Stockholm School of Economics

Department of Accounting

Master Thesis in Accounting and Financial Management

# The link between corporate environmental performance and corporate financial performance

# - A study of Swedish firms

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#### Abstract

In light of the huge recent interest in climate change and environmental issues, this thesis aims to explore why companies invest in environmental performance. This is done by investigating the link between between corporate environmental performance (CEP) and corporate financial performance (CFP) for listed Swedish companies during the period of 2004-2007. Previous research has mainly focused on aggregated global, American or European data, despite Sweden being a leading country in terms of environmental awareness. Using a fixed effects panel data regression model, we study the effects of a corporate environment score on ROE and Tobin's q. These measures were chosen in order to reflect the potential direct and indirect effects of environmental performance. Our results show that there is a positive relationship between both CFP indicators and corporate environmental performance. Furthermore, the results are accentuated when allowing for a lag period of one year. Thus we can conclude that investments in environmental activities are beneficial to shareholders.

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# **List of Abbreviations**

- CEP Corporate Environmental Performance
- CFP Corporate Financial Performance
- CO<sub>2</sub> Carbon Dioxide
- CSP Corporate Social Performance
- CSR Corporate Social Responsibility
- EU European Union
- FTSE Financial Times Stock Exchange
- GES GES Investment Services
- GRI Global Reporting Initiative
- RBV Resource-Based View
- S&P Standard and Poor's
- SIRP Sustainable Investment Research Platform
- UN United Nations

# **1** Introduction

## 1.1 Background

It is rare for a day to pass without watching, experiencing or reading something related to the environment or climate change. CO<sub>2</sub> emissions, carbon footprints, greenhouse gases, global warming, ecological homes and hybrid cars are just some of the buzzwords that have bloomed and become natural in our daily lives. During the past few years, a topic that was once reserved for lobbyists and environmental activists has become a current issue in the public debate and political agendas around the world. In Sweden, 0.4% of GDP in 2004 was spent on environmental protection.<sup>1</sup> A Eurobarometer survey published in September 2008 showed that 62% of EU citizens and 74% of Swedish citizens considered global warming and climate change as the most serious problem currently facing the world, ahead of poverty, terrorism and armed conflicts.<sup>2</sup> Furthermore, over 85% of the Swedish population felt well informed about the causes and consequences of climate change. The graph below shows the number of news article hits for the word 'environment'<sup>3</sup> in Swedish media over the past 8 years. Included in the graph are a few events which may have catalyzed the significant acceleration noticeable from 2004 onwards.



Figure 1: Number of articles in Swedish media including variations of the word 'environment'

<sup>&</sup>lt;sup>1</sup> Eurostat, "Environmental Protection Expenditure by Industry in the European Union 1997-2004", 2008-09-03

<sup>&</sup>lt;sup>2</sup> Special Eurobarometer 300, "European's attitudes towards climate change", Sep 2008 [2008-11-27]

<sup>&</sup>lt;sup>3</sup> Search on *News* in the database Affärsdata using *miljö*\* which includes all variants of the word

Within the public sector, action has been taken on national, regional and international levels. The infamous Kyoto Protocol from 1997 paved the way for a large number of agreements and policies dealing with issues such as greenhouse gas emission targets, emission trading legislation and commitment to renewable energy sources. Governments worldwide are looking to set a price on carbon dioxide emissions by introducing a cap-and-trade system<sup>4</sup> and in January 2008, the European Union's environment commission put forward a legally binding plan popularly known as 20/20/20<sup>5</sup> with an aim to cut Europe's overall carbon emissions by at least 20% from their 1990 levels until 2020, and to derive 20% of all Europe's energy needs from renewable sources.<sup>6</sup>

In the private sector, the environmental trend is clear and companies are almost expected to become greener. Volvo and SAAB were recently criticized by the Swedish Deputy Prime Minister for not having developed environmentally friendly cars sooner.<sup>7</sup> The global market for ecological products is currently growing at approximately 20 percent per year and is estimated to reach a value of 360 billion SEK by 2010.<sup>8</sup> Companies are offering green alternatives to traditional products, assessing their supply chains and extending financial reports to include sustainability and corporate social responsibility accounts. In Sweden, 83% of companies have some sort of sustainability reporting in their annual reports, despite this only being required from government-owned companies.<sup>9</sup>

Few can object when individuals choose to be environmentally friendly. However, when companies do the same the issue becomes more complicated. From a traditional shareholder perspective, management should work to maximize returns to shareholders and thus not invest in activities which are not value additive. Investment in corporate social responsibility (CSR) is arguably beyond the scope and purpose of the firm. Despite this view, companies are unstoppable on their green missions. Even though some companies honestly proclaim the profitable business opportunities of becoming environmentally friendly many stress the duty of good corporate citizenship.

#### **1.1.1** A note on terminology

For the remainder of this thesis, corporate environmental performance (CEP) is defined in accordance with the Global Reporting Initiative (GRI) guidelines. GRI's guidelines are the global standard for sustainability reporting used by the United Nations Environment Programme (UNEP),

<sup>&</sup>lt;sup>4</sup> "Green protectionism", *The Economist*, 2007-11-15

<sup>&</sup>lt;sup>5</sup> Commission of the European Communities (2008), "20 20 by 2020 - Europe's climate change opportunity"

<sup>&</sup>lt;sup>6</sup> "Climate of fear", *The Economist*, 2008-10-23

<sup>&</sup>lt;sup>7</sup> Bergsell, T., "Forsatt nej från regeringen", *Dagens Nyheter*, 2008-12-03

<sup>&</sup>lt;sup>8</sup> Ryegård, C., "Den ekologiska världsmarknaden växer 20 procent per år", *Ekoweb.nu*, 2008-08-25

<sup>&</sup>lt;sup>9</sup> "Nu hållbarhetsredovisar allt fler svenska bolag", PriceWaterhouseCoopers, 2008-08-18

multinationals, NGO's and from 2009 onwards, all state-owned Swedish companies.<sup>10</sup> GRI's environmental performance indicators include material use and recycling, energy consumption, water use, impact on biodiversity, greenhouse gas emissions, value of fines for non-compliance with environmental laws and environmentally friendly products and services.<sup>11</sup> Although CEP is the standard term used in this thesis, expressions such as 'corporate environmentalism', 'environmentally friendly', and 'green' can be used instead for the sake of variation.

# 1.2 Purpose and formulation of a question

In light of the large corporate interest in climate change and the environment, the purpose of this thesis is to investigate why companies invest in environmental performance. Bansal and Roth (2000) conducted a study of the motivations that bring about ecological responsiveness and revealed three possible motivations: *competitiveness, legitimation* and *ecological responsibility* (Figure 2). The authors defined *competitiveness* as potential for long-term profitability improvement, *legitimation* as compliance with institutional norms and regulations and finally *environmental responsibility* as a motivation that stems from the concern for social obligations and values.<sup>12</sup>



#### Figure 2: Advanced Model of Corporate Ecological Responsiveness (Adapted from Bansal and Roth (2000))

*Legitimation* and regulatory compliance undoubtedly explain companies' environmental performance to a certain extent. Swedish companies are required to follow Swedish and EU environmental laws and regulations regarding for example climate change, waste management,

<sup>12</sup> Bansal and Roth (2000)

<sup>&</sup>lt;sup>10</sup> "Sweden introduces state sector sustainability reporting regulations" *PriceWaterhouseCoopers*, 2008-09-10 <u>http://www.pwc.com/extweb/pwcpublications.nsf/docid/C47394D175710FE9852573D10076B800</u>

<sup>&</sup>lt;sup>11</sup> For a more detailed description of GRI's environmental performance indicators, please refer to www.globalreporting.org

noise pollution and chemical use, risking sanctions if they do not abide by the rules. However, *legitimation* does not fully explain why companies choose to take compliance one step further and act beyond what is legally required.<sup>13</sup> In Sweden, sustainability reporting is voluntary for private sector companies, but despite this over 80% of large and mid cap companies on the Swedish stock exchange produced sustainability reports for 2007.<sup>14</sup> Companies can also voluntarily implement environmental management standards such as ISO 14001 and EMAS which provide frameworks for an organization's environmental policy, plans and actions. According to the International Organization for Standardization (ISO), these standards are "practical tools for the manager who is not satisfied with mere compliance with legislation."<sup>15</sup> Interestingly Sweden is, by far, the country in the world with the highest number of environmentally certified companies per capita.<sup>16</sup>



#### Figure 3: Number of companies with environmental certifications per million citizens in 2007

Thus, when revisiting Bansal and Roth's model of ecological responsiveness we acknowledge that one likely reason for companies' attention to environmental performance is *legitimation*, but that this does not explain the recent intensification of corporate environmentalism or why companies move ahead of legislation. Some researchers have suggested that companies go beyond compliance for pre-emptive reasons in order to become better positioned to meet tighter future standards,<sup>17</sup> but we choose to attach more weight to *competitiveness* and *environmental responsibility*.

<sup>13</sup> 

<sup>&</sup>lt;sup>14</sup> Öhrlings PricewaterhouseCoopers' webpage: Pressrum: Pressmeddelande - Sverige. [2008-12-03]

<sup>&</sup>lt;sup>15</sup> International Organization for Standardization's (ISO) webpage: Products: ISO Standards: Management standards: ISO 9000/ISO 14000, [2008-11-30]

<sup>&</sup>lt;sup>16</sup> Nutek's webpage: Faktabanken: Fakta om företagande: Miljöcertifiering, [2008-12-04]

<sup>&</sup>lt;sup>17</sup> Lyon and Maxwell (2008); Klassen and McLaughlin (1996)



In modern business, the shareholder theory is the most dominant view of the firm<sup>18</sup>, implying that the purpose of a firm is to maximize shareholder value. Inevitably, publicly listed companies will be analyzed from this perspective due to the strong influence of financial markets. Hypothetically, this entails that if unprofitable environmental activities should not be accepted by a company's shareholders. Since *competitiveness* is more concrete and simpler to quantify than *environmental responsibility*, a good starting-point is to investigate whether it is profitable for companies to focus on improving their environmental performance. Hence, we wish to investigate the reasons for corporate environmental performance (CEP) by asking the question:

#### Does corporate environmental performance affect financial performance?

# 1.3 Structure of thesis

The remainder of the thesis is tructured as follows: Section 2, gives a general overview of previous research within the field of linking different measurements of corporate social performance to financial performance. Section 3 describes the theoretical background and it is divided into theories supporting a negative relationship and theories supporting a positive relationship. Section 4 describes the data we have selected to represent corporate financial and corporate environmental performance. In Section 5 we explain our methodology and the statistical tests we used to analyse our data. Our results are revealed in Section 6, and in Section 7 they are analyze and discuss. Section 8 wraps up the thesis with a few concluding remarks and suggestions for future research.

<sup>&</sup>lt;sup>18</sup> Jensen (2002)

# 2 Previous research

A significant body of work has investigated the link between corporate social responsibility (CSR) and economic performance, using a wide array of different proxies to represent these concepts. A popular method has been to study the fund returns of ethical mutual funds. By comparing the market performance of an ethical fund in relation to a general index, researchers have drawn conclusions on how highly investors value CSR, if at all.<sup>19</sup> Waddock, Graves and Gorski (2000) for example, studied the stock returns of S&P 500 companies which passed a social responsibility screen versus those which did not, showing that there was a slightly positive relationship between CSR and market returns. Other examples of utilized CSR measures are charity<sup>20</sup>, revealed offences<sup>21</sup>, transparency<sup>22</sup> and of course, environmental performance. In a working paper from Harvard University, Joshua D. Margolis et al examine 167 studies on the link between corporate social performance and financial performance, and arrive at the conclusion that out of 145 comparable studies, 67% are non-significant, 31% positive and 2% negative.<sup>23</sup>

The studies which specifically focus on environmental performance also present conflicting results.<sup>24</sup> According to Griffin and Mahon (1997) the reasons for this are the differences in methodology and selection of CEP and CFP measures.<sup>25</sup> Studies which quantitatively study the CEP-CFP link can broadly be divided into market-based and accounting-based studies, the prior category consisting of stock market returns and event studies, while the latter focuses on profitability ratios and market-to-book values. CEP measures used in research have ranged from toxic pollution release data<sup>26</sup> and number of law-suits<sup>27</sup> in the early nineties to today's complex multidimensional data compiled by specialized research institutes.<sup>28</sup> Furthermore, not all data is derived from objective sources. Examples are a study by Clemens (2006) based on survey answers from company executives, and Griffin and Mahon (1997) which is based on the popular annual reputation rating by Fortune magazine. The wide range of CEP proxies hampers the comparison of previous studies since what is seen as evident and essential from an environmental perspective changes over time along with scientific research, regulation and public opinion.

<sup>25</sup> Cf. 7.3 General comments and limitation

<sup>&</sup>lt;sup>19</sup> Cf. McWilliams and Siegel (2000); Waddock, Graves and Gorski (2000)

<sup>&</sup>lt;sup>20</sup> Cf. Wokutch and Spencer (1987); Fombrun and Shanley (1990); Brown, Helland and Smith (2006)

<sup>&</sup>lt;sup>21</sup> Cf. Staw and Szwajkowski (1975); Davidson and Worrel (1988); Hersch (1991)

<sup>&</sup>lt;sup>22</sup> Cf. Ingram (1978); Verschoor (1998)

<sup>&</sup>lt;sup>23</sup> Margolis, Joshua D., Elfenbein, Hillary A., Walsh, James P., (2007)

<sup>&</sup>lt;sup>24</sup> Cf. Positive relationship: King and Lenox; Konar and Cohen; Dowell, Hart and Yeung. Negative relationship: Galbreath (2006); Brammer, Brooks and Pavelin (2006)

<sup>&</sup>lt;sup>26</sup> Dooley and Lerner (1994)

<sup>&</sup>lt;sup>27</sup> Muoghalu, Robison and Glascock (1990)

<sup>&</sup>lt;sup>28</sup> Brammer, Brooks, & Pavelin (2006)

Previous studies have mostly been based on selections of US or UK companies, for instance the S&P 500<sup>29</sup>, Fortune 500<sup>30</sup> or FTSE Index<sup>31</sup>. The Sustainable Investment Research Platform (SIRP), based in Umeå University in Sweden is the most prominent research institution within this field in Scandinavia; however most of SIRP's research is based on global or European stock indices. There is to our knowledge very little research done on the link between CEP and CFP in Swedish firms. The research in existence is mostly of a descriptive nature and associated with the Swedish government's Environmental Objectives Council (Miljömålsrådet) or the Swedish Agency for Economic and Regional Growth (NUTEK). An example is a study conducted by NUTEK which is based on survey answers from 14,000 small enterprises and interviews with 21 small and mid-sized companies<sup>32</sup>. Although NUTEK's study showed that environmental work is profitable, it does not discuss the potential problem of using self-reported data as a source. Due to the lack of Swedish studies, the frame of reference for this thesis is to a large extent based on foreign studies. We refer to subsequent sections for a more detailed account of previous research results.

#### 2.1 Delimitations

#### 2.1.1 Geographical delimitation

In order to make the investigation more manageable we have chosen to limit our study to Swedish companies. The main reason is that there is little objective research done on this subject in Sweden. Sweden is an interesting market to analyze since it has held a leading position within the environmental area for several years relative to other countries. As described in previous sections, Swedish citizens have a high awareness of climate change and environmental issues and Sweden is the country in the world with the highest number of corporate environmental certifications per capita. In FutureBrand's Country Brand Index, Sweden received the pole position in environmentalism two years in a row.<sup>33</sup> Furthermore, in the Environmental Performance Index presented at the World Economic Forum, Sweden has attained positions 4, 2 and 3 in 2005, 2006 and 2008 respectively.<sup>34</sup> The large interest and awareness of environmental issues in Sweden implies that consumers and regulators might put more pressure on companies, leading them to focus on increasing their CEP. This in turn implies that if one studies the link between corporate environmental performance and financial performance, it might be clearer in an environmentally aware country like Sweden compared to a study on an aggregated global, American or European

<sup>&</sup>lt;sup>29</sup> Dowell, Hart and Yeung (2000)

<sup>&</sup>lt;sup>30</sup> Dooley and Lerner (1994)

<sup>&</sup>lt;sup>31</sup> Brammer, Brooks, and Pavelin (2006)

<sup>&</sup>lt;sup>32</sup> NUTEK, "Det lönsamma miljöarbetet – Miljöstrategier och resultat i småföretag", 2005

<sup>&</sup>lt;sup>33</sup>Country Brand Index's webpage: Country Brand Rankings, 2008-09-30

<sup>&</sup>lt;sup>34</sup> Environmental Performance Index's webpage, [2008-11-29]

level. Furthermore, the high environmental awareness might also contribute to higher quality environmental performance data.

# 3 Theoretical Background

In the following section we aim to account for different theories that can be applied when studying the link between corporate environmental performance and financial performance. For the sake of clarity we have chosen to present them as theories supporting a negative relationship and theories supporting a positive relationship.

# 3.1 Theories supporting a negative relationship

A dominant view within business ethics is the *nexus of contracts theory*. In this view, a company's employees, customers, investors and suppliers all provide assets in return for some gain, the terms of which are stipulated in contracts (both implicit and explicit). Since the company is the common denominator, the contracts are connected to form a nexus<sup>35</sup> (hence the name). Shareholder theory has its foundation in the argument that shareholders provide capital to a company but have only residual claims on its gains. To protect themselves, shareholders bargain for corporate control and the benefit of managers' duty towards them. Other stakeholders accept this in their contracts, since shareholders minimize the risk that they would have had to take otherwise.<sup>36</sup>

In 1970, Milton Friedman published an article in the New York Times Magazine entitled "The Social Responsibility of Business is to Increase its Profits." Friedman claimed that "there is one and only one social responsibility of business – to use it resources and engage in activities designed to increase its profits so long as it stays within the rules of the game [...]."<sup>37</sup> Friedman argues that individuals are free to be socially responsible because they are their own *principals*. However, employees of a business are *agents*, serving the interests of the stockholders. By using a firm's money for CSR activities, executives are in effect imposing a tax on stockholders (lower profits), customers (higher prices) or employees (lower wages). Furthermore, Friedman questions the ability of executives to correctly redistribute resources in complicated issues such as protecting the environment and fighting poverty.<sup>38</sup>

Proponents of a negative CEP-CFP relationship emphasize this, stating that responsible firms suffer a *competitive disadvantage* because, as opposed to competitors, they incur costs that could have been prevented or that should have been borne by others (such as governments or individuals).<sup>39</sup> Examples might include implementation of environmental management systems, sustainability

<sup>&</sup>lt;sup>35</sup> Nexus: "a connection or series of connections linking two or more things" The Oxford Dictionary of English (2nd ed. revised)

<sup>&</sup>lt;sup>36</sup> Boatright (2002)

<sup>&</sup>lt;sup>37</sup> Friedman (1970)

<sup>&</sup>lt;sup>38</sup>Ibid.

<sup>&</sup>lt;sup>39</sup> Waddock and Graves (1997)

reporting, recycling costs and pollution control. Walley and Whitehead (1994) extend this argument, saying that "responding to environmental challenges has always been a costly and complicated proposition for managers." They understand the popular appeal of environmental improvements which increase a company's efficiency and profitability; however, they state that these *win-win* situations do not come along very often. Furthermore, the authors predict that companies will start by solving the relatively easy environmental problems, and as environmental challenges become more complex, *win-win* solutions will become increasingly scarce.<sup>40</sup> Instead of looking at compliance, emissions, or costs, the suggested solution is a value-based approach which allows trade-offs between costs and environmental benefits. "For all environmental issues, shareholder value, [...] is the critical unifying metric."<sup>41</sup>

According to Hunt III and Grinnell (2004), it is the complexity of measuring environmental performance and the insecurity regarding its impact on value, that cause a reluctance among financial analysts to incorporate environmental variables into their evaluation models. Previous research has shown that the use of environmental information is very limited in financial circles even though it is believed that the importance of it will increase.<sup>42</sup>

Jensen (2002) maintained that "200 years' worth of work in economics and finance indicate that social welfare is maximized when all firms in an economy maximize total firm value."<sup>43</sup> The enhancement of shareholder value is the most dominant theory of the purpose of a firm. Even if one does not agree with this view, it is so central in economics and business management that a firm's CSR activities will undoubtedly be scrutinized from this perspective. The nexus of contracts and stockholder theories imply that CSR activities should not be a part of a business' actions. Friedman argues that CSR activities can be achieved only at the expense of corporate profitability, implying that no company is likely to be both profitable and green.<sup>44</sup>

Despite this theory, if there is a situation in which a company can become more profitable (or less unprofitable) due to investments in environmental performance then this *win-win* situation should be accepted by even the most orthodox economist.

<sup>&</sup>lt;sup>40</sup> Porter and van der Linde (1995)

<sup>&</sup>lt;sup>41</sup> Walley and Whitehead (1994)

<sup>&</sup>lt;sup>42</sup> Hunt III, Herbert G. and Grinnell (2004)

<sup>&</sup>lt;sup>43</sup> Jensen (2002)

<sup>&</sup>lt;sup>44</sup> Friedman(1970)

#### 3.2 Theories supporting a positive relationship

The argument that environmental performance could provide a competitive advantage developed in the 1980's after a long period of traditional neo-classicism.<sup>45</sup> The nexus of contracts theory was used as a basis on which to develop stakeholder theory. Instead of seeing shareholder value maximization as the sole purpose of the firm, stakeholder theory proposes that firms should pay attention to all their constituencies.<sup>46</sup> These include, but are not limited to, employees, customers, suppliers and local communities.<sup>47</sup> According to Clarkson (1995), "the corporation's survival and continuing success depend upon the ability of its managers to create sufficient wealth, value, or satisfaction for those who belong to each stakeholder group [...]. Failure to retain the participation of a primary stakeholder group will result in the failure of that corporate system."<sup>48</sup> Clarkson receives support from Epstein and Roy (2001), who state that stakeholder management has been recognized as a driver of strategic success.<sup>49</sup>

The lasting advantage that arises as a result of good stakeholder relationships can specifically be applied to the field of environmental performance. Scholars within industry ecology argue that beyond-compliance behavior creates *win-win* situations for both the environment and companies.<sup>50</sup> An example is Porter and van der Linde (1995) who hypothesize that stricter national environmental regulation results in a competitive advantage for first-mover firms.<sup>51</sup> According to Brammer et al (2006) a company's investment in CSP can affect financial performance both directly and indirectly. Directly a company can earn money by cost reductions and productivity improvements; indirectly it can improve its overall reputation, making investors more willing to invest in the company and analysts more willing to recommend the company stock.<sup>52</sup> Since CEP is an element of CSP, one can assume that these direct and indirect forces are in action when analyzing environmental performance.

In a widely cited article from 1995, Hart proposes a theory of competitive advantage called the natural-resource-based view. The traditional resource-based view (RBV) is the idea that "competitive advantage can be sustained only if the capabilities creating the advantage are supported by resources that are not easily duplicated by competitors."<sup>53</sup> Hart predicts that in the future companies

<sup>&</sup>lt;sup>45</sup> Clemens (2006)

<sup>&</sup>lt;sup>46</sup> Boatright (2002); Jensen (2002); Galbreath (2006)

<sup>&</sup>lt;sup>47</sup> Boatright (2002)

<sup>&</sup>lt;sup>48</sup> Clarkson (1995)

<sup>&</sup>lt;sup>49</sup> Epstein and Roy (2001)

<sup>&</sup>lt;sup>50</sup> King and Lenox (2001)

<sup>&</sup>lt;sup>51</sup> Elsayed and Paton (2004)

<sup>&</sup>lt;sup>52</sup> Brammer, Brooks and Pavelin (2006)

<sup>&</sup>lt;sup>53</sup> Hart (1995)

will be constrained by the biophysical environment and for that reason, it should be included when creating and examining corporate strategy. In his view going green can be a sustainable competitive advantage. An example is continuous improvement of pollution prevention through better house-keeping, material substitution and recycling. These activities lead to cost savings and thus a cost advantage relative to competitors.<sup>54</sup> Porter and van der Linde see environmental pollution as a form economic waste since pollution signals that a company's resources have been used "incompletely, inefficiently or ineffectively."<sup>55</sup>



#### Figure 4: The resource-based view. Adapted from Hart (1995)

Pollution prevention is just one example of a direct effect of CEP on CFP as discussed by Brammer et al. Klassen and McLaughlin (1996) clearly illustrate different ways of how environmental management and thus improved environmental performance can lead to improved financial performance (Figure 5).<sup>56</sup>

CEP also has an indirect effect on financial performance through the reputation of a firm. Brands and logos help consumers distinguish one product from another by signaling core benefits and brand attitudes.<sup>57</sup> The increased interest in climate change and the environment over the past few years has made words such as eco-friendly and carbon neutral a part of our vocabulary. Ecological products have become more common and the market growth for ecological food in Sweden for 2006 was estimated at 10-15%.<sup>58</sup> By being positioned as a green brand, firm's can earn price premiums, enjoy higher brand attractiveness and create a reputational advantage.<sup>59</sup> However, when it comes to environmental performance, it is crucial to distinguish corporate words from corporate actions. *Greenwash* is the coined term for the act of misleading consumers regarding the environmental practices of a company or the environmental benefits of a product or service.<sup>60</sup> The lack of coherent, third-party audits on companies' green marketing facilitates greenwash. Despite this, it is what is

<sup>&</sup>lt;sup>54</sup> Hart (1995)

<sup>&</sup>lt;sup>55</sup> Porter and van der Linde (1995)

<sup>&</sup>lt;sup>56</sup> Klassen and McLaughlin (1996)

<sup>&</sup>lt;sup>57</sup> Keller (2003), p.3

<sup>&</sup>lt;sup>58</sup> Ekologiska Lantbrukarna (2007)

<sup>&</sup>lt;sup>59</sup> Miles and Covin (2000)

<sup>&</sup>lt;sup>60</sup> Lyon and Maxwell (2008)

projected outwards and accepted by stakeholders which affects a company's reputation, regardless of whether it is the truth.

In summary, theories supporting a positive CEP-CFP relationship are mainly based on the idea that companies can create competitive advantages by becoming environmentally friendly. These can affect financial performance through decreased costs, increased revenues and a better reputation.



Figure 5: Linkage of environmental management to firm profitability. Adapted from Klassen and McLaughlin (1996)

# 3.3 Hypothesis

Previous research on the link between CEP and CFP has led to ambiguous results. Based on our theoretical background, one can distinguish two perspectives on environmental performance. The first is the actual impact of decreased costs and increased revenues on financial performance (*direct* effect). By adjusting production processes to environmental requirements, costs can be saved and companies can charge a higher price from consumers.<sup>61</sup> The second element is the image of being green or as Margolis et al (2007) put it, "the appeal of CSP<sup>62</sup>" (*indirect* effect).

The general trend in business literature is a movement from the traditional stockholder theory and value maximization, to a stakeholder approach suggesting value creation through the consideration of all constituencies. Theories supporting a negative relationship between CEP and CFP have valid and strong arguments, however the world is changing and during recent years being environmentally friendly has become increasingly important for companies. Nowadays even stockholder theory can imply a positive CEP-CFP relationship. One can argue that if CEP were not expected to be profitable, stockholders would not accept investments in green marketing, green products and green processes. Since Swedish companies are becoming greener and investing in environmental performance one can draw the conclusion that it has been accepted by stockholders. Thus, previous research and theories lead us to believe that there is a positive relationship between corporate environmental performance and corporate financial performance. However, we acknowledge that certain issues brought forth by the scholars suggesting a negative link, will have a curbing effect on the relationship. For example, Walley and Whitehead's (1994) proposal that win-win situations will become scarcer will probably reduce the effect of CEP on profitability measures.

We state the following general hypothesis for the link between corporate environmental performance and corporate financial performance, with an aim to test both the *direct* and *indirect* effects of CEP:

General hypothesis: There is a positive relationship between CEP and CFP

<sup>&</sup>lt;sup>61</sup> Hart (1995); Porter and van der Linde (1995); Brammer, Brooks and Pavelin (2006); Shrivastava (1995) and Karagozoglu and Lindell (2000)

<sup>&</sup>lt;sup>62</sup> Margolis et al (2007)

# 4 Data Description

#### 4.1 Measures of corporate financial performance

In line with previous research we have selected return on equity (ROE) and Tobin's q as measures of financial performance. Galbreath (2006), Griffin and Mahon (1997) and Waddock and Graves (1997) have previously used ROE as a measure of corporate financial performance when testing the link between CEP and CFP. ROE reflects a company's ability to generate profit in relationship to equity size; i.e. the return to the owners. We believe that this is appropriate especially considering the dominance of stockholder theory in business literature. Furthermore, ROE serves as a correct measurement for the *direct* effects of CEP since it includes both market gains and cost savings. We have calculated ROE as follows:<sup>63</sup>

## ROE = <u>Net Income</u> Average Stockholders' Equity

Tobin's q is used in addition to the profitability ratios since it better reflects the inherent value of the firm.<sup>64</sup> Prior research within this area that has used Tobin's q as a financial performance measure includes Dowell et al (2000), King and Lenox (2001) and Konar and Cohen (2001). Tobin's q is the relationship between a company's market value and book value on a replacement cost basis. Q values below 1 imply that the firm earns less than the required rate of return implying poor firm performance.<sup>65</sup> Since it is based on market values it reflects expected future gains which according to King and Lenox (2001) is in line with more recent "pays to be green" studies.<sup>66</sup> Furthermore it is a good proxy of *indirect* CEP since it picks up on effects of intangible assets.

The main difficulty with Tobin's q is to correctly measure the replacement cost of a firm's assets. This difficulty arises because of the lack of functioning markets for used equipment. Furthermore, measurement of intangible assets is challenging due to difficulties in correctly assessing the value of expenditures on advertising and R&D.<sup>67</sup> A theoretically correct model for estimating Tobin's q is constructed in a widely cited article by Lindenberg and Ross (1981).<sup>68</sup> However, since inflation rates in Sweden have been low for the past ten to fifteen years one does not expect book values of assets to greatly differ from their replacement cost.<sup>69</sup> Furthermore, a study by Chung and Pruitt (1995)

<sup>&</sup>lt;sup>63</sup> White, Sondhi and Fried (2003)

<sup>&</sup>lt;sup>64</sup> King and Lenox (2001)

<sup>&</sup>lt;sup>65</sup> White, Sondhi and Fried (2003)

<sup>&</sup>lt;sup>66</sup> King and Lenox (2001)

<sup>&</sup>lt;sup>67</sup> Carlton and Perloff (2000)

<sup>&</sup>lt;sup>68</sup> Lindenberg and Ross (1981)

<sup>69</sup> Skogsvik (2008)

indicated that at least 96.6% of the variability of Tobin's q as calculated by Lindenberg and Ross (1981) can be explained by a simple approximation of q.<sup>70</sup> In King and Lenox (2001) and Konar and Cohen (2001) an approximation of Tobin's q is presented (see below) which we will be using in our study.

Tobin's q = <u>Equity Value + Book Value of LongTerm Debt + Net Current Liabilities</u> <u>Total Assets</u>

#### 4.1.1 Source and selection of corporate financial performance data

The financial data was collected from the databases Orbis and Datastream. In order to prevent potential discrepancies due to the use of two data sources, we cross-checked the financial data between the databases as well as with the original company documents.

#### 4.1.1.1 Selection of companies and time period

The selection of companies and time period was conditioned by the supply of CEP data. We were granted access to environmental performance ratings for approximately 270 Swedish listed companies between 2005 and 2008. Companies that have since been delisted are excluded from our sample. In addition, companies that did not meet the following criteria were removed: 1) available data for three consecutive years and 2) comparable financial statements. The first criterion had an aim to prevent the appearance of outliers, the second excluded companies in the bank industry. We accepted this exclusion due to the low environmental risk in the banking sector as well as consumer insensitivity regarding bank's CEP.<sup>71</sup>

Accounting information was gathered for fiscal years 2004 through 2007. An annual financial data point (ROE and Tobin's q) was matched with a CEP rating for the equivalent year. Since the CEP data is published in August each year, we matched year-end CFP with August CEP from the following year. The rationale behind this is that the published CEP rating is based on the latest financial data.

We checked the data for outliers by identifying data points which were 3 standard deviations from the mean. When we identified abnormal values we investigated this further and corrected the value manually with information from the companies' official financial documents.

# 4.2 Measure of corporate environmental performance

To estimate companies' CEP we have used environmental ratings from GES Investments Services (GES). GES investigates the environmental performance of most companies on the Swedish large cap, mid cap and small cap lists. The GES Investment Risk Rating analysis is based on international norms

<sup>&</sup>lt;sup>70</sup> Chung and Pruitt (1994)

<sup>&</sup>lt;sup>71</sup> Differ report (2008)

on Environmental Social and Governance (ESG) issues in accordance with the United Nations Principles for Responsible Investment. The evaluation is based on two factors; the companies' environmental preparedness and performance. Preparedness includes organization and routines, policy and programs, external verification, environmental reporting and supplier evaluation. Performance includes greenhouse gases, energy use, use of water resources, travel management, and hazardous waste among others.

Each company receives an individual annual rating, as well as a general industry risk rating. The data is consolidated into an environment score which is on a scale from to 3 in 2005 and 0 to 7 from 2006 to 2008. This grade was normalized to a scale from 0 to 10 for the purpose of comparability over years. The exact elements and calculation method of the companies' environment score is the intellectual property of GES and can therefore not be shared publicly.<sup>72</sup>

<sup>&</sup>lt;sup>72</sup> For a more detailed account of the GES environment score, refer to Appendix A

# 5 Methodology

#### 5.1 Econometric Model

Our thesis aims to study the link between corporate environmental performance and financial performance in Swedish listed companies over a period of four years. This implies a data set with both cross-sectional and time series dimensions. Since a simple OLS regression cannot distinguish data from different companies or points in time, we have chosen to use a panel data regression model.<sup>73</sup> The model can be defined as follows:<sup>74</sup>

 $y_{it} = \beta_1 x_{it1} + \beta_2 x_{it2} + \dots + \beta_k x_{itk} + \alpha_i + u_{it}$ 

Where:

 $\begin{array}{l} y = \text{measure of financial performance (dependent variable)} \\ \beta = \text{co-efficient} \\ x = \text{explanatory variables (independent variables)} \\ \alpha = \text{unobserved time-constant factors that affect } y_{it} \\ u = \text{error term} \\ i = \text{company id} \\ t = \text{time period (1-4)} \end{array}$ 

We have chosen to use a fixed effects panel data regression because we cannot be sure that the unobserved term  $\alpha$  is completely uncorrelated with the explanatory variables.<sup>75</sup> A fixed effects model implies that we control for omitted variables that differ between cases but are constant over time. This is not unreasonable considering that we are only looking at four years of data. In general, a fixed effects model is recommended for data samples with a relatively large number of i and a small number of t.<sup>76</sup>

#### 5.1.1 Explanatory variables

In our model the CFP indicators of ROE and Tobin's q are the dependent variables and the CEP rating is the key independent variable. In order to be able to distinguish a link between CFP and CFP we need to control for a series of other variables that might affect a companies' financial performance. In this section we describe the control variables we have used. The choice of these control variables is in line with previous research on the CSP-CFP link.<sup>77</sup>

<sup>&</sup>lt;sup>73</sup> Edlund (2008) and Lyckeborg (2008)

<sup>&</sup>lt;sup>74</sup> Cf. Appendix B for a description of the necessary assumptions of multiple regression analysis

<sup>&</sup>lt;sup>75</sup> Wooldridge (2002)

<sup>&</sup>lt;sup>76</sup> Wooldridge (2002)

<sup>&</sup>lt;sup>77</sup> Elsayed and Paton (2004)

Firstly we controlled the sample for size, which has been shown to affect firm performance through economies of scale.<sup>78</sup> Based on established financial theory, a firm's returns are dependent on the risk and therefore we control for this variable. One approach is to use the ratio of total debt to total assets,<sup>79</sup> however we follow the example of several scholars and use the firm's beta. The measure of intangible assets/sales is taken to represent marketing and R&D expenses in line with Elsayed and Paton (2004). Industry is controlled for due to the large effect that it has on firm performance. The companies in the sample were grouped by industry and then clustered in STATA in order to be compared with each other. Finally, capital intensity and growth in sales were controlled for as they have proven to be linked to financial performance.

Explanatory variable	Description	Examples in previous research		
Sizo	Natural logarithm of total assots	Elsayed and Paton (2004), Galbreath		
5126	Natural logarithin of total assets	(2006)		
Pielz	Average beta over a 5-year	Elsayed and Paton (2004), Klassen and		
NISK	period	McLaughlin (1996), Galbreath (2006)		
Intangible assets	Intangible assets / Sales	Elsayed and Paton (2004)		
Industry	Companies clustered into 25	Elsayed and Paton (2004), King and		
muustry	industries	Lenox (2001), Galbreath (2006)		
Capital intensity	Capital expenditures / Sales	King and Lenox (2001)		
Growth in sales (has been				
shown to correlate with	Growth in sales	King and Lenox (2001)		
financial performance)				

<sup>&</sup>lt;sup>78</sup> Elsayed and Paton (2004)

<sup>&</sup>lt;sup>79</sup> Cf. Waddock and Graves (1997)

# 6 Results

Using STATA we performed a panel data regression analysis with the two measurements of CFP as dependent variables and CEP and the other explanatory factors as the independent variables. We first tested ROE and Tobin's q with CEP from the equivalent year (immediate CEP effect) and then we tested the effect of CEP on CFP with a lagging CEP effect. Previous research has suggested that there might be a lagging effect of CEP on CFP. In line with Hart and Ahuja (1996) and Russo and Fouts (1997) we lag the independent variables by one year.

#### 6.1 ROE with immediate CEP effect

When testing the CEP effect on ROE we found a positive correlation of 1.7%. The test is significant for CEP within a 95% confidence interval. However, the other control variables showed mixed results. The test is only significant for the size and growth variables. The other three control variables; beta, capital intensity and advertising effects proved to be insignificant and we can disregard their coefficients.

Fixed-effects (within) regression Number of obs =						= 559
Group variable (i): industry Number of groups =						= 25
R-sq: within	= 0.1005			Obs per	group: min	= 6
between	= 0.0330				avg	= 22.4
overall	= 0.0969				max	= 68
				F(6,24)		= 13.49
corr(u_i, Xb)	= -0.1306			Prob > F	'	= 0.0000
		(Std. E:	rr. adjust	ed for 25	clusters i	n industry)
		Robust				
roel	Coef	Std Err	+	P>1+1	[95% Conf	Intervall
cep	.017108	.0073933	2.31	0.030	.001849	.032367
size	.0179315	.0082904	2.16	0.041	.0008209	.035042
beta	0660252	.0526977	-1.25	0.222	1747878	.0427374
growth	.090255	.0215051	4.20	0.000	.0458707	.1346393
capitalint~y	0516382	.0333338	-1.55	0.134	1204358	.0171593
int_ass	.0026111	.0036521	0.71	0.482	0049263	.0101486
_cons	1276984	.0953755	-1.34	0.193	3245438	.0691469
+-						
sigma_u	.09295722					
sigma_e	.17766003					
rho	.21492929	(fraction	of varian	ice due to	u_i)	

The test has an R<sup>2</sup> of 10,05% which indicates that 10,05% of the variation in ROE within each industry cluster can be explained by the included variables. This is a relatively modest R<sup>2</sup>, but it is important to keep in mind that profitability measures such as ROE are multidimensional and extremely complex, making it impossible to explain all of the variation. It is hard to establish what a satisfactory R<sup>2</sup> level is, since it depends on the complexity of the dependent variable. Naturally, a higher R<sup>2</sup> indicates a better explanation ratio, but a low R<sup>2</sup> does not necessarily mean that the test is wrong. According to Gujarati (2003) "it is important that one does not play the maximizing R<sup>2</sup> game."<sup>80</sup>

#### 6.2 Tobin's q with immediate CEP effect

The correlation between Tobin's q and CEP was considerably higher than the ROE-CEP link despite the lower p. Within a 90% confidence interval the test is significant for the variable CEP, with a 14.34% coefficient. Unfortunately, all control variables except for intangible assets are insignificant.

The test shows an  $R^2$  of 8.17%, which indicates that explanation ratio of the test is even lower than for ROE. Again it is important to note that many factors are at play in a measurement like Tobin's q and it is impossible to control for all elements.

Fixed-effects (within) regression Number of					f obs	=	559
Group variable (i): industry Number of groups =						25	
R-sq: within	= 0.0817			Obs per	group: m:	in =	6
between	= 0.0005				av	vg =	22.4
overall	= 0.0471				ma	ax =	65
				F(6,24)		=	2.08
corr(u_i, Xb)	= -0.1409			Prob > F		=	0.0937
		(Std. Er	r. adjust	ed for 25	clusters	s in	industry)
		Robust					
tobinsq	Coef.	Std. Err.	t	P> t	[95% Co	onf.	Interval]
+ cep	.1433539	.0722945	1.98	0.059	005854	47	.2925625
size	1272301	.0874828	-1.45	0.159	307785	57	.0533254
beta	0628882	.524729	-0.12	0.906	-1.1458	76	1.020099
growth	.2385473	.1849954	1.29	0.210	143264	43	.620359
capitalint~y	.0046693	.1048052	0.04	0.965	21163	38	.2209766
int_ass	.0519066	.0218588	2.37	0.026	.006792	22	.0970211
_cons	2.658545	.8346886	3.19	0.004	.935832	26	4.381258
+							
sigma_u	.84662365						
sigma_e	1.1024075						
rho	.3709856	(fraction	of varian	ce due to	u_i)		

<sup>80</sup> Gujarati (2003), p. 222

# 6.3 ROE with lagging effect

The lower number of observations in this test can be attributed to the removal of one year of observations. The test between a lagging CEP and ROE gives a coefficient of 1.78% and the test is significant within a 95% confidence interval. The test has an R<sup>2</sup> of 9.45% implying that the explanation ratio for this test is slightly lower than the CEP-ROE test without the lagging effect.

Fixed-effects (within) regression				Number o	f obs	=	397
Group variable		Number o	f groups	=	25		
R-sq: within	= 0.0945			Obs per	group: mir	n =	4
between	= 0.0083				avo	g =	15.9
overall	= 0.0780				max	x =	49
				F(6,24)		=	5.20
corr(u_i, Xb)	= -0.1824			Prob > F		=	0.0015
		(Std. Err	. adjust	ed for 25	clusters	in	industry)
1		Robust					
roe	Coef.	Std. Err.	t	P> t	[95% Cor	nf.	Interval]
+-							
cep	.0178428	.0072135	2.47	0.021	.0029548	3	.0327307
beta	0596722	.057127	-1.04	0.307	1775766	6	.0582323
size	.0142109	.0089828	1.58	0.127	0043287	7	.0327506
int_ass	.0040042	.0038828	1.03	0.313	0040096	6	.012018
capitalint~y	0565817	.0436055	-1.30	0.207	1465791	1	.0334156
growth	.0939373	.0396455	2.37	0.026	.012113	3	.1757617
_cons	07641	.1092013	-0.70	0.491	3017905	5	.1489705
+-							
sigma_u	.0938346						
sigma_e	.17874774						
rho	.2160418	(fraction o	f varian	ice due to	u_i)		

# 6.4 Tobin's q with lagging effect

When testing for a lagging effect between Tobin's q and CEP, we found a large increase of the coefficient from 14.33% to 18.03% and significant within a 95% confidence interval. Similar to the immediate effect test, only the CEP and intangible assets are significant explanatory variables. The test has an R<sup>2</sup> of 10.67%, which is higher than the immediate effect Tobin's q test.

Fixed-effects (within) regression Number of obs =						400
Group variable (i): industry Number of groups =						
R-sq: within = 0.1067				Obs per	group: min =	4
between	= 0.0009				avg =	16.0
overall	= 0.0603				max =	47
				F(6,24)	=	2.13
corr(u_i, Xb)	= -0.1667			Prob > F	=	0.0874
		(Std. Err	. adjust	ed for 25	clusters in	industry)
I		Robust				
tobinsq	Coef.	Std. Err.	t	P> t	[95% Conf.	Interval]
+						
cep	.1802613	.0842928	2.14	0.043	.0062895	.354233
beta	.0422107	.5832348	0.07	0.943	-1.161527	1.245948
size	1383532	.1032265	-1.34	0.193	3514023	.0746958
int_ass	.0592974	.0259756	2.28	0.032	.0056864	.1129085
capitalint~y	0304204	.1055183	-0.29	0.776	2481995	.1873588
growth	.1642429	.2118938	0.78	0.446	2730843	.6015701
_cons	2.671209	.9663077	2.76	0.011	.6768483	4.66557
+						
sigma_u	.89454059					
sigma_e	1.1881034					
rho	.36178929	(fraction of	f varian	ce due to	u_i)	

# 7 Analysis and Discussion

In the following section we will analyze the results of our statistical test and discuss what conclusions can be drawn from them. First, we will discuss the impact of CEP on ROE followed by a discussion of the impact of CEP on Tobin's q. After that we will consider the general effects which are applicable to both tests.

#### 7.1 ROE and CEP

Our results indicate that there is a slightly positive correlation between companies' CEP and ROE at a significance level of p<0.05. Even if our R<sup>2</sup> is modest at approximately 10%, the result indicates that CEP indeed has a positive correlation with profitability. ROE was used as a profitability measurement in an attempt to capture the potential *direct* effects of CEP since it encompasses both market gains and cost savings. A positive relationship between CEP and ROE indicates that win-win scholars are correct in assuming that there are CEP-improving measures that can affect the bottom line. The low coefficient can be attributed to the complexity and the many conflicting forces that make up ROE. From our test it is also evident that the relationship is slightly stronger when allowing for a one year lag effect of CEP which also results in a lower  $\rho$ . This implies that even if investments in CEP give shareholders a direct positive effect, the effect after one year is greater. One can draw the conclusion that environmental performance should be viewed as a long term investment that will generate future profitability for a company and its shareholders.

# 7.2 Tobin's q and CEP

The results from our test showed a strong coefficient (14.34%) between CEP and Tobin's q. When the lagging effect was added, the coefficient rose to 18.03% on a p<0.05 significance level. The high coefficient is surprising considering the research that shows that financial analysts do not include environmental aspects in their company valuations. However, improved environmental performance has been shown to lead to brand attractiveness and a better reputation which can lead to a higher market valuation. Tobin's q was used to capture the potential *indirect* effects of CEP since it shows the overvaluation of a firm's replacement cost of capital. These two tests confirm the importance of CEP on market valuation and that the market values environmental signals. Since Tobin's q reflects market sentiment and expectations, a high coefficient might imply that shareholders see some future benefits of investing in companies with good environmental performance. A possible explanation for this is the increased interest in climate change and the environment as well as the increasing influence of stakeholder theory. The market is driven by expectations, and at the moment being green is expected to be a competitive advantage.

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For both measures of CFP, there is a stronger link when a one year lag is introduced. This lag effect could be attributed to the initial investment required to become more environmentally friendly or that it takes some time before cost savings and price premiums are realized.

# 7.3 General comments and limitations

Our statistical tests support our hypothesis that there is a positive link between corporate environmental performance and corporate financial performance. However, it is important to reflect upon what our results really indicate and where potential sources of error might lie.

#### 7.3.1 Company snapshot

Our results only provide an annual snapshot view of how the relationship between profitability and CEP has been for the last four years. This is not a guarantee for past or future validity. With the prevailing financial crisis and potential recession the future of CEP is uncertain. The years that were studied in our statistical test experienced both environmental and economic booms. During a boom it is more likely that consumer are willing to pay the extra price premium for eco-labeled food and that companies invest in extra CSR activities. During a recession, companies might still be willing to contribute, but they may not be able to do so.<sup>81</sup>

Being categorised as a green company today can be seen as a competitive advantage, but as environmental awareness spreads, it might no longer be seen as a unique attribute. Current voluntary environmental actions might become mandatory for companies in the future and thus CEP will no longer give companies a competitive edge, instead it might just become a necessity.

#### 7.3.2 Causality

When analysing the link between CEP and CFP one has to question the causality of the link. Some cases of previous research show that the CEP-CFP correlation goes both ways, leading to what is called a virtuous circle.<sup>82</sup> We aimed to investigate the reasons for why companies invest in CEP by studying the effects of CEP on CFP. Our positive results show that CEP has a positive impact on CFP, however, this does not rule out a potential positive correlation in the other direction. If this were the case, once could say that profitable companies invest in CEP, which in turn increases profitability. In order to get a better understanding of the underlying mechanisms of the CEP-CFP relationship we suggest further research over a longer period of time in which the causality of the correlation can be tested.

<sup>&</sup>lt;sup>81</sup> Sjödén, K. (2008)

<sup>&</sup>lt;sup>82</sup> Waddock and Graves (2000)

#### 7.3.3 Comparison with previous research

The general positive direction of our correlation coefficient for ROE and Tobin's q is in line with the majority of the studies within the field. We discussed that using data for Swedish companies might make a link between environmental performance clearer due to the widespread knowledge and interest for the issue in Sweden. Unfortunately this has not been translated into our results. Previous studies show for example R<sup>2</sup> levels of 36.5% on the link with Tobin's q<sup>83</sup> and between 25-30% on ROE.<sup>84</sup> The discrepancy in R<sup>2</sup> levels can be attributed to different explanatory variables as well as sample size. Despite this, there are also examples of previous studies which show R<sup>2</sup> levels as low as 7.4%.<sup>85</sup> In terms of the magnitude of the coefficients for Tobin's q and ROE, it is even more complicated to compare the results across studies in order to get a general idea of how large the effects might be. In terms of Tobin's q, Elsayed and Paton (2004) receive different coefficient of 14% while a dynamic fixed effects panel data results in a coefficient of 6.8%.<sup>86</sup> For ROE, Hart and Ahuja (1996) show an average coefficient of 3.3% over a period of 4 years.<sup>87</sup>

measures of the tested variables. As evidenced in this section, it is difficult to hypothesize over what results are good. Even though some scholars have reached  $R^2$  levels of almost 40%, there are also published articles with an  $R^2$  level lower than ours.

#### 7.3.4 Cut-off point

Another aspect which needs to be addressed is the optimal cut-off point for investments in CEP. It would be unreasonable to assume that there exists an endless linear relation between the CEP and CFP. The cut-off point would lie where the marginal benefit of investments in CEP is equal to zero. After the cut-off point, investments in CEP would have a negative effect on CEP. This cut-off point is very hard to estimate since it is both industry and company specific and can probably not be easily quantified. Unfortunately it is out of the scope of the study to analyse a potential cut-off point.

<sup>&</sup>lt;sup>83</sup> Konar and Cohen (2001)

<sup>&</sup>lt;sup>84</sup> Hart and Ahuja (1996)

<sup>&</sup>lt;sup>85</sup> Mahoney and Roberts (2001)

<sup>&</sup>lt;sup>86</sup> Elsayed and Paton (2004)

<sup>&</sup>lt;sup>87</sup> Hart and Ahuja (1996)



#### 7.3.5 Difficulties in measuring environmental performance

A difficulty with analyzing the relationship between CEP and CFP is the measurement of environmental performance. Environmental issues are very complex and still today it is unclear what actions should be taken to protect the environment and prevent climate change. When opinions about what actions are considered to be environmentally friendly change from day to day, so do the optimal environmental indicators. This causes a problem when trying to compare environmental performance and previous research over time. However, one can argue that what gets measured is what matters. At any point in time one can assume that people measuring environmental performance, (regardless if it is managers, investors or researchers) will value environmental performance indicators similarly.

#### 7.3.5.1 Correlation Test of Environmental Performance Indicators

GES is a professional ranking institution, and leading within sustainable investments in the Nordic market. They have clear and defined objectives for their CEP rating, but although the evaluation is based on objective measures and standards one must remember a certain level of subjectivity will always be present. In order to minimize the risk of subjective data we performed a linear regression between the GES data set and an alternative environment score provided by Globe Forum. Globe Forum attributes their scores to companies by looking at external company information, while GES analyzes official company documents, interviews employees and gathers information from NGO's and the media. We wanted to test whether environmental performance scores from different sources were related. By correlating annual environmental scores of 62 matching pairs from 2008, we can see that there is an almost perfect linear correlation of 1.02. Furthermore the R<sup>2</sup> is equal to 0.76, which is a relatively high explanation ratio.



This implies that one would probably see similar results if a study had been performed using Globe Forum data. However, due to the larger sample size and comprehensive data collection, we have chosen to analyze the environmental scores from GES.

#### 7.3.6 Lagging effect

In our results we have tested for a lagging effect of one year between the effect of CEP on CFP, which proved to show a greater correlation than when testing for CEP and CFP for the equivalent year. However, it is possible that the lagging effect is greater if one were to introduce a longer lag between the two variables. Unfortunately, we were not able to test for this hypothesis due to insufficient data.



In the results there is also a hidden lagging effect which has to be regarded. We have measured the effect between financial performances at book end and the year when GES rating was published; but the companies' actual environmental activities take place before the GES rating, implying a hidden lagging effect. This hidden lagging effect is impossible to test or evaluate since the timing of the highly individual for every company. In addition, we do not know the exact time lag between the actual improved CEP and when GES rates it.

#### 7.3.7 Control variables

In our regression we controlled for six variables: beta, size, growth, industry, capital intensity and intangible assets. There are several other variables that have an impact on a ROE and Tobin's q which could have been added in our analysis in order to increase our R<sup>2</sup> values. However, we have chosen to control for the variables suggested in previous research since they have shown the greatest significance. ROE and Tobin's q are hard variables to estimate and it is impossible to control for all possible variables that affect their value.<sup>88</sup>

<sup>&</sup>lt;sup>88</sup> Clemens (2006)

# 8 Concluding Remarks

The purpose of our essay was to investigate why companies invest in environmental performance. From our results it is evident that there is a positive link between CFP and CEP. According to Bansal and Roth (2000) there are three reasons for a company to pursue ecological responsive initiatives: competitiveness, legitimation and environmental responsibility. Legitimation was dismissed early on as potential explanatory factor, since Swedish companies over-comply with environmental regulation. This over-compliance can then be explained by competitiveness or environmental responsibility. Since we found a positive link between CEP and CFP, we propose that one reason for companies to pursue environmental activities is competitiveness. As expected, our results showed a higher correlation between CEP and Tobin's q, compared to CEP and ROE. This mirrors the indirect effects of CEP on market sentiment regarding environmentally friendly companies. The direct effect on ROE is more difficult to reach due to the complex nature of the parameter.

The third possible reason discussed by Bansal and Roth (2000) is environmental responsibility. Since we received support for our hypothesis regarding competitiveness it is not possible to draw any conclusions regarding environmental responsibility. However, it is important to keep in mind that environmental responsibility and competiveness are not mutually exclusive and companies can be willing to invest in environmental performance for both reasons. The difficulty with environmental responsibility is that it is very hard to quantify and test. Bansal and Roth (2000) name donations to environmental causes and unpublicized initiatives as examples of this concept. It lies in the nature of both these initiatives that they are not public reputation-building activities because that would imply potential effects on competitiveness. An analysis of the concept of environmental responsibility would most probably have to be based on qualitative interviews.

We can conclude from our results that Swedish companies gain from investing in corporate environmental performance. We used two stockholder related measures, ROE and Tobin's q, in order to test whether investing in environmental activities should be accepted by the market. CEP turned out to be positively correlated with both measures and in particular Tobin's q. We attribute this to win-win situations, the creation of competitive advantages from a natural-resource-based view and last, but not least, the current green boom which has engaged a whole world.

#### 8.1 Future research

Suggestions for future research include developing a deeper understanding for the causality of the link between CEP and CFP. Secondly, we suggest investigating how the relationship between CEP and CFP develops during a boom as compared to a recession. This theme can be linked to the causality

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issue addressed above. The virtuous circle will probably grind to a halt when companies no longer have slack resources to invest in environmental performance. The current financial crisis is already making scholars wonder about what the effects will be on the environmental movement. Is this green boom just a trend? Another interesting area for future research is the investigation of the lagging effect between CEP and CFP. How long does it take before a company which for example implements an environmental management system, can see the effects in the profit and loss account? Fourthly, a very interesting research area is the optimal cut-off point or plateau level for investments in CEP. The theories backing a positive correlation state that greenness can be a competitive advantage. However, all companies cannot invest indeterminately in environmental performance. If all companies are expected to be green, this will no longer be a differentiating factor. Finally, we recommend future research to investigate a way in which to make environmental performance measurement more objective. The GRI sustainability reporting guidelines are a start, but in order to make research significant, environmental performance data must be comparable across geographies and over time.

# **9** References

#### 9.1 Books

Keller, K. L. (2003), Strategic Brand Management: Building, Measuring, and Managing Brand Equity,

2nd edition, Upper Saddle River, NJ: Pearson Education

Gujarati, D. (2003), Basic Econometrics, 4th ed, McGrawHill

Wooldridge, J., (2002), *Introductory Econometrics: A modern approach*, 2<sup>nd</sup> ed, South-Western, Div of Thomson Learning

#### 9.2 Periodical Articles

- Bansal, P. and Roth, K., (2000), "Why companies go green: a model of ecological responsiveness", *The Academy of Management Journal*, 43 (4), pp. 717–736
- Boatright, John R., (2002), "Contractors as stakeholders: Reconciling stakeholder theory with the nexus-of-contracts firm" *Journal of Banking and Finance*, 26
- Brammer, S., Brooks, C. and Pavelin, S. (2006), "Corporate Social Performance and Stock Returns: UK Evidence from Disaggregate Measures", *Financial Management*, 35 (3), pp. 97–116
- Brown, W. O., Helland, E. and Smith J. K. (2006), "Corporate philanthropic practices", *Journal of Corporate Finance*, 12, pp. 855–877
- Carlton and Perloff's companion website for Modern Industrial Organization (2000). Available [online]: <u>http://wps.aw.com/aw\_carltonper\_modernio\_4/21/5566/1424977.cw/index.html</u> [2008-12-05]
- Chung, K. H. and Pruitt, S. W. (1994, "A Simple Approximation of Tobin's q", *Financial Management*, 23 (3), pp. 70-74
- Clarkson, M.B.E., (1995), "A stakeholder framework for analyzing and evaluating corporate social performance", *Academy of Management Review*, Vol. 20, pp. 92-117
- Davidson, W. N. and Worrell, D. L. (1988), "The impact of announcements of corporate illegalities on shareholder returns", *Academy of Management Journal*, 31 (1), pp. 195–200
- Dooley, R. S. and Lerner, L. D. (1994), "Pollution, profits, and stake-holders: The constraining effect of economic performance on CEO concern with stakeholder expectations", *Journal of Business Ethics*, 13, pp. 701–711.
- Dowell, G. Hart, S. and Yeung B (2000), "Do corporate global environmental standards create or destroy value?", *Management Science*, 46 (8), pp. 1059–1074
- Elsayed, K. and Paton, D. (2004), "The impact of environmental performance on firm performance: static and dynamic panel data evidence", *Structural Change and Economic Dynamics*, 16 (2005), pp. 395–412

- Epstein, M. J. and Roy, M-J., (2001) "Sustainability in Action: Identifying and Measuring the Key Performance Drivers", *Long Range Planning*, 34, pp. 585-604
- Fombrun, C. and Shanley, M. (1990), "What's in a name? Reputation building and corporate Strategy", *Academy of Management Journal*, 33, pp. 233–258
- Griffin, J. J. and Mahon, J. F. (1997), "The corporate social performance and corporate financial performance debate: Twenty-Five Years of Incomparable Research", *Business and Society*, 36 (1), pp. 5-31
- Hart, S. (1995), "A natural-resource-based view of the firm", *Academy of Management Review*, 20 (4), pp. 986–1014
- Hersch, J. (1991), "Equal employment opportunity law and firm profitability", *Journal of Human Resources*, 26, pp. 139–153
- Hunt III, Herbert G. and Grinnell, D. Jacque, (2004), "Financial analysts' view of the value of environmental information", *Advances in Environmental Accounting and Management*, 2, 101– 120
- Ingram, R. W. (1978), "An investigation of the information content of (certain) social responsibility Disclosures", *Journal of Accounting Research*, 16, pp. 270–285
- Jensen, M. (2002), "Value maximization, stakeholder theory, and the corporate objective function", Business Ethics Quarterly, 12, pp. 235–256
- Karagozoglu, N. and Lindell, M. (2000), "Environmental management: testing the win-win model." Journal of Environmental Planning and Management, 43 (6), pp. 817–829
- King, A. and Lenox, M. (2001), "Does It Really Pay to Be Green?", *Journal of Industrial Ecology*, 5 (1), pp. 105–116
- Klassen, R. D. and McLaughlin, C. P. (1996), "The impact of environmental management of firm performance", *Management Science*, 42, pp. 1199–1214.
- Konar, S. and Cohen, M. A. (2001), "Does the market value environmental performance?" *Review of Economics and Statistics*, 83, pp. 281–289
- Lindenberg, E. and Ross, S. (1981). "Tobin's q ratio and industrial organization", *Journal of Business*, 54 (1), pp. 1–32
- Lyon, T. P. and Maxwell, J. W., (2008), "Corporate Social Responsibility and the Environment: A Theoretical Perspective", *Review of Environmental Economics and Policy*, 1, pp. 1-22
- Mahapatra, S. (1984), "Investor reaction to a corporate social accounting", *Journal of Business Finance and Accounting*, 11 (1), pp. 29–40
- Margolis, Joshua D., Elfenbein, Hillary A. and Walsh, James P., (2007), "Does it pay to be good?", Working paper, Available online:

www.unglobalcompact.org/NewsandEvents/articles\_and\_papers/margolis\_november\_07.pdf

- McWilliams, A. and Siegel, D. (2000), "Corporate social responsibility and financial performance: Correlation or misspecification?" *Strategic Management Journal*, 21, pp. 603–609.
- McWilliams, A. and Siegel, D. (2001), "Corporate social responsibility: a theory of the firm perspective", *Academy of Management Review*, 26 (1), pp. 117–127
- Miles, M. P. and Covin, J. G., (2000), "Environmental marketing: A source of reputational, competitive and financial advantage" *Journal of Business Ethics*, 23, pp. 299-311
- Muoghalu, M. I., Robison, H. D. and Glascock, J. L. (1990), "Hazardous waste lawsuits, stockholder returns, and deterrence", *Southern Economic Journal*, 57, pp. 357–370.
- Porter, M. and Van der Linde, C. (1995), "Green and competitive: ending the stalemate", *Harvard Business Review*, 73, pp. 120–134
- Shrivastava, P. (1995),"The role of corporations in achieving ecological sustainability", *Academy of Management Review*, 20 (4), pp. 936–960.
- Staw, B. M. and Szwajkowski, E. (1975), "The scarcity-munificence component of organizational environments and the commission of illegal acts", *Administrative Science Quarterly*, 20, pp. 345–354
- Verschoor, C. C. (1998). "A study of the link between a corporation's financial performance and its commitment to ethics", *Journal of Business Ethics*, 17, pp. 1509–1516.
- Waddock, S. A. and Graves, S. B. (1997), "The corporate social performance-financial performance link", *Strategic Management Journal*, 18, pp. 303–319.
- Waddock, S., Graves, S. B. and Gorski, R. (2000), "Performance characteristics or social and traditional investments", *Journal of Investing*, 9, pp. 27–38.
- Walley, N., and Whitehead, B. (1994), "It's not easy being green", *Harvard Business Review* (May–June), 46–52
- White, G.I., Sondhi, A.C., and Fried, D. (2003), *The Analysis and Use of Financial Statements*, John Wiley and Sons
- Wokutch, R. R and Spencer, B. A. (1987), "Corporate saints and sinners: The effects of philanthropic and illegal activity on organizational performance", *California Management Review*, 29 (2), pp. 62–77.

#### 9.3 Newspaper and magazine articles

Bergsell, T. (2008), "Fortsatt nej från regeringen", Dagens Nyheter. Available [online]:

http://www.dn.se/DNet/jsp/polopoly.jsp?a=859328 [2008-12-03]

*The Economist*, "Green protectionism", Published: 2007-11-15. Available [online]: <u>http://www.economist.com/research/articlesbysubject/displaystory.cfm?subjectid=348924&stor</u> <u>y\_id=10134052&CFID=30783855&CFTOKEN=45120025</u> [2008-11-30] *The Economist*, "Climate of fear", Published: 2008-10-23. Available [online]: <u>http://www.economist.com/people/displaystory.cfm?story\_id=12470467</u> [2008-11-27]

- Friedman, Milton, "The Social Responsibility of Business is to Increase its Profits" *The New York Times Magazine*, [1970-09-13]
- Sjödén, K. (2008), "Miljön i skuggan av finanskrisen", Sydsvenskan. Available [online]: <u>http://sydsvenskan.se/ekonomi/article385009/Miljon-i-skuggan-av-finanskrisen.html</u> [2008-12-04]
- Ryegård, C. (2008), " Den ekologiska världsmarknaden växer 20 procent per år", EkoWeb. Available [online]: http://www.ekoweb.nu/?p=9735 [2008-12-05]

# 9.4 Reports

Commission of the European Communities (2008), "20 20 by 2020 - Europe's climate change opportunity". Available [online]: <u>http://eur-http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0030:FIN:EN:PDF</u> [2008-12-01]

Country Brand Index's webpage: Country Brand Rankings. Available [online]:

http://www.countrybrandindex.com/country-brand-rankings/ [2008-09-30]

- Ekologiska Lantbrukarna (2007), "Växande marknad: Försäljning, volymer & Trender för ekologisk mat". Available [online]: http://www.ekolantbruk.se/marknad/pdf/VM2007.pdf [2008-10-16]
- Eurostat, "Environmental Protection Expenditure by Industry in the European Union 1997-2004", 2008-09-03
- NUTEK, "Det lönsamma miljöarbetet Miljöstrategier och resultat i småföretag" Verket för näringslivsutveckling (NUTEK), 2005
- Special Eurobarometer 300: "European's attitudes towards climate change". Available [online]: http://ec.europa.eu/public\_opinion/archives/ebs/ebs\_300\_full\_en.pdf [2008-11-27]

# 9.5 Websites

Differ (2008), "Sveriges grönaste varumärke 08", Available [upon request]: <u>info@differ.com</u> Environmental Performance Index's webpage. Available [online]: <u>http://epi.yale.edu/</u> [2008-11-29] International Organization for Standardization's (ISO) webpage: Products: ISO Standards:

Management standards: ISO 9000/ISO 14000. Available [online]:

http://www.iso.org/iso/iso\_catalogue/management\_standards/iso\_9000\_iso\_14000 [2008-11-30]

Nutek's webpage: Faktabanken: Fakta om företagande: Miljöcertifiering. Available [online]: http://www.nutek.se/sb/d/215 [2008-12-04]

- *Öhrlings PricewaterhouseCoopers' webapage: Pressrum: Pressmeddelande Sveriges.* Available [online]:<u>http://www.pwc.com/extweb/ncpressrelease.nsf/docid/F01D9B6DCAEE188C802574A90</u> <u>02DF98E</u> [2008-12-03]
- PricewaterhouseCoopers' website: Our Services: Publications. Available [online]:

http://www.pwc.com/extweb/pwcpublications.nsf/docid/C47394D175710FE9852573D10076B80 <u>0</u> [2008-12-03]

# 9.6 Interviews

Edlund, P. O., Conversation, 2008-11-05

Lyckeborg, H., Coversation, 2008-11-01

Skogsvik, K. (2008), Mail Communication and Telephone Conversation, 2008-11-24.

# **10** Appendices

## 10.1 Appendix A

#### **10.1.1 GES Investment**

GES Investment Services is Northern Europe's leading research and service provider for Responsible Investment. GES perform a risk rating on a quarterly basis where they analyses companies' management of Environment, Social and Corporate Governance. GES Investment was founded in 1992 and has been devoted to bring the



concept of sustainability into the business sector. Regarding the development of GES Risk Rating, GES Investment Services cooperates with Umeå School of Business in Sweden through a MISTRA funded research program on Sustainable Investment, which assures independent research.

GES Investment Risk Rating analysis is based on international norms on Environmental Social and Governance (ESG) Factors in accordance with the United Nations Principles for Responsible Investment. The evaluation is two-folded; the companies' preparedness, through for example management systems, and performance, through a number of criteria and sub-criteria, is evaluated. The specific criteria in GES Risk Rating for Environment can be viewed in the box on you right.



Policy	Program	Management System	Progress	Performance	Verification
• A company's position regarding a specific aspect	<ul> <li>Refers to a plan with detailed goals and measures aimed to fulfil intensions</li> </ul>	• Routines to secure program implementation as intended and/or to deal with incidents that are not compliant with the policy.	<ul> <li>Reporting that clarifies to what extent policies and goals have been reached.</li> </ul>	<ul> <li>Information that enables evaluation of whether a company is making progress towards goals.</li> </ul>	Statement from third party that verifies information in company reporting concerning certain assessment criteria.

GES Risk Rating is for each individual company is based on official company documents, dialogue with companies, information from non-governmental organizations, the media and GES partners. GES Risk Rating also take into consideration the specific industry risk that concern a company's business activities which means that GES Risk Rating reports illustrate both the company's risk rating as well as the general risk of the industry in which the company operates. The analysis model for the criteria is build upon for the Plan, Do, Check, Act methodology, which also is used in ISO 14000.

Based on these criteria the companies obtain a rating from Aa to Cc, for each of the areas

environment, human rights and corporate governance. In this essay we have chosen to only focus on the environmental aspect and will disregard the rating for human rights and corporate governance. The capital letters (A-C) indicate the general risk level in the company's industry, where C is the highest risk, and the lower case letters (a-c) indicate the risk level in the particular company, based on preparedness and performance. From this rating companies can be divided in groups according to the matrix below. For example if a company is active within a low risk industry and has a low



company risk they will be placed in the upper right corner, the dark green area. Companies, placed in the dark green area can be given a score between 2-3 points, whereas companies in the light green areas only can be given a score between 1,67 - 2,5. This means, the higher score, the better environmental performance. Altogether the rating shows the company's ability to deal with the general risks that concern their activities and to comply with international norms and procedures.

# 10.2 Appendix B

In order to perform a fixed effects panel data regression we need to make the following assumptions:

- We have a random sample from the cross section
- Each explanatory variable changes over time (for at least some i) and no perfect linear relationships exist among the explanatory variables
- For each t, the expected value of the idiosyncratic error given the explanatory variables in all time periods and the unobserved effect is 0: E(u<sub>it</sub> | X<sub>i</sub>, a<sub>i</sub>) = 0
- $Var(u_{it}|X_{i},a_{j}) = Var(u_{it}) = \sigma^{2}$ , for all t = 1, ..., T.
- Cov(u<sub>it</sub> ~N (0,σ<sup>2</sup>)

# 10.3 Appendix C

We categorized the companies in our data sample according to the following industries:

- 1. Biotechnology
- 2. Building Products
- 3. Commercial Banks
- 4. Commercial Services & Supplies
- 5. Construction & Engineering
- 6. Diversified Financial Services
- 7. Diversified Telecommunication Services
- 8. Electrical Equipment
- 9. Electronic Equipment & Instruments
- 10. Food Products
- 11. Health Care Equipment & Supplies
- 12. Household Durables
- 13. Industrial Conglomerates
- 14. IT Services
- 15. Machinery
- 16. Marine
- 17. Media
- 18. Metals & Mining and Oil & Gas
- 19. Paper & Forest Products
- 20. Pharmaceuticals
- 21. Real Estate Investment Trusts (REITs)
- 22. Software
- 23. Specialty Retail
- 24. Textiles, Apparel & Luxury Goods
- 25. Trading Companies & Distributors