and subsequent rationing). The disappearing IPO could then be due to the increased supply of green IPOs 2018–2021 being sufficient to fill the demand, or the demand for ESG credentials could be disappearing.

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