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# Environmental Sustainability and Implied Cost of Equity: International Evidence

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**Abstract** In this paper, we examine the relationship between the environmental practices and implied cost of equity. Using a comprehensive sample of 23,301 firm–year observations from 43 countries, we find that an improvement in environmental practices leads to reduction of the implied cost of equity. Further, the results are stronger in countries where country-level governance is weak. Our results indicate that most of the benefits come from the reduction of emission and unnecessary wastage of resources. Our results remain robust to alternative specifications and endogeneity concerns.

**Keywords** Environmental sustainability · Implied cost of capital · Financial performance

**JEL Classifications** G15 · G18 · Q50 · Q51

## Introduction

As per the Social Investing Forum 2014 report, one out of every $6 invested in the US follows sustainable and responsible investment (SRI) strategies. By the end of 2014, over $6.57 trillion of US-domiciled assets use various environmental, social, and governance (ESG) criteria. Further, environmental issues feature in the top five concerns of the ESG with over $2.94 trillion in assets under management. Given an increasing awareness about environmental protection, there is a continuing debate on whether a firm can benefit from undertaking environment-friendly practices (Horváthová 2010). We find that an improvement in environmental practices leads to reduction of the implied cost of equity, but the effect is not systematic across countries.

The extant literature presents contrasting views on the link between environmental practices and financial performance. For example, Derwall et al. (2005) and Dowell et al. (2000) find that environment-friendly firms have higher market value and stock return. Similarly, Gilley et al. (2000) and Klassen and McLaughlin (1996) document positive abnormal stock returns on the announcement of environmental performance awards. Yamashita et al. (1999) form portfolios based on environmental practices and show that environment-friendly firms perform significantly better than less environment-friendly firms. In contrast, Friedman (1970), Gray and Shadbegian (1993), Jaffe et al. (1995), and Walley and Whitehead (1994) argue that strict environmental controls can have a detrimental effect on firm's operational efficiency. Separately, Cohen et al. (1997) and Fogler and Nutt (1975) do not find any significant relation between environmental practices and financial performance. Wagner (2001) adds that existing studies do not provide conclusive evidence on the relationship between environmental practices and financial performance.

We find that an improvement in environment-friendly practices leads to a reduction of the implied cost of equity. The results are statistically and economically significant. We investigate the country-level determinants and document that the results are stronger in countries where country-level governance mechanism is weak. The results suggest that the market rewards a firm for undertaking environment-friendly practices. Further results indicate that firms located in a weak-governance country can potentially

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access equity at a lower rate by demonstrating a high commitment towards environment-friendly practices. This is potentially due to easier access to funds from banks, funds, and other funding agencies that increasingly use ESG criteria in funding projects.

This study contributes to the existing literature in a number of ways. First, by using a comprehensive sample of 23,301 firm–year observations from 43 countries, we show the relationship between environmental practices and financial performance on a global scale. Previous studies mainly investigate environmental practices and financial performance of industrialized economies. Therefore, it is not clear whether the results of previous studies are generalizable. In addition, Wagner et al. (2001) espouse that, "Although there is ample anecdotal evidence on the considerable economic benefits of individual firms from environmental performance improvement…systematic evidence for larger samples of firms across several industries is much more inconclusive". To the best of our knowledge, there has been no systematic study investigating the link between environmental practices and financial performance in a multicountry setting.

Second, the study considers country-level determinants that are known to influence the behaviour of firms in taking steps towards environment-friendly practices. Dixon-Fowler et al. (2013) suggest that economic, social, legal, and political factors are different across countries. Similarly, Schaltegger and Synnestvedt (2002) assert that the relationship between environmental practices and financial performance is affected by regulatory regime, cultural setting, and customer behaviour. Cormier and Magnan (2007) find that national institutional contexts are important in explaining the relationship between environmental reporting and earnings valuation multiple. We control for these factors and provide new evidence on how the country-level determinants affect firm-level commitment towards environmental practices.

Third, this study uses 38 environmental indicators to capture the environmental performance of a firm. The measure is much broader and arguably reflects better environmental performance metric, compared to the KLD database that covers few environmental indicators. In addition, KLD data covers only the US market. Thus, we use a new indicator of environmental practices and check the validity of previous studies that mostly rely on the KLD data.

Finally, we use a forward-looking measure of capturing ex-ante financial performance. We use the implied cost of equity that is based on forecasted earnings per share (EPS). This measure is dependent on the expected cash flows rather than historical cash flows and potentially captures unbooked environment liability, spillover risk, regulatory, and litigation risk associated with an environmental disaster (Clarkson et al. 2004). Thus, we address a major concern raised in the extant literature that suggests that ex-post realized returns are poor proxy of expected returns (Fama and French 1993).

The rest of this paper is organized as following: the relevant literature is reviewed and hypotheses developed in "Literature Review and Hypotheses Development" section. Data and methodology is presented in "Data and Methodology" section. In "Empirical Results" section, we present empirical results and their implications. Finally, "Conclusion" section summarizes research findings and concludes.

## Literature Review and Hypotheses Development

The relationship between environmental practices and financial performance has been extensively studied. However, it is not clear whether undertaking environment-friendly practices adds value or imposes additional costs on the firm. One strand of literature advocates that improving environmental practices translates to increase in revenue generation, lower cost, product differentiation, access to certain markets, reduction of wastage, eliminating substantial fines, and minimizing liability costs associated with environmental spillovers (Choi and Ng 2011). Klassen and McLaughlin (1996) report positive abnormal return for the stocks that are given environmental performance awards. The results from Dowell et al. (2000) suggest that firms that maintain stringent environmental standards have a higher market value. Derwall et al. (2005) find that superior environmental practices lead to higher stock return, while Yamashita et al. (1999) rank stocks into high and low portfolios based on environmental performance and find risk-adjusted returns of environment-friendly firms significantly outperforming less environment-friendly firms.

In contrast, another strand of literature argues that there is a cost involved in maintaining stringent environmental practices. This can lead to extra burden on a firm's financial resources. For instance, Gray and Shadbegian (1993) find that strict environmental controls can have a negative effect on a firm's productivity. Lioui and Sharma (2012) note that investors perceive environmental strengths as an additional costs or penalties. Friedman (1970) and Jaffe et al. (1995) posit that environmental controls impose high direct and indirect costs, which can further erode a firm's financial resource and competitiveness. Walley and Whitehead (1994) allege that high environmental costs do not justify financial benefits associated with it. Oberndorfer et al. (2013) show that inclusion of German corporations in Dow Jones STOXX sustainability index and the Dow Jones sustainability world index leads to negative stock return. Cohen et al. (1997) and Fogler and Nutt (1975), however, do not find any significant relation between environmental practices and financial performance. Overall, existing studies do not provide a clear link between improving environmental performance and economic benefits (Wagner 2001).

Extant literature also provides evidence on how environmental practices impact expected cash flow of a firm. For instance, Karpoff et al. (2005) note that shareholders may bear the cost of imposed penalties due to environmental spillovers or other concerns. This suggests that environmental practices may not have an explicit cost but an implicit cost that shareholders may have to bear in an event of environmental disaster. The results are in line with Clarkson et al. (2004) who show that environmental disclosure contains material information, which can affect the cash flow of a firm. Similarly, Porter and Van der Linde (1995) suggest that better environment-friendly practices can lead to more effective resource utilization and consequently firms gain competitive advantage. For instance, British Petroleum achieved a 10 % reduction in carbon emissions and a $650 million savings in 3 years by undertaking environment-friendly practices (Carey 2004). Further, an environment-friendly firm can create a positive image in society that may further strengthen the brand and perception of the firm (Hart 1995; Miles and Covin 2000).

It is also important to note that many SRI funds have positive and negative screenings. For example, the trustees can restrict the funds from investing in a firm that has a history of polluting environment. Similarly, the trustees may encourage fund to invest in firms that undertake environment-friendly practices (Amalric 2006). The importance of SRI can be seen at the global level with the launch of principles for responsible investment (PRI) by the United Nations in 2006. Assets under management by PRI signatories stand at $45 trillion as of April 2014,[1] compared to $4 trillion in 2006. The number of PRI signatories has increased substantially from 100 to 1260 as of April 2014, where 94 % have a responsible investment policy in place and over half of the externally managements funds are subject to ESG integration. The increase in the investment universe adhering to ESG criteria suggests that environment-friendly companies may have easier access to funding, which in turn, lowers the cost of capital (Chava 2014).

In addition, a large number of banks have adopted the Equator Principles[2] that advocates lending to firms that are environmentally and socially conscious. Currently, 80 financial institutions from 35 countries have officially adopted these principles, covering more than 70 % of the global lending volume in the emerging markets. The recent initiative on lending suggests that environment-friendly firms may be able to borrow money relatively easier and potentially at a cheaper rate. Based on the above discussion, we formulate the following hypothesis as following:

**$H_1$** Improvement in environment-friendly practices leads to a lower cost of equity.

The second aspect that we investigate is the effects of country-level determinants in explaining the cross-country differences in environmental performance. A majority of the existing studies use data of industrialized economies to establish a relationship between the financial performance and environment-friendly practices. However, the results may not be generalizable to other countries due to differences in economics, social, legal, and political factors (Dixon-Fowler et al. 2013). Schaltegger and Synnestvedt (2002) add that the relationship between environmental practice and financial performance is influenced by factors, such as regulatory regime, cultural setting, and customer behaviour.

Further, social norms, public pressure, and expectations regarding environmental practices can significantly influence a firm's decision to undertake environment-friendly practices (Dixon-Fowler et al. 2013; Pasquero 1991; Sharma and Vredenburg 1998). The problem is further exacerbated in the era of globalization where free trade policy restricts governmental role in import and export. This has led to "race to the bottom" socioeconomic phenomenon where polluting firms threaten to relocate to developing economies if strict environmental standards are enforced (David 1995; Wheeler 2001). Consequently, many developing countries have poor environmental regulations, and thus firms control costs by giving less priority to environmental practices.

Gupta and Goldar (2005) add that capital markets in developing economies play an important role in monitoring the environmental practices as the institutional level monitoring and enforcement mechanism are weak. Also, many SRI funds have emerged with a mandate to invest only as per ESG guidelines (Climent and Soriano 2011). As funds are increasingly investing globally, this may open up opportunities for firms that are located in developing countries. For instance, banks adhering to Equator Principles, which cover more than 70 % of global lending in the emerging markets, are more receptive to lending to firms that are environmentally and socially conscious. Consequently, this may incentivize firms in developing countries to improve their environmental track record in order to access the equity at a cheaper rate.

Dasgupta et al. (2001) suggest that monitoring from market forces in addition to the environmental regulator may provide firms with financial and reputational incentives in the developing countries. The authors indicate that

[1] http://www.unpri.org/news/pri-fact-sheet/, retrieved on 2014.

[2] http://www.equator-principles.com/.

while local communities pressure firms to improve environment-friendly practices, the capital market react negatively to adverse environmental incidents and positively to announcement of environment-friendly practices. The findings are in line with Hettige et al. (1996), where the authors note that despite weak formal regulation, many firms in developing countries undertake environment-friendly practices in order to achieve efficiency, scale and innovation. Based on the above discussion, our second hypothesis is following:

**$H_2$** The effect of environment-friendly practices on cost of equity is stronger in countries with poor governance mechanism.

This paper is closely related to Bauer and Hann (2010), Chava (2014) and Sharfman and Fernando (2008). Sharfman and Fernando (2008) consider environmental practices and cost of capital. However, their sample size is restricted to the US firms and the authors use capital asset pricing model (CAPM) model to estimate the cost of capital. Chava (2014) consider the impact of environmental concerns on the cost of equity and debt. The author reports a positive relationship between the environmental concern and implied cost of equity and debt. However, Chava (2014) study only US firms and the environmental concerns are calculated using the KLD data. Finally, Bauer and Hann (2010) find lower cost of debt for environment-friendly US-listed firms but they do not include the cost of equity.

## Data and Methodology

The environmental performance data comes from Asset4, owned by Thomson Reuters. This database is extensively used by investment professionals to determine firms' ESG performance. Founded in Switzerland, trained research analysts collect over 900 evaluation points per company where all the primary data used is objective and publicly available (Chatterji et al. 2014). Subsequently, these evaluations are categorized into 250 key performance indicators and grouped into 4 major categories and 18 subcategories. Research analysts do not solely rely on the feedback of the company as multiple sources, e.g., stock exchange filings, annual reports, company websites, and various other media outlets are used to verify the accuracy and quality of the information.

The environmental performance of each firm is standardized into *z*-scores measuring the units of standard deviation of that value from the mean value of all firms. By the measure of construction, *z*-scores are normalized to position the score between 0 and 100 %. However, we do not use this measure, as the exact benchmarks against whom the *z*-score is calculated are not disclosed. Further, we do not know which environmental indicators are used in calculating *z*-score and whether they are consistent across time.

To address the above shortcomings, we construct our own environmental performance index using information on each environmental indicator provided by Asset4. For each indicator, Asset4 provides binary information on whether or not the firm meets with the particular attribute. After removing indicators with missing or incomplete information, our index is constructed based on 38 individual indicators. We add all the positive attributes and divide by the total number of attributes to arrive at the overall environmental performance index. This is in line with the previous literature where an additive index is constructed from a set of individual indicators (see Aggarwal et al. 2010 among others). We term it as environmental sustainability index (ESI).

The details of each of the variables are given in Appendix 1 of this paper. Asset4 also provides information on whether the attributes are related to *emission reduction*, *product innovation*, or *resource reduction*. As evident from Appendix 1, around 70 % of the firms have a policy for reducing the use of natural resources as well as describing the implementation of its resource's efficiency policy through the processes in place. Conversely, only 8 % of the companies are willing to end a partnership with a sourcing partner, if the environmental criteria are not met. Further, only 5 % of the firms comment on the results of objectives set in previous years. We note that none of the environmental indicators has a compliance rate of 100 %. We use 11 years of data from 2002 to 2012 as the starting year of Asset4 coverage is 2002.

### Implied Cost of Equity

We next calculate the implied cost of equity using forecasted EPS. Our choice of using implied cost of equity as a measure of financial performance is motivated by the increasing use of ex-ante based measure in the accounting and finance literature. This measure is used in the existing literature in areas such as agency cost and control rights (Chen et al. 2011; Guedhami and Mishra 2009), corporate governance (Chen et al. 2009), audit quality (Hope et al. 2009), labour unions (Chen et al. 2011), political connections (Boubakri et al. 2012), and religion (El Ghoul et al. 2012).

Implied cost of equity provides a number of advantages over ex-post measure, such as realized stock return. Realized returns are backward-looking measure and, by definition, do not fully account for cash flow or discount rate shocks (Campbell 1991; Campbell and Shiller 1988). Vuolteenaho (2002) finds that an individual firm's stock return is primarily driven by cash flow news. However, the unexpected arrival of cash flow news or fundamentals is not properly captured in the realized returns measure. In fact, Blume and Friend (1973), Elton (1999) and Sharpe (1978) argue that realized returns are a poor proxy of expected returns and the measure provides noisy estimation. Further, Fama and French (1997) claim that asset-pricing models, such as CAPM, arbitrage pricing theory or Fama and French's (1993) three-factor model that use realized returns are "woefully imprecise estimates of the cost of equity". Also, Lundblad (2007) and Chava and Purnanandam (2010) allege that a long time-series of realized return is needed to detect a true relationship between risk and return. This may not be feasible for many firms that have a short listing history.

To overcome these limitations, a number of alternatives are suggested where the cost of equity is backed out when a firm's stock price equals expected cash flows. Pástor et al. (2008) favour this approach as the authors opine that this approach is superior in capturing time variation in expected stock returns. Similarly, Tang et al. (2014) document that substituting implied cost of equity with realized return results in disappearance of many anomalies noted in the existing literature. Further, Lee et al. (2009) show that implied costs of equity are economically more robust and less noisy compared to traditional realized returns.

In order to avoid criticism arising from the use of analysts provided EPS, we use cross-sectional model proposed by Hou et al. (2012) and Li and Mohanram (2014) in estimating forecasted EPS. The rationale for not considering analyst supplied forecasted EPS is due to recent criticism that the analyst's estimates are biased (Hou et al. 2012; Abarbanell and Bushee 1997; Francis et al. 2000). We use three different models, namely *HVZ*, earnings persistence (*EP*), and residual income (*RI*) which uses financial statements instead of analysts forecast in deriving forecasted EPS. The details of each model are provided in Appendix 4 of the paper.[3]

We focus on four different models proposed by Claus and Thomas (2001), Easton (2004), Gebhardt et al. (2001) and Ohlson and Juettner-Nauroth (2005). We take an average of four different models as an overall estimate of implied cost of equity. We winsorize the cost of equity to within 0 and 0.60 to remove the effect of outliers. The details of each model are provided separately in Appendix 2: Cost of equity estimates.

### Control Variables

In order to control other factors known to affect the cost of equity, we use illiquidity, standard deviation, leverage, log of total asset, realized inflation, price to book value, blockholding and profitability. We calculate illiquidity as per the Lesmond et al. (1999) model where a stock with no change in price over a period of time is considered illiquid. This measure is calculated as the ratio of zero trading days to the total number of trading days over the last 1 year. It is expected that illiquidity and cost of equity are positively related. Next, we use the daily standard deviation of stock returns over the last 1 year as a measure of risk. It is again expected that a positive relationship exists between riskiness and cost of equity. We measure leverage as long-term debt divided by the total assets. Fama and French (1992) document a negative relationship between firm size and price to book value with stock returns. We use the log of total asset and ratio of price to book value to control these factors. Following Hail and Leuz (2006) and Chen et al. (2009), we annualize country-specific 1-year ahead-realized monthly inflation rates. This measure takes into account the nominal terms of the inputs, such as stock price, book value per share and forecasted EPS. We also use return on assets as a measure of profitability.

We use a number of sources to retrieve data needed for the cost of equity and control variables. Stock prices are from Datastream, control variables are from Worldscope, and inflation rates are downloaded from World Bank. The control variables are winsorized at 1 and 99 percentile to minimize the effect of outliers. The details of the control variables are given separately in Appendix 3.

In Table 1, we provide a brief description of the sample. The country coverage is comprehensive as it includes developed, developing, and transitional economies. In the second column, we provide number of firm–year observations per country. The US, Japan, the UK and Canada dominate the sample with a large number of firm–year observations. However, robustness checks do not indicate that the results are driven by these countries. The table also reports median values of country-level governance variables retrieved from the World Bank database. As evident from the table, majority of the countries with low governance score are from developing economies.

## Empirical Results

We report a year-wise ESI score in Panel A of Table 2 and implied cost of equity in Panel B of Table 2. The ESI mean score has progressively increased from 2002 to 2012. The mean score in 2002 was 14.04 %, and it increased to 39.05 % by the end of 2012. The highest jump is seen in the year 2007, where it increased from 22.64 to 32.91 %. This is around the same time when the Kyoto Protocol entered into force (16 February 2005).

[3] See Li and Mohanram (2014) for details.

**Table 1** Sample distribution and country statistics

| Nos. | Countries | Firm-years | Government effectiveness | Regulatory quality | Rule of law | Voice and accountability |
|---|---|---|---|---|---|---|
| 1 | Australia | 1391 | 1.70 | 1.77 | 1.75 | 1.44 |
| 2 | Belgium | 192 | 1.61 | 1.32 | 1.33 | 1.36 |
| 3 | Bermuda | 335 | 1.00 | 1.37 | 1.11 | 1.04 |
| 4 | Brazil | 91 | −0.12 | 0.18 | −0.01 | 0.47 |
| 5 | Canada | 1299 | 1.77 | 1.68 | 1.79 | 1.43 |
| 6 | Cayman Islands | 188 | 1.23 | 1.13 | 0.89 | 0.54 |
| 7 | Chile | 61 | 1.26 | 1.48 | 1.36 | 1.05 |
| 8 | China | 279 | 0.10 | −0.21 | −0.34 | −1.63 |
| 9 | Denmark | 182 | 2.16 | 1.88 | 1.93 | 1.60 |
| 10 | Egypt | 19 | −0.55 | −0.33 | −0.39 | −1.11 |
| 11 | Finland | 213 | 2.21 | 1.81 | 1.96 | 1.55 |
| 12 | France | 774 | 1.49 | 1.22 | 1.44 | 1.24 |
| 13 | Germany | 539 | 1.57 | 1.53 | 1.64 | 1.35 |
| 14 | Greece | 95 | 0.61 | 0.86 | 0.78 | 0.90 |
| 15 | Hong Kong | 364 | 1.74 | 1.91 | 1.54 | 0.52 |
| 16 | India | 305 | −0.01 | −0.36 | −0.04 | 0.43 |
| 17 | Indonesia | 75 | −0.25 | −0.33 | −0.61 | −0.05 |
| 18 | Israel | 42 | 1.33 | 1.20 | 0.90 | 0.61 |
| 19 | Italy | 400 | 0.42 | 0.95 | 0.42 | 1.02 |
| 20 | Japan | 3376 | 1.46 | 1.13 | 1.32 | 1.02 |
| 21 | Jordan | 3 | 0.10 | 0.30 | 0.37 | −0.73 |
| 22 | Kuwait | 7 | 0.02 | 0.09 | 0.55 | −0.54 |
| 23 | Malaysia | 132 | 1.03 | 0.59 | 0.52 | −0.48 |
| 24 | Mexico | 48 | 0.31 | 0.29 | −0.56 | 0.11 |
| 25 | Netherlands | 290 | 1.79 | 1.75 | 1.76 | 1.58 |
| 26 | New Zealand | 35 | 1.85 | 1.83 | 1.91 | 1.55 |
| 27 | Norway | 157 | 1.86 | 1.45 | 1.92 | 1.58 |
| 28 | Peru | 5 | −0.16 | 0.48 | −0.61 | 0.07 |
| 29 | Philippines | 58 | 0.08 | −0.21 | −0.55 | −0.04 |
| 30 | Poland | 75 | 0.64 | 0.96 | 0.74 | 1.03 |
| 31 | Russia | 66 | −0.45 | −0.36 | −0.77 | −0.88 |
| 32 | Singapore | 320 | 2.18 | 1.80 | 1.68 | −0.20 |
| 33 | South Africa | 310 | 0.41 | 0.40 | 0.11 | 0.58 |
| 34 | South Korea | 320 | 1.22 | 0.94 | 0.99 | 0.70 |
| 35 | Spain | 364 | 1.00 | 1.21 | 1.13 | 1.12 |
| 36 | Sri Lanka | 2 | −0.17 | −0.11 | −0.09 | −0.58 |
| 37 | Sweden | 421 | 2.01 | 1.64 | 1.90 | 1.56 |
| 38 | Switzerland | 548 | 1.96 | 1.65 | 1.81 | 1.59 |
| 39 | Taiwan | 399 | 1.15 | 1.14 | 1.04 | 0.82 |
| 40 | Thailand | 73 | 0.21 | 0.21 | −0.20 | −0.42 |
| 41 | Turkey | 90 | 0.31 | 0.31 | 0.08 | −0.12 |
| 42 | UK | 2418 | 1.66 | 1.74 | 1.66 | 1.33 |
| 43 | US | 6940 | 1.57 | 1.50 | 1.58 | 1.12 |
| | Total | 23,301 | | | | |

This table shows sample distribution and firm–year observations per country. The table also reports country-level governance variables retrieved from the World Bank database

**Table 2** Yearly distribution of environment sustainability scores and implied cost of equity

| Years | Mean (%) | SD (%) | Distribution | | | | | Firm-years |
|---|---|---|---|---|---|---|---|---|
| | | | 5th (%) | 25th (%) | 50th (%) | 75th (%) | 95th (%) | |
| Panel A: Environmental sustainability index | | | | | | | | |
| 2002 | 14.04 | 17.13 | 0.00 | 0.00 | 5.26 | 26.32 | 50.00 | 725 |
| 2003 | 15.47 | 16.99 | 0.00 | 0.00 | 10.53 | 28.95 | 47.37 | 1063 |
| 2004 | 14.85 | 16.93 | 0.00 | 0.00 | 7.89 | 26.32 | 47.37 | 1681 |
| 2005 | 17.21 | 18.26 | 0.00 | 0.00 | 13.16 | 28.95 | 55.26 | 1782 |
| 2006 | 22.64 | 21.58 | 0.00 | 2.63 | 18.42 | 36.84 | 63.16 | 1811 |
| 2007 | 32.91 | 24.92 | 0.00 | 10.53 | 31.58 | 52.63 | 73.68 | 1904 |
| 2008 | 34.72 | 27.00 | 0.00 | 10.53 | 31.58 | 57.89 | 78.95 | 2425 |
| 2009 | 34.05 | 26.86 | 0.00 | 10.53 | 31.58 | 55.26 | 78.95 | 2796 |
| 2010 | 34.61 | 25.86 | 0.00 | 10.53 | 31.58 | 55.26 | 76.32 | 3174 |
| 2011 | 37.11 | 27.17 | 0.00 | 13.16 | 34.21 | 60.53 | 81.58 | 3399 |
| 2012 | 39.05 | 27.51 | 0.00 | 13.16 | 36.84 | 63.16 | 84.21 | 2541 |
| Panel B: Implied cost of equity | | | | | | | | |
| 2002 | 9.89 | 6.46 | 3.98 | 6.15 | 8.07 | 11.47 | 23.53 | 725 |
| 2003 | 7.75 | 6.34 | 2.30 | 4.47 | 6.21 | 8.68 | 18.36 | 1063 |
| 2004 | 7.91 | 5.78 | 3.01 | 4.92 | 6.39 | 8.86 | 17.55 | 1681 |
| 2005 | 7.82 | 4.71 | 3.20 | 5.21 | 6.77 | 8.95 | 16.15 | 1782 |
| 2006 | 8.02 | 4.98 | 3.23 | 5.27 | 6.88 | 9.22 | 16.15 | 1811 |
| 2007 | 7.89 | 4.61 | 2.90 | 5.29 | 7.06 | 9.16 | 15.31 | 1904 |
| 2008 | 11.25 | 6.58 | 4.20 | 7.13 | 9.50 | 13.40 | 24.44 | 2425 |
| 2009 | 8.92 | 5.30 | 3.85 | 5.92 | 7.57 | 10.19 | 18.83 | 2796 |
| 2010 | 8.13 | 5.14 | 3.43 | 5.27 | 6.88 | 9.28 | 17.13 | 3174 |
| 2011 | 9.47 | 5.72 | 3.95 | 6.05 | 7.85 | 10.92 | 20.44 | 3399 |
| 2012 | 9.60 | 6.16 | 3.95 | 5.98 | 7.85 | 10.82 | 22.29 | 2541 |

This table shows yearly distribution of ESI and implied cost of equity

Panel B of Table 2 show implied cost of equity over the sample period. As expected, the cost of equity was highest during the global financial crisis, reaching 11.25 % in 2008. Similarly, the cost of equity was lower during the financial boom, falling to 7.75 % in 2003. The effect of European sovereign debt crisis is also be seen in the result as the average implied cost of equity increase in the year 2012 to 9.60 %. Summing up, the results from Table 2 suggest that the ESI and implied cost of equity measures capture stylized events over the sample time period.

In Table 3, we report the distribution of control variables. The average implied costs of equity calculated using *EP*, *HVZ*, and *RI* model are 8.88, 9.00 and 8.52 %, respectively. We find that the compliance of environment-friendly practices is relatively lower as the average score is 30.06 %. The daily average standard deviation of stock returns is 2.27 %. The long-term debt–asset ratio is around 18.20 %. Illiquidity ratio is 7.27 %, suggesting that on average the prices of firms did not change in 7 out of 100 days. The average ratio of price to book value of firms under observation is 2.56. The blockholding is 24.98 % indicating that ownership is highly concentrated for our sample firms. We find the average return on assets for our sample is 6.05 %. Summing up, the control variables reported in Table 3 are within the expected range of values.

## Regression Results

We estimate the effect of ESI on the implied cost of equity by performing the following regression:

$$R_{i,j,c,t} = \alpha_0 + \alpha_1 \mathrm{ESI}_{i,j,c,t} + \Sigma\alpha_2 \mathrm{Controls} + \varepsilon_{i,j,c,t},$$

where $R_{i,j,c,t}$ is the implied cost of equity of firm *i* in industry *j*, country *c*, and year *t*. $\mathrm{ESI}_{i,j,c,t}$ is ESI of firm *i* in industry *j*, country *c*, and year *t*. The main coefficient of interest is $\alpha_1$ (ESI) with the expectation that $\alpha_1$ is negative. The regression also includes firm- and year-fixed effects. The use of firm- and year-fixed effects control time-invariant factors, and therefore potentially captures unobservable heterogeneity and omitted factor that are related to both ESI and implied cost of equity. For instance, a firm that is listed as ADR in the US stock exchange may have a lower cost of equity (Hail and Leuz 2009). Similarly, firms included in Dow Jones sustainability index may have a

**Table 3** Control variable

| Variables | Mean | SD | Distribution | | | | |
|---|---|---|---|---|---|---|---|
| | | | 5th | 25th | 50th | 75th | 95th |
| Imp. COE-EP (%) | 8.88 | 5.69 | 3.41 | 5.61 | 7.40 | 10.18 | 19.48 |
| Imp. COE-HVZ (%) | 9.00 | 5.25 | 3.49 | 5.81 | 7.87 | 10.66 | 18.18 |
| Imp. COE-RI (%) | 8.52 | 5.48 | 2.98 | 5.37 | 7.27 | 9.91 | 18.61 |
| ESI (%) | 30.06 | 25.96 | 0.00 | 5.26 | 23.68 | 50.00 | 76.32 |
| Illiquidity (%) | 7.27 | 5.90 | 2.30 | 4.21 | 5.51 | 8.81 | 17.24 |
| Riskiness (%) | 2.27 | 1.17 | 1.03 | 1.52 | 2.00 | 2.71 | 4.43 |
| Leverage (%) | 18.20 | 15.48 | 0.00 | 4.91 | 15.80 | 27.50 | 47.58 |
| Log of asset | 15.69 | 1.65 | 13.21 | 14.62 | 15.55 | 16.66 | 18.60 |
| Blockholding (%) | 24.98 | 23.50 | 0.14 | 3.11 | 18.57 | 40.95 | 70.78 |
| PTBV | 2.56 | 2.25 | 0.65 | 1.20 | 1.89 | 3.10 | 6.76 |
| Realized inflation (%) | 2.19 | 1.83 | −0.36 | 1.31 | 2.17 | 3.16 | 4.80 |
| Return on assets (%) | 6.05 | 6.95 | −3.20 | 2.08 | 5.32 | 9.31 | 18.27 |

This table presents the descriptive statistics of the main variables used in this study. Implied cost of equity is calculated using three different models, namely EP, HVZ and RI

*ESI* environment sustainability score calculated for each firm using 38 indicators; *illiquidity* calculated as the ratio of zero trading days to the total number of trading days over the last 1 year; *riskiness* calculated as the volatility of returns over the last 1 year; *leverage* calculated as long-term debt divided by the total assets; *log of asset* logarithm of total assets; *realized inflation* calculated by annualizing country-specific 1 year ahead as realized monthly inflation rates; *PTBV* price to book value; *blockholding* percentage of shares closely held; *return on assets* net income scaled by total assets

lower cost of equity. These, among other time-invariant factors, are captured by means of firm-fixed effects. Further, firm-fixed effects subsume country- and industry-fixed effects.

Table 4 reports the effects of ESI on three alternative implied cost of equity estimates. In Model 1 of Table 4, we regress ESI on the implied cost of equity computed using *EP* model. In Model 2 of Table 4, we use *HVZ* model, whereas in Model 3, we use *RI* model in estimating implied cost of equity.

The coefficient ESI in Model 1 is −0.0171 and statistically significant at the 1 % level, suggesting that environment-friendly firms have lower cost of equity. The results are consistent in Model 2 where the ESI is −0.0142 and statistically significant at the 5 % level. In Model 3, we use *RI* model to estimate implied cost of equity and find qualitatively similar results. The ESI coefficient is −0.0124 and statistically significant at the 1 % level. We find the signs of control variables are consistent with our expectation. Illiquidity, riskiness, inflation and leverage coefficients are positively related to implied cost of equity. On the other hand, large firms with growth opportunities have a lower cost of equity. We find that blockholding has a significant negative effect on the cost of equity, suggesting that blockholding reduces agency costs.

The initial results confirm our a priori hypothesis that a negative relationship exists between environment-friendly practices and the implied cost of equity. The market rewards environment-friendly firms by lowering the cost of equity. The results are also economically significant. For example, when a firm improves environment-friendly practices from the bottom 25 % (ESI = 5.26) to the top 25 % (ESI = 50), the cost of equity can be reduced by 0.77 % (=0.0171 × (50 − 5.26)) using Model 1 estimates. In the following tables, we report the results using *EP* model due to paucity of space. Our results remain qualitatively the same by substituting either *HVZ* or *RI* model.

## Alternative ESI Scores

In this section, we propose an alternative measure of ESI where the environmental practices undertaken by a firm is benchmarked against the firms in the *same* country. The ESI index is standardized by subtracting the average ESI for the country and dividing by the standard deviation of ESI index. This procedure will address the concern that environmental practices undertaken by firms in different countries are not comparable. Without standardizing, the ESI measure will be benchmarked against *all firms* in the sample instead of *relative* to other firms in the *same* country. For instance, level of environmental disclosure is also affected by stakeholder groups' demands in the country (Huang and Kung 2010). In addition, the use of country-adjusted ESI score control mandatory versus voluntary environmental compliance, which vary across countries. Finally, environmental practices vary by

**Table 4** Effect of environment-friendly practices on cost of equity

| | (1) EP model Imp. COE | (2) HVZ model Imp. COE | (3) RI model Imp. COE |
|---|---|---|---|
| ESI | −0.0171*** (−3.89) | −0.0142*** (−2.62) | −0.0124*** (−2.93) |
| Illiquidity | 0.142*** (7.60) | 0.110*** (5.07) | 0.122*** (5.45) |
| Riskiness | 0.815*** (9.62) | 0.732*** (5.97) | 0.810*** (8.11) |
| Leverage | 0.0418*** (5.84) | 0.0342*** (4.11) | 0.0314*** (4.28) |
| Log of asset | −0.0118*** (−5.96) | −0.000490 (−0.16) | −0.00977*** (−4.91) |
| Blockholding | −0.00443 (−1.38) | 0.00357 (0.82) | −0.00109 (−0.30) |
| PTBV | −0.00488*** (−13.53) | −0.00525*** (−12.20) | −0.00487*** (−12.31) |
| Realized inflation | 0.220*** (4.52) | 0.201*** (2.60) | 0.148** (2.41) |
| Return on assets | 0.00856 (0.68) | 0.00742 (0.52) | −0.0551*** (−4.39) |
| Firm FE? | Yes | Yes | Yes |
| Year FE? | Yes | Yes | Yes |
| *N* | 23,301 | 14,815 | 17,595 |
| Adj. $R^2$ | 0.129 | 0.172 | 0.176 |

This table shows the effect of environment-friendly practice on firm's implied cost of equity. In Model 1, the results are run using implied cost of equity from EP model. In Models 2 and 3, implied cost of equity using HVZ and RI model are used, respectively. *t*-statistics in parenthesis and are based on robust standard errors. The model includes firm- and year-fixed effects

*ESI* environment sustainability score calculated for each firm using 38 indicators, *illiquidity* calculated as the ratio of zero trading days to the total number of trading days over the last 1 year, *riskiness* calculated as the volatility of returns over the last 1 year, *leverage* calculated as long-term debt divided by the total assets, *log of asset* logarithm of total assets, *realized inflation* calculated by annualizing country-specific 1 year ahead as realized monthly inflation rates, *PTBV* price to book value, *blockholding* percentage of shares closely held, *return on assets* net income scaled by total assets

* Statistically significant at 10 %, ** statistically significant at 5 %, *** statistically significant at 1 % level

industry, and the importance of environmental protection is more pronounced in certain industries, such as in mining and chemical industry. Consequently, we also benchmark the environmental performance of a firm against other firms that are based in the *same* industry within a country. This standardized measure is calculated as follows:

$$\text{ESI adjusted scores} = \frac{\text{Firm ESI} - \text{mean ESI}}{\text{SD}},$$

where mean ESI is either a country, industry, supersector or sector ESI mean score. SD is the standard deviation of the ESI score within a country, industry, supersector, or sector. We set a minimum of five firms to be present within the particular division to calculate standard deviation. The classification of firms in an industry, supersector, or sector is from industry classification benchmark (ICB). As per the ICB classification, a firm can be identified into 1 of the 10 industries, partitioned into 19 supersectors, and which can be further divided into 41 sectors.

The results from Table 5 document a strong negative relationship between the ESI adjusted score and the implied cost of equity. The coefficients of ESI are −0.00287 for country-adjusted, −0.00268 for industry-adjusted, −0.00229 for supersector-adjusted, and −0.00254 for sector-adjusted. All coefficients are statistically significant at the 1 % level. This suggests that when the environmental performances of firms are benchmarked against other firms in the same country, the strong relationship still exists. In the following analysis, we revert to our original ESI measure. However, our results do not weaken with country-, industry-, supersector-, or sector-adjusted ESI score.

## Components of ESI

In this section, we investigate the components of environmental practices that are most likely related to the implied cost of equity. Our main variable, ESI, can be further subdivided into three components, namely *emission reduction*, *product innovation*, and *resource reduction*. As seen in Appendix 1, *emission reduction* is related to 16 indicators, *product innovation* is related to 9 indicators, and *resource reduction* is related to 13 indicators.

Asset4[4] defines *emission reduction* as "… measures a company's management commitment and effectiveness

[4] http://thomsonreuters.com/en/about-us/corporate-responsibility/esg-performance.html.

**Table 5** Alternative measures of environment-friendly practices and cost of equity

| | (1) EP model Imp. COE | (2) EP model Imp. COE | (3) EP model Imp. COE | (4) EP model Imp. COE |
|---|---|---|---|---|
| ESI country adj. | −0.00287*** (−2.95) | | | |
| ESI industry adj. | | −0.00268*** (−3.04) | | |
| ESI supersector adj. | | | −0.00229*** (−2.63) | |
| ESI sector adj. | | | | −0.00254*** (−2.79) |
| Illiquidity | 0.144*** (7.63) | 0.138*** (6.78) | 0.139*** (6.49) | 0.131*** (5.79) |
| Riskiness | 0.815*** (9.58) | 0.873*** (9.76) | 0.933*** (10.35) | 0.903*** (9.75) |
| Leverage | 0.0418*** (5.83) | 0.0423*** (5.63) | 0.0407*** (5.54) | 0.0362*** (4.64) |
| Log of asset | −0.0116*** (−5.81) | −0.0110*** (−5.46) | −0.0108*** (−5.23) | −0.00948*** (−4.42) |
| Blockholding | −0.00469 (−1.46) | −0.00322 (−0.95) | −0.000474 (−0.13) | −0.000314 (−0.08) |
| PTBV | −0.00490*** (−13.48) | −0.00446*** (−11.69) | −0.00433*** (−10.99) | −0.00401*** (−10.52) |
| Realized inflation | 0.221*** (4.50) | 0.288*** (5.00) | 0.316*** (4.86) | 0.404*** (6.06) |
| Return on assets | 0.00783 (0.62) | −0.000557 (−0.04) | −0.00331 (−0.25) | −0.0159 (−1.17) |
| Firm FE? | Yes | Yes | Yes | Yes |
| Year FE? | Yes | Yes | Yes | Yes |
| *N* | 23,253 | 20,996 | 18,916 | 16,557 |
| Adj. $R^2$ | 0.129 | 0.135 | 0.145 | 0.152 |

This table shows the effect of standardized ESI scores on implied cost of equity. The standardized ESI scores are adjusted within country, industry, supersector and sector in Model 1, 2, 3 and 4, respectively. Dependent variable is implied cost of equity from EP model. *t*-statistics in parenthesis and are based on robust standard errors. The model includes firm- and year-fixed effects

*Illiquidity* calculated as the ratio of zero trading days to the total number of trading days over the last 1 year, *riskiness* calculated as the volatility of returns over the last 1 year, *leverage* is calculated as long-term debt divided by the total assets, *log of asset* logarithm of total assets, *realized inflation* calculated by annualizing country-specific 1 year ahead as realized monthly inflation rates, *PTBV* price to book value, *blockholding* percentage of shares closely held, *return on assets* net income scaled by total assets

* Statistically significant at 10 %, ** statistically significant at 5 %, *** statistically significant at 1 % level

towards reducing environmental emission in the production and operational processes". *Product innovation* is defined as "… measures a company's management commitment and effectiveness towards supporting the research and development of eco-efficient products or services". Finally, *resource reduction* is defined as "… measures a company's management commitment and effectiveness towards achieving an efficient use of natural resources in the production process".

We report the results in Table 6. We find firms that score high in *emission reduction* and *resource reduction* have a lower implied cost of equity. This relationship is statistically significant at the 1 % level. However, the results do not suggest that *product innovation* plays an important role in decreasing implied cost of equity. The result is largely in line with the findings of Wagner (2010), where the author finds that innovation activities do not improve economic performance. The results indicate that firms, which decrease emission, are rewarded as they are less likely affected by penalties and fines (Hart and Ahuja 1996). Similarly, firms that emphasize the importance of limiting unnecessary wastage of resource are rewarded positively by the market (Large and Thomsen 2011).

### Country-Level Determinants

We concentrate on the impact of country-level determinants in explaining firm-level environmental performance and implied cost of equity in Table 7. The worldwide governance indicator data comes from World Bank and provides a time-series score for most of the countries, starting in 2002. We use four country-level determinants, namely government effectiveness, regulatory quality, rule of law, and voice and accountability. The definitions of governance variables are given in Appendix 3 of this paper.

In Models 1 and 2, we split the sample based on the median values of government effectiveness score in each year. We find the effect of ESI on implied cost of equity is stronger in countries with low government effectiveness score. The ESI coefficient in Model 1 is −0.0161 and statistically significant at the 1 % level. We find similar results with regulatory quality, rule of law, and voice and accountability governance variables. Summing up, the results in Table 7 indicate that an improvement in environment-friendly practices is valued more in countries with weak governance mechanism.

**Table 6** Components of ESI index

| | (1) EP model Imp. COE | (2) EP model Imp. COE | (3) EP model Imp. COE |
|---|---|---|---|
| ESI emission reduction | −0.0136*** (−3.68) | | |
| ESI product innovation | | 0.000575 (0.19) | |
| ESI resource reduction | | | −0.0200*** (−5.38) |
| Illiquidity | 0.142*** (7.61) | 0.142*** (7.62) | 0.140*** (7.56) |
| Riskiness | 0.812*** (9.59) | 0.818*** (9.61) | 0.812*** (9.59) |
| Leverage | 0.0419*** (5.85) | 0.0417*** (5.83) | 0.0419*** (5.86) |
| Log of asset | −0.0117*** (−5.90) | −0.0119*** (−6.05) | −0.0117*** (−5.92) |
| Blockholding | −0.00439 (−1.37) | −0.00434 (−1.35) | −0.00458 (−1.42) |
| PTBV | −0.00488*** (−13.53) | −0.00493*** (−13.63) | −0.00488*** (−13.52) |
| Realized inflation | 0.220*** (4.54) | 0.220*** (4.52) | 0.213*** (4.38) |
| Return on assets | 0.00824 (0.66) | 0.00781 (0.62) | 0.00886 (0.71) |
| Firm FE? | Yes | Yes | Yes |
| Year FE? | Yes | Yes | Yes |
| *N* | 23,301 | 23,301 | 23,301 |
| Adj. $R^2$ | 0.129 | 0.128 | 0.130 |

This table uses the components of ESI, namely emission reduction, product innovation, and resource reduction instead of ESI. Dependent variable is the implied cost of equity from EP model. *t*-statistics in parenthesis and are based on robust standard errors. The model includes firm- and year-fixed effects;

*Illiquidity* calculated as the ratio of zero trading days to the total number of trading days over the last 1 year; *riskiness* calculated as the volatility of returns over the last 1 year; *leverage* calculated as long-term debt divided by the total assets; *log of asset* logarithm of total assets; *realized inflation* calculated by annualizing country-specific 1 year ahead as realized monthly inflation rates; *PTBV* price to book value; *blockholding* percentage of shares closely held; *return on assets* net income scaled by total assets

* Statistically significant at 10 %; ** statistically significant at 5 %; *** statistically significant at 1 % level

Gupta and Goldar (2005) add that capital markets in developing economies play an important role in monitoring the environmental practices as the institutional level monitoring and enforcement mechanism are weak. Also, many SRI funds have emerged with a mandate to invest only as per ESG guidelines (Climent and Soriano 2011). As funds are increasingly investing globally, this may open up opportunities for firms that are located in developing countries. Consequently, this may incentivize firms in developing countries to improve their environmental track record in order to access the equity at a cheaper rate.

Our results are in line with Dasgupta et al. (2001), who suggest that monitoring from market forces in addition to the environmental regulator may provide firms with financial and reputational incentives in the developing countries. Similarly, our results support the findings of Hettige et al. (1996), where the authors note that many firms in developing countries undertake environment-friendly practices in order to achieve efficiency, scale and innovation.

## Robustness Checks

We undertake a battery of robustness checks to reinforce the findings of this study. In Column 1 of Table 8, we use two-way clustering by firm and time. This follows the suggestion of Petersen (2009), where the author note that controlling for the correlation among different firms in the same year and different years in the same firm are statistically more robust and suitable for panel data. We find the ESI coefficient is −0.0174 (*t*-statistics −2.72) in Model 1, suggesting that our results remain strong even after controlling for correlation of residuals across firms and time. In Model 2, we use Fama and MacBeth (1973) two-step regression procedure to check whether time effect is driving our result. We again find that it is not the case and the ESI coefficient remains negative and statistically significant.

As seen in Table 1, the sample is dominated by the US, Japanese, Canadian, and Australian firms. Therefore, it may be the case that these countries are driving the result. To negate this concern, we remove US firms from the sample in Model 3. We find that excluding US firms from the sample do not change our main results. Further, we also remove Japanese, Canadian, and Australian firms from the sample. In untabulated result, we find that our findings remain qualitatively same.

In Model 4, we use the readily available environmental indicator (Asset4-ENV) provided by Asset4. This indicator

**Table 7** Country-level governance factors and cost of equity

| | (1) EP model Imp. COE Government effectiveness | (2) EP model Imp. COE | (3) EP model Imp. COE Regulatory quality | (4) EP model Imp. COE | (5) EP model Imp. COE Rule of law | (6) EP model Imp. COE | (7) EP model Imp. COE Voice and accountability | (8) EP model Imp. COE |
|---|---|---|---|---|---|---|---|---|
| | Low | High | Low | High | Low | High | Low | High |
| ESI | −0.0161*** (−3.34) | −0.0101 (−1.14) | −0.0183*** (−3.70) | −0.00518 (−0.59) | −0.0161*** (−3.28) | −0.0131 (−1.49) | −0.0159*** (−3.25) | −0.0131 (−1.48) |
| Illiquidity | 0.302*** (8.65) | 0.0834*** (4.29) | 0.306*** (8.31) | 0.0670*** (3.74) | 0.309*** (8.51) | 0.0724*** (3.73) | 0.271*** (8.95) | 0.0674*** (3.37) |
| Riskiness | 0.791*** (8.62) | 1.090*** (5.91) | 0.717*** (7.43) | 0.979*** (5.69) | 0.751*** (7.94) | 1.020*** (5.90) | 0.836*** (9.06) | 0.984*** (5.81) |
| Leverage | 0.0304*** (3.47) | 0.0355*** (3.14) | 0.0289*** (3.31) | 0.0358*** (3.09) | 0.0283*** (3.20) | 0.0394*** (3.50) | 0.0301*** (3.50) | 0.0390*** (3.46) |
| Log of asset | −0.0128*** (−4.60) | −0.00695** (−2.41) | −0.0122*** (−4.36) | −0.00572** (−2.26) | −0.0127*** (−4.52) | −0.00844*** (−2.84) | −0.0125*** (−4.40) | −0.0103*** (−3.50) |
| Blockholding | −0.00422 (−0.97) | 0.000952 (0.21) | −0.00522 (−1.17) | 0.00710 (1.63) | −0.00419 (−0.96) | −0.000295 (−0.06) | −0.000906 (−0.22) | 0.00147 (0.31) |
| PTBV | −0.00412*** (−9.86) | −0.00583*** (−8.65) | −0.00411*** (−10.12) | −0.00556*** (−8.08) | −0.00425*** (−10.15) | −0.00533*** (−8.22) | −0.00417*** (−9.78) | −0.00568*** (−8.66) |
| Realized inflation | 0.300*** (4.84) | 0.170* (1.66) | 0.195*** (2.93) | 0.336*** (2.95) | 0.257*** (4.39) | 0.0926 (0.81) | 0.357*** (5.94) | −0.210* (−1.82) |
| Return on assets | −0.0459*** (−2.62) | 0.0574*** (3.21) | −0.0368** (−2.09) | 0.0474*** (2.67) | −0.0331* (−1.88) | 0.0452** (2.58) | −0.0255 (−1.45) | 0.0360** (2.09) |
| Firm FE? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| $N$ | 15,280 | 8021 | 15,930 | 7371 | 15,508 | 7793 | 14,861 | 8440 |
| Adj. $R^2$ | 0.159 | 0.179 | 0.144 | 0.184 | 0.145 | 0.178 | 0.157 | 0.181 |

This table shows the effect of country-level governance and firm-level ESI score on implied cost of equity. Dependent variable is implied cost of equity from EP model. Government effectiveness, regulatory quality, rule of law, and voice and accountability are from World Bank governance database. *t*-statistics in parenthesis and are based on robust standard errors. The model includes firm- and year-fixed effects

*ESI* environment sustainability score calculated for each firm using 38 indicators, *illiquidity* calculated as the ratio of zero trading days to the total number of trading days over the last 1 year, *riskiness* calculated as the volatility of returns over the last 1 year, *leverage* calculated as long-term debt divided by the total assets, *log of asset* logarithm of total assets, *Realized inflation* calculated by annualizing country-specific 1 year ahead as realized monthly inflation rates, *PTBV* price to book value, *blockholding* percentage of shares closely held, *return on assets* net income scaled by total assets

* Statistically significant at 10 %, ** statistically significant at 5 %, *** statistically significant at 1 % level

**Table 8** Robustness checks

| | (1) Double clustered | (2) Fama and MacBeth | (3) Excluding US | (4) Asset4-ENV | (5) Country-fixed effect | (6) Tobin's $Q$ | (7) Sample-selection bias | (8) Hierarchical model | (9) Realized return | (10) Including tax ratio | (11) Ex government, financial and utilities |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ESI | −0.0171*** (−2.63) | −0.00636** (−2.96) | −0.0276*** (−4.30) | | −0.00339* (−1.68) | 0.0957** (2.49) | −0.0134*** (−2.89) | −0.0165** (−2.24) | −0.0811*** (−3.38) | −0.0249*** (−4.99) | −0.0189*** (−3.87) |
| ENV-Asset4 | | | | −0.000112*** (−4.14) | | | | | | | |
| Inverse Mills ratio | | | | | | | −0.00811 (−1.61) | | | | |
| Illiquidity | 0.142*** (3.09) | 0.103*** (6.00) | 0.149*** (7.62) | 0.143*** (7.37) | 0.120*** (9.46) | −1.160*** (−9.22) | 0.148*** (7.02) | 0.0987*** (3.43) | 0.239*** (3.31) | 0.156*** (6.94) | 0.173*** (7.05) |
| Riskiness | 0.815*** (3.55) | 0.949*** (7.47) | 0.882*** (6.84) | 0.778*** (8.86) | 0.947*** (7.98) | 0.625 (1.19) | 0.937*** (9.90) | 1.077*** (10.55) | −1.258** (−2.44) | 0.787*** (7.09) | 0.718*** (6.66) |
| Leverage | 0.0418*** (3.09) | 0.0239*** (8.37) | 0.0612*** (5.96) | 0.0446*** (6.27) | 0.0260*** (9.09) | −1.152*** (−16.49) | 0.0469*** (6.08) | 0.0271*** (3.87) | −0.228*** (−5.36) | 0.0486*** (5.80) | 0.0423*** (5.39) |
| Log of asset | −0.0118*** (−3.30) | 0.00122* (2.05) | −0.0162*** (−5.99) | −0.0112*** (−5.44) | 0.00179*** (4.49) | −0.230*** (−12.27) | −0.0166*** (−5.77) | 0.000220 (0.37) | −0.110*** (−9.64) | −0.0119*** (−5.10) | −0.0148*** (−7.15) |
| Blockholding | −0.00443 (−0.78) | 0.00307 (1.32) | −0.0119*** (−2.99) | −0.00400 (−1.23) | −0.00147 (−0.72) | 0.0171 (0.63) | 0.00159 (0.38) | −0.00475 (−1.25) | −0.0427* (−1.93) | −0.0062 (−1.61) | −0.00580 (−1.51) |
| PTBV | −0.00488*** (−7.16) | −0.00337*** (−8.98) | −0.00579*** (−10.92) | −0.00487*** (−13.43) | −0.00377*** (−18.68) | 0.223*** (26.50) | −0.00536*** (−10.30) | −0.00597*** (−10.71) | 0.0753*** (20.07) | −0.0049*** (−12.11) | −0.00477*** (−12.21) |
| Realized inflation | 0.220 (0.80) | | 0.0448 (0.78) | 0.210*** (4.25) | 0.289*** (5.25) | | 0.221*** (4.18) | −0.252*** (−2.92) | | 0.1102* (1.91) | 0.114* (1.94) |
| Return on assets | 0.00856 (0.35) | 0.0175 (0.83) | 0.0237 (1.41) | 0.00742 (0.58) | 0.0146 (1.64) | | 0.0123 (0.98) | 0.0956*** (3.28) | 0.153** (2.27) | 0.0071 (0.51) | 0.0133 (1.03) |
| Tax ratio | | | | | | | | | | 0.0424 (0.89) | |
| Firm FE? | Yes | No | Yes | Yes | No | Yes | Yes | No | Yes | Yes | Yes |
| Year FE? | Yes | No | Yes | Yes | Yes | Yes | Yes | No | Yes | Yes | Yes |
| Industry FE? | No | Yes | No | No | Yes | No | No | No | No | No | No |
| Country FE? | No | Yes | No | No | Yes | No | No | No | No | No | No |
| $N$ | 23,301 | 23,301 | 16,361 | 22,762 | 23,301 | 28,564 | 20,945 | 23,301 | 27,524 | 17,297 | 16,635 |
| Adj. $R^2$ | 0.495 | 0.296 | 0.122 | 0.127 | 0.207 | 0.477 | 0.138 | | 0.400 | 0.125 | 0.139 |

This table reports a number of test to check the robustness of the result. In Model 1, we use two-way clustering using firm and time variable. In Model 2, we implement Fama and MacBeth (1973) procedure. In Model 3, we exclude US firms from the sample. In Model 4, firm-fixed effect is replaced with country- and industry-fixed effect. In Model 5, we substitute ESI with environmental score provided by Asset4. In Model 6, we use an alternative measure of firm performance, Tobin's $Q$. In Model 7, we consider potential sample-selection bias and included inverse Mills ratio. In Model 8, we use longitudinal hierarchical technique to control for potential interdependencies at different level. In Model 9, we use realized stock return as dependent variable. In Model 10, we include tax ratio as an additional control variable. In Model 11, we exclude firms that have at least 10 % of holding by a government or a government institution. We also exclude firms that are located in financial and utilities industries is based on the $z$-score as discussed in "Data and Methodology" section. The rationale for substituting our ESI index with Asset4-ENV is to check whether ESI index is a poor proxy of environmental practices. The ENV-Asset4 coefficient is −0.000112 ($t$-statistics −4.14), suggesting that environment-friendly practices contribute in decreasing implied cost of equity and consistent with our previous results. In Model 5, we replace firm-fixed effects with country- and industry-fixed effects. The results are slightly weaker, with the ESI coefficient statistically significant at the 10 % level.

We consider an alternative proxy of financial performance by substituting implied cost of equity with Tobin's $Q$. We use this measure as Tobin's $Q$ captures the valuation effect that is observable (tangible asset) and unobservable (intangibles). We compute this measure as the sum of total assets less the book value of equity plus the market value of equity, divided by the total assets. If environment-friendly practices contribute positively towards financial performance, then we would expect a positive relationship between ESI and Tobin's $Q$. In Model 6, we show that an increase in environment-friendly practices positively contribute to firm valuation. The ESI coefficient is 0.0957 and statistically significant at the 5 % level, suggesting that environment-friendly practices contribute positively towards firm valuation.

In Model 7, we consider the self-selection bias as our sample is based on the firms that are covered by Asset4. Thus, it is important to check whether Asset4 covered firms have certain characteristics that are different from the firms that are not covered by Asset4. Stated alternatively, we investigate if the results are biased due to nonrandomly selected sample. We follow two-step procedure suggested by Heckman (1979) to address this concern. Specifically, in the first step, we estimate a probit regression in which the dependent variable is a dummy variable taking the value of 1 if the ESI score is available. We then regress the control variables and store the residuals. Next, we transform the residuals to inverse Mills ratio using the procedure outlined by Heckman (1979) and use in the second step as an additional control variable. In order to undertake this test, we use the full universe of sample available to us. 174,020 out of a total of 196,197 firm–year observations do not have ESI score. The results indicate that the inverse Mills ratio is statistically not significant and the ESI coefficient is −0.0134 ($t$-statistics −2.24). Thus, we conclude that self-selection bias is unlikely to affect our main findings.

In Model 8, we use longitudinal hierarchical model. This model is superior in controlling for independencies at the firm-, industry-, and country-level. This study uses firm-level data with repeated observation across years and nested within an industry, and country. Thus, the data can be organized at three levels, i.e., at the firm-, industry- and country-level. For example, repeated monthly observations of Exxon Mobil Corp. are nested at the firm-level, which can be further nested within the oil and gas producers (industry-level) and ultimately to the US (country-level). An additional benefit of hierarchical model is that it controls for uneven sample distribution. Our results, reported in Model 8, indicate that high ESI firms benefit from low implied cost of equity.

In Model 9, we use realized return of the firm instead of implied cost of equity. The rationale for including this test is to check whether ex-ante estimation of the cost of equity is imprecise and whether the results are affected by the estimation errors of the implied cost of equity. The realized return is calculated over 1 year and it includes capital and dividend yield gain. The results in Model 9 suggest that the ESI coefficient is −0.0811 ($t$-statistics −3.38). This is consistent with our expectation that an inverse relationship exists environmental practices and return demanded by the investors. Stated alternatively, firms with poor history of environment practices are likely to be seen more risky by the investors and consecutively they will demand higher returns to compensate for additional risk. This can be due to number of reasons, including unbooked environment liability, spillover risk, regulatory, and litigation risk (Clarkson et al. 2004). Similarly, investors may worry about implicit cost of huge penalties as a result of environment spillovers (Karpoff et al. 2005).

In our second last robustness check, we consider the possibility that tax rates around the world are not consistent, thereby effecting the cash flow of the firm. To control for this effect we calculate tax ratio as the taxes payable scaled by the total assets of the firm. Including the tax ratio as an additional control variable in Model 10 do not alter our main findings. In the last robustness check, we investigate whether ownership of firm by a government or a government institution has a significant effect on the firm's environment-friendly practices and cost of equity. As many of our sample observations come from developing countries, where government control is often high, we exclude firms that have 10 percentage or more held by a government or a government institution to check if our results hold strong.[5] We also exclude the firms that are in the financials and utilities industry as some papers suggest imposing this filter (see Kim et al. 2014 among others).[6] We find the ESI coefficient in Model 11 is −0.0189 ($t$-statistics −3.87), suggesting that the results are robust even after excluding government-controlled firms and the firms

[5] The results are also qualitatively similar if we impose a filter of either 5 or 20 percentage.

[6] We thank an anonymous referee for suggesting the tests in Models 10 and 11.

that are located in highly regulated industries, such as financial and utilities.

### Endogeneity Concerns

Another concern that requires attention is the endogeneity between the implied cost of equity and environmental practices followed.[7] Garcia-Castro et al. (2010) show that it is important to undertake endogeneity checks in order to check whether the results suffer from reverse causality or unobservable firm-specific variables. Further, Ytterhus and Sjaker (1998) note that managers are willing to improve environmental standards only if the financial condition of the firm is good. For instance, it may be the case that firms that are able to lower the cost of equity are more committed towards environmental standards. Alternatively, the results may be driven by a spurious relationship as a missing factor can drive both the cost of equity and environmental performance. However, this issue can be largely addressed by including a firm-fixed effect that captures time-invariant unobservable heterogeneity. Nevertheless, we undertake multiple endogeneity checks to negate these concerns. The rationale to undertake multiple endogeneity checks arises as the extant literature does not suggest which approach is the best.

In Model 1, we use a simultaneous equation system and refer to extant literature in finding an appropriate instrument. We follow Cheng et al. (2014) and use yearly country-mean ESI scores as our instrument. In this approach, we run a two-stage regression. In the first stage, we regress ESI on the yearly country-mean ESI scores, a set of control variables, country-, industry-, and year- fixed effects. Next, we use the residual from the first regression in the second-stage regression in place of ESI. Due to paucity of space, we do not report the results of first stage regression, but will be made available from the authors on request. The results presented in Model 1 of Table 9 indicate that the negative relationship between ESI and implied cost of equity remains strong, indicating the endogeneity concerns may not be the primary driver of the result. The ESI coefficient is −0.00432 and statistically significant at the 5 % level.

In Model 2, we use the simultaneous equation approach suggested by Cai et al. (2012).The authors suggest modelling CSR as a function of operating cash flow to assets, number of analysts following, control variables, and industry dummies. However, we also add country and year dummies as our sample includes firm from multiple countries and across multiple years. Cai et al. (2012) argue that operating cash flows is a proxy of financial constraints, whereas number of analysts following a firm captures public attention and scrutiny. Similar to Model 1, we use the residual estimates of ESI from the first-stage regression in the second-stage regression. Consistent with Model 1, we find the ESI coefficient is negative and statistically significant at the 1 % level, suggesting that an improvement in environment-friendly practices leads to reduction of the implied cost of equity.

In Model 3, we use lag ESI score to control for contemporaneous relationship between ESI and implied cost of equity. The rationale to use lag ESI score is based on the study by Schreck (2011). The author espouse that using lag values fulfil both the relevancy condition and the exclusion restriction, i.e., the instrument should be highly correlated with the ESI, while the correlation between the instrument and implied cost of equity should be low. We again obtain a negative and statistically significant relationship between environment-friendly practices and implied cost of equity.

To further substantiate the results, we test our results using the system generalized method of moments (GMMs) proposed by Arellano and Bover (1995) and Blundell and Bond (1998). The advantage of system GMM is that instead of relying on an instrument, it uses its own past realizations as well as independent variables that are not strictly exogenous as instrumental variables. Therefore, GMM method is useful when a valid instrument cannot be located. The results, after controlling for endogeneity, in Model 4 suggests that ESI coefficient is negative and statistically significant at the 5 % level. In summary, the various checks undertaken above suggests that our results are robust to endogeneity concerns.

## Conclusion

In this study, we test the effect of environment-friendly practices on the implied cost of equity in a multicountry setting. Using a comprehensive 23,301 firm–year observations from 43 countries, we find that an improvement in environmental practices leads to a reduction of the cost of equity. The results are also economically significant. We find that firms can reduce the cost of equity by 0.77 % if they move from bottom 25 % to the top 25 % ESI. We further investigate the country-level determinants and document that this result is dominant in countries where the governance mechanism is weak. Collectively, the results suggest that a firm can signal its commitment to environmental standards by improving its environmental practices. This may distinguish the firm from others firms in the same country and possibly attract SRI investments or access funds at a cheaper rate. The results from this study have major implications for government policy makers, regulators, managers, and market participants. It is imperative for

[7] We acknowledge the referee's suggestion to be more cautious about the endogeneity issues.

**Table 9** Endogeneity checks

| | (1) System equation | (2) System equation | (3) Lag ESI | (4) GMM |
|---|---|---|---|---|
| ESI | −0.00432** (−2.01) | −0.108*** (−7.41) | | −0.0336** (−2.33) |
| Lag ESI | | | −0.0147*** (−3.25) | |
| Illiquidity | 0.120*** (16.69) | 0.129*** (15.13) | 0.190*** (7.45) | 0.0712*** (3.07) |
| Riskiness | 0.947*** (23.66) | 0.831*** (18.42) | 0.864*** (9.46) | 0.564*** (4.59) |
| Leverage | 0.0259*** (9.82) | 0.0179*** (5.86) | 0.0457*** (5.87) | 0.0539*** (2.75) |
| Log of asset | 0.00189*** (5.19) | 0.0122*** (8.46) | −0.00822*** (−4.36) | 0.000568 (0.11) |
| Blockholding | −0.00160 (−0.90) | −0.00819*** (−3.82) | −0.00577* (−1.73) | 0.00265 (0.39) |
| PTBV | −0.00377*** (−21.06) | −0.00268*** (−11.62) | −0.00461*** (−11.50) | −0.00345*** (−4.21) |
| Realized inflation | 0.291*** (5.78) | 0.276*** (5.18) | 0.168*** (2.90) | 0.188** (2.48) |
| Return on assets | 0.0150** (2.42) | 0.0239*** (3.39) | 0.0128 (0.95) | 0.0670*** (3.65) |
| *N* | 23,253 | 22,481 | 19,788 | 23,253 |
| Adj. $R^2$ | 0.210 | 0.112 | 0.121 | |

In this table, we propose a number of endogeneity checks. In Model 1, we use two-stage equation. In the first stage, we regress ESI on the country-mean ESI, a set of control variables, country, industry, and year fixed effects. We use the residual from the first regression in the second-stage regression. Model 2 follows Model 1 but instead of using country-mean ESI, we augment this with operating cash flow and number of analysts following. Due to paucity of space, we do not report the first-stage regression results. In Model 3, we use lagged ESI to control for contemporaneous relationship between ESI and implied cost of equity. In Model 4, we use system generalized method of moments (GMMs). Dependent variable is implied cost of equity from EP model. *t*-statistics in parenthesis and are based on robust standard errors

*ESI* environment sustainability score calculated for each firm using 38 indicators, *illiquidity* calculated as the ratio of zero trading days to the total number of trading days over the last 1 year, *riskiness* calculated as the volatility of returns over the last 1 year, *leverage* calculated as long-term debt divided by the total assets, *log of asset* logarithm of total assets, *realized inflation* calculated by annualizing country-specific 1 year ahead as realized monthly inflation rates, *PTBV* price to book value, *blockholding* percentage of shares closely held, *return on assets* net income scaled by total assets

* Statistically significant at 10 %, ** statistically significant at 5 %, *** statistically significant at 1 % level

the firm to seriously consider the importance of environment-friendly practices and the associated benefits. In addition, the government, especially in developing countries, should take steps that encourage firms to undertake environment-friendly practices.

A limitation that our study potentially suffers is large-cap bias. We address this issue to a large extent by using Heckman (1979) procedure that controls for self-selection bias. Nevertheless, Dixon-Fowler et al. (2013) note that existing literature does not provide clear guidance on whether large-sized firms benefit more than small-sized firms. For example, d'Amboise and Muldowney (1988) and Woo and Cooper (1981) suggest that large-sized firms are able to implement environment-friendly practices as they have strong financial resources. On the contrary, Chen and Hambrick (1995) and Fiegenbaum and Karnani (1991) argue that small-sized firms do not face the same pressure and scrutiny as large-sized counterparts. Thus, small-sized firms are more efficient and flexible in allocating resources to the changing needs of the business. Future research that includes small-sized firms may enhance our knowledge. In addition, follow-up research opportunity exists that investigate the holdings of SRI fund, its impact on firm performance, and incentive to undertake environment-friendly practices.

## Appendix 1

See Table 10.

**Table 10** Asset4 environmental indicators and percentage of firms complying

| Nos. | Description | Compliance (%) |
|---|---|---|
| | Component A: emission reduction | |
| 1 | Does the company have a policy for reducing environmental emissions or its impacts on biodiversity? | 56.85 |
| 2 | Does the company have a policy for maintaining an environmental management system? | 49.34 |
| 3 | Does the company describe the implementation of its emission reduction policy through a public commitment from a senior management or board member? | 20.70 |

**Table 10** continued

| Nos. | Description | Compliance (%) |
|---|---|---|
| 4 | Does the company describe the implementation of its emission reduction policy through the processes in place? | 51.83 |
| 5 | Does the company monitor its emission reduction performance? | 26.00 |
| 6 | Does the company set specific objectives to be achieved on emission reduction? | 23.10 |
| 7 | Does the company report on initiatives to protect, restore or reduce its impact on native ecosystems and species, biodiversity, protected and sensitive areas? | 25.14 |
| 8 | Does the company show an initiative to reduce, reuse, recycle, substitute, phased out or compensate $CO_2$ equivalents in the production process? | 21.35 |
| 9 | Does the company report on initiatives to reduce, substitute, or phase out ozone-depleting (CFC-11 equivalents, chlorofluorocarbon) substances? | 9.50 |
| 10 | Does the company report on initiatives to recycle, reduce, reuse, substitute, treat or phase out total waste, hazardous waste or wastewater? | 47.89 |
| 11 | Does the company report on the concentration of production locations in order to limit the environmental impact during the production process? OR Does the company report on its participation in any emissions trading initiative? OR Does the company report on new production techniques to improve the global environmental impact (all emissions) during the production process? | 17.81 |
| 12 | Does the company report on partnerships or initiatives with specialized NGOs, industry organizations, governmental or supragovernmental organizations that focus on improving environmental issues? | 38.18 |
| 13 | Does the company report or provide information on company-generated initiatives to restore the environment? | 20.81 |
| 14 | Does the company report on initiatives to reduce the environmental impact of transportation of its products or its staff? | 31.46 |
| 15 | Is the company aware that climate change can represent commercial risks and/or opportunities? | 31.82 |
| 16 | Does the company report on its environmental expenditures or does the company report to make proactive environmental investments to reduce future risks or increase future opportunities? | 24.45 |
| | Component B: product innovation | |
| 17 | Does the company have an environmental product innovation policy (eco-design, life cycle assessment, dematerialization)? | 36.80 |
| 18 | Does the company describe the implementation of its environmental product innovation policy? | 24.30 |
| 19 | Does the company describe, claim to have or mention the processes it uses to accomplish environmental product innovation? | 24.30 |
| 20 | Does the company set specific objectives to be achieved on environmental product innovation? | 8.15 |
| 21 | Does the company report on at least one product line or service that is designed to have positive effects on the environment or which is environmentally labelled and marketed? | 24.20 |
| 22 | Does the company develop products or technologies for use in the clean, renewable energy (such as wind, solar, hydro and geo-thermal and biomass power)? | 10.81 |
| 23 | Does the company report on specific products which are designed for reuse, recycling or the reduction of environmental impacts? | 11.44 |
| 24 | Does the company reports about take-back procedures and recycling programmes to reduce the potential risks of products entering the environment? OR Does the company report about product features and applications or services that will promote responsible, efficient, cost-effective and environmentally preferable use? | 33.72 |
| 25 | Has the company received product awards with respect to environmental responsibility? OR Does the company use product labels (e.g., FSC, Energy Star, MSC) indicating the environmental responsibility of its products? | 12.67 |
| | Component C: resource reduction | |
| 26 | Does the company have a policy for reducing the use of natural resources? | 70.09 |
| 27 | Does the company have a policy to lessen the environmental impact of its supply chain? | 42.11 |
| 28 | Does the company describe the implementation of its resource efficiency policy through a public commitment from a senior management or board member? | 44.74 |
| 29 | Does the company describe the implementation of its resource efficiency policy through the processes in place? | 70.64 |
| 30 | Does the company monitor its resource efficiency performance? | 46.11 |
| 31 | Does the company set specific objectives to be achieved on resource efficiency? | 18.46 |
| 32 | Does the company comment on the results of previously set objectives? | 4.71 |
| 33 | Does the company have environmentally friendly or green sites or offices? | 18.60 |
| 34 | Does the company report on initiatives to use renewable energy sources? | 29.57 |

**Table 10** continued

| Nos. | Description | Compliance (%) |
|---|---|---|
| 35 | Does the company report on initiatives to increase its energy efficiency overall? | 52.40 |
| 36 | Does the company report on initiatives to reuse or recycle water? OR Does the company report on initiatives to reduce the amount of water used? | 24.24 |
| 37 | Does the company use environmental criteria (ISO 14000, energy consumption, etc.) in the selection process of its suppliers or sourcing partners? | 32.65 |
| 38 | Does the company report or show to be ready to end a partnership with a sourcing partner, if environmental criteria are not met? | 7.97 |

## Appendix 2: Cost of equity estimates

### Gebhardt et al. (2001)

$$P_t = \mathrm{BV}_t + \sum_{i=1}^{12} \frac{\mathrm{FEPS}_{t+i} - (R_{\mathrm{GLS}} * \mathrm{BV}_{t+i-1})}{(1+R_{\mathrm{GLS}})^i} + \frac{\mathrm{FEPS}_{t+12} - (R_{\mathrm{GLS}} * \mathrm{BV}_{t+11})}{R_{\mathrm{GLS}}(1+R_{\mathrm{GLS}})^{12}}.$$

This model uses two-stage approach to estimate the intrinsic value of the stock. Specifically, the first stage considers EPS forecasts for the first 3 years ahead. The second stage, starting from 4th year to 12th year, assumes that EPS will grow linearly to the industry-specific median ROE. Industry-specific median ROE is calculated as historical 5-year industry-specific median returns where industry is classified either as industrial, financial or services. This adjustment suggests that in long run firm characteristic is more representative of other firms operating in the same industry. The terminal value beyond 12th year assumes 0 incremental economic profits, i.e., RI does not change. This model assumes "clean surplus" relation, e.g., $\mathrm{BV}_{t+1} = \mathrm{BV}_t + \mathrm{FEPS}_{t+1} - \mathrm{DIV}_{t+1}$. The forecasted dividend per share $\mathrm{DIV}_{t+1}$ is calculated as $\mathrm{FEPS}_{t+1}$ * - DPOUT where DPOUT is forecasted dividend payout ratio. Firms with negative ROE are excluded from calculation.

### Claus and Thomas (2001)

$$P_t = \mathrm{BV}_t + \sum_{i=1}^{5} \frac{\mathrm{FEPS}_{t+i} - (R_{\mathrm{CT}} * \mathrm{BV}_{t+i-1})}{(1+R_{\mathrm{CT}})^i} + \frac{\mathrm{FEPS}_{t+5} - (R_{\mathrm{CT}} * \mathrm{BV}_{t+4}) * (1+g_{\mathrm{lt}})}{(R_{\mathrm{CT}} - g_{\mathrm{lt}})(1+R_{\mathrm{CT}})^5}.$$

This model uses abnormal earnings, a special case of RI approach, to circumvent various problems noted in the dividend growth model. The abnormal earnings are calculated from earnings forecasts up to 5 years ahead. More specifically, the model uses earnings forecasts for the first 3 years ahead. The forecasts for the fourth and fifth year are calculated from the forecasted third year EPS and long-term earnings growth rate. In the absence of long-term earnings growth rate, it is substituted by the earnings growth derived from $\mathrm{FEPS}_{t+2}$ and $\mathrm{FEPS}_{t+3}$. After the fifth year, it is assumed that the abnormal earnings will grow at a constant rate $g_{\mathrm{lt}}$. Country-specific inflation rate is used as a proxy for long-term earnings growth rate. This model also assumes "clean surplus" relation.

### Ohlson and Juettner-Nauroth (2005)

$$P_t = \frac{\mathrm{FEPS}_{t+1}}{R_{\mathrm{oJ}}} + \frac{\mathrm{FEPS}_{t+2} - \mathrm{FEPS}_{t+1} - (R_{\mathrm{oJ}} * \mathrm{FEPS}_{t+1} * (1-\mathrm{DPOUT}))}{R_{\mathrm{oJ}}(R_{\mathrm{oJ}} - g_{\mathrm{lt}})},$$

which can be further written as

$$R_{\mathrm{oJ}} = A + \sqrt{A^2 + \frac{\mathrm{FEPS}_{t+1}}{P_t}\left(\frac{\mathrm{FEPS}_{t+2} - \mathrm{FEPS}_{t+1}}{\mathrm{FEPS}_{t+1}} - g_{\mathrm{lt}}\right)},$$

where

$$A = \frac{1}{2}\left(g_{\mathrm{lt}} + \frac{\mathrm{DPOUT} * \mathrm{FEPS}_{t+1}}{P_t}\right).$$

This model follows the procedure outlined in Gode and Mohanram (2003). It uses short-term growth computed from 1-year ahead earnings forecasts which gradually declines to long-term growth rate $g_{\mathrm{lt}}$. The short-term growth rate is calculated as the average between the forecasted percentage change in earnings from year $t + 1$ to $t + 2$, while the long-term growth rate can be obtained from I/B/E/S. The model requires positive earnings for the period $t + 1$ and $t + 2$ for numerical approximation to converge. The long-term growth rate equals country-specific inflation rate.

**Easton (2004)**

$$P_t = \frac{\mathrm{FEPS}_{t+2} - \mathrm{FEPS}_{t+1} - (R_{\mathrm{Easton}} * \mathrm{FEPS}_{t+1} * \mathrm{DPOUT})}{R^2_{\mathrm{Easton}}}.$$

This model is a special case of the OJ model where the abnormal returns are assumed to exist in perpetuity after the initial period. It uses 1- and 2-year ahead earnings forecasts combined with dividend payout to estimate abnormal earnings. This model requires positive changes in forecasted earnings for numerical approximation to converge.

## Appendix 3

See Table 11.

**Table 11** Variable definitions

| | Variables | Definition | Sources |
|---|---|---|---|
| A | Country-level variables | | |
| 1 | Government effectiveness | Perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies | World Bank |
| 2 | Regulatory quality | Perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development | World Bank |
| 3 | Rule of law | Perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence | World Bank |
| 4 | Voice and accountability | Perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media | World Bank |
| B | Firm-level variables | | |
| 1 | PTBV | Price to book value | Worldscope |
| 2 | Log of asset | Logarithm of total asset | Worldscope |
| 3 | Blockholding | Blockholding is percentage of shares closely held | Worldscope |
| 4 | Illiquidity | Following Lesmond et al. (1999), illiquidity is calculated as the ratio of zero trading days to the total number of trading days over the last 1 year | Author's own calculation |
| 5 | Riskiness | Firm risk is volatility of daily returns over the last 1 year | Author's own calculation |
| 6 | Leverage | Long-term debt divided by the total assets | Worldscope |
| 7 | Realized inflation | Annualized country-specific 1 year ahead realized monthly inflation rates | World Bank |
| 8 | ESI | Environmental sustainability index: using firm-level 38 environmental indicators | Asset4, author's own calculation |
| 9 | ESI country-adjusted | (Firm ESI—country-mean ESI)/SD | Author's own calculation |
| 10 | ESI sector-adjusted | (Firm ESI—country, sector mean ESI)/SD | Author's own calculation |
| 11 | ESI emission reduction | "… measures a company's management commitment and effectiveness towards reducing environmental emission in the production and operational processes" | Asset4, author's own calculation |
| 12 | ESI product innovation | "… measures a company's management commitment and effectiveness towards supporting the research and development of eco-efficient products or services" | Asset4, author's own calculation |
| 13 | ESI resource reduction | "… measures a company's management commitment and effectiveness towards achieving an efficient use of natural resources in the production process" | Asset4, author's own calculation |
| 14 | ENV-Asset4 | "… measures a company's impact on living and non-living natural systems, including the air, land and water, as well as complete ecosystems" | Asset4 |
| 15 | Tobin's $Q$ | Sum of total assets less the book value of equity plus the market value of equity, divided by total assets | Author's own calculation |
| 16 | Realized return | Ex-post stock return over the last year | Worldscope |
| 17 | Return on assets | Net income scaled by total assets | Worldscope |
| 18 | Tax ratio | Income taxes payable scaled by total assets | Worldscope |

**Table 11** continued

| | Variables | Definition | Sources |
|---|---|---|---|
| 19 | Government holding | The percentage of strategic holdings of 10 % or more held by a government or a government institution | Datastream |
| 20 | No. of analyst following | Number of analysts following a firm | I/B/E/S |
| C | Implied cost of equity capital estimates | | |
| 1 | $P_t$ | Market price of a firm's stock at time $t$ | Datastream |
| 2 | $\mathrm{BV}_t$ | Most recent available book value per share of a firm | Worldscope |
| 3 | $\mathrm{BV}_{t+i}$ | Expected book value per share of a firm assuming "clean surplus" relationship holds | Author's own calculation |
| 4 | DPOUT | Forecasted dividends payout ratio calculated from firm-specific historical 3-year median dividends payout ratio. A country-specific 3-year historical median dividend payout ratio is used as a substitute whenever firm-specific dividend payout ratio is missing | Author's own calculation |
| 5 | $g_{\mathrm{lt}}$ | Expected (perpetual or long-term) earnings growth rate. $g_{\mathrm{lt}}$ is calculated by annualizing country-specific 1-year ahead realized monthly inflation rates and winsorized to within 0 and 0.25 | Author's own calculation |
| 6 | $\mathrm{FEPS}_{t+i}$ | Forecasted earnings per share of a firm. FEPS is calculated using three alternative models, EP, HVZ and RI. See Appendix 4 for details | Author's own calculation |

## Appendix 4

See Table 12.

**Table 12** Forecasted earnings per share

| | Variables | Definitions | Sources |
|---|---|---|---|
| A | *EP* earnings persistence model from Li and Mohanram (2014) | | |
| | $E_{j,t+i} = \beta_0 + \beta_1$ Negative $E_{j,t} + \beta_2 E_{j,t} + \beta_3$ Negative $E_t * E_{j,t} + \varepsilon_{j,t+i}$ | | |
| 1 | $E_{t+i}$ | Earnings in year $t + i$ divided by total number of shares outstanding in year $t$ | Worldscope |
| 2 | Negative $E_t$ | Dummy variable indicating negative earnings | Worldscope |
| 3 | Negative $E_t * E_{j,t}$ | Interaction term of Negative $E_t$ and $E$ | Worldscope |
| B | *HVZ* Hou, van and Zhang model from Hou et al. (2012) | | |
| | $E_{j,t+i} = \alpha_0 + \alpha_1 A_{j,t} + \alpha_2 D_{j,t} + \alpha_3 \mathrm{DD}_{j,t} + \alpha_4 E_{j,t} + \alpha_5$ Negative $E_{j,t} + \alpha_6 \mathrm{AC}_{j,t} + \varepsilon_{j,t+i}$ | | |
| 1 | $E_{t+i}$ | Earnings in year $t + i$ | Worldscope |
| 2 | $A_t$ | Total assets in year $t$ | Worldscope |
| 3 | $D_t$ | Common dividend paid | Worldscope |
| 4 | $\mathrm{DD}_t$ | Dummy variable indicating whether the firms pays dividend or not | Worldscope |
| 5 | Negative $E_t$ | Dummy variable indicating negative earnings | Worldscope |
| 6 | $\mathrm{AC}_t$ | Change in noncash current assets less change in current liabilities excluding change in short-term debt and change in taxes payable minus depreciation and amortization | Worldscope |
| C | *RI* residual income model from Li and Mohanram (2014) | | |
| | $E_{j,t+i} = \gamma_0 + \gamma_1$ Negative $E_{j,t} + \gamma_2 E_{j,t} + \gamma_3$ Negative $E_t * E_{j,t} + \gamma_4 B_{j,t} + \gamma_5 \mathrm{TACC}_{j,t} + \varepsilon_{j,t+i}$ | | |
| 1 | $E_{t+i}$ | Earnings in year $t + i$ divided by total number of shares outstanding in year $t$ | Worldscope |
| 2 | Negative $E_t$ | Dummy variable indicating negative earnings | Worldscope |
| 3 | Negative $E_t * E_{j,t}$ | Interaction term of Negative $E_t$ and $E$ | Worldscope |
| 4 | $B_t$ | Book value of equity divided by total number of shares outstanding | Worldscope |
| 5 | $\mathrm{TACC}_t$ | Total accruals ((sum of change in net working capital, change in non-current operating assets, and change in net financial assets) divided by total number of shares outstanding) | Worldscope |

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