Stockholm School of Economics
Bachelor Thesis
Accounting & Financial Management
Spring 2015

Corporate Social Responsibility and the Cost of Capital

Is CSR priced in the Swedish capital market?

Abstract

This study aims to investigate whether corporate social responsibility (CSR) could increase firm value by lowering the cost of equity capital. Data is collected from firms on the Stockholm Stock Exchange (OMX Stockholm) between 2006 and 2014. The results show a significant negative relationship between CSR and the cost of equity capital obtained through accounting-based valuation models; thus implying that firms with higher CSR rating have lower cost of equity capital. However, by including firm fixed effects and using an instrumental variable method to test the causality between CSR and cost of equity capital, the result indicates that endogeneity seems to drive the relationship. Furthermore, the results also show a curvilinear relationship where the majority of firms in our sample that have not reached the tipping point can enjoy lower cost of equity capital associated with an increase in CSR activities, especially in environmental efforts as these are more valued by the Swedish capital market than social efforts.

Authors: Josefin Halvarsson (22508) and Anna Zhan (22749)
Tutor: Florian Eugster

Keywords: Corporate Social Responsibility, Cost of Equity Capital, Information Asymmetry, Instrumental Variable, Value Relevance

Acknowledgements: We would like to thank Katarzyna Burger and Agnieszka Kulczynska at GES Investment Services. We are also grateful to Aleksander A. Aleszczyk, Ph.D. student at London Business School, Evelina Bonnier, Ph.D. student at Stockholm School of Economics, Matteo Zambanini and friends for valuable help. A special thanks to our tutor Florian Eugster, Assistant Professor at Stockholm School of Economics, for guidance and support.

Table of content

1. Introduction

Corporate social responsibility (CSR) has become more important in recent years due to the increased awareness of sustainability, therefore interdependence between business and society is key (Porter and Kramer, 2006). To stay competitive in a global market, where firms have to secure their long-term profitability, it is important to gain understanding of the relationship between CSR and financial performance from the capital market participants' perspective (Cheng et al., 2014). It is therefore essential to answer the following question; is CSR value relevant for the firm and priced in the capital market?

Based on US data, El Ghoul et al. (2011) show that firms with high CSR performance have lower cost of equity capital. They argue that decreased information asymmetry is one of the channels through which CSR affects the cost of equity capital as investors perceive less risk. As norm-conscious investors neglect firms with low CSR performance, the relatively smaller investor base limits the risk-sharing among investors. Moreover, as analysts are more prone to follow firms with high CSR performance, these firms are more willing to voluntary disclose information. Consequently, voluntary CSR disclosure decreases information asymmetry and therefore lowers the firm's cost of equity capital (Dhaliwal et al., 2011). Although being well-developed, the Swedish market has had relatively low analyst coverage compared to other European countries (Doukas and McKnight, 2005). Since analysts act as intermediaries of information in the stock market, a shortage of analysts would suggest that investors demand a higher compensation for information asymmetry. Therefore we believe that the effect of CSR ratings, as a way of decreasing information asymmetry on the cost of capital, should be stronger in Sweden.

There are several reasons to why the Swedish market is interesting from a sustainability perspective. Sweden was the first country in the world to require state-owned firms to publish sustainability reports according to the Global Reporting Initiative; the globally accepted sustainability reporting guidelines (Swedish Government, 2007). The government's objective is to ensure long-term value growth and focus on including sustainability in firms' business strategy (ibid). Thus we can see an increasing importance placed on sustainability practices from the government's perspective. Furthermore, pension funds are amongst the main investors on the European socially responsible investing (SRI) market due to their long-term investment horizons. In 2007, Swedish national pension funds formed an ethical council to exert influence on firms to

improve their environmental and social actions (Eurosif, 2014). The United Nations initiative Principles for Responsible Investment (UN PRI) was launched in 2006 as a framework instructing incorporation of environmental, social and governance issues into investment analyses and decision-making processes (Phillips, 2014). As of June 2014, 38 asset owners, investment managers and professional services partners in Sweden had signed the UN PRI (Eurosif, 2014). These are signs of how social responsibility is developing into a natural part of investment decisions.

Previous research has investigated the relationship between corporate social performance to both accounting-based and market-based measures with mixed results (Waddock and Graves, 1997; McWilliams and Siegel, 2000; Orlitzky et al., 2003). The findings by Dhaliwal et al. (2011) and El Ghoul et al. (2011) have given rise to new research to gain understanding of the relationship between CSR and financial performance from the capital market participants' perceptions of CSR (Cheng et al., 2014). Examining the relationship between CSR and the cost of equity capital can consequently help managers comprehend the effect of CSR investments on firms' financing costs.

This study contributes to previous research in the field in several aspects. First, CSR has received increased societal attention in Sweden, however research done in a Swedish context has been limited. Semenova, Hassel and Nilsson (2009) studied the value relevance of CSR on the market value of equity on Swedish firms and found a positive relationship. Therefore, the Swedish capital market needs to be studied further. Second, this study examines the underlying mechanism driving the relationship between CSR and cost of capital, and introduces two ways to control for endogeneity. Previous studies have mainly focused on the direction and not put enough weight on the causality. Third, this study further contributes by investigating changes in the marginal effect of CSR to find whether there is an optimum level or time period as this has not been done before.

1.1 Purpose of study

The purpose of the study is to investigate whether CSR performance has any value relevance for firms. One way to measure value relevance is through the cost of capital of a firm, which takes the investor's perception and preference into consideration. If investors' investment analyses take CSR performance into account in the decision-making process, this would be reflected in the firm's cost of capital. Thus, CSR could be a hidden treasure for firms and increase firm value. Therefore, this study aims to answer the following research question:

"Does a firm's CSR performance affect its cost of capital?"

1.2 Research boundaries

The scope of the study is to investigate Swedish firms listed on the OMX Stockholm. The sample period has been limited to the years 2006 to 2014 due to the data provided by GES Investment Services. Only environmental and social dimensions of CSR are evaluated, whereas corporate governance is excluded due to the shortage of data. The quality and disclosure of sustainability reports is not investigated, instead CSR ratings from independent rating institutes are taken as given. Furthermore, the cost of capital is calculated through the ex-ante approach using accounting-based valuation models, causing a sample that is limited by firms with analyst coverage. Since we are mainly interested in the relative level of cost of capital against CSR, rather than the absolute level, we do not incorporate the probability of bankruptcy failure in the cost of capital and it is therefore not representative of an unbiased expected return (Skogsvik, 2006). Cost of equity and cost of capital are used interchangeably in this study, whereas cost of debt is not considered.

1.3 Outline

This study is outlined as follows. Chapter 2 presents the theoretical framework and previous research on CSR and cost of capital. The test logic and general hypotheses are presented in Chapter 3. In Chapter 4, the chosen method and sample are described and motivated. Results and analysis from our statistical tests are presented in Chapter 5. Chapter 6 provides a discussion of our findings and reliability of assumptions, as well as robustness tests. Finally, in Chapter 7 conclusions of the research are presented as well as suggestions for future research on the subject. References and appendix are presented in Chapter 8 and 9 respectively.

2. Theoretical framework and previous research

In this chapter we put forward the theoretical framework and relevant research that motivates our study of the relationship between CSR performance and cost of equity capital.

2.1 CSR

As of today, CSR is a widely used concept in corporations and the business world. It has a variety of definitions, some of which are listed below.

"*CSR is concerned with treating stakeholders of the firm ethically or in a responsible manner.*"
(Hopkins, 2004)

"*The social responsibility of business encompasses the economic, legal, ethical and discretionary expectations that a society has of organizations at a given point in time.*"
(Carroll, 1991)

"*[CSR is] the responsibility of enterprises for their impacts on society.*"
(European Commission, 2011)

While the scope and dimensions of CSR may differ among the definitions, the central idea is to describe *"actions that appear to further some social good, beyond the interests of the firm and that which is required by law"* (McWilliams and Siegel, 2001), which is the definition used in this study. Business and society are interdependent and CSR serves as the link between them. The competitive ability of firms relies on the locations and social settings in which they operate, therefore, focus should be placed on these elements (Porter and Kramer, 2002). For example, firms' productivity depend on safe, educated and healthy workers, therefore, focusing on society creates shared value; mutual benefits for business and society when business decisions and social policies follow the same agenda (Porter and Kramer, 2006).

2.1.1 Value creating or value destroying?

There are two main schools regarding value relevance of CSR; the cost-concerned school and the value-creation school. The former school, rooted in neoclassical economics argues that investments in sustainability activities only lead to increased costs and hence a lower market value (Friedman, 1962). Taking a shareholder view, Friedman (1970) argues that CSR activities are not in the interest of shareholders and that the only social responsibility a firm has is to increase profits.

The latter school, concerned with value-creation and commonly credited to Freeman (1984), incorporates the interests of different stakeholders who benefit from the firm's actions. He advocates that by engaging in CSR activities, the firm will get a competitive advantage as well as increase its profitability (Patten, 1991; Orlitzky et al., 2003). Furthermore, engaging in CSR activities also attract a different investor base of socially responsible investors (Kapstein, 2001), as well as socially conscious consumers (Hillman and Keim, 2001). CSR performance also has an impact by attracting and retaining higher quality employees (Greening and Turban, 2000). Building on the aforementioned arguments, future financial performance and CSR are positively correlated, which indicates superior management skills (Waddock and Graves, 1997; Moskowitz, 1972).

Empirical studies investigating the relationship between corporate social performance and financial performance, measured by either accounting-based or market-based measures, suggest that CSR is value relevant. For example, a meta-analysis performed by Margolis, Elfenbein and Walsh (2007) showed that there is a positive but small relationship. However, other studies have also found mixed results of whether the relationship is positive or negative (Waddock and Graves, 1997; McWilliams and Siegel, 2001; Orlitzky et al., 2003). A previous study of the value relevance of CSR on Swedish firms by Semenova, Hassel and Nilsson (2009) found a positive relationship between environmental and social performance on the market value of equity, measured by the residual income valuation model. This suggests that environmental and social ratings are value relevant and complement financial information.

2.2 Cost of capital

The cost of capital is the required rate of return by an investor, given the perceived riskiness of a firm's future cash flows and alternative investments available in the market (Berk and DeMarzo, 2007). The cost of capital plays an important role in the valuation of a firm as future cash flows are discounted by the cost of capital to determine the present value; namely, the higher the cost of capital, the lower the current firm value. In the stock market, investors have access to investments that can yield high returns at the cost of bearing a risk of losing their invested money. An investor wants to know if the expected return of an investment is higher than the return of alternative investments available in the market to determine whether it compensates for the risk. Similarly, firms must pay a return to investors that is at least equivalent to the rate they can expect from other investments with the same risk level. From a firm's perspective, better performance and a

competitive advantage can be achieved by taking on profitable investments. Moreover, the present value of a firm's investments is assessed by discounting the future cash flows it generates by the cost of financing the investment. That discount rate is the cost of capital, the same required rate of return demanded by outside investors. Consequently, access to financial capital, especially cheap capital, is essential for the survival and performance of the firm, as they would otherwise miss out on profitable investments (Cheng et al, 2014).

In the academic literature, there has generally been two approaches to estimate the cost of equity capital (Reverte, 2012). One is the ex-post realized returns approach, in which the cost of equity capital in terms of the expected return of other investments on the market with equivalent risk is inferred by the previously realized returns. Estimating expected returns from the average realized returns of a large sample assumes that information surprises and unexpected returns cancel out over the studied time period (Elton, 1999). The Capital Asset Pricing Model (CAPM) is a commonly used pricing model for calculating the expected return based on the risk-free interest rate plus a risk premium measured by the stock's sensitivity to the market return.[1] However, this approach has been criticized as realized returns and expected returns show weak correlation, even for a large portfolio of firms over a long time period (Elton, 1999). Botosan (2000) further highlights that the CAPM assumes that variations in cost of capital across firms are driven by variations in beta alone and leaves no room for other factors, such as disclosure level or in our case CSR rating, without having to assume that variations in beta capture the variations in these factors across firms.

Another method of estimating the cost of equity capital is the ex-ante implied approach, in which the cost of equity is implied in the current market price. In other words, it is the discount rate that sets the present value of expected future cash flows equal to the current share price. This approach is derived from the dividend discount model, which calculates current share price from a finite time period of expected cash flows and a terminal value, discounted to the present value by the cost of capital (Botosan et al, 2011). Since the expected future cash flows are not directly observable, analysts' earnings forecasts are assumed to be reasonable proxies for the market's expectation of future cash flows (Gode and Mohanram, 2003). A good estimation depends on the

[1] CAPM: Expected return = risk-free rate + stock beta*(expected market return - risk-free rate)
$E[R] = r_f + \beta * (E[R_m] - r_f)$

forecast of the terminal value as well as analysts' responsiveness to market information (Botosan et al., 2011; El Ghoul et al., 2011).

2.3 CSR and the cost of capital

In this section we provide theory and previous empirical research on how the capital market acts as an intermediary mechanism through which CSR affects the cost of capital. The arguments put forward by El Ghoul et al. (2011) are the relative size of the investor base of a firm and its perceived risk. These build upon information asymmetry and investor preference as well as risk diversification, and are presented hereafter.

2.3.1 Investor base

Agency theory[2] defines information asymmetry as when an agent has more information than a principal, such as between managers and investors (Jensen and Meckling, 1979). A well-known example of information asymmetry is the lemons problem (Akerlof, 1970). The author argues how information asymmetry lowers the price a buyer is willing to pay for a car on the used-car market as it is impossible for the buyer to assess if the seller is selling a car of good or bad quality.[3]

Information intermediaries such as analysts and media work to transmit private information to the public. In a CSR context, the information asymmetry between firms and the market can be mitigated by analysts providing rating services on firms' CSR activities. Firms with high CSR performance receive more analyst coverage, compared to firms operating in sin industries such as alcohol, tobacco and gambling (Hong and Kacperczyk, 2009). However, the information asymmetry process is associated with two costs for firms and analysts; *i)* the cost of gathering and processing data and *ii)* the cost of transmitting information from one party to another (Merton, 1987). The transmission process can be separated into disclosure of sustainability reports and signalling by the firm as well as different intermediaries transmitting the information to the market, therefore through voluntary disclosure of CSR activities a firm lowers the costs for analysts associated with gathering information (Graham et al., 2005). Furthermore, Diamond and Verrecchia (1991) find that large firms will benefit the most by this reduction of information asymmetry and hence are more willing to disclose private information in comparison to smaller

[2] The agency theory addresses information asymmetry such that agents maximize their own utility instead of acting in the best interest of the principals, thus creating agency costs due to the separation of ownership and control (Jensen and Meckling, 1979).

[3] Due to Gresham's law the buyer assesses that cars being traded are cars with poor quality. Every car must be of bad quality, since no car of good quality can be traded, as they both trade for the same price (Akerlof, 1970).

firms. The authors argue that by overcoming the problem of information asymmetry firms can attract large investors and hence increase the liquidity of their shares. This is a result of a reduction of new information in the bid-ask spread, thus prices react less and liquidity is increased as a consequence. Building on the aforementioned arguments, change in information asymmetry through disclosure of private information by firms affect the risk premium demanded by investors. Dhaliwal et al. (2011) showed empirically that decreased information asymmetry through voluntary CSR disclosure lowers the firm's cost of equity capital for high CSR performing firms. Therefore, managers are incentivized to voluntarily disclose CSR activities.

According to Merton (1987), investors only invest in a portfolio with securities they have information about, thus they do not invest in shares that are unknown to them. Norm-based institutional investors are less likely to invest in firms operating in sin industries than arbitrage-seeking hedge and mutual funds, thus social norms and SRI have an effect on the capital market (Hong and Kacperczyk, 2009). Moreover, on the European SRI market, pension funds are among the main investors due to their long-term investment horizon (Eurosif, 2014). This is in line with Guenster et al. (2010) who report that large institutional investors such as the California Public Employees' Retirement System (CalPERS) prefer to invest in firms engaged in CSR activities. As a result, firms with low CSR performance such as polluting firms attract a smaller and more neutral investor base, since green investors typically neglect stocks which do not fulfill their preferences (Heinkel et al., 2001). The authors find supportive evidence that risk diversification is poorer with a relatively small investor base. By increasing the relative size of the investor base firms can experience a lower cost of capital and hence increase their market value.

In conclusion, an increased investor base due to lowered information asymmetry decreases the cost of capital for high CSR performing firms.

2.3.2. Perceived risk

The value relevance of CSR is an ambiguous question. One way how CSR could matter is through risk-mitigation. According to classical corporate finance theory, investors are not compensated for idiosyncratic risk[4] that can be diversified by holding a large portfolio, but instead compensated with a risk premium for the systematic risk[5]. El Ghoul et al. (2011) discuss whether firms with low CSR performance have more undiversifiable risk and thus face a higher cost for equity financing.

[4] Firm-specific, diversifiable risk.
[5] Market-wide, undiversifiable risk.

This is motivated by previous work made on the impact of CSR on firm's riskiness (McGuire et al., 1988; Starks, 2009). Moreover, CSR can act as an insurance effect for firms and hence mitigate reputational risk as well as litigation costs (Renneboog et al., 2008). This implies that even though one might not assess that CSR generates extra cash inflows it could act as self-insurance against extra cash outflows.

Moreover, Hong and Kacperczyk (2009) claim that sin firms operating in alcohol, tobacco and gambling industries face higher litigation risk than other firms. This can be understood as low CSR performing firms may struggle to get access to cheap financing relative to high CSR performing firms. Research by Goss and Roberts (2011) indicated that firms with higher CSR ratings pay less on their bank debt compared to firms with the lowest ratings, which implies that banks consider the latter firms more risky and therefore require compensation for bearing the risk of lending money to them. This statement may hold for other investors as well, such as equity holders, since the firms obtain capital from both debt and equity holders, and the latter is assumed to be as rational and well-informed as debt holders.

In addition, investors face a risk associated with the uncertainty of a firm's cash flows and earnings. Some of the risk is mitigated as socially responsible firms are driven to meet investors' and societal norms, and are therefore less engaged in earnings management or other accounting manipulations (Kim et al., 2012). If CSR is associated with high earnings quality, this could imply that lower earnings management makes it easier for analysts to make a more accurate valuation of a firm's future performance. This is in line with the argumentation that analysts who use environmental information are superior in their analyst forecasts compared to their counterparts not using this information (Nilsson et al., 2008). The authors mention abilities such as predicting earnings and risk assessment together with the ability to identify mispricing as an explanation.

In line with aforementioned arguments, Lee and Faff (2009) found supportive evidence that the relationship between CSR performance and idiosyncratic risk is negative. Furthermore, the idiosyncratic risk is not priced on the market since it can be diversified. The systematic risk, on the other hand, affects risk premiums and consequently the cost of capital. However, norm-driven investors prefer not to invest in firms with low CSR performance and thus a smaller investor base limits the risk-sharing among investors (Heinkel et al., 2010). Hong and Kacperczyk (2009)

argue that due to Merton's capital market equilibrium model[6], the beta as well as the idiosyncratic risk have an impact on the pricing. As a result of the limited risk-sharing, the risk of CSR firms cannot be diversified away and is thus priced in the market.

2.3.3 The underlying relationship between CSR and cost of capital

Another way to look at CSR and the cost of capital is to investigate the underlying relationship. Previous studies, such as El Ghoul et al. (2011), have assumed it to be linear, but McWilliams and Siegel (2001) argue, in the theory of the firm that the relationship between CSR and firm value is a supply and demand model. According to the theory, a firm's level of CSR is dependent on factors such as size, advertising, level of diversification, research and development, such that each firm has an ideal level of CSR determined by a cost-benefit analysis (ibid). This means that different levels of social responsibility are due to different market conditions. An optimal level of CSR for each firm offers an explanation to the previous literature that found contradicting results to whether CSR performance increases firm value or not (Waddock and Graves, 1997; Orlitzky et al., 2003). Empirical findings of U-shaped as well as inverse U-shaped relationships support this view (Margolis and Walsh, 2001, Barnett and Salomon, 2012).

In a cost of capital-context, El Ghoul et al. (2011) found US-evidence of a non-linear relationship across time. The negative correlation of CSR was found to be more significant in the 2000s than the 1990s, showing the strongest effect in the period 2000-2003. This reflects the growing trend of SRI in recent years and increased awareness among investors. The sustainability trend is also seen in Sweden, from government regulations on mandatory sustainability reports for state-owned firms and long-term investment goals of institutional investors (Swedish Government, 2007; Eurosif, 2014). Furthermore, many asset owners, investment managers and professional services partners in Sweden have signed the UNPRI, signalling that social responsibility is a part of investment decisions (Eurosif, 2014).

[6] In Merton's capital market equilibrium model, increasing the relative investor base of a firm results in lower cost of capital and higher market value (Merton, 1987).

3. Test logic and general hypotheses

The theoretical background and empirical research presented provide a guide for the focus of this study. In summary, the cost of capital reflects an investor's required return of an investment based on its risk level. CSR performance, as reflected by ratings, decreases the information asymmetry to outside investors. Since social norms affect investors' preferences, high CSR performing firms can attract a relatively larger investor base compared to low CSR firms. With a larger investor base, the firm's idiosyncratic risk is better diversified and thus cost of capital is lowered. This leads us to formulate the first hypothesis;

Hypothesis 1: *Firms with high CSR performance have lower implied cost of equity capital compared to firms with low CSR performance.*

After studying the relationship between CSR performance and the implied cost of equity capital in the first hypothesis, we investigate whether there is a change in the marginal effect of CSR and if there is an optimal level. Thus we divert from previous studies in the area that assume a linear relationship and argue that the non-linear CSR-financial performance relationship could be applied analogically to the cost of equity capital. Acknowledging the growing sustainability trend, we also investigate the effect across time. This leads us to formulate the second hypothesis;

Hypothesis 2: *There is a non-linear and time-varying relationship between CSR performance and the implied cost of equity capital.*

4. Method

4.1 Sample

From an initial list of 292 firms listed on the OMX Stockholm on the 26th of March 2015, we use the following criteria for selecting our sample. Firstly, firms not rated in the GES Investment Services Risk Rating database at the end of 2014 are excluded due to the lack of CSR rating. Secondly, we are restricted to firms with analyst coverage in order to obtain up to five years' forecasted earnings for the valuation models (described in section 4.2). The Thompson Institutional Brokers' Estimate System (I/B/E/S) database has been used for retrieving analyst forecast data. Thirdly, to control for dispersion in analyst forecasts affecting the implied cost of equity capital, firms are required to be followed by at least two analysts. Finally, we retain firms for which we have all other data required for the calculation of cost of equity capital and the control variables. This selection process restricts our final sample to 82 firms across the years 2006-2014, consisting of 577 firm-year observations. Please refer to *Table 1* and *Table 2* for the sample distribution.

4.2 Research method and statistical tests

4.2.1 Hypothesis 1

Baseline model

To test the first hypothesis; whether firms with high CSR performance have lower cost of equity capital compared to firms with low CSR performance, we use four accounting-based valuation models to retrieve the implied cost of equity capital through reverse engineering. An average of the four estimates for each firm is then regressed on the CSR performance proxy and a set of control variables. Due to the use of panel data, year and industry fixed effects are included in the regression model to eliminate year-specific and industry-specific factors. After adjusting for these fixed effects, the implied cost of equity capital is not affected by differences between years or differences across industries. The unit of r_{AVG}, *CSR SCORE*, *LEVERAGE* and *GROWTH* are expressed in decimal form and the estimated coefficients interpreted as the effect of a percentage point change. All variables are explained in more detail in the coming sections. The regression model is as follows;

$$r_{AVG,it} = \beta_0 + \beta_1 CSR\ SCORE_{it} + \beta_2 BETA_{it} + \beta_3 SIZE_{it} + \beta_4 BTM_{it} + \beta_5 LEVERAGE_{it}$$
$$+\beta_6 GROWTH_{it} + \beta_7 DISPERSION_{it} + \beta_8 INDUSTRY + \beta_9 YEAR + u_{it}$$

Where:

r_{AVG}: Average implied cost of equity estimate

$CSR\ SCORE$: CSR performance proxy

$BETA$: Market beta

$SIZE$: Natural logarithm of total assets

BTM: Book-to-market ratio

$LEVERAGE$: Leverage ratio, debt over equity

$GROWTH$: Long-term growth forecast

$DISPERSION$: Analyst forecast dispersion

$INDUSTRY$: Industry fixed effects

$YEAR$: Year fixed effects

i: Cross-sectional unit, firm

t: Valuation year

The coefficient of interest is β_1. If the estimated coefficient is negative and statistically significant at a 10% level, we reject the null-hypothesis.

$$H_0: \beta_1 \geq 0\ , \qquad H_1: \beta_1 < 0$$

Firm fixed effects

An important aspect to keep in mind when using OLS regressions is that the correlation it shows does not imply causality between variables. A drawback is the possibility of endogeneity; namely that one of the explanatory variables is correlated with the error term, causing biased or inconsistent coefficients. In our context this would mean that an unknown factor would determine both the cost of capital and the firm's CSR performance, or that firms with low cost of capital can afford to invest in CSR to a greater extent than other firms. To address this problem, we include a dummy variable for each firm to control for any time-constant and firm-specific factor, such as good management, that may be omitted in the original regression model. The model only uses the variation within a firm and not between firms, thus industry fixed effects is not necessary anymore To ensure the highest variation possible within firms, the regression is also performed on a

balanced panel of firms that have data for the whole sample period. The regression model is as follows;

$$r_{AVG,it} = \beta_0 + \beta_1 CSR\ SCORE_{it} + \beta_2 BETA_{it} + \beta_3 SIZE_{it} + \beta_4 BTM_{it} + \beta_5 LEVERAGE_{it} + \beta_6 GROWTH_{it} + \beta_7 DISPERSION_{it} + \beta_8 FIRM + \beta_9 YEAR + u_{it}$$

Where:

$FIRM$: Firm fixed effects

The coefficient of interest is β_1. If the estimated coefficient is negative and statistically significant at a 10% level, we reject the null-hypothesis.

$$H_0: \beta_1 \geq 0\ , \qquad H_1: \beta_1 < 0$$

Dynamic level

Keeping firm fixed effects to control for endogeneity, we refine the level relationship to investigate the dynamic relationship between CSR and the implied cost of equity capital. This model estimates the change in r_{AVG} within a firm on the change in *CSR SCORE* within a firm and the same set control variables as before.

$$\Delta r_{AVG,it} = \beta_0 + \beta_1\ \Delta CSR\ SCORE_{it} + \beta_2 BETA_{it} + \beta_3 SIZE_{it} + \beta_4 BTM_{it} + \beta_5 LEVERAGE_{it} + \beta_6 GROWTH_{it} + \beta_7 DISPERSION_{it} + \beta_8 FIRM + \beta_9 YEAR + u_{it}$$

Where:

Δr_{AVG}: change in average implied cost of equity estimate from year *t-1* to year *t*

$\Delta CSR\ SCORE$: change in CSR performance proxy from year *t-1* to year *t*

The coefficient of interest is β_1. If the estimated coefficient is negative and statistically significant at a 10% level, we reject the null-hypothesis.

$$H_0: \beta_1 \geq 0\ , \qquad H_1: \beta_1 < 0$$

Instrumental variable estimation

Another statistical method used when suspecting endogeneity is an instrumental variable (IV) estimation where the endogenous independent variable, CSR performance, is replaced with an instrumental in a two-stage least-squares (2SLS) regression. This eliminates the effect of any time-varying omitted variable and indicates whether a causal relationship exists in the regression model. A valid instrument needs to be exogenous; namely, not have any partial effect on the dependent

variable after controlling for the independent variables along with being uncorrelated with the omitted variable in the error term, and relevant; have a non-zero correlation to the endogenous independent variable (Wooldridge, 2012). In other words, the instrument cannot have any effect on the cost of capital other than through the endogenous CSR performance variable. In line with previous studies, we argue that the average industry CSR performance each year serves as a valid instrument (El Ghoul et al., 2011, Cheng et al., 2014). The intuition is that each firm's CSR performance is influenced by other firms in the same industry due to peer competition and industry trends. The instrument is also external to the firm, such that it is not under the influence of firm management. The practical usefulness and reliability of the IV method depends on having a good instrument that fulfills the two validity criteria. While the exogeneity criteria cannot be tested, the relevance criteria can be tested by having a statistically significant instrument coefficient in the first stage of the 2SLS regression (Wooldridge, 2012). The regression models for the instrumental variable estimation are as follows;

Structural model:

$$r_{AVG,it} = \beta_0 + \beta_1 CSR\ SCORE_{it} + \beta_2 BETA_{it} + \beta_3 SIZE_{it} + \beta_4 BTM_{it} + \beta_5 LEVERAGE_{it} + \beta_6 GROWTH_{it} + \beta_7 DISPERSION_{it} + \beta_8 INDUSTRY + \beta_9 YEAR + u_{it}$$

Reduced form - first stage:

$$CSR\ SCORE_{it} = \pi_0 + \pi_1 IV_{it} + \pi_2 BETA_{it} + \pi_3 SIZE_{it} + \pi_4 BTM_{it} + \pi_5 LEVERAGE_{it} + \pi_6 GROWTH_{it} + \pi_7 DISPERSION_{it} + \pi_8 INDUSTRY + \pi_9 YEAR + v_{it}$$

Where:

$IV:$ average industry CSR performance score per year

The coefficient of interest is π_1. If the estimated coefficient is significantly different from zero at a 10% level, and the estimated model shows F-statistic higher than 10, we reject the null-hypothesis and conclude that the instrument is relevant and strong.[7]

$$H_0: \pi_1 = 0, \quad H_1: \pi_1 \neq 0$$

[7] A rule of thumb for "weak" instruments is a first-stage F-statistic less than 10 (Staiger and Stock, 1997)

Reduced form - outcome:

$$r_{AVG,it} = \gamma_0 + \gamma_1 IV_{it} + \gamma_2 BETA_{it} + \gamma_3 SIZE_{it} + \gamma_4 BTM_{it} + \gamma_5 LEVERAGE_{it} + \gamma_6 GROWTH_{it} + \gamma_7 DISPERSION_{it} + \gamma_8 INDUSTRY + \gamma_9 YEAR + e_{it}$$

The coefficient of interest is γ_1. If the estimated coefficient is negative and statistically significant at a 10% level, we reject the null-hypothesis.

$$H_0: \gamma_1 \geq 0, \quad H_1: \gamma_1 < 0$$

4.2.1 Hypothesis 2

Non-linear model

For the second hypothesis, we will employ two models to investigate the non-linear and time-varying relationship of CSR performance on the implied cost of equity capital. First, to investigate if the relationship is non-linear, we add a squared *CSR SCORE* variable to the baseline regression model;

$$r_{AVG,it} = \beta_0 + \beta_1 CSR\ SCORE_{it} + \beta_2 CSR\ SCORE_{it}^2 + \beta_3 BETA_{it} + \beta_4 SIZE_{it} + \beta_5 BTM_{it} + \beta_6 LEVERAGE_{it} + \beta_7 GROWTH_{it} + \beta_8 DISPERSION_{it} + \beta_9 INDUSTRY + \beta_9 YEAR + u_{it}$$

The coefficients of interest are β_1 and β_2. If the estimated coefficients are statistically different from zero at a 10% significance level, we reject the null-hypothesis.

$$H_0: \beta_1 = 0 \text{ and } \beta_2 = 0, \qquad H_1: \beta_1 \neq 0 \text{ and } \beta_2 \neq 0$$

Changes across time

Second, to test the changing relationship across time, we add a variable interacting *CSR SCORE* with the dummy variable *YEAR*, that takes the value of 1 for each year in 2007-2014 and 0 otherwise, to the baseline regression model;

$$r_{AVG,it} = \beta_0 + \beta_1 CSR\ SCORE_{it} + \beta_{2,t} CSR\ SCORE_{it} * YEAR + \beta_3 BETA_{it} + \beta_4 SIZE_{it} + \beta_5 BTM_{it} + \beta_6 LEVERAGE_{it} + \beta_7 GROWTH_{it} + \beta_8 DISPERSION_{it} + \beta_9 INDUSTRY + \beta_{10} YEAR + u_{it}$$

The coefficient of interest is β_2. If the estimated coefficient in year t is statistically different from the previous year at a 10% significance level, we reject the null-hypothesis.

$$H_0: \beta_{2,t} = \beta_{2,t-1}\ , \qquad H_1: \beta_{2,t} \neq \beta_{2,t-1}$$

4.3 Estimating the cost of equity capital

The cost of equity capital is estimated by the implied approach. Due to the short sample period and the use of cross-sectional variation in firms, the ex-ante cost of equity capital is a better measure for expected returns than using ex-post realized returns (Reverte, 2012). Previous research such as Hail and Leuz (2006) has used the following accounting-based valuation models to obtain the implied cost of equity capital; *i)* Claus and Thomas (2001), *ii)* Gebhardt, Lee, Swaminathan (2001), *iii)* Ohlson and Jeuttner-Nauroth (2005), *iv)* Easton (2004).[8] These models build on different assumptions regarding the terminal value and the growth in earnings, therefore an average of the four models will be a good estimate of the cost of equity capital for each firm. The first two are variations of the residual income valuation (RIV) model based on the dividend discount model, while the other two are based on the abnormal earnings growth valuation model. The RIV models assume clean surplus relation, which means that earnings that are not paid out as dividends the current year are added to the book value of equity the next year. The abnormal earnings models assume that the change in abnormal earnings each year grows at a constant rate into perpetuity. The implied cost of equity capital will be the internal rate of return that sets the expected future residual incomes or abnormal earnings equal to the actual share price at the valuation date.

Common variables and assumptions

P_t = Share price on the 30th of June of year *t*

DPS_0 = actual dividend per share in year *t-1*

EPS_0 = actual earnings per share in year *t-1*

LTG = long-term growth forecast on the 30th of June year *t*

$ae_{t+\tau}$ = abnormal earnings for year $t+\tau$ recorded on the 30th of June year *t*

$FEPS_{t+\tau}$ = forecasted earnings per share for year $t+\tau$ recorded on the 30th of June year *t*

B_t = book value per share at the beginning of year *t*

r_f = yield on a 10-year Swedish government bond on the 30th June year *t*

$Inflation$ = expected long-term inflation rate of 3%

t = valuation year

τ = forecast year

[8] In the remainder of the study we denote the models by Claus and Thomas (2001) as CT, Gebhardt, Lee, Swaminathan (2001) as GLS, Ohlson and Jeuttner-Nauroth (2005) as OJ and Easton (2004) as ES.

One-year ahead and two-year ahead FEPS are obtained from I/B/E/S. FEPS beyond year two, as required by the CT and GLS models, are calculated as $FEPS_{t+\tau} = FEPS_{t+\tau-1}(1 + LTG)$. If LTG has not been available in I/B/E/S, it has been substituted with the short-term growth (STG), defined as the growth between two-year-ahead and one-year-ahead FEPS.[9]

4.3.2 Claus and Thomas (2001) model

$$P_t = B_t + \sum_{t=1}^{5} \frac{ae_{t+\tau}}{(1 + r_{CT})} + \frac{\mathrm{ae}_{t+5}(1 + g)}{(r_{CT} - g)(1 + r_{CT})^5}$$

Where:

$ae_{t+\tau} = FEPS_{t+\tau} - r_{e_{CT}} B_{t+\tau-1}$

$B_{t+\tau} = B_{t+\tau-1} + FEPS_{t+\tau}(1 - DPS_{t+\tau})$

$DPR_{t+\tau} = 0.5$

$g = r_f - inflation$

Claus and Thomas (2001) implement the RIV model using a five-year forecasting horizon, beyond which forecasted earnings grow at the expected inflation rate. This model allows share price to be expressed in terms of forecasted earnings and book values. As a proxy for economic profits, abnormal earnings are the earnings in excess of the firm's cost of equity times its book value per share. This model assumes clean surplus relation and dividend payout ratio is assumed to be constant at 50%.

[9] This was done by Gebhardt, Lee and Swaminathan (2001). Dhaliwal et al (2011) define LTG as the growth between two-year-ahead and one-year-ahead FEPS.

4.3.3 Gebhardt, Lee and Swaminathan (2001) model

$$P_t = B_t + \sum_{t=1}^{11} \frac{FROE_{t+\tau} - r_{GLS}}{(1 + r_{GLS})} B_{t+\tau-1} + \frac{FROE_{t+12} - r_{GLS}}{r_{GLS}(1 + r_{GLS})^{11}} B_{t+11}$$

Where:

$FROE_{t+\tau}$ = forecasted return on equity for year $t+\tau$

$B_{t+\tau} = B_{t+\tau-1} + FEPS_{t+\tau}(1 - DPR_{t+\tau})$

$DPR_{t+\tau}$ = expected dividend payout ratio in year $t+\tau$

This model allows share price to be expressed in terms of forecasted returns on equity (FROE) and book values. It uses a forecasting horizon of three years, beyond which FROE declines linearly to the median industry ROE by the twelfth year. For the first three years, $FROE_{t+\tau} = FEPS_{t+\tau} / B_{t+\tau-1}$. The industry ROE is calculated from the median ROE for the past 10 years, classifying firms according to the Industry Classification Benchmark and excluding loss firms. The payout ratio is winsorized at zero and one and the model assumes clean surplus relation.

4.3.4 Ohlson and Juettner-Nauroth (2005) model

$$r_{OJ} = A + \sqrt{A^2 + \frac{FEPS_{t+1}}{P_t}\left(g_2 - (\gamma - 1)\right)}$$

Where:

$$A = \frac{1}{2}\left((\gamma - 1) + \frac{DPS_{t+1}}{P_t}\right)$$

$DPS_{t+1} = DPS_0$

$$g_2 = \frac{STG + LTG}{2}$$

$$STG = \frac{FEPS_{t+2} - FEPS_{t+1}}{FEPS_{t+1}}$$

$(\gamma - 1) = r_f - inflation$

In this model, following Gode and Mohanram's (2003) implementation, the cost of equity capital is reversed from the relation between price, next year's forecasted earnings per share and next year's expected dividends per share. The explicit forecast horizon is set to one year, after which forecasted earnings grow at a near-term rate g_2 that decays to a perpetual rate $(\gamma - 1)$. The near-term earnings growth rate is the average of STG and LTG. The perpetual growth rate is the expected inflation rate. The model requires positive one-year-ahead and two-year-ahead earnings forecasts, and dividend per share is assumed to be constant. If EPS is negative, it has been substituted by 6% times the total assets per share of the firm.[10]

4.3.5 Easton (2004) model

$$P_t = \frac{FEPS_{t+2} + r_{ES}DPS_{t+1} - FEPS_{t+1}}{r_{ES}^2}$$

Where:

$DPS_{t+1} = DPS_0$

This is a special case of the Ohlson and Juettner-Nauroth (2005) model. The current share price is expressed in terms of the next two year's forecasted earnings per share and the next year's dividend per share. The explicit forecast horizon is two years, beyond which forecasted abnormal earnings grow at a constant rate into perpetuity. The model requires positive one-year-ahead and two-year-ahead earnings forecasts as well as positive change in earnings forecast.

4.4 Measuring CSR

The proxy for CSR performance used in this study is based on ratings from GES Investment Services. Founded in 1992, it is Northern Europe's leading research and service provider for Responsible Investment based on international guidelines for environmental, social and governance (ESG) issues. Since 2005, GES has released a Risk Rating for firms on the OMX Stockholm, evaluating risks in their methods of dealing with reactions to environment, human rights and corporate governance. The rating of the three dimensions is assessed according to the UN PRI, using information from official firm documents, non-governmental organizations, media,

[10] 6% is the long-run return on assets in the US (Gebhardt et al., 2001).

GES' partners and dialogue with firms.[11] This rating has been used in previous studies on Swedish data (Semenova et al., 2009).

Both present performance and future preparedness are taken into account in the evaluation of the environmental dimension, whereas the human rights dimension evaluates how each firm manages the relations with employees, communities, and suppliers according to the internationally agreed human rights norms. Within the environmental dimension, each firm is evaluated on two categories; *i)* performance, measuring changes in greenhouse gases and emissions, energy and water usage, waste management and fourteen other criteria; *ii)* preparedness, in terms of environmental routines, the extent and quality of policies, strategy for renewable energy production, environmental reporting, supplier evaluation and nine other criteria. The human rights dimension is divided into the following three categories: *i)* employees, including policies on health and safety, freedom of association, diversity, working hours and wages, child and forced labour; *ii)* community, covering policies and programmes about community involvement and corruption; *iii)* suppliers, including programmes, policies and reporting of human rights and supply chain.

The score of each criterion is combined into an overall rating for each dimension. The Risk Rating in 2005 covers one third of the firms on the Stockholm Stock Exchange and was released five months later than our valuation date (30th of June), and has therefore been excluded from our sample period. The corporate governance score is also excluded since it was only available from the end of 2013. Human rights score, hereafter renamed as social score, and environmental score that a firm can obtain every year have been transformed to a percentage score ranging from 0 to 1, due to the fact that the scale changes throughout the sample years (0-7 in 2006-2008 and 0-3 in 2009-2014). To create the overall CSR performance score (*CSR SCORE)* used in the regression models, we have used the average of each firm's latest environmental and social score available at the valuation date.

4.5 Control variables

Conventional control variables for our multivariate analysis are the risk factors affecting the cost of capital proposed by Fama and French (1992, 1993) and used in a number of previous studies (eg. Gebhardt et al., 2001; Hail and Leuz, 2006; El Ghoul et al., 2011). *BETA* (+)[12] is included to

[11] The information about GES Investment Services is obtained from the company and its external website www.ges-invest.com.
[12] The predicted sign of the control variable is shown in parentheses.

control for the stock's sensitivity to the market risk and is expected to be positively related to expected returns (Sharpe, 1964). *SIZE* (-) is included as a control variable since large firms have more analyst coverage and thus more information available and lower investor risk (Gebhardt et al., 2001). Further, Fama and French (1992) showed empirically that *SIZE* was negatively associated while the book-to-market ratio, *BTM* (+), was positively associated with expected returns and that they together explained the cross-sectional variations of risk. *LEVERAGE* (+) is also suggested to correlate with higher cost of equity capital (Fama and French, 1992).

We include two more variables expected to influence the cost of equity capital (Gebhardt et al., 2001; Gode and Mohanram, 2003). Long-term growth forecast, *GROWTH* (+), is included since firms with high growth are generally considered to be more risky. With the intuition that firms with higher earnings volatility or uncertainty have a higher risk premium, analyst forecast dispersion, *DISPERSION* (+), is also included. *Table 3* provides definitions and data sources for the control variables.

Table 3. Variable definitions and data sources

Control variable	*Definition*	*Source*
BETA	Market beta from regressing a firm's monthly excess stock return on the OMX Stockholm index excess returns, using 24 to 60 months ending in 30th of June of year *t*. Excess returns are monthly returns minus the 10-year Swedish Government bond.	I/B/E/S in Datastream and Riksbanken
SIZE	Natural logarithm of a firm's total assets in thousands SEK at the beginning of year *t*.	Worldscope in Datastream
GROWTH	Long-term growth (LTG) forecast reported on 30th of June each year, defined as the growth between four-year ahead and five-year ahead earnings forecast. Missing values of LTG has been replaced by the short-term growth (STG), defined as the growth between one-year ahead and two-year ahead earnings forecast. [1, 2]	I/B/E/S in Datastream
BTM	Book-to-market value, calculated as the book value of common equity divided by market value of total equity at the beginning of year *t*. [1]	Datastream
LEVERAGE	Leverage calculated as the total debt divided by the market value of equity. [1]	Worldscope in Datastream
DISPERSION	Dispersion of analyst forecasts, defined as the natural logarithm of one plus the coefficient of variation of the one-year-ahead forecasted EPS.	I/B/E/S in Datastream

All currencies are converted to SEK.
[1] *GROWTH*, *BTM* and *LEVERAGE* have been winsorized at the 5th and 95th percentiles to mitigate the effect of extreme values.
[2] Gebhardt et al (2001). Dhaliwal et al (2011) define LTG as the growth between one-year ahead and two-year ahead earnings forecast.

Due to the use of panel data, year and industry fixed effects are included in the regression model to eliminate year-specific and industry-specific factors. After adjusting for these fixed effects, the level of cost of equity capital are not affected by differences between years or differences across industries.

Even though the three Fama-French factors *BETA*, *SIZE* and *BTM* typically control for risk when expected returns are proxied by realized returns, and not explicitly in the case when expected returns are calculated by the implied approach, they have been commonly used in the previous implied cost of equity literature. For example, Botosan et al. (2011) and El Ghoul et al. (2011) showed that the risk factors do have an effect on the implied cost of equity capital and are therefore used in this study.

5. Results and analysis

The findings from our research are presented below in four sections. Descriptive statistics and correlations between all main variables are presented in section 5.1. In 5.2 and 5.3 we comment on the results for Hypothesis 1 and Hypothesis 2 respectively.

5.1 Descriptive statistics

Figure 1 shows the average implied cost of equity estimates, environmental score, social score and the overall CSR score in our sample across the years 2006-2014. From 2006-2007, both CSR and the implied cost of equity capital trended upwards. Between 2008 and 2012, CSR trended upwards while the implied cost of equity capital trended downwards, suggesting a negative correlation and support our first hypothesis. After a stagnation of both CSR and the implied cost of equity capital in 2012, the negative relationship is further observed in 2013 as the CSR scores increases while the average cost of capital shows a sharp decline. Overall, CSR score trends upwards during the sample period, hinting on the increased sustainability trend in Sweden. Environmental scores have historically been higher than social scores, but in recent years the two have converged. Finally, *Figure 1* clearly shows that during the financial crisis year 2008, the implied cost of equity capital peaked while CSR scores dropped, suggesting an increased systematic risk on the market as well as a decrease in CSR activities.

Figure 1. CSR and cost of equity capital trend across years

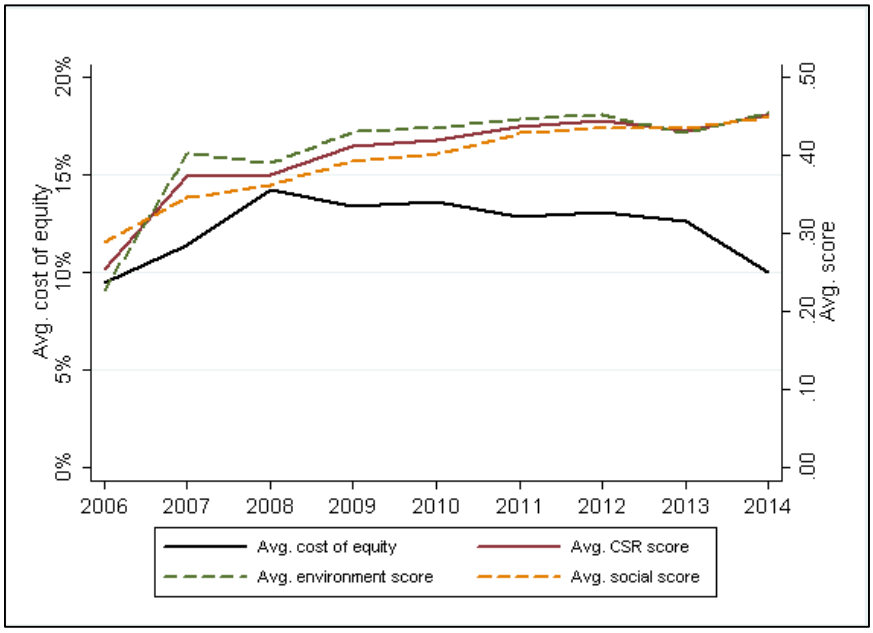

Figure 1 shows the average implied cost of equity estimate, environmental score, social score and CSR score for the 577 firm-year observations across the years 2006-2014.

Table 4 in Appendix provides descriptive statistics for all main variables used in the regression models. The mean of the average implied cost of equity estimate r_{AVG} across the four models is 12%. The OJ and ES models have slightly higher means (13% and 14% respectively), whereas the CT and GLS models have slightly lower estimates (12% and 11%). This in line with the estimates of El Ghoul et al. (2011) and Gode and Mohanram (2003). The average standard deviation of the implied cost of equity estimates is 0.06, suggesting that the variation across firms is not very large. The r_{CT} shows the highest standard deviation (0.10) and maximum value (0.96), driven by extreme values due the LTG component used in the CT and GLS models to forecast EPS and book values.[13] The mean *CSR SCORE* is 0.40 out of the maximum score 1.00, and the standard deviation is 0.20, indicating significant variation in CSR performance across firms and a sample consisting of both high and low performers. As seen in *Figure 2* in Appendix, Banks and Basic Resources are the industries with highest average CSR score, while Financial Services and Health Care have the lowest score. For example, the firms in Basic Resources (eg. SSAB and Holmen) might engage in excessive CSR activities to compensate for the environmental resources used in the heavy industries they operate in.

Table 5 in Appendix, shows the Pearson correlation coefficients all the variables. Panel A shows the correlation coefficients between the implied cost of equity estimates. The highest correlation between the four models (0.878) is found between r_{OJ} and r_{ES} models, which is expected since these are both abnormal earnings growth valuation models. However, the lowest correlation (0.463) is found between r_{CT} and r_{GLS}, which is surprising since these are both RIV-models.[14] Consistent with Dhaliwal et al. (2006) and El Ghoul et al. (2011), r_{OJ} shows higher correlation with r_{AVG} (0.941), while r_{CT} and r_{GLS} shows lower correlation with r_{AVG} (0.929 and 0.658 respectively).

In Panel B, showing correlation between the dependent and independent variables used in the regression models, we note that *CSR SCORE* has a significantly negative correlation (-0.114) with the average implied cost of equity capital estimate r_{AVG}, in line with our hypothesis. Consistent with the discussion of control variables in section 4.5, these have the expected correlation signs with $r_{AVG,}$ except for *LEVERAGE* that has negative but insignificant correlation. The highest

[13] See section 6.1.1 for discussion about the impact of LTG substitution.
[14] See section 6.1.1 for discussion about the impact of LTG substitution.

correlation between independent variables (0.644) is found between *SIZE* and *CSR SCORE*.[15] A variance inflation factor (VIF) from the main regression shows that no variables has a VIF value above 10, suggesting that there is no multicollinearity problem, which allows us to keep *SIZE* as a control variable.[16]

5.2 Hypothesis 1

To examine the first hypothesis, whether firms with high CSR performance have lower implied cost of equity estimates compared to firms with low CSR performance, we regress the average implied cost of equity estimates r_{AVG} on *CSR SCORE* and the control variables *BETA, SIZE, GROWTH, BTM, LEVERAGE, DISPERSION*. *Table 6* shows the results from OLS regressions with robust standard errors clustered at firm level. In the baseline model (1) the coefficient on *CSR SCORE* is negative (-0.036*) and statistically significant on a 10% level, implying that a one percentage point increase in *CSR SCORE* leads to 3.6 percentage points lower cost of equity capital, holding all other variables constant. We regard the magnitude of the coefficient as large and economically significant. A standard deviation increase in CSR score decreases the cost of capital with 0.12 standard deviations, as compared to 0.04 in the study by El Ghoul et al. (2011). Our sample indicate that the effect of CSR is stronger in Sweden than in the US. The control variables have the expected signs consistent with previous research, although, *SIZE* and *LEVERAGE* are not significant. The adjusted R^2, indicating the goodness-of-fit of the statistical model, shows that 60.3% of the sample variation in the implied cost of equity capital can be explained by the independent variables, which is higher than previous studies.[17] In sum, the coefficient of CSR SCORE is negative (-0.036*, t-stat=-1.75) whereby the null-hypothesis is rejected at a 10% significance level. We conclude that firms with high CSR performance have lower implied cost of equity capital compared to firms with low CSR performance.

Firm fixed effects are included in (2) to control for time-constant firm-specific factors, while industry fixed effects are omitted due to collinearity.[18] Contrary to the result in (1), we find that *CSR SCORE* is positive (0.033) but insignificant. The coefficients of the control variables

[15] This has been pointed out by for example Knox et al. (2005); that large firms are more capable of prioritizing stakeholders through CSR programmes and Waddock and Graves (1997); larger firms have a greater need to engage in socially responsible activities.
[16] See Appendix for VIF-test and further discussion in section 6.2.3 for the implication of multicollinearity.
[17] For example, El Ghoul et al. (2011) received an adjusted R^2 of 33.2% with the same set of control variables.
[18] Some industries are only represented by one firm, see sample distribution in Table 1.

decreases slightly and *BETA* (0.004) loses its significance. In a balanced panel (3), a higher *CSR SCORE* variation within firms comes at the cost of losing 271 observations. The effect of *CSR SCORE* is larger (0.097**) and significant on a 5% level. Therefore, we fail to reject the null-hypothesis in (1) of a non-negative coefficient, meaning higher CSR score gives higher implied cost of equity.

Table 6. Baseline regressions

	Baseline model	Firm fixed effects, unbalanced panel	Firm fixed effects, balanced panel	Dynamic effect, *ΔCSR SCORE*
	(1)	(2)	(3)	(4)
	r_{AVG}	r_{AVG}	r_{AVG}	Δr_{AVG}
CSR SCORE (-)	-0.036*	0.033	0.097**	-0.003**
	(0.020)	(0.031)	(0.044)	(0.001)
BETA (+)	0.010**	0.004	0.012*	0.002
	(0.005)	(0.004)	(0.007)	(0.004)
SIZE (-)	-0.000	-0.000	0.017	0.015
	(0.002)	(0.016)	(0.014)	(0.010)
GROWTH (+)	0.150***	0.149***	0.166**	0.144***
	(0.028)	(0.026)	(0.066)	(0.020)
BTM (+)	0.031***	0.020***	0.016*	0.025**
	(0.006)	(0.008)	(0.009)	(0.012)
LEVERAGE (+)	0.000	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
DISPERSION (+)	0.010***	0.010***	0.016**	0.008**
	(0.003)	(0.004)	(0.007)	(0.003)
CONSTANT	0.028	0.026	-0.294	-1.239
	(0.035)	(0.316)	(0.254)	(0.196)
Firm effects	No	Yes	Yes	Yes
Industry effects	Yes	No	No	No
Year effects	Yes	Yes	Yes	Yes
Observations	577	577	306	481
Adj. R^2	0.603	0.689	0.694	0.769
Firms	82	82	34	78

The table shows the results from an OLS regression of the implied cost of equity estimates on CSR scores and control variables across the years 2006-2014. r_{AVG} is the average implied cost of equity estimates from the four models: Claus and Thomas (2001); Gebhardt, Lee, and Swaminathan (2001); Ohlson and Juettner-Nauroth (2005) and Easton (2004). *CSR SCORE* is the average of the GES Risk Rating environmental and social score. *BETA* is the market beta from regressing 24 to 60 monthly excess returns on the OMX Stockholm index. *SIZE* is the natural logarithm of total assets. *GROWTH* is the long-term growth forecast and substituted with the short-term growth forecast if missing. *BTM* is the book-to-market value of equity. *LEVERAGE* is the debt over equity ratio. *DISPERSION* is the natural logarithm of the dispersion of analyst forecasts. Δr_{AVG} is the yearly percentage change in r_{AVG}. *ΔCSR SCORE* is the yearly percentage change in *CSR SCORE*. (2) consists of all 577 firm-year observations and (3) consists of a balanced panel. Firms are categorized by the Industry Classification Benchmark Supersectors. The expected sign for each coefficient is shown in parenthesis by the variable name. Robust standard errors clustered at firm level are shown in parenthesis, significant at levels *** p<0.01, ** p<0.05, * p<0.1.

A potential explanation for these contradicting results is that a firm-specific omitted variable is affecting the relationship between CSR and cost of capital. Previous studies have

suggested that factors such as management skills, firm-level corporate governance, analyst following and financial constraints could affect both the CSR and cost of capital level of a firm (Moskowitz, 1987, Brown et al., 2006; Chen et al., 2009; Barnea and Rubin, 2010). This explains why there is correlation, but not causality in our results.

Keeping firm fixed effects in (4), we investigate the dynamic relationship by using the yearly percentage change in *CSR SCORE* and r_{AVG} within each firm. The coefficient of *CSR SCORE* is negative (-0.003**) as in the baseline model (1), rejecting the null-hypothesis on a 5% level. A change in CSR score is negatively related to a change in the implied cost of equity within a firm, contradicting the results from above. Thus, increased CSR lowers the implied cost of equity.

Table 7. Instrumental variable estimation

	OLS regression (4)	IV regression (5)	IV regression (6)
	r_{AVG}	*(first stage)*	r_{AVG}
CSR SCORE (-)	-0.035**		0.145**
	(0.014)		(0.058)
IV		0.667***	
		(0.083)	
BETA (+)	0.010***	-0.009	0.009**
	(0.004)	(0.009)	(0.004)
SIZE (-)	0.000	0.073***	-0.013***
	(0.002)	(0.003)	(0.005)
GROWTH (+)	0.150***	0.023	0.144***
	(0.009)	(0.022)	(0.010)
BTM (+)	0.031***	0.027**	0.023***
	(0.005)	(0.131)	(0.006)
LEVERAGE (+)	0.000	-0.000*	0.000**
	(0.000)	(0.000)	(0.000)
DISPERSION (+)	0.010***	0.005	0.009***
	(0.002)	(0.005)	(0.002)
CONSTANT	0.028	-1.083***	0.181***
	(0.023)	(0.065)	(0.055)
Firm effects	No	No	No
Industry effects	Yes	Yes	Yes
Year effects	Yes	Yes	Yes
Wald χ^2		1317 (p=0.000)	558.82 (p=0.000)
F-stat.	32.21 (p=0.000)	37.92 (p=0.000)	19.96 (p=0.000)
Observations	577	577	577
Adj. R^2	0.603	0.714	0.516†
Firms	82	82	82

The table shows the results from regressing the implied cost of equity estimates on CSR scores and control variables across the years 2006-2014. r_{AVG} is the average implied cost of equity estimates from the four models: Claus and Thomas (2001); Gebhardt, Lee, and Swaminathan (2001); Ohlson and Juettner-Nauroth (2005) and Easton (2004). *CSR SCORE* is the average of the GES Risk Rating environmental and social score. *BETA* is the market beta from regressing 24 to 60 monthly excess returns on the OMX Stockholm index. *SIZE* is the natural logarithm of total assets. *GROWTH* is the long-term growth forecast and substituted with the short-term growth forecast if missing. *BTM* is the book-to-market value of equity. *LEVERAGE* is the debt over equity

ratio. *DISPERSION* is the natural logarithm of the dispersion of analyst forecasts. *IV* is the exogenous instrumental variable average industry CSR score per year. (4) is an OLS regression, (5) is the first stage and (6) is the second stage of a 2SLS IV regression. Firms are categorized by the Industry Classification Benchmark Supersectors. The expected sign for each coefficient is shown in parenthesis by the variable name. Standard errors are shown in parenthesis, significant at levels *** p<0.01, ** p<0.05, * p<0.1. †R^2 from IV estimation can be negative and cannot be used in the usual way for F-tests of joint restrictions.

We are unable to establish a causal effect of CSR on the implied cost of equity capital. This shows a stronger positive effect than the results (2) and (3), implying that a possibly omitted variable does not have to be time-constant or firm-specific. Thus, the likelihood of the abovementioned omitted variables driving our results depends on to what extent they are market-wide factors and vary across time. In summary, the results in *Table 6* and *Table 7* show that the relationship between CSR performance score and the implied cost of equity capital is negative on a static and dynamic level. Nevertheless, a causal effect of CSR on the implied cost of equity capital cannot be established as endogeneity issues seem to drive our results in the baseline model.

5.3 Hypothesis 2

To test the second hypothesis; whether there is a non-linear and time-varying effect of CSR performance on the implied cost of equity capital, we perform two tests shown in *Table 8* and *Table 9*. Firm fixed effects are included as previous tests of Hypothesis 1 showed that endogeneity needs to be controlled for. In *Table 8* (8), a squared CSR variable is added to the firm fixed effects model (2). A positive *CSR SCORE* coefficient (0.103*) and negative *CSR SCORE*^{2} coefficient (-0.115**) imply that the underlying relationship is inverse U-shaped and the null-hypothesis is rejected at a 5% significance level.

These results imply that firms with a CSR score lower (higher) than 0.45 have an implied cost of equity that is increasing (decreasing) at a decelerating (accelerating) rate in relation to their CSR score until (after) they reach the peak of the curve. Thus, there is a diminishing returns to scale of CSR performance score on the cost of equity capital up to the score 0.45, after which there is an increasing returns to scale. The lowest and highest CSR performing firms experience the largest effect on implied cost of equity capital. The latter group of firms have such a high CSR performance that it convinces investors about their commitment which is seen in the negative correlation. As expected, Atlas Copco, H&M and Volvo belong to this group of firms. These are firms with a history of strong financial performance and recognized as good corporate citizens.[19]

[19] For instance, Atlas Copco engages in sustainable innovations and has integrated the UN Global Compact principles; H&M engages in sustainable material, good working conditions, animal welfare; and Volvo engages in a partnership with WWF, low-emission transportation. (Atlas Copco, 2015; H&M, 2015; Volvo, 2015).

Table 8. Non-linear relationship

	CSR	ENVIRONMENT	SOCIAL
	(7)	(8)	(9)
	r_{AVG}	r_{AVG}	r_{AVG}
SCORE	0.103*	0.051	0.120*
	(0.057)	(0.032)	(0.071)
SCORE ^{2}	-0.115**	-0.073**	-0.116*
	(0.058)	(0.033)	(0.068)
BETA (+)	0.004	0.003	0.004
	(0.005)	(0.005)	(0.005)
SIZE (-)	0.000	0.000	-0.002
	(0.016)	(0.016)	(0.016)
GROWTH (+)	0.148***	0.148***	0.148***
	(0.025)	(0.025)	(0.025)
BTM (+)	0.020***	0.021***	0.020**
	(0.007)	(0.007)	(0.008)
LEVERAGE (+)	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
DISPERSION (+)	0.010***	0.010***	0.009***
	(0.003)	(0.003)	(0.003)
CONSTANT	0.029	0.040	0.058
	(0.318)	(0.317)	(0.307)
Firm effects	Yes	Yes	Yes
Industry effects	No	No	No
Year effects	Yes	Yes	Yes
Observations	577	577	577
Adj. R^2	0.691	0.690	0.693
Firms	82	82	82

The table shows the results from an OLS regression of the implied cost of equity estimates on CSR scores and control variables across the years 2006-2014. r_{AVG} is the average implied cost of equity estimates from the four models: Claus and Thomas (2001); Gebhardt, Lee, and Swaminathan (2001); Ohlson and Juettner-Nauroth (2005) and Easton (2004). *CSR SCORE* is the average of the GES Risk Rating environmental and social score. *BETA* is the market beta from regressing 24 to 60 monthly excess returns on the OMX Stockholm index. *SIZE* is the natural logarithm of total assets. *GROWTH* is the long-term growth forecast and substituted with the short-term growth forecast if missing. *BTM* is the book-to-market value of equity. *LEVERAGE* is the debt over equity ratio. *DISPERSION* is the natural logarithm of the dispersion of analyst forecasts. *ENVIRONMENT SCORE* is the GES Risk Rating environmental score. *SOCIAL SCORE* is the GES Risk Rating social score. Firms are categorized by the Industry Classification Benchmark Supersectors. The expected sign for each coefficient is shown in parenthesis by the variable name. Robust standard errors clustered at firm level are shown in parenthesis, significant at levels *** p<0.01, ** p<0.05, * p<0.1.

The median *CSR SCORE* in our sample is 0.38, indicating that half of the sample firms have not enjoyed a lower cost of equity capital from their CSR performance. Therefore to reach the highest marginal utility, they should invest in more CSR activities. The inverse U-shape relationship is also found when breaking down *CSR SCORE* into environmental (9) and social (10) dimensions, although environmental score is not significant at a 10% level. The tipping point of environmental score is 0.35, which is lower than the sample median 0.41, whereas the tipping point of social score is 0.52, which is higher than the sample median 0.40. This indicates that the Swedish market values environmental performance more than social performance. Since Sweden has a

well-developed welfare system and influential labour unions, investors may see the social benefits as hygiene factors[20], which means that an increase in social score does not lead to higher satisfaction while a reduction leads to dissatisfaction. On the other hand, results show that Sweden is very environmental-conscious, which is reinforced by a World Wide Fund for Nature study showing that there is an increased environmental consciousness in the country (WWF, 2015).

In *Table 9* in Appendix, we add a variable to the firm fixed effects model (2), interacting *CSR SCORE* with a dummy for each year from 2007-2014. In the base group year 2006, the relationship between *CSR SCORE* and implied cost of equity estimates is positive (0.077) but not significant. The interaction variable *CSR SCORE*2009* has the largest and most significant coefficient (-0.108***) relative to the base group, followed by *CSR SCORE*2010* (-0.083**). We can reject the null-hypothesis at a 5% significance level and accept the alternative hypothesis of a changing CSR effect across years.

We have observed that the negative effect of CSR score on the implied cost of equity estimates within each firm is the strongest in 2009, which indicates that investors valued CSR more after the financial crisis of 2008. One explanation could be that CSR activities serve as an insurance mechanism and the information disclosed by responsible firms increase transparency, which make the investors more aware of firm's riskiness. Another explanation could be that CSR is used to signal going concern despite short-run financial difficulties and in this way overcome investors' doubts. Therefore, CSR could be used as a tool for managing the consequences of a financial crisis (Souto, 2009). Nevertheless, our sample period is too short to draw the conclusion of that CSR performance and the relationship to cost of capital correlates with business cycles.

[20] Hygiene factor: a workplace factor such as work condition, job security and salary that does not give increased satisfaction or motivation, however an absence of it leads to dissatisfaction (Hertzberg et al., 2011).

6. Discussion

In this chapter we discuss the sensitivity of choices and assumptions that may have an impact on our results. In the sensitivity analysis section 6.1, the investigated variables and estimation method are discussed. In the next section 6.2, we present robustness tests to check the validity of the assumptions required for the chosen estimation method.

6.1 Sensitivity analysis and reliability of assumptions

6.1.1 Estimating the cost of equity capital

Calculating the implied cost of equity capital from the four valuation models could give rise to measurement errors. First of all, we do not know if all the data retrieved from Datastream is correct. By cross-checking missing values and zeros with other internet sources and the annual reports of randomly chosen firms, we found that some errors were incorrect and hence complemented with data from WRDS Compustat. This also applies to the control variables *BTM*, *LEVERAGE* and *SIZE*. Second, we do not outrule errors in forecasting the required EPS, book value and ROE each valuation year, as well as when calculating beta and the historical industry ROE. Third, solving for the implied cost of equity capital in CT, GLS and ES models can give multiple solutions and yield extreme values, which we have mitigated by limiting the solved cost of capital to the range 0%-100%.

As a sensitivity test of the implied cost of equity estimate, the median value along with individual estimates from the four models are shown in *Table 10*. Overall, the coefficient of *CSR SCORE* is negative but only significant for the median implied cost of equity estimate (16). The relatively large coefficient of *GROWTH* in the CT model (12) compared to the other models indicates that the choice of substituting LTG with STG to increase our sample size has indeed affected the estimated values. This echoes the low correlation (0.463) between CT and GLS models seen in *Table 5*. Since STG has most often been higher than LTG, a relatively higher cost of capital is needed in the RIV model to discount the inflated FEPS to the current share price. This has an effect on the CT model due to the short forecast horizon and FEPS being a part of the terminal value. The GLS model is less sensitive to the growth level due to the long forecast horizon and terminal value determined by the historical industry ROE. This choice was made to increase the sample size as there are relatively few analysts following Swedish firms compared to European firms (Doukas and McKnight, 2005).

6.1.2 Measuring CSR

We acknowledge that CSR performance is difficult to measure since sustainability reporting is voluntary and not standardized, as opposed to financial information in annual reports. As we do not intend to evaluate whether firms disclose sustainability reports or the quality of disclosure, we rely on that the ratings of independent rating institutions reflect the firm's actual CSR performance. Therefore, our results may contain measurement errors to the extent of how well the public CSR ratings measure a firm's "real" CSR performance. The ratings are further subject to limitations since the valuation criteria and perceptions of CSR is likely to differ between rating institutions. In *Table 11*, we use different proxies for CSR and the Thomson Reuters Asset4 ESG database to test the sensitivity of the results in our baseline model.[21] Overall, the CSR-coefficient remains negative. The results show that CSR scores released within half a year (20) and one year (17) prior to the cost of capital valuation date have a stronger negative correlation with implied cost of equity estimate than the current year's CSR score.

Furthermore, we put equal weights on environmental and social score when merging them into the overall CSR score, although they measure different aspects and criteria. Regressing the baseline model with environmental and social score separately in (23) and (24) in *Table 12*, shows that environmental scores have a larger effect (-0.032*) on the implied cost of equity capital than social score (-0.013). This result is also shown by the Thomson Reuters Asset4 environmental score (25), which echoes the result in *Table 8* of that the Swedish market values environmental performance more than social performance.

6.1.3 Sample and Model specification

Excluding financial firms and underrepresented industries

In *Table 13*, financial firms are excluded in (28) due to their distinct capital structure and high level of leverage. In (29) the industries Media and Automobile are excluded as they only consist of one firm each which is not representative of the industry as a whole. Nonetheless, our results remain unchanged.

[21] Thomson Reuters Asset4 ESG database evaluates more than 4 300 firms globally, evaluating more than 750 data points of sustainability reporting and 250 key performance indicators. The overall ESG score ranges from 0-100 and consists of four dimensions of a firm's performance; economic, environmental, social and corporate governance. Although being used in studies such as Cheng et al. (2014), the Asset4 ESG rating only covers 39 firms in our sample.

Extreme values and outliers

Due to the presence of extreme values, *GROWTH*, *BTM* and *LEVERAGE* have been winsorized to the 5th and 95th percentiles, and *DISPERSION* has been converted to a logarithmic form in our regressions. To test whether the extreme values affect our results, we regress the baseline model (1) with the three variables winsorized at the 1st and 99th percentiles in (30) *Table 14* and find that *GROWTH*, *BTM* and *DISPERSION* have a smaller effect (0.073***, 0.017*** and 0.008*** respectively), *BETA* has a larger effect (0.015***) while the effect of *CSR SCORE* remains unchanged (-0.036**). The logarithmic transformation of *DISPERSION* gives a percentage change interpretation of the coefficient and puts the same weight in the relative change in analyst dispersion regardless of the absolute value. However, it can be argued that the higher the coefficient of variation in one-year ahead FEPS, the more severe is the disagreement among analyst forecasts and the uncertainty about the firm's future prospects. Taking this into consideration, all variables are kept in their original values in (31). Disregarding the insignificant coefficients of *SIZE* and *LEVERAGE*, the signs of the other coefficients remain unchanged. *CSR SCORE* is no longer significant at a 10% level (-0.029) and the effects of *GROWTH* and *DISPERSION* are greatly reduced (0.044*** and 0.000*** respectively). Finally, in (32) we re-run the baseline model excluding Mycronic from the sample due to its extreme cost of equity estimates (56.1% in 2007, 49.7% in 2009 and 53.6% in 2010) and find that *CSR SCORE* loses its significance (-0.021). In sum, our main results are found to be sensitive to extreme values in *GROWTH* and *DISPERSION* as well as the outlier firm Mycronic.

Choice of estimation method

Under the assumptions that *i)* the underlying population model is linear in parameters, *ii)* we have a random sample of the population, *iii)* independent variables are not perfectly correlated, *iv)* no important variables are omitted in the model, and *v)* the error term has a constant variance, the OLS estimation method is the best linear unbiased estimator (BLUE).[22] If any of the assumptions do not hold, the estimated coefficients could be biased or inefficient. We suspect that potential bias in our estimated model is mainly caused by endogeneity or an omitted variable. Thus we try to correct for this using firm fixed effects and an IV estimator. Inefficient estimators give invalid

[22] According to the Gauss-Markov Theorem (Wooldridge, 2012).

standard errors and make confidence intervals unreliable, and robustness tests of heteroskedasticity and serial correlation is therefore performed in the next section.

Noting that OLS may not be the best estimator, other panel data methods are performed and presented in *Table 15*. The fixed effects (FE) and random effects (RE) estimation methods show positive CSR coefficient (0.036* and 0.014 respectively), giving the same signs as the firm fixed effects model (2), (3) and IV regression (6). A Hausman test, shown in *Figure 5* in Appendix, is also performed to see which of the two models is favourable. The result shows that FE is rejected in favor of RE. Nevertheless, these panel data methods require an additional assumption of strict exogeneity in the error term in order to show unbiased estimators (Wooldridge, 2012). The error term in each period needs to be uncorrelated with past, present and future values of *CSR SCORE*, such that the current CSR score is fully independent of implied cost of equity capital in the past. This is unlikely to hold since firms take the cost of capital into account in any kind of future investments, including CSR. This motivates our choice to keep the OLS estimator despite its weaknesses and to be cautions with its statistical inference.

Sample bias

We note that a substantial number of firms have been excluded due to restrictions posed by the valuation models, leaving us with a non-representative sample of our population. The firms in our sample are likely to be biased to relatively large firms with more analyst coverage, even though *SIZE* is already controlled for in the regression model. Earlier research suggests that analyst bias may cause more noise in the forecast and over-optimism, which would overvalue our implied cost of equity estimates (Kothari, 2001). Firms outside our sample are possibly smaller, younger and have less than two analysts following, which could be perceived as higher risk and thus we have undervalued the implied cost of equity estimates in our sample. We argue that these two biases cancel out, but highlight that this limits the inference and conclusions that can be drawn from our sample.

6.2 Robustness tests

To check the robustness of our results we perform the following tests;

6.2.1 Heteroskedasticity

Heteroskedasticity arises when the variance of the unobserved error term is not constant across an independent variable. This does not cause biased or inconsistent coefficient estimates but affects their variance, making the OLS standard errors unreliable (Wooldridge, 2012). We perform a Breusch-Pagan Cook-Weisberg test with the null hypothesis that the error variances are constant (homoskedastic) against the alternative hypothesis that the error variances are a function of one or more variables (heteroskedastic). A χ^2-value of 888.57 and p=0.000 indicates that heteroskedasticity is present. Similarly, a White test for a non-linear form of heteroskedasticity gives a χ^2-value of 387.94 and p=0.000, yielding the same result. To correct for the heteroskedasticity we use robust standard errors in our regressions. Please refer to *Figure 4* for a scatter plot of the residuals.

6.2.2 Serial correlation

In a panel data, error terms that correlate across time is called serial correlation or autocorrelation. Similar to heteroskedasticity, serial correlation leads to unbiased but inefficient coefficient estimators in OLS regressions (Wooldridge, 2012). We perform a Wooldridge test for serial correlation in panel data and reject the null hypothesis of no serial correlation (F-value=6.801 and p=0.01). In a Cumby-Huizinga test, the null hypothesis of no serial correlation is also rejected (χ^2-value=6.521 and p=0.01). Two methods are employed in our regressions to correct for the serial correlation. First, standard errors are clustered at the firm level so that each firm is a cluster of observations across time, allowing correlation in standard errors within the cluster. The standard errors corrected for heteroskedasticity and serial correlation are larger and therefore better reflect the difference between the sample and the population coefficients, allowing us to use the OLS regression under weaker assumptions (Wooldridge, 2012). Second, if there is a time-constant omitted variable causing the correlation in the error terms, this type of endogeneity is tested through firm fixed effects and an IV regression.

6.2.3 Multicollinearity

Multicollinearity occurs when independent variables are highly correlated with each other and variation in one independent variable can be explained by another, making it hard to distinguish the effect of one variable from another. This does not violate the multiple linear regression assumptions for unbiased and consistent OLS estimates, but can lead to higher variance and lower efficiency. *Figure 3* shows a matrix of pair-wise scatter plots of variables and *Table 5* shows the Pearson correlation coefficients between variables, in which we identified a correlation of 0.644 between *SIZE* and *CSR SCORE*. The VIF is a measure of how much the variance in a coefficient is affected by correlation between the independent variables. As the VIF values in our baseline regression are below 10, which is usually considered as the cutoff value, we conclude that multicollinearity is not a problem and keep *SIZE* as a control variable (Wooldridge, 2012). Please refer to *Figure 6* in Appendix for VIF results.

7. Conclusion

This study aims to investigate the value relevance of CSR performance, more specifically if it affects a firm's cost of equity capital since it plays an important role in the financing and operating decisions of firms. Four accounting-based valuation models are used to calculate the implied cost of equity capital for Swedish firms between the years 2006-2014.

Our main result is that the cost of equity capital is a channel through which the market prices a firm's CSR performance. More specifically, firms with high CSR performance have lower cost of equity capital, confirming both theory and previous research outside of the Swedish context. We further investigate the causal relationship by introducing firm fixed effects and an instrumental variable method to account for endogeneity issues. The results confirm that a causal effect of CSR on the cost of equity capital cannot be established as a potential omitted variable such as management skills seems to drive our main results, thus further research is necessary to gain an understanding of the relationship.

As we find a curvilinear relationship, low CSR performing firms may not be as convincing as high CSR performing firms to be rewarded by investors. An additional CSR performance score is related to higher cost of equity capital until the point of 0.45, whereafter firms enjoy lower cost of equity capital. The majority of firms in our sample have not reached the optimal level and are therefore not able to enjoy lowered cost of equity capital associated with an increase in CSR performance. Furthermore, environmental efforts are found to be more valued by the Swedish market than social efforts.

Finally, the results show that the CSR effect in our sampling period is largest in 2009. An explanation could be that CSR is used as a signalling and insurance tool to convince investors about their going concern after a financial crisis. The sensitivity and robustness tests indicate that our results are sensitive to extreme values and that caution should be taken to the extent of conclusions that can be drawn from our research.

7.1 Validity, reliability and generalizability

The validity of our study affects the ability to draw reliable conclusions of whether CSR performance affects a firm's cost of equity capital. Since neither CSR performance nor cost of equity capital can be directly observed, they have been proxied according to previous studies and tested for sensitivity. We do not, however, rule out the possibility of measurement error from our

side. In the choice of appropriate control variables for the cost of capital, the impact of the conventional control variables *SIZE* and *LEVERAGE* could be questioned as our tests have shown insignificant coefficients close to zero. Nonetheless, if they would have been excluded from the model, the sample bias would be more severe. Furthermore, the robustness tests indicate that caution should be taken to the extent of conclusions that can be drawn from our research, especially related to the efficiency of our estimates and making statistical inference.

Regarding the reliability of this study, other researches should be able to replicate it given the assumptions described and the research method that relies on previous studies. Potential measurement errors identified are mainly related to deriving the implied cost of equity estimates from valuation models, such as whether the calculations have been interpreted and performed correctly or the use of the correct data from Datastream.

Lastly, the generalizability of this study outside the scope of Swedish listed firms and our sample period is considered to be moderate. Limitations exist in terms of how well our sample represents the population and the non-random bias caused by analyst coverage. Having this in mind, the results from our study should be cautiously transferred to areas outside the scope of our method and research boundaries.

7.2 Suggestions for further research

This study aims to investigate the relationship between CSR performance and the cost of equity capital in a Swedish context. The results from our study are of interest for future research in this field. As we could not prove a causal effect of CSR, this calls for further research to understand the underlying mechanism driving the relationship between CSR and cost of equity capital. Moreover, our sample shows that the Swedish market values environmental efforts more than social efforts. This study can be extended to incorporate the third dimension, corporate governance, to examine if it would alter the results. Finally, as we find a stronger effect of CSR performance on the cost of equity capital after the financial crisis in 2008, compared to other years in the sample period, it would be interesting to investigate its correlation with business cycles over a longer time period.

References

Akerlof, G.A. 1970, "The market for" lemons": Quality uncertainty and the market mechanism", *The Quarterly Journal of Economics*, pp. 488-500.

Barnea, A. & Rubin, A. 2010, "Corporate social responsibility as a conflict between shareholders", *Journal of Business Ethics*, vol. 97, no. 1, pp. 71-86.

Barnett, M.L. & Salomon, R.M. 2012, "Does it pay to be really good? Addressing the shape of the relationship between social and financial performance", *Strategic Management Journal*, vol. 33, no. 11, pp. 1304-1320.

Berk, J.B. & DeMarzo, P.M. 2007, *Corporate Finance*, Pearson Education.

Bodie, Z., Kane, A. & Marcus, A.J. 2011, *Investment and portfolio management*, McGraw Hill Education.

Botosan, C.A. 2000, "Evidence that greater disclosure lowers the cost of equity capital", *Journal of Applied Corporate Finance*, vol. 12, no. 4, pp. 60-69.

Botosan, C.A., Plumlee, M.A. & Wen, H. 2011, "The Relation between Expected Returns, Realized Returns, and Firm Risk Characteristics", *Contemporary Accounting Research*, vol. 28, no. 4, pp. 1085-1122.

Brown, W.O., Helland, E. & Smith, J.K. 2006, "Corporate philanthropic practices", *Journal of Corporate Finance*, vol. 12, no. 5, pp. 855-877.

Carroll, A.B. 1991, "The pyramid of corporate social responsibility: Toward the moral management of organizational stakeholders", *Business Horizons*, vol. 34, no. 4, pp. 39-48.

Chen, K.C., Chen, Z. & Wei, K.J. 2009, "Legal protection of investors, corporate governance, and the cost of equity capital", *Journal of Corporate Finance*, vol. 15, no. 3, pp. 273-289.

Cheng, B., Ioannou, I. & Serafeim, G. 2014, "Corporate social responsibility and access to finance", *Strategic Management Journal*, vol. 35, no. 1, pp. 1-23.

Claus, J. & Thomas, J. 2001, "Equity premia as low as three percent? Evidence from analysts' earnings forecasts for domestic and international stock markets", *The Journal of Finance*, vol. 56, no. 5, pp. 1629-1666.

Dhaliwal, D.S., Li, O.Z., Tsang, A. & Yang, Y.G. 2011, "Voluntary nonfinancial disclosure and the cost of equity capital: The initiation of corporate social responsibility reporting", *Accounting Review*, vol. 86, no. 1, pp. 59-100.

Diamond, D.W. & Verracchia, R.E. 1991, "Disclosure, Liquidity, and the Cost of Capital", *The Journal of Finance*, vol. 46, no. 4, pp. 1325-1359.

Doukas, J.A. & McKnight, P.J. 2005, "European Momentum Strategies, Information Diffusion, and Investor Conservatism", *European Financial Management,* vol. 11, no. 3, pp. 313-338.

Easton, P.D. 2004, "PE ratios, PEG ratios, and estimating the implied expected rate of return on equity capital", *The Accounting Review,* vol. 79, no. 1, pp. 73-95.

El Ghoul, S., Guedhami, O., Kwok, C.C.Y. & Mishra, D.R. 2011, "Does corporate social responsibility affect the cost of capital?", *Journal of Banking and Finance,* vol. 35, no. 9, pp. 2388-2406.

Elton, E.J. 1999, "Presidential address: expected return, realized return, and asset pricing tests", *The Journal of Finance,* vol. 54, no. 4, pp. 1199-1220.

European Commission 2011, *A renewed EU strategy 2011-14 for Corporate Social Responsibility*, European Commission, Brussels.

Eurosif 2014, *European SRI Study 2014*, European Sustainable Investment Forum, Brussels.

Fama, E.F. & French, K.R. 1992, "The cross-section of expected stock returns", *The Journal of Finance,* vol. 47, no. 2, pp. 427-465.

Fama, E.F. & French, K.R. 1993, "Common risk factors in the returns on stocks and bonds", *The Journal of Financial Economics,* vol. 33, no. 1, pp. 3-56.

Friedman, M. 1962, *Capitalism and freedom,* University of Chicago Press, Chicago.

Friedman, M. 1970, "The social responsibility of business is to increase its profits", *New York Times Magazine,* vol. 13, pp. 32-33.

Gebhardt, W.R., Lee, C. & Swaminathan, B. 2001, "Toward an implied cost of capital", *Journal of Accounting Research,* vol. 39, no. 1, pp. 135-176.

Gode, D. & Mohanram, P. 2003, "Inferring the cost of capital using the Ohlson–Juettner model", *Review of Accounting Studies,* vol. 8, no. 4, pp. 399-431.

Goss, A. & Roberts, G.S. 2011, "The impact of corporate social responsibility on the cost of bank loans", *Journal of Banking & Finance,* vol. 35, no. 7, pp. 1794-1810.

Graham, J.R., Harvey, C.R. & Rajgopal, S. 2005, "The economic implications of corporate financial reporting", *Journal of Accounting and Economics,* vol. 40, no. 1–3, pp. 3-73.

Greening, D.W. & Turban, D.B. 2000, "Corporate social performance as a competitive advantage in attracting a quality workforce", *Business & Society,* vol. 39, no. 3, pp. 254-280.

Guenster, N., Bauer, R., Derwall, J. & Koedijk, K. 2011, "The economic value of corporate eco-efficiency", *European Financial Management,* vol. 17, no. 4, pp. 679-704.

Hail, L. & Leuz, C. 2006, "International differences in the cost of equity capital: Do legal institutions and securities regulation matter?", *Journal of Accounting Research*, vol. 44, no. 3, pp. 485-531.

Heinkel, R., Kraus, A. & Zechner, J. 2001, "The effect of green investment on corporate behavior", *Journal of Financial and Quantitative Analysis*, vol. 36, no. 04, pp. 431-449.

Hertzberg, F., Mausner, B., Snyderman B.B. 2011, *The Motivation to Work*, Transaction Publishers.

Hillman, A.J. & Keim, G.D. 2001, "Shareholder value, stakeholder management, and social issues: what's the bottom line?", *Strategic Management Journal*, vol. 22, no. 2, pp. 125-139.

Hong, H. & Kacperczyk, M. 2009, "The price of sin: The effects of social norms on markets", *Journal of Financial Economics*, vol. 93, no. 1, pp. 15-36.

Hopkins, M. 2004, "Corporate social responsibility: an issues paper", *International Labour Office Working Paper No.27*.

Hughes, J.S., Liu, J. & Liu, J. 2007, "Information Asymmetry, Diversification, and Cost of Capital", *The Accounting Review*, vol. 82, no. 3, pp. 705-729.

Jensen, M.C. & Meckling, W.H. 1976, "Theory of the firm: Managerial behavior, agency costs, and ownership structure", *Journal of Financial Economics*, vol. 3, no. 4, pp. .

Kapstein, E.B. 2001, "The corporate ethics crusade", *Foreign Affairs, September/October Issue*, pp. 105-119.

Kim, Y., Park, M.S. & Wier, B. 2012, "Is earnings quality associated with corporate social responsibility?", *The Accounting Review*, vol. 87, no. 3, pp. 761-796.

Knox, S., Maklan, S. & French, P. 2005, "Corporate social responsibility: Exploring stakeholder relationships and programme reporting across leading FTSE companies", *Journal of Business Ethics*, vol. 61, no. 1, pp. 7-28.

Kothari, S.P. 2001, "Capital markets research in accounting", *Journal of Accounting and Economics*, vol. 31, no. 1–3, pp. 105-231.

Lee, D.D. & Faff, R.W. 2009, "Corporate sustainability performance and idiosyncratic risk: A global perspective", *Financial Review*, vol. 44, no. 2, pp. 213-237.

Margolis, J.D. & Walsh, J.P. 2001, *People and profits?: The search for a link between a company's social and financial performance*, Psychology Press.

Margolis, J.D., Elfenbein, H.A. & Walsh, J.P. 2007, "Does it pay to be good? A meta-analysis and redirection of research on the relationship between corporate social and financial performance", *Ann Arbor*, vol. 1001, pp. 48109-41234.

McGuire, J.B., Sundgren, A. & Schneeweis, T. 1988, "Corporate social responsibility and firm financial performance", *Academy of Management Journal*, vol. 31, no. 4, pp. 854-872.

McWilliams, A. & Siegel, D. 2000, "Corporate social responsibility and financial performance: Correlation or misspecification?", *Strategic Management Journal,* vol. 21, no. 5, pp. 603-609.

McWilliams, A. & Siegel, D. 2001, "Corporate social responsibility: A theory of the firm perspective", *Academy of Management Review,* vol. 26, no. 1, pp. 117-127.

Merton, R.C. 1987, "A simple model of capital market equilibrium with incomplete information", *The Journal of Finance,* vol. 42, no. 3, pp. 483-510.

Moskowitz, M. 1972, "Choosing socially responsible stocks", *Business and Society Review,* vol. 1, no. 1, pp. 71-75.

Nilsson, H., Cunningham, G.M. & Hassel, L.G. 2008, "A study of the provision of environmental information in financial analysts' research reports", *Sustainable Development,* vol. 16, no. 3, pp. 180-194.

Ohlson, J.A. & Juettner-Nauroth, B.E. 2005, "Expected EPS and EPS growth as determinants of value", *Review of Accounting Studies,* vol. 10, no. 2-3, pp. 349-365.

Orlitzky, M., Schmidt, F.L. & Rynes, S.L. 2003, "Corporate social and financial performance: A meta-analysis", *Organization Studies,* vol. 24, no. 3, pp. 403-441.

Patten, D.M. 1991, "Exposure, legitimacy, and social disclosure", *Journal of Accounting and Public Policy,* vol. 10, no. 4, pp. 297-308.

Phillips, B. 2014, *Annual Report 2014,* PRI Association, UK.

Porter, M.E. & Kramer, M.R. 2002, "The competitive advantage of corporate philanthropy", *Harvard Business Review,* vol. 80, no. 12, pp. 56-68.

Porter, M.E. & Kramer, M.R. 2006, "The link between competitive advantage and corporate social responsibility", *Harvard Business Review,* vol. 84, no. 12, pp. 78-92.

Renneboog, L., Ter Horst, J. & Zhang, C. 2008, "Socially responsible investments: Institutional aspects, performance, and investor behavior", *Journal of Banking & Finance,* vol. 32, no. 9, pp. 1723-1742.

Reverte, C. 2012, "The Impact of Better Corporate Social Responsibility Disclosure on the Cost of Equity Capital", *Corporate Social Responsibility and Environmental Management,* vol. 19, no. 5, pp. 253-272.

Semenova, N., Hassel, L. & Nilsson, H. 2009, "The value relevance of environmental and social performance: Evidence from Swedish SIX 300 companies", *Sustainable Investment and Corporate Governance Working Papers, Sustainable Investment Research Platform.*

Sharpe, W.F. 1964, "Capital asset prices: A theory of market equilibrium under conditions of risk", *The Journal of Finance,* vol. 19, no. 3, pp. 425-442.

Skogsvik, K. 2006, "Probabilistic Business Failure Prediction in Discounted Cash Flow Bond and Equity Valuation", *SSE/EFI Working Paper Series in Business Administration*, no. 2006, pp. 5.

Souto, B.F. 2009, "Crisis and corporate social responsibility: threat or opportunity?", *International Journal of Economic Sciences and Applied Research*, no. 1, pp. 36-50.

Staiger, D. & Stock, J.H. 1997, "Instrumental Variables Regression with Weak Instruments", *Econometrica*, vol. 65, no. 3, pp. 557-586.

Starks, L.T. 2009, "Corporate governance and corporate social responsibility: What do investors care about? What should investors care about?", *Financial Review*, vol. 44, no. 4, pp. 461-468.

Swedish Government 2007, last updated 03/12/2007, *Clearer requirements for information about sustainability for state-owned companies*, Ministry of Enterprise and Innovation, [Online]. Available: http://www.government.se/sb/d/7329/a/93506 [05/03/2015].

Thomson Reuters 2012, Asset4 ESG Data, [Online]. Available: http://financial.thomsonreuters.com/content/dam/openweb/documents/pdf/financial/asset4-esg-data-fact-sheet.pdf [16/05/2015].

Waddock, S.A. & Graves, S.B. 1997, "The corporate social performance-financial performance link", *Strategic Management Journal*, vol. 18, no. 4, pp. 303-319.

Wooldridge, J. 2012, *Introductory econometrics: A modern approach*, Cengage Learning.

WWF 2015, last updated 24/03/2015, *Earth Hour Klimatbarometer 2015: Svenskarna vill se politiska krafttag för klimatet*, World Wide Fund for Nature, [Online]. Available: http://www.wwf.se/press/pressrum/pressmeddelanden/1592379-earth-hour-klimatbarometer-2015-svenskarna-vill-se-politiska-krafttag-fr-klimatet [17/05/2015]

Sustainability reports:

Atlas Copco, 2015, *Annual Report incl. Sustainability Report and Corporate Governance Report 2014*

H&M, 2015, *Concious Actions Sustainability Reports 2014*

Volvo Group, 2015, *Volvo Group Sustainability Report 2014*

Appendix

A.1 Sample distribution

Table 1. Sample distribution across industries

Industry category	Firms	Observations	Percentage
Automobiles & Parts	1	8	1.39%
Banks	2	15	2.60%
Basic Resources	5	31	5.37%
Construction & Materials	5	40	6.93%
Financial Services	2	12	2.08%
Health Care	9	55	9.53%
Industrial Goods & Services	24	175	30.33%
Media	1	9	1.56%
Personal & Household Goods	7	50	8.67%
Real Estate	4	34	5.89%
Retail	6	43	7.45%
Technology	10	61	10.57%
Telecommunications	3	20	3.47%
Travel & Leisure	3	24	4.16%
Total	82	577	100%

Firms categorized according to the Industry Classification Benchmark ICB, 14 out of 19 Supersectors are represented in our sample.

Table 2. Sample distribution across years

Year	Observations	Percentage
2006	45	7.80%
2007	59	10.23%
2008	67	11.61%
2009	65	11.27&
2010	73	12.65%
2011	68	11.79%
2012	66	11.44%
2013	69	11.96%
2014	65	11.27%
Total	577	100%

A.2 Descriptive statistics

Table 4. Descriptive statistics for all main variables

	Obs.	*Min.*	*25%*	*Mean*	*Median*	*75%*	*Max.*	*St. Dev.*
r_{CT}	564	0.02	0.08	0.12	0.10	0.13	0.96	0.10
r_{GLS}	576	0.01	0.08	0.11	0.10	0.13	0.30	0.04
r_{OJ}	420	0.02	0.10	0.13	0.12	0.15	0.35	0.04
r_{ES}	515	0.04	0.10	0.14	0.12	0.16	0.42	0.06
r_{AVG}	577	0.01	0.09	0.12	0.11	0.14	0.56	0.06
CSR SCORE	577	0.00	0.27	0.40	0.38	0.57	0.80	0.20
BETA	577	-0.13	0.71	1.06	0.96	1.31	2.88	0.50
SIZE	577	11.21	14.50	16.18	16.03	17.56	21.76	2.06
GROWTH	577	-0.05	0.04	0.16	0.10	0.18	0.82	0.20
BTM	577	0.10	0.28	0.59	0.45	0.78	1.82	0.44
LEVERAGE	577	0.00	15.93	66.09	51.04	101.54	217.13	61.62
DISPERSION	577	0.14	1.84	2.46	2.29	2.90	6.80	0.91

This table presents descriptive statistics for all main variables for 577 firm-year observations between 2006-2014. r_{AVG} is the average implied cost of equity estimates from the four models: Claus and Thomas (2001) (r_{CT}); Gebhardt, Lee, and Swaminathan (2001) (r_{GLS}); Ohlson and Juettner-Nauroth (2005) (r_{OJ}) and Easton (2004) (r_{ES}). *CSR SCORE* is the average of the GES Risk Rating environmental and social score. *BETA* is the market beta from regressing 24 to 60 monthly excess returns on the OMX Stockholm index. *SIZE* is the natural logarithm of total assets. *GROWTH* is the long-term growth forecast and substituted with the short-term growth forecast if missing. *BTM* is the book-to-market value of equity. *LEVERAGE* is the debt over equity ratio. *DISPERSION* is the natural logarithm of the dispersion of analyst forecasts.

Figure 2. Average cost of capital and CSR score per industry

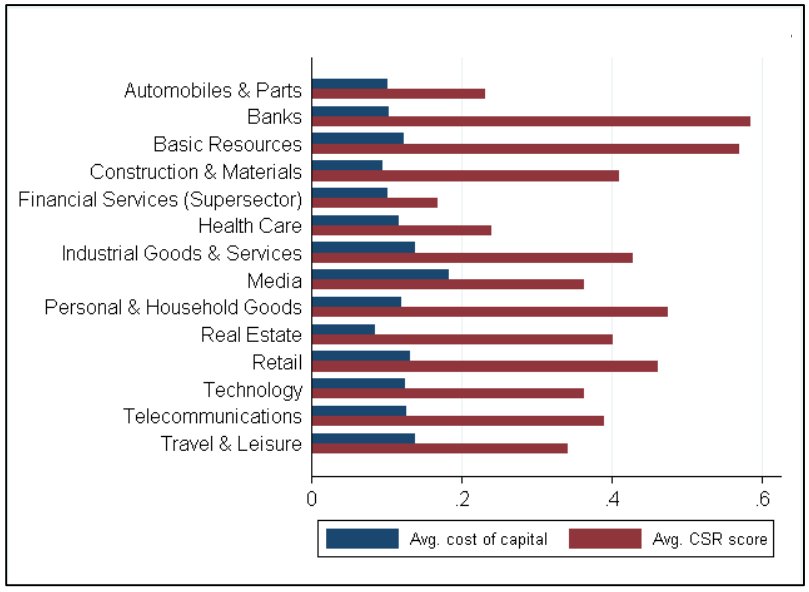

Figure 2 shows the average implied cost of equity estimates and CSR scores for the 577 firm-year observations across the years 2006-2014, categorized by the Industry Classification Benchmark Supersectors.

Table 5. Pearson correlation coefficients

Panel A. Pearson correlation coefficients between the cost of equity estimates							
	r_{CT}	r_{GLS}	r_{OJ}	r_{ES}			
r_{GLS}	0.463***						
r_{OJ}	0.728***	0.532***					
r_{ES}	0.636***	0.551***	0.878***				
r_{AVG}	0.929***	0.658***	0.941***	0.883***			
Panel B. Pearson correlation coefficients between variables							
	r_{AVG}	*CSR SCORE*	*BETA*	*SIZE*	*LTG*	*BTM*	*LEVERAGE*
CSR SCORE	-0.114***						
BETA	0.312***	0.097**					
SIZE	-0.240***	0.644***	-0.007				
GROWTH	0.641***	-0.166***	0.119***	-0.343***			
BTM	0.348***	0.122***	0.302***	-0.039	0.148***		
LEVERAGE	-0.014	0.156***	0.039	0.454***	-0.105**	0.072*	
DISPERSION	0.443***	-0.057	0.165***	-0.162***	0.424***	0.485***	-0.025

This table shows the Pearson correlation coefficients for the 577 firm-year observations across the years 2006-2014. Panel A shows the pair-wise correlation coefficients of dependent variables, Panel B shows the pair-wise correlation coefficients of main variables used in the regression models. r_{AVG} is the average implied cost of equity estimates from the four models: Claus and Thomas (2001) (r_{CT}); Gebhardt, Lee, and Swaminathan (2001) (r_{GLS}); Ohlson and Juettner-Nauroth (2005) (r_{OJ}) and Easton (2004) (r_{ES}). *CSR SCORE* is the average of the GES Risk Rating environmental and social score. *BETA* is the market beta from regressing 24 to 60 monthly excess returns on the OMX Stockholm index. *SIZE* is the natural logarithm of total assets. *GROWTH* is the long-term growth forecast and substituted with the short-term growth forecast if missing. *BTM* is the book-to-market value of equity. *LEVERAGE* is the debt over equity ratio. *DISPERSION* is the natural logarithm of the dispersion of analyst forecasts. Significance levels *** p<0.01, ** p<0.05, * p<0.1.

Figure 3. Scatter plot matrix of main variables

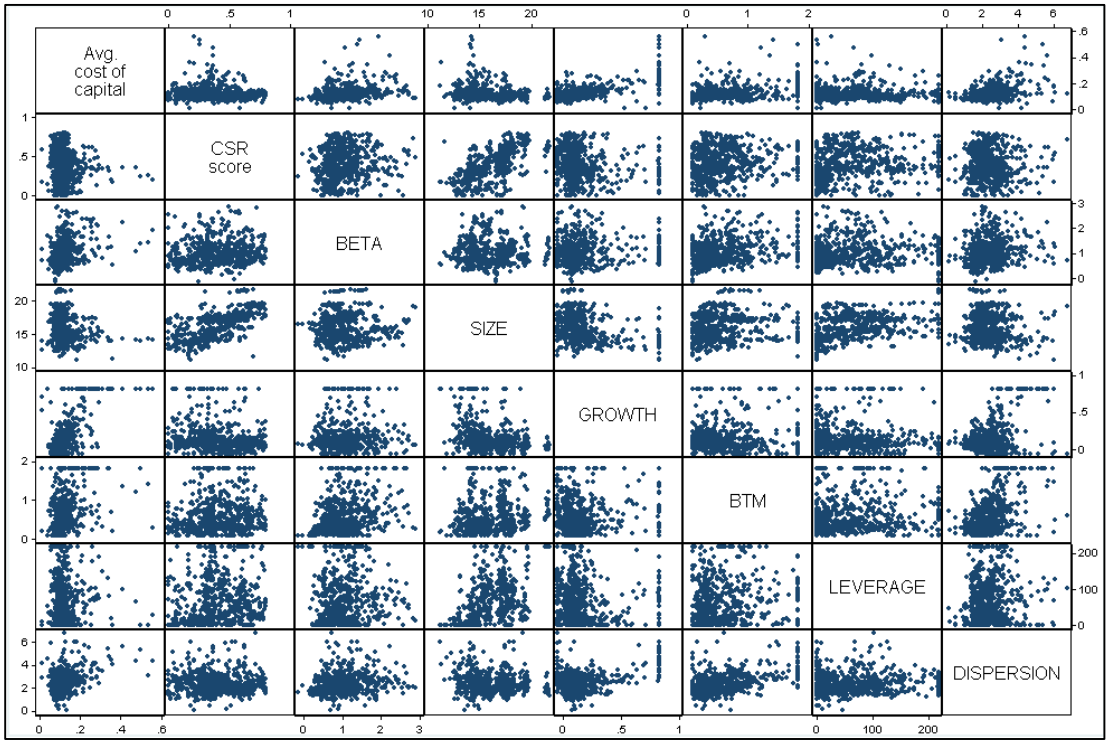

Figure 3 shows a matrix of pair-wise scatter plots of the main variables for the 577 firm-year observations across the years 2006-2014.

A.3 Hypothesis 2

Table 9. The effect of CSR across the years 2006-2014

	(11)
	r_{AVG}
CSR SCORE	0.077
	(0.048)
*CSR SCORE * 2007*	-0.047
	(0.036)
*CSR SCORE * 2008*	-0.039*
	(0.023)
*CSR SCORE * 2009*	-0.108***
	(0.035)
*CSR SCORE * 2010*	-0.083**
	(0.038)
*CSR SCORE * 2011*	-0.025
	(0.022)
*CSR SCORE * 2012*	-0.042*
	(0.023)
*CSR SCORE * 2013*	-0.053
	(0.041)
*CSR SCORE * 2014*	-0.008
	(0.027)
BETA (+)	0.003
	(0.004)
SIZE (-)	0.000
	(0.016)
GROWTH (+)	0.148***
	(0.024)
BTM (+)	0.019***
	(0.007)
LEVERAGE (+)	0.000
	(0.000)
DISPERSION (+)	0.011***
	(0.003)
CONSTANT	0.003
	(0.315)
Firm effects	Yes
Industry effects	No
Year effects	Yes
Observations	577
Adj. R^2	0.696
Firms	82

The table shows the results from an OLS regression of the implied cost of equity estimates on CSR scores and control variables across the years 2006-2014. r_{AVG} is the average implied cost of equity estimates from the four models: Claus and Thomas (2001); Gebhardt, Lee, and Swaminathan (2001); Ohlson and Juettner-Nauroth (2005) and Easton (2004). *CSR SCORE* is the average of the GES Risk Rating environmental and social score. *BETA* is the market beta from regressing 24 to 60 monthly excess returns on the OMX Stockholm index. *SIZE* is the natural logarithm of total assets. *GROWTH* is the long-term growth forecast and substituted with the short-term growth forecast if missing. *BTM* is the book-to-market value of equity. *LEVERAGE* is the debt over equity ratio. *DISPERSION* is the natural logarithm of the dispersion of analyst forecasts. *2007, 2008, 2009, 2010, 2011, 2012, 2014* and *2014* are dummy variables for each year. Firms are categorized by the Industry Classification Benchmark

Supersectors. The expected sign for each coefficient is shown in parenthesis by the variable name. Robust standard errors clustered at firm level are shown in parenthesis, significant at levels *** p<0.01, ** p<0.05, * p<0.1.

A.3 Sensitivity tests

Table 10. Variations of cost of equity capital estimates

	CT	GLS	OJ	ES	Median
	(12)	(13)	(14)	(15)	(16)
	r_{CT}	r_{GLS}	r_{OJ}	r_{ES}	r_{MEDIAN}
CSR SCORE (-)	-0.034	-0.018	-0.021	-0.013	-0.035*
	(0.037)	(0.014)	(0.015)	(0.020)	(0.019)
BETA (+)	-0.000	0.010**	0.017***	0.018***	0.011**
	(0.008)	(0.004)	(0.005)	(0.005)	(0.004)
SIZE (-)	-0.001	-0.000	-0.000	-0.003	-0.000
	(0.004)	(0.001)	(0.002)	(0.002)	(0.002)
GROWTH (+)	0.339***	0.038***	0.162***	0.091***	0.148***
	(0.058)	(0.008)	(0.016)	(0.018)	(0.026)
BTM (+)	0.037**	0.038***	0.007	0.022***	0.030***
	(0.013)	(0.005)	(0.007)	(0.007)	(0.006)
LEVERAGE (+)	-0.000	0.000	0.000**	0.000***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
DISPERSION (+)	0.004	0.003*	0.017***	0.025***	0.008***
	(0.006)	(0.002)	(0.002)	(0.003)	(0.003)
CONSTANT	0.050	0.041	0.050**	0.071**	0.039
	(0.064)	(0.025)	(0.023)	(0.030)	(0.032)
Firm effects	No	No	No	No	No
Industry effects	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes
Observations	564	576	420	515	577
Adj. R^2	0.584	0.522	0.620	0.604	0.611
Firms	82	82	73	79	82

The table shows the results from an OLS regression of the implied cost of equity estimates on CSR scores and control variables across the years 2006-2014. r_{AVG} is the average and r_{MEDIAN} is the median implied cost of equity estimates from the four models: Claus and Thomas (2001) (r_{CT}); Gebhardt, Lee, and Swaminathan (2001) (r_{GLS}); Ohlson and Juettner-Nauroth (2005) (r_{OJ}) and Easton (2004) (r_{ES}). *CSR SCORE* is the average of the GES Risk Rating environmental and social score. *BETA* is the market beta from regressing 24 to 60 monthly excess returns on the OMX Stockholm index. *SIZE* is the natural logarithm of total assets. *GROWTH* is the long-term growth forecast and substituted with the short-term growth forecast if missing. *BTM* is the book-to-market value of equity. *LEVERAGE* is the debt over equity ratio. *DISPERSION* is the natural logarithm of the dispersion of analyst forecasts. Firms are categorized by the Industry Classification Benchmark Supersectors. The expected sign for each coefficient is shown in parenthesis by the variable name. Robust standard errors clustered at firm level are shown in parenthesis, significant at levels *** p<0.01, ** p<0.05, * p<0.1.

r_{CT} : Implied cost of equity estimate from Claus and Thomas (2001) model

r_{GLS} : Implied cost of equity estimate from Gebhardt, Lee and Swamintathan (2001) model

r_{OJ} : Implied cost of equity estimate from Ohlson and Juettner-Nauroth (2005) model

r_{ES} : Implied cost of equity estimate from Easton (2004) model
r_{MEDIAN} : Median implied cost of equity, requiring at least one out of four estimates

Table 11. Variations of CSR proxy

	1-year lag (17)	1-year lead (18)	ΔCSR score (19)	Spring (20)	Autumn (21)	Asset4 ESG (22)
	r_{AVG}	r_{AVG}	r_{AVG}	r_{AVG}	r_{AVG}	r_{AVG}
CSR PROXY (-)	-0.047**	-0.029	-0.002*	-0.051**	-0.031	-0.022
	(0.023)	(0.024)	(0.001)	(0.023)	(0.021)	(0.015)
BETA (+)	0.010*	0.013***	0.008	0.006	0.009*	0.012***
	(0.005)	(0.005)	(0.006)	(0.006)	(0.005)	(0.004)
SIZE (-)	0,001	-0.001	-0.003***	0.001	0.000	0.000
	(0.002)	(0.003)	(0.001)	(0.002)	(0.002)	(0.002)
GROWTH (+)	0.153***	0.158***	0.142***	0.148***	0.152***	0.094***
	(0.028)	(0.029)	(0.022)	(0.022)	(0.023)	(0.017)
BTM (+)	0.031***	0.028***	0.035***	0.034***	0.030***	0.012
	(0.006)	(0.006)	(0.008)	(0.007)	(0.008)	(0.008)
LEVERAGE (+)	0.000	0.000	0.000*	0.000*	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
DISPERSION (+)	0.011***	0.011***	0.008***	0.008***	0.009**	0.010***
	(0.003)	(0.003)	(0.002)	(0.002)	(0.004)	(0.002)
CONSTANT	0.017	0.038	0.058**	0.061*	0.026	0.065**
	(0.032)	(0.037)	(0.025)	(0.031)	(0.033)	(0.030)
Firm effects	No	No	No	No	No	No
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	499	507	493	471	433	259
Adj. R^2	0.610	0.622	0.621	0.620	0.621	0.623
Firms	81	81	81	82	81	39

The table shows the results from an OLS regression of the implied cost of equity estimates on CSR scores and control variables across the years 2006-2014. r_{AVG} is the average implied cost of equity estimates from the four models: Claus and Thomas (2001); Gebhardt, Lee, and Swaminathan (2001); Ohlson and Juettner-Nauroth (2005) and Easton (2004). *CSR SCORE* is the average of the GES Risk Rating environmental and social score. *BETA* is the market beta from regressing 24 to 60 monthly excess returns on the OMX Stockholm index. *SIZE* is the natural logarithm of total assets. *GROWTH* is the long-term growth forecast and substituted with the short-term growth forecast if missing. *BTM* is the book-to-market value of equity. *LEVERAGE* is the debt over equity ratio. *DISPERSION* is the natural logarithm of the dispersion of analyst forecasts. Firms are categorized by the Industry Classification Benchmark Supersectors. The expected sign for each coefficient is shown in parenthesis by the variable name. Robust standard errors clustered at firm level are shown in parenthesis, significant at levels *** p<0.01, ** p<0.05, * p<0.1.

CSR SCORE (original proxy): average of GES Risk Rating environmental and social score released in autumn year *t-1* and spring year *t.*

1-year lag: *CSR SCORE* from year *t-1* (one year prior to the cost of equity valuation date)

1-year lead: *CSR SCORE* from year *t+1* (one year after to the cost of equity valuation date)

ΔCSR SCORE: percentage change in *CSR SCORE* from year *t-1* to year *t*.

Spring: only *CSR SCORE* released prior to the valuation date 30th of June year *t*.

Autumn: only *CSR SCORE* released after the valuation date 30th of June year *t*.

Asset4 ESG: Environmental, Social and Governance ratings from Thomson Reuters Asset4 database released in year *t*.

Table 12. Disaggregated CSR dimensions

	ENVIRONMENT	SOCIAL	Asset4 ENV	Asset4 SOC	Asset4 GOV
	(23)	(24)	(25)	(26)	(27)
	r_{AVG}	r_{AVG}	r_{AVG}	r_{AVG}	r_{AVG}
CSR PROXY (-)	-0.032*	-0.013	-0.022*	-0.016	-0.005
	(0.018)	(0.014)	(0.113)	(0.111)	(0.008)
BETA (+)	0.010**	0.010**	0.013***	0.012***	0.011***
	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)
SIZE (-)	0.000	-0.002	0.000	-0.000	-0.002
	(0.002)	(0.001)	(0.002)	(0.002)	0.002
GROWTH (+)	0.151***	0.150***	0.092***	0.096***	0.100***
	(0.028)	(0.028)	(0.017)	(0.018)	(0.018)
BTM (+)	0.031***	0.031***	0.011	0.012	0.013
	(0.006)	(0.007)	(0.009)	(0.008)	(0.008)
LEVERAGE (+)	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
DISPERSION (+)	0.010***	0.010***	0.010***	0.010***	0.010***
	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)
CONSTANT	0.025	0.051*	0.060*	0.064**	0.078**
	(0.036)	(0.027)	(0.031)	(0.029)	(0.030)
Firm effects	No	No	No	No	No
Industry effects	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes
Observations	575	575	259	259	259
Adj. R^2	0.604	0.599	0.626	0.621	0.617
Firms	82	82	39	39	39

The table shows the results from an OLS regression of the implied cost of equity estimates on CSR scores and control variables across the years 2006-2014. r_{AVG} is the average implied cost of equity estimates from the four models: Claus and Thomas (2001); Gebhardt, Lee, and Swaminathan (2001); Ohlson and Juettner-Nauroth (2005) and Easton (2004). *CSR SCORE* is the average of the GES Risk Rating environmental and social score. *BETA* is the market beta from regressing 24 to 60 monthly excess returns on the OMX Stockholm index. *SIZE* is the natural logarithm of total assets. *GROWTH* is the long-term growth forecast and substituted with the short-term growth forecast if missing. *BTM* is the book-to-market value of equity. *LEVERAGE* is the debt over equity ratio. *DISPERSION* is the natural logarithm of the dispersion of analyst forecasts. Firms are categorized by the Industry Classification Benchmark Supersectors. The expected sign for each coefficient is shown in parenthesis by the variable name. Robust standard errors clustered at firm level are shown in parenthesis, significant at levels *** p<0.01, ** p<0.05, * p<0.1.

ENVIRONMENT SCORE: average of GES Risk Rating environmental score released in autumn year *t-1* and spring year *t.*

SOCIAL SCORE: average of GES Risk Rating human rights score released in autumn year *t-1* and spring year *t.*

Asset4 ENV: Environmental rating from Thomson Reuters Asset4 database released in year *t*.

Asset4 SOC: Social rating from Thompson Asset4 database released in year *t*.

Asset4 GOV: Governance rating from Thompson Asset4 database released in year *t*.

Table 13. Subsample of industries

	Excluding Banks and Financial services (28)	Excluding Media and Automobiles (29)
	r_{AVG}	r_{AVG}
CSR SCORE (-)	-0.039*	-0.038*
	(0.021)	(0.021)
BETA (+)	0.009**	0.009*
	(0.005)	(0.005)
SIZE (-)	-0.001	0.000
	(0.002)	(0.002)
GROWTH (+)	0.151***	0.151***
	(0.028)	(0.028)
BTM (+)	0.033***	0.031***
	(0.006)	(0.006)
LEVERAGE (+)	0.000	0.000
	(0.000)	0.000
DISPERSION (+)	0.010***	0.010***
	(0.003)	(0.003)
CONSTANT	0.016	0.028
	(0.037)	(0.035)
Firm effects	No	No
Industry effects	Yes	Yes
Year effects	Yes	Yes
Observations	550	560
Adj. R^2	0.609	0.599
Firms	78	80

The table shows the results from an OLS regression of the implied cost of equity estimates on CSR scores and control variables across the years 2006-2014. r_{AVG} is the average implied cost of equity estimates from the four models: Claus and Thomas (2001); Gebhardt, Lee, and Swaminathan (2001); Ohlson and Juettner-Nauroth (2005) and Easton (2004). *CSR SCORE* is the average of the GES Risk Rating environmental and social score. *BETA* is the market beta from regressing 24 to 60 monthly excess returns on the OMX Stockholm index. *SIZE* is the natural logarithm of total assets. *GROWTH* is the long-term growth forecast and substituted with the short-term growth forecast if missing. *BTM* is the book-to-market value of equity. *LEVERAGE* is the debt over equity ratio. *DISPERSION* is the natural logarithm of the dispersion of analyst forecasts. Firms are categorized by the Industry Classification Benchmark Supersectors. The expected sign for each coefficient is shown in parenthesis by the variable name. Robust standard errors clustered at firm level are shown in parenthesis, significant at levels *** p<0.01, ** p<0.05, * p<0.1.

Table 14. Extreme values and outliers

	Winsor 1-99% (30)	Original values (31)	Excluding Mycronic (32)
	r_{AVG}	r_{AVG}	r_{AVG}
CSR SCORE (-)	-0.036**	-0.029	-0.022
	(0.019)	(0.020)	(0.015)
BETA (+)	0.015***	0.018***	0.009***
	(0.005)	(0.006)	(0.005)
SIZE (-)	0.000	-0.002	-0.002
	(0.002)	(0.002)	(0.002)
GROWTH (+)	0.073***	0.044***	0.124***
	(0.018)	(0.015)	(0.015)
BTM (+)	0.017***	0.018***	0.031***
	(0.006)	(0.006)	(0.006)
LEVERAGE (+)	0.000	-0.000	0.000***
	(0.000)	(0.000)	(0.000)
DISPERSION (+)	0.008***	0.000**	0.008***
	(0.003)	(0.000)	(0.002)
CONSTANT	-0.051*	0.104***	0.054***
	(0.028)	(0.027)	(0.024)
Firm effects	No	No	No
Industry effects	Yes	Yes	Yes
Year effects	Yes	Yes	Yes
Observations	577	577	568
Adj. R^2	0.644	0.535	0.631
Firms	82	82	81

The table shows the results from an OLS regression of the implied cost of equity estimates on CSR scores and control variables across the years 2006-2014. r_{AVG} is the average implied cost of equity estimates from the four models: Claus and Thomas (2001); Gebhardt, Lee, and Swaminathan (2001); Ohlson and Juettner-Nauroth (2005) and Easton (2004). *CSR SCORE* is the average of the GES Risk Rating environmental and social score. *BETA* is the market beta from regressing 24 to 60 monthly excess returns on the OMX Stockholm index. *SIZE* is the natural logarithm of total assets. *GROWTH* is the long-term growth forecast and substituted with the short-term growth forecast if missing. *BTM* is the book-to-market value of equity. *LEVERAGE* is the debt over equity ratio. *DISPERSION* is the natural logarithm of the dispersion of analyst forecasts. Firms are categorized by the Industry Classification Benchmark Supersectors. The expected sign for each coefficient is shown in parenthesis by the variable name. Robust standard errors clustered at firm level are shown in parenthesis, significant at levels *** p<0.01, ** p<0.05, * p<0.1.

(30): Growth, BTM and Leverage winsorized at 1-99% to eliminate the effect of outliers. Dispersion is the natural logarithm of the coefficient of variation.
(31): All variables are original values.
(32): Excluding firm Mycronic due to extreme cost of equity estimates.

Table 15. Fixed Effects and Random Effects estimation methods

	Fixed Effects	Random Effects
	(33)	(34)
	r_{AVG}	r_{AVG}
CSR SCORE (-)	0.036*	0.014
	(0.016)	(0.010)
BETA (+)	0.004	0.010**
	(0.004)	(0.005)
SIZE (-)	-0.006	-0.003**
	(0.010)	(0.002)
GROWTH (+)	0.145***	0.146***
	(0.024)	(0.024)
BTM (+)	0.022***	0.023***
	(0.007)	(0.007)
LEVERAGE (+)	0.000	0.000***
	(0.000)	(0.000)
DISPERSION (+)	0.010***	0.008***
	(0.003)	(0.003)
CONSTANT	0.141	0.094
	(0.159)	(0.025)
Firm effects	No	No
Industry effects	Yes	Yes
Year effects	Yes	Yes
Observations	577	577
R^2	0.382 (within)	0.503 (overall)
Firms	82	82

The table shows the results from an OLS regression of the implied cost of equity estimates on CSR scores and control variables across the years 2006-2014. r_{AVG} is the average implied cost of equity estimates from the four models: Claus and Thomas (2001); Gebhardt, Lee, and Swaminathan (2001); Ohlson and Juettner-Nauroth (2005) and Easton (2004). *CSR SCORE* is the average of the GES Risk Rating environmental and social score. *BETA* is the market beta from regressing 24 to 60 monthly excess returns on the OMX Stockholm index. *SIZE* is the natural logarithm of total assets. *GROWTH* is the long-term growth forecast and substituted with the short-term growth forecast if missing. *BTM* is the book-to-market value of equity. *LEVERAGE* is the debt over equity ratio. *DISPERSION* is the natural logarithm of the dispersion of analyst forecasts. Firms are categorized by the Industry Classification Benchmark Supersectors. The expected sign for each coefficient is shown in parenthesis by the variable name. Robust standard errors clustered at firm level are shown in parenthesis, significant at levels *** p<0.01, ** p<0.05, * p<0.1.

A.4 Robustness tests

Figure 4. Scatter plot of residuals

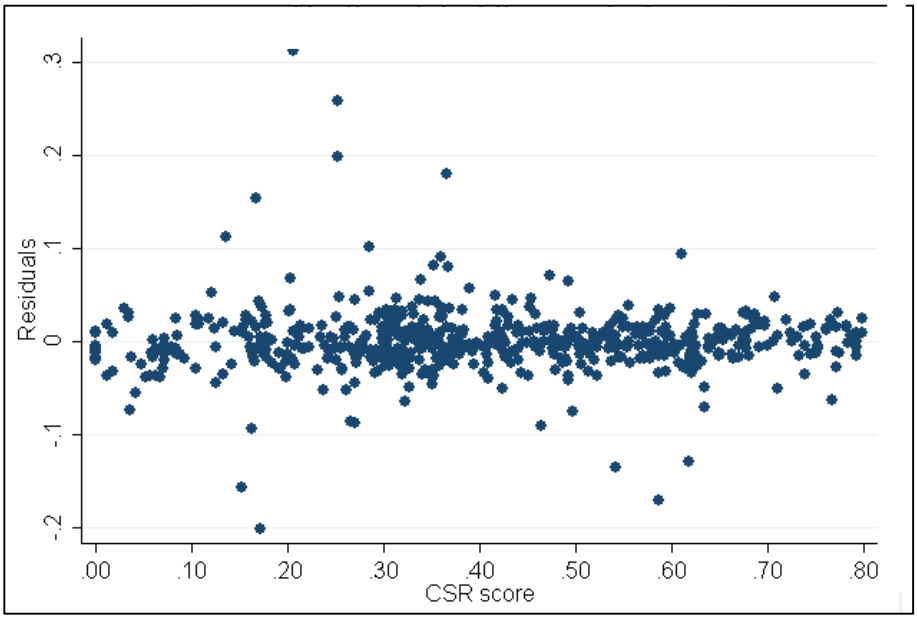

Figure 4 shows a scatter plot of the residuals from the OLS regression of the average implied cost of equity estimate on *CSR SCORE* and control variables in the baseline model in Table 6. The sample consists of 577 firm-year observations across the years 2006-2014.

Figure 5. Hausman test

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
csr_score	.0331443	-.0194934	.0526377	.0199743
beta	.0039997	.0063745	-.0023749	.0024223
size_ta_s	-.0000548	-.0009203	.0008655	.0065095
growth_w5	.1489035	.1463974	.002506	.0038384
btm_w5	.0199151	.0286097	-.0086946	.0046749
lev_doe_w5	.0001051	.0000773	.0000278	.0000411
lndisp	.0103079	.0095195	.0007884	.001133
2007bn.year	-.0114652	-.0007833	-.0106819	.0042246
2008.year	.0167923	.0291073	-.0123149	.0047923
2009.year	-.004674	.0027642	-.0074382	.0052531
2010.year	.0059366	.0154338	-.0094972	.0053917
2011.year	.0004863	.012622	-.0121357	.0056112
2012.year	.0060026	.0171609	-.0111583	.005647
2013.year	.000847	.0120569	-.0112099	.0055956
2014.year	-.0218658	-.0100358	-.0118301	.0059515

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(15) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 11.45
Prob>chi2 = 0.7200
(V_b-V_B is not positive definite)

Figure 5 shows a Hausman test of the fixed effects and random effects models in Table 6. The sample consists of 577 firm-year observations across the years 2006-2014.

Figure 6. VIF multicollinearity test

Variable	VIF	1/VIF
csr_score	3.41	0.293532
beta	1.43	0.697389
size_ta_s	4.10	0.243639
growth_w5	1.54	0.648672
btm_w5	2.08	0.480170
lev_doe_w5	1.88	0.532535
lndisp	1.80	0.555595
year		
2007	2.51	0.398106
2008	2.65	0.377154
2009	2.85	0.350588
2010	2.86	0.349151
2011	2.78	0.359435
2012	2.70	0.370129
2013	2.74	0.364725
2014	2.64	0.379203
ind		
2300	2.62	0.381007
2700	5.89	0.169887
3300	1.41	0.709150
3700	2.88	0.347757
4500	3.47	0.288556
5300	2.61	0.382443
5500	1.43	0.698682
5700	1.99	0.503706
6500	2.13	0.468395
8300	2.25	0.444671
8600	2.39	0.417750
8700	1.81	0.551090
9500	3.22	0.310966
Mean VIF	2.57	

Figure 6 shows a variance inflation factor test of the OLS regression of the average implied cost of equity estimate on *CSR SCORE* and control variables of the baseline model in Table 6. The sample consists of 577 firm-year observations across the years 2006-2014.