SCHOOL OF ECONOMICS
AND MANAGEMENT
Lund University

FEKP01 Master Thesis

January 2008

Does the environment matter?

-A study on the relationship between environmental performance and firm value

Advisor:

Maria Gårdängen

Authors:

Stefan Nordahl

Lina Sultan

Sammanfattning

Examensarbetets titel:	Does the environment matter? – A study on the relationship between environmental performance and firm value
Seminariedatum:	2008-01-18
Ämne/kurs:	FEK P01, Examensarbete Magisternivå Finansiering, 15 ECTS
Författare:	Lina Sultan och Stefan Nordahl
Handledare:	Maria Gårdängen
Fem nyckelord:	Miljöprestation, Carbon Disclosure Project, Tobins Q, Företagsvärde, Multipel regressionsanalys
Syfte:	Syftet med studien är att bidra till den relativt begränsade, men existerande forskningen om relationen mellan miljöprestation och företagets värde, samt stärka medvetandet hos både managers och investerare.
Metod:	En deduktiv, kvantitativ ansats i form av regressionsanals har använts för att uppnå syftet.
Teoretiska perspektiv:	Corporate Social Responsibility, Risk Management, samt tidigare forskning på relationen mellan miljöprestationer och finansiella prestationer
Empiri:	Multipel regressionsanalys med CDPs Climate Leadership Index som undersökande oberoende variabel och Tobins Q som beroende variable
Slutsatser:	Företagets värde påverkas av miljöprestationer i företag som klassificeras som låg-utsläppare av CO2, men inte i företag som klassificeras som hög-utsläppare. Orsaken till värdeskapandet är att låg-utsläppare har möjlighet att skapa möjliga positiva kassaflöden genom att miljöinvesteringar ses som en core-risk. För högutsläpparna blir miljöinvesteringar ett måste, men med begränsat utrymme för att förflytta risken från non-core till core.

Abstract

Title:	Does the environment matter? – A study on the relationship between environmental performance and firm value
Seminar date:	2008-01-18
Course:	Master thesis in business administration, major: finance, 15 University Credit Points (15 ECTS)
Authors:	Lina Sultan and Stefan Nordahl
Advisor:	Maria Gårdängen
Purpose:	The purpose of this study is to contribute to a relatively small, but existing research on the relationship between environmental performance and firm value, and improve the awareness among company managers as well as investors.
Five key words:	Environmental performance, Carbon Disclosure Project, Tobin's Q, Firm value, multiple regression analysis
Methodology:	A deductive, quantitative approach using regression analysis is used to serve the purpose
Theoretical perspectives:	Corporate Social Responsibility, Risk Management, and previous research on the relationship between environmental and financial performance.
Empirical foundation:	Multiple regression analysis using CDP's Climate Leadership Index as our research independent variable and Tobin's Q as dependent variable
Conclusions:	Firm value is affected by companies classified as low emitters of CO2, but not by companies classified as high emitters. The value derives from the possible cash flows created by the low emitters by seeing climate changes as a core risk. The high emitters, on the other hand, have to consider environmental investments, but have limited possibilities to transfer the non-core risk into a core risk.

Table of contents

1. Introduction

The first chapter will introduce the subject and give some background information, leading up to the problem discussion concretizing the problem. We will then present the purpose of the research, the delimitations and who the target group is.

1.1 Background

The world is changing; globalization has opened up new markets and new players are entering the arena ready to compete. China, once a poor nation, is now the second largest economy in the world, growing by approximately ten per cent per year[1] and is believed to surpass the US before 2040;[2] the global welfare is increasing and the GDP per capita has improved for a majority of countries, resulting in a growing middle class world wide;[3] the growing middle class has boozed consumption and we are now consuming more goods than ever before. Worldwide, people are buying TVs, mobile phones and cars. In China for instance, the automotive market has seen an impressive growth rate and in 2006 the sales represented 23.2% of the total sales growth in the world.[4]

On the flip side, we are experiencing a major climate change worldwide. Emanuel (2005) has found evidence that hurricanes are becoming both stronger and more frequent;[5] Tsunami is, sadly, a word everyone is familiar with these days; and polar bears are diminishing rapidly as the Antarctic ice is melting, which also

[1] http://www.worldwatch.org/node/4529, https://www.cia.gov/library/publications/the-world-factbook/geos/ch.html#Econ
[2] http://www.nottingham.ac.uk/china-policy-institute/events/documents/Shujie_YAo_Inaugural_Lecture_Press_Release.pdf
[3] http://www.worldbusinesslive.com/article/609473/world-bank-predicts-rise-global-middle-class/
[4] PriceWaterhouseCooper's "Global Automotive Financial Review-An overview of industry data, trends and financial reporting practices", 2007 edition.

poses a major threat to most nations, nonetheless the Netherlands which most likely will disappear under the surface.[6]

The world is changing by two sides of the same coin: the global economy and the global environment.

Most people have an understanding of how globalization can affect both the domestic and global economy, but what about the effects on the environment. Is that equally obvious?
The debate on climate change is neither simple nor homogenous. Over the years two sides have been discussing whether or not the habits of mankind is causing the climate to change, or if it is just another era of the climate cycle. However, recent trends in research suggest that a consensus is starting to develop where most, if not all, scientist are agreeing on the fact that climate change is not following the normal cycle. In fact of the more than 900 studies published in 2006, none were contradicting[7].

Mann's et al. (1998, 1999) studies on climate change over the last millennium, using tree rings and ice core, shows that there has been a sharp upturn in the Earth's mean temperature the last decades. Shaw (2006) reports that the warmest years on record have all been recorded in the past ten years. This is in line with the Intergovernmental Panel on Climate Change's (IPCC) research from 2001, stating that the average surface temperature has increased by approximately 0.6 degrees Celsius during the 20th century; with 2005 being the warmest in several 1000 years and 2007 is believed to be the warmest ever.

In addition to these studies, Petit's et al. (1999) study covering the past 400.000 years shows that the correlation between the Greenhouse gas concentration in the atmosphere, the Earth's temperature and the diminishing ice core in Arctic and Greenland is significant. NASA's observation from satellite images concludes, in

[6] Washington Post, "Debate on Climate Shifts to Issue of Irreparable Change," Juliet Eilperin, January 29, 2006, Page A1.
[7] An Inconvenient Truth, Al Gore 2007.

accordance with other research, that Greenland is losing at lest 20 % of its ice mass (net) each year, causing the sea level to increase.

Since this is neither a thesis on geology or meteorology, nor chemistry or physics, and we are not sufficiently educated in these fields, we will not elaborate further. Rather, the above-mentioned articles and research, all of which are at the frontier of their field and are accepted globally, will have to serve as an adequate amount of evidence for the ongoing climate change in the world.

In recent years, the discussion on climate change, and the role that companies play as the "villains of the piece", has reached the boardrooms of many companies worldwide and more reports and studies have been made, but from the private sector instead of government research, adding to the debate. Companies like Innovestgroup, pioneers in company valuation and newly awarded by the UN for their work, introduced Carbon Beta as a new variable and risk measurement when valuating a company; The Carbon Disclosure Project (CDP), operating as a secretariat for 315 of the most powerful institutional investors in the world with a combined $ 41 trillion of assets under management; Generation Investment Management (founded by the former Vice President Al Gore and the former CEO of Goldman Sachs Asset Management, David Blood) showing that abnormal earnings can be made even when integrating sustainability research with traditional fundamental equity analysis , are all examples of how companies and investors are changing the way they do business.

1.2 Problem discussion

Given the increasing awareness of global climate change and its potential effects on companies, questions have been raised regarding the relationship between a company's effect on the environment and the performance of that company. The question has led to an abundant amount of research in the field of Corporate Social Responsibility (CSR), where many try to find evidence for, and legitimize the use of CSR in a company. The fact that the biggest institutional investors in

the world, led by the Carbon Disclosure Project (CDP), are posing questions and taking an interest in CSR has fuelled the research even further. Questions like "is CSR financially viable for a firm or should they focus on maximize shareholder value", are now more than ever on the agenda.

Despite the increasing awareness internationally, CSR have still not been globally accepted as a way of enhancing value. Scholars are divided in the question and 25 years of empirical research has been unable to merge them together. Skeptics like Griffin and Mahon (1997) are still referring to "maximizing shareholder value" as the firms main objective and believe CSR to be a waste of resources. Friedman (1962) and Walley and Whitehead (1994) claims that applying CSR would only increase operating costs and neglect shareholder wealth. Henderson (2002) adds to this research and identifies a lack of consensus when determining social responsibility as a key reason for its limitations. Friedman (1962) talks about the difficulty of identifying CSR, why focusing on shareholder value maximization should be a firms soul responsibility. He continues by stating that shareholders themselves will decide if the firm is taking the appropriate social responsibility.

On the other side, the proponents are showing evidence, which would legitimize the use of CSR and integrate it into the firm's strategy. An organization could create significant goodwill and new market opportunities may arise by applying a social an environmental awareness, which is widely discussed by Porter and van der Linde (1995), Hart and Ahuja (1996), Russo and Fouts (1997), and Fombrun et al. (2000). It could also improve the brand which, according to Turban and Greening's (1996) study on attracting high-quality employees, could help gain and retain key personal which would generate a comparative advantage. The studies by Vandermerwe and Oliff (1996) and Russo and Fouts (1997) indicate that CSR could have an effect on sales.

Despite the potential benefits an organization might gain by adopting an environmental awareness and integrating it into the organization's overall business objectives, most scholars, for example Guenster et al. (2005), seem to believe that sustainable value will only be created when real changes are made. A company that change due to regulations will not create a competitive advantage

since all industry peers will have to make the same change. Instead, a proactive approach should be applied to create a "first mover advantage" as Grant (2007) suggests. Porter and van der Linde (1995) see environmental performance as a measurement of a firm's operational efficiency. A firm with a solid environmental performance also have operational efficient. Hart and Ahuja (1996), Russo and Fouts (1997), and Dowell et al (2000) suggest a proactive approach where production and manufacturing process are improved which would ultimately improve the environmental performance.

Fuelled by the above-mentioned studies and research, a question is sparked. *Is there a relationship between a firm's environmental performance and its firm value?*

1.3 Purpose

The purpose of this study is to contribute to a relatively small, but existing research on the relationship between environmental performance and firm value, and improve the awareness among company managers as well as investors.

1.4 Delimitations

We have chosen to conduct the study on the Nordic market, since this has not been done before. We will not examine other markets, which exposes the study to biasness. Furthermore, we will only examine the implications on Firm Value *as defined by Tobin's Q*.

1.5 Target group

The thesis will be of particular interest for company managers, as it will examine the alleged tradeoff between taking an environmental responsibility and creating

firm value. It should also be of interest for investors that whish to go further than the traditional valuation models.

1.6 Thesis outline

Chapter 2 presents the methodology and practical framework, as well as covering the data collection and methodological limitations. Chapter 3 will display the theoretical framework of this thesis, focusing on Corporate Social Responsibility and Risk Management, and will provide the reader with previous research that is of relevance to this study. In Chapter 4 the empirical findings will be presented and in Chapter 5 the findings will be discussed and a thoroughly analyzed. Chapter 6 is serving as the ending chapter, where a conclusion will be made and suggestions on future research will be presented.

2. Methodology and practical framework

This chapter will describe the main parts of the methodology and practical framework used when gathering data and conducting the regressions. The last section will discuss the methodological limitations.

"Experiment is the sole source of truth. It alone can teach us something new, it can alone give us certainty" (Poincare, 1905)

2.1 Research approach

This study will use a deductive approach, which is described by Jacobsen (2002) as taking a starting point in the already existing research, moving towards empirical proof. Due to the purpose of this essay, the study will be quantitative to its nature. The CDP report and Folksam's climate index that we use as our test independent variables, are both created from interviews and questionnaires, and Datastream, which is the database we use, is based on quantitative research. We believe that the qualitative studies performed by CDP and Folksam will function well in our quantitative data set why we have chosen not to try to recreate them.

2.2 Collection of data

The data used in this study is primarily secondary data collected from external sources. The data serves three different purposes. The first purpose is to allot the companies a grade depending on how well they have performed environmentally. The data chosen for that purpose is the CDP report's ranking system. The second purpose is to find data suitable for the control variables as well as the depending variable, Tobin's *Q*, which has partly been served by Datastream, but mostly been

calculated manually due to the lack of information in Datastream. Any other gaps found have also been collected directly from the company website. Finally, we test the robustness of our findings using Folksam's climate index as a second ranking system.

2.2.1 The CDP report

The Carbon Disclosure Project has published five consecutive global reports in the last five years, written by Innovestgroup. The 2007 report is a more extensive study covering more markets, including the Nordic market. The "Carbon Disclosure Project Nordic Report 2007", written by Ethix SRI Advisors AB and U&W [you&we] includes the largest Nordic companies (125 in total), all of which were given a questionnaire asking them to answer a set of questions. 84 of these companies
responded. More detailed response rate is presented in chapter 4, Empirical findings. The study ranks the companies based on a set of criteria (see appendix). The criteria include:[8]

For all companies:

1. Risks:
    a. Awareness of regulatory risks following existing or expected government regulations on emissions limits or energy efficiency standards.
    b. Awareness of operational risks due to e.g. extreme weather events or sea level rise.
    c. Awareness of other risks e.g. changes in consumer demand because of increased societal environmental awareness.
2. Identification of opportunities following climate change.
3. Undertaken strategies to manage the risks and opportunities.
4. Set reduction targets and activities to reach the targets.
5. Green house gas emissions accounting

[8] CDP Nordic Report 2007

a. Green house gas accounting methodology.
b. Information on Scope 1 of GHG Protocol included in the annual report.
c. Information on Scope 2 of GHG Protocol included in the annual report.
d. Information about electricity consumption included in the annual report.
e. Information on Scope 3 of GHG Protocol included in the annual report.

For carbon intensive sector companies:

6. Additional green house gas emissions accounting: Breakdown of emissions by country.[9]
7. Emission reduction programs.
8. Strategy for trading in the EU Emissions Trading Scheme or other trading systems.
9. Emissions intensity measurement, both historical and current, and how the intensity is managed.
10. Energy costs and estimation of future emissions.
11. The set-up of an executive body to govern the company's emissions and energy usage.

The different criteria are then rated on a scale from 0 to 10, where 0 indicates no environmental awareness in relation to the questionnaire.

2.2.2 Folksam's climate index

Ethix, the same organization as behind the CDP report, presents Folksam's 2007 report and for the first time this index is based upon the CLI index presented in the CDP report. What differs Folksam's study from the CDP report is that

[9] The breakdown is necessary due to differences in regulations between the countries the company operates in.

Folksam only includes Swedish companies. Folksam also adds eleven companies to their study that are not included in the CDP report. However, the majority of these companies do not provide the information required in this study on the company website or anywhere else easily accessible, why these companies are not included in our study. Furthermore, Folksam rates the companies somewhat differently than the CDP report and do not separate high emitters from low emitters. These differences enable us to test the robustness of the study.

2.2.3 Dependent variable – Tobin's Q

James Tobin, American economist and Nobel Price winner, introduced the *Q* concept in his article "A General Equilibrium Approach to Monetary Theory" in 1969. In theory, the market value of a firm includes not only its assets but also an intangible value that will provide the company with growth options. According to the article, firm value is expressed as the replacement costs of all assets, plus the value of growth options. *Q* is then calculated as the market value of the firm divided by the replacement cost of its assets. A *Q* higher than one would indicate that the firm has future growth options, since the market assigns the company a higher value than the replacement cost of its assets. The company would then be considered a good investment. A *Q* lower than one would mean the opposite, a bad investment, since the market values the firm lower than its replacement cost.

Tobin's *Q* is chosen as the dependent variable because it proposes a gap between market value and replacement, as discussed by Guenster et al. (2006). The gap could indicate an intangible value not reflected in the firm assets, such as R&D investments, patents or, as we propose, investment in environmental efficiency. We will calculate Tobin's *Q* by using an approximation presented by Kaplan & Zingales (1997). Even though there are more accurate ways to calculate *Q*, authors like Perfect and Wiles (1994) and Chung and Pruitt (1994) argue that this approximation is highly correlated with the more complex methods.

$$Q = \frac{MVAssets}{BVAssets} \tag{2.1}$$

$$MV\ Assets = BV\ Assets + MV\ Common\ Stocks\ outstanding - BV\ Common\ Stocks\ outstanding - Net\ deferred\ taxes. \tag{2.2}$$

2.3.2 Explanatory variables

The explanatory variable that we wish to examine is corporate financial performance defined by CLI score as presented in the CDP report. Since we have a decreasing linear relationship, we use the natural logarithm of the score in the regression. The companies are separated into "high emitters" and "low emitters" due to the additional questionnaire answered by carbon intensive-sector companies, which would give them a higher score compared to low emitters even though they do not necessarily have to be better environmental performers. Some companies classified as "low emitters" answered the second questionnaire as well and instead of two observation samples, we subsequently have four groups.

The first group is the group *Low Emitters* from the CDP study, which includes the low carbon intensive-sector companies that answered only the first questionnaire sent out by CDP. The second group is *High Emitters* which includes the high carbon intensive-sector companies that answered both CDP questionnaires. There are however companies in the High Emitters group that answered both questionnaires but really are from low carbon intensive-sectors. When we add these companies to the Low Emitters group, we form a third group which we from now on call *Low Emitters Plus*. Consequently, the group High Emitters will be reduced to a fourth group; *High Emitters Minus*.

The fifth regression group is assigned the name *Folksam*, which includes the companies included in Folksam's climate index. The Folksam climate index does not separate high emitters from low emitters and therefore present a mixed sample at the same time that it tests the robustness of the study. In the regression analysis,

the Folksam score will substitute the CLI score in the regression formula and the natural logarithm of the score will be used.

We also consider other independent variables that could affect the firm value defined by Tobin's Q. The first control variable we use is the two-year sales growth, since previous research performed by Guenster et al. (2006) and Hirsch (1991) has found evidence for such relationship. The second control variable is firm age, which is the natural logarithm of the time between the initial floatation date and 2007, plus 1, as proposed by for example Konan and Cohen (2001). As a size indicator, we use the natural logarithm of book value of assets, which is used by Gompers et al., (2003) Other researchers, such as Bharadwaj et al. (1999) have used the natural logarithm of the number of employees as a size variable, why we include this as well.

Three country dummies for each Nordic country, except for Sweden, are included in the analysis. The Sweden dummy will function as the base value and consequently all country specific results will be in relation to Sweden. Because of different regulatory environments, there is reason to believe that the companies' origin would affect firm value.

Our original aim was to include Research & Development as a control variable as suggested by for example King and Lenox (2002). Since we could only access such data for a small number of the companies in our study, our sample would be too small for the OLS regression, which is why this was purposely left out.

Three companies were missing some important information needed to calculate Tobin's *Q*, both in Datastream and on the company website, why they accordingly have been excluded from the regression. These companies are Codan A/S (Denmark), Tandberg Television (Norway), and Orion Group (Finland). The implications of the exclusion are discussed further below.

2.3 Regression analysis

2.3.1 Choice of regression

When choosing the type of regression analysis to perform, Baltagi (1995) makes a distinction between time series analysis and cross-sectional analysis, where the first is suitable when you wish to study how your sample varies over time and the latter when you want to compare different observations at one point in time. A combination of them both, a panel data analysis, would indeed be preferable since that would give you a robustness of the study as well as control for heterogeneity. However, since the studies of company environmental performance is a relatively new phenomenon – especially on the Nordic market, there is very limited historical data to access. This of course makes it difficult to conduct a time series analysis and consequently a panel data analysis. Therefore, the method of choice is a cross-sectional analysis.

2.3.2 The OLS assumptions

We perform an ordinary least squares test (OLS) in the user-friendly EViews. The OLS estimators are known to be "BLUE" (best linear unbiased estimators), i.e. have minimum variance compared to other linear estimators, as stated by the Gauss-Markov theorem presented by for example Damodar (2006), which is why this test is preferable. The OLS regression analysis requires that the data fulfill a number of assumptions, as proposed by Brooks (2003).

Assumption 1: $E(u_t) = 0$

The first assumption is that the expected residual is equal to zero. According to Brooks (2003), by choosing to include an intercept in the regression, this assumption will automatically be fulfilled.

Assumption 2: $\text{var}(u_t) = \sigma^2 < \infty$

The second assumption regards heteroscedasticity, i.e. if the error terms are identically distributed, with the same variance. We choose to test for heteroscedasticity through White's (1980) heteroscedasticity test (no cross-terms). The regressions that show heteroscedasticity are run again with White's (1980) heteroscedasticity-consistent standard error estimates, which according to Brooks (2003) should solve the problem with heteroscedasticity.

Assumption 3: $\text{cov}(u_i, u_j) = 0, i \neq j$

The third assumption is that there is no autocovariance between the variables. Since we are not using time-series data, autocovariance and autocorrelation is seldom a problem. To be sure, this is tested through the Durbin-Watson statistics, which confirms our expectations.

Assumption 4: The X-variables variables are non-stochastic

The fourth assumption regarding non-stochastic X-variables is taken care of by the OLS regression, as long as the dependent variables and the residuals are independent.

Assumption 5: $u_t \in N(0, \sigma^2)$

The fifth assumption is that the residuals are normally distributed. After sorting for outliers, the number of included observations is too low to assume normal distribution. A study of the histogram and performance of Jarque-Bera test confirms that we cannot confidently accept the null-hypothesis that the residuals are normally distributed. We therefore have to support our findings with a non-parametric method that does not require normal distribution, as proposed by Damodar (2006). It is however likely that if more observations were included, the error terms would be normally distributed and the regression output would be reliable.

Assumption 6: Linearity

The sixth assumption for the linear regression method OLS is of course linearity. This is identified both by studying the plotted regression as well as observing changes in the explanatory degree when substituting the independent variables

with polynomials of themselves one by one to see the implications on the explanatory degree. In addition, Ramsey's RESET test is also run to test the specificity.

Assumption 7. No multicollinearity

The seventh and last assumption is that the variables are not correlated. By studying the correlation matrix, we can exclude one of the variables of the two that are correlated with a value above 0.8, as implicated by Damodar (2006).

2.3.3 Non-parametric regression

Only the reduced regression models for the groups Low Emitters and Low Emitters Plus, and the regression with Folksam's score as an independent variable have significant Jarque-Bera values, indicating that we cannot reject the null-hypothesis about normal distribution. Since the histograms for the above-mentioned regression groups do not present a perfect normal distribution view, and because the other regression groups show no such sign, we unfortunately cannot assume normal distribution. Moreover, after rinsing for outliers, the number of observations included in the regressions is too low to ignore the violation of normality. As normal distribution is a condition for the OLS regression, the Wilcoxon non-parametric test is run for all groups.

2.3.4 Regression input and hypotheses

We form the hypotheses:

H01: A high CLI score has a positive impact on Tobin's Q

H02: A high Folksam score has a positive impact on Tobin's Q

In EViews we thereafter enter the following regression equations:

$$Q1 = c1 + c2 * \ln cli + c3 * sales\_g + c4 * \ln age + c5 * \ln bva + c6 * \ln size + c7 * den + c8 * fin + c9 * nor \quad (2.3)$$

$$Q2 = c1 + c2 * \ln folksam + c3 * sales\_g + c4 * \ln age + c5 * \ln bva + c6 * \ln size \quad (2.4)$$

The hypotheses will be accepted on 10%, 5%, and 1% significance.

2.5 Methodological limitations

There are areas one must consider when reading this study. There are inevitably methodological limitations due to a number of factors. One methodological limitation is the usage of the CDP scoring system, which prevents us from comparing high emitters and low emitters. Since the high emitters answered a second questionnaire, they are able to gain a higher total score than low emitters, which is of course misleading. Other methodological limitations are discussed below.

2.5.1 Internal validity

Internal validity is determined by how much control has been attained in the study. Ryan et al. (2002) discusses that a higher internal validity is achieved when the outcome of the empirical research is decided by changes in the independent variable and not affected largely by other factors. I.e. if the outcome of the regression analysis is affected by other variables than environmental performance in the tested companies, the internal validity will be lower. Examples of such variables could in our case be measurement errors or the risk of choosing inadequate control variables. The tests are performed several times to minimize the measurement errors, and when rinsing for outliers, the outliers are double-checked to ensure that the reason for why they are outliers is not due to measurement errors. The choice of control variables is supported with previous research that provides evidence for the control variables' influence on Tobin's *Q*.

The internal validity is somewhat set-off by ignoring R&D expenses in the regression. This is, however, out of our control.

2.5.2 External validity

External validity is about interpreting the study accurately, which is discussed by Ryan et al. (2002) He argues that this includes generalizing the results in order to make predictions. A low internal validity will inevitably lead to a low external validity. However, it is impossible to optimize both internal and external validity, which means that you have to prioritize one or another. One problem with this study is that the companies that have been included in the study are not randomly chosen companies. The sample includes only companies that have answered the questionnaire that CDP and Folksam sent out. If there are biases within the accessible group, this will of course affect the study negatively. However, since we have no way of controlling the answers from the participating companies and cannot force the others to answer, we believe this to be the best way. Furthermore, 84 out of 125 companies *did* reply (67%), which is a fairly good response rate.

The exclusion of some companies also affects the external validity. As mentioned above, companies that presented poor information on their websites or in Datastream have been excluded. In addition, when sorting for extreme values both among independent and dependent variables, these companies were excluded from the regressions. However, if we were to include these companies, the consequences would be worse, since the outliers would give a very misleading picture of the data set.

Another problem is the validity of the regression, i.e. determining the future based on the past. A high firm value today does not have to mean that the firm value will be high tomorrow as well and the cross-sectional regression can be misleading. However, by using Tobin's *Q* as an indication of firm value, the value can be expected to be stable in the nearest future. Tobin's *Q* is, as mentioned above, calculated by dividing the market value of a firm's assets with the replacement cost of the assets. The replacement cost of the assets will probably not change too fast and neither will the market value, unless something extreme happens (which we cannot ignore has happened to many companies historically).

Finally, a "data-snooping" bias, as presented by Lo and MacKinlay (1990), can arise since this study is based upon a database that has been used in another study. This is however uncontrollable since we cannot gather primary data ourselves.

2.5.3 Reliability

Except for validity, the study needs to show reliability in both measurements and data sources. Reliable results would, according to Bryman and Bell (2003) be achieved if we were to repeat the study and receive the same results.

The database we use for estimating the control variables and the *Q* variable is primarily Datastream and secondarily companies' financial reports. Datastream is a widely used database that gathers information from the companies' financial reports, i.e. all our data is indirectly or directly gathered from the firms' externally reported financial results. Since the external reports are highly controlled by accountants we can expect this data to be quite accurate, or at least the most accurate data we can access. In addition, the companies we use in this study are all listed companies, which will increase the exercised control from external stakeholders such as accountants, shareholders and exchanges.

The second database we use is the CDP report and its scoring system. The CDP report can be considered reliable and the global CDP report is used in several academic reports, such as Guenster et al. (2006) However, it is important to take into consideration that the responses to the questionnaire that serves as a base for the ranking method might not give an accurate image of a company's environmental performance. All answers are subjective and self-reported, which will violate the reliability. If we could have controlled the reported information through interviews or by redoing the CDP study, the reliability would have increased, but there are no ways this is realistic.

The regressions are performed in the user-friendly EViews and one of the tests for linearity and identification of outliers are conducted in SPSS. Both EViews and

SPSS are commonly used economic tools and can therefore be considered reliable. We do the tests several times to eliminate mistakes and increase the reliability. One issue is that the error terms are not normally distributed as proposed by the OLS method. If the sample is large enough, we can according to Brooks (2005) assume normal inference, but it is questionable if we have enough observations to make such assumptions, in particular in the testing of the high emitters. In line with the *central limit theorem* presented by Westerlund (2005), we can assume normal inference with an increased number of observations. In other words, the statistics for the companies classified as low emitters by CDP and Folksam's climate index, and perhaps even high emitters could be considered normally distributed. Performing a non-parametric regression in addition to the parametric OLS regression also controls for the normality issue.

3. Theoretical framework

This chapter will serve as our theoretical backbone, on which we will base our analysis and conclusion on. We will start by presenting different motives for being environmental conscientious and than exhibit previous studies that are of relevance to our study.

3.1 Corporate Social Responsibility

"*The law does not say that there are to be no cakes or ale, but to be no cakes and ale except such are required for the benefit of the company…charity has no business to sit at boards of directors qua charity. There is, however, a kind of charitable dealing which is in the interest of those who practice it, and to that extent and to that grab (I admit not a very philanthropic grab) charity may sit at the board but for no other purpose*." Lord Bowen (1883)[10]

As mentioned in the first chapter, the debate on CSR and its advantages or disadvantages is highly miscellaneous. Friedman (1970) comes to the conclusion that a firm poses minimum obligations beyond maximizing profits and obeying the law. This is in line with the conclusions of the non-proponents studies as mentioned in chapter one. In addition to the proponents research in the first chapter, Fombrun and Shanley's (1990) study on gaining and retaining high quality staff; Smith and Stodghill's (1994) study on corporate image; and the study by Creyer and Ross (1997) which shows a positive correlation between a costumers intent to purchase goods from the company and the degree of which the perception of that company's ethical behavior exceeds their expectations, are all (in addition to the studies mentioned in the first chapter) examples of how

[10] Lord Bowen (1883) Hutton v West Cork Railway company 23 Chancery Division 654

scholars are still divided in the question regarding the advantage or disadvantage of adopting CSR and incorporating it into the firm's strategy.

A second notion, displaying the doubts of applying a CSR-mindset, is the lack of a clear definition, brought up as a problem by Tyrrell (2006). We will therefore describe the theory of CSR, which is the most commonly accepted definition. It is also the definition of CSR we will use in this thesis.

In 1979, Carroll defined CSR as a construct that "encompasses the economic, legal, ethical and discretionary expectations that society has of organizations at a given point of time". Andreasen (2001) argues that when starting an entity, one is also entering into contact with society, forcing the firm to take society into account when making a decision.

Ten years later, Carroll structured CSR into four kinds of social responsibilities as shown in the pyramid below.

Figure 1. The Pyramid of CSR (Carroll 1991)

At the base of the pyramid we find the fundamental aspects of a firm (its reason for existence): The Economic responsibility, which is to maximize profits and maximize shareholder value, if there are any shareholders.
When maximizing profits the firm will have to acknowledge its legal responsibilities and keep within the framework of the law.
The ethical responsibilities reflect the standards, norms and expectations of the customers, employees, shareholders and the society, but are not codified by law.

The philanthropic responsibility is similar to the ethical responsibility, in the way that both takes into account the standards, norms and morals of the society. The difference is that the philanthropic approach is more voluntary; hence it is not expected in the same way as the ethical responsibilities are. For example sponsoring inner-city kids' football tournaments, giving out scholarships, etc are examples of philanthropy.

The environmental responsibility is incorporated in all 4 parts of the pyramid. There are regulations that need to be uphold in accordance with the law, but companies that are regarded as good citizens (Ethical responsibility) often do more than what is required by law, e.g. recycle, cut down on traveling, use environmental friendly products, etc. More and more, companies are also taking a philanthropic responsibility, working towards becoming CO2 neutral. Regarding the economic responsibility, the company's main objective is to maximize profits. If it is true what other researchers are stating, and what this study will investigate, than taking an environmental responsibility will increase profits, hence maximize profits even further.

3.2 Risk Management

Among the earliest research on risk management, we find Modigliani and Miller's (1961) theories applicable to perfect market conditions without e.g. taxes and transaction fees. In Modigliani and Miller's world, shareholders should therefore be the only ones that should be engaged in risk management and particularly hedging activities, since all risk could be eliminated by using the financial markets.

Many theorists have thereafter tried to prove them wrong, mainly by emphasizing the unlikeliness of a perfect market. Banks (2005) concluded that since the market is not efficient, there is information asymmetry and shareholders do not possess any control over a company's investment decisions, which means that

shareholders cannot exclusively manage their risk. Instead, in order to maximize shareholder value, companies must manage their risks.

Other arguments for the value of risk management is here divided into five sub-areas; the possibility to reduce equity capital, the division of risks into core- and non-core risk, maximization of firm value, tax management, and finally the management of new types of risk.

Since risk has a strong link to cash flow volatility and the higher the volatility, the higher the risk, we can draw the conclusion that risk has an influence on firm value, which we here define as Tobin's *Q*. As 80% of the responding companies to the CDP questionnaire and 82% of the respondents to Folksam's questionnaire consider environmental change as a commercial risk to the company, the risk factor is highly relevant in this study.[11]

3.2.1 Reducing equity capital

Risk management as a method to reduce the regulatory capital requirement is brought up by e.g. Merton (2005). Companies could either choose to keep safe a certain amount of equity capital or it can reduce the regulatory capital requirement by reducing its risk exposure. The amount of equity capital that the firm must put aside in order to back-up its risk is based on the Value at Risk, VaR – not on the size of the company or the WACC. If VaR is low, then the regulatory capital requirement will also be low. As a result, by reducing the firm risk, hence reducing VAR, the firm can free up some of its equity and either pay it back to its shareholders, substituting it with high rated debt, or invest it in something else. Therefore, according to Merton (2005), reducing firm risk is something that all firms should engage in.

Another argument that supports risk management in terms of reduction of equity capital is brought up by Myers and Majluf (1984). Their theory implies that by reducing risk, the more expensive equity capital can be substituted by debt. Equity

[11] CDP Nordic Report 2007; Folksam's climate index 2007

capital has many downsides such as the fact that it is tax bearing, when debt is tax deductible. Moreover, issuing equity capital is expensive due to large transaction costs as well as some lost of control, which is the reason for why issuing new equity capital is the last step in the pecking order.

3.2.2 Core and non-core risk

Merton (2005) separates risk exposure into two types of risk: *core risk* and *non-core risk*. Non-core risk is the type of risk that a company is exposed to that will not cause anything else but damage to the company if the risk is realized. Core risk on the other hand cannot only bring downsides, but also upsides. The idea of separation of value adding and non-value adding risks was first introduced by Stulz (1996). Being able to identify the value adding risks would imply a comparative advantage for firms that successfully do so.

Merton (2005) says in his article that non-core risk is best managed through hedging, i.e. paying a premium for transferring the risk to someone else through derivative contracts or insurance. Due to the advanced derivatives market that we have today, shareholders can expect to be exposed only to value-adding risks, since all other risks can be hedged or insured. Merton (2005) means that it is important to identify core risk at an early stage in order to discriminate the risks that do not provide a chance to earn economic rent and focus on the ones who do. By doing so, managers could save the company a lot of time and money, and create opportunities to gain more money.

An example related to this study is a company that identifies environmental awareness as a risk, seeing added CO2 tax on flight tickets as a possible outcome. If the company then reduces the flight time for its employees by bundling meetings taking place in one of its offices so that they take place on fewer occasions, but more meetings at the time, the company would perhaps not only reduce its flight time, but also make the organization more efficient. The outcome

would be less tickets purchased, reducing travel costs, and a lot of time saved from traveling; time that can be used on something else.

Following the growing environmental awareness, many companies have realized the importance of investing in environmental improvements, which could possibly present a core risk. Opportunities that could bring future stable cash flows are for example the development of processes, products and services that reduce climate change impacts or shape future markets of consumption patterns. Seizing these opportunities could then give the company what Grant (2007) called an "early mover advantage". An early mover advantage in the case of managing environmental risk is something that might not give result yet, but could be an advantage in the near future when environmental awareness has been acknowledged by many more companies and shareholders.

3.2.3 Maximize firm value

According to Banks (2005), since shareholders require higher return the riskier activities the companies are involved in, one of the key corporate goals is maximizing firm value. In other words, emphasize will be on maximizing net cash flows and minimizing volatility and losses. One must however also scale the possible gains of managing the risk and the input costs of doing so. If the costs of managing the climate change risks are higher than the increased corporate value, it can be questionable if it is worth the pain. If the value as defined by Tobin's *Q* does not increase sufficiently, that indicates that the firm's shareholders do not value the investments made in environmental efficiency and the investors will undoubtedly question the investment strategy. Hence, according to this theory, one must minimize the costs of managing risks in order to maximize firm value.

Another argument brought forward by Myers and Majluf (1984) against shareholder vale maximization, for the benefit of firm value maximization is in the circumstances of high default risk. When a firm is close to default, positive net present value projects may be rejected if the firm acts in the interest of the

shareholder – an *underinvestment* problem arises. According to Myers and Majluf (1984), in these circumstances, a well-functioning risk management strategy may have proposed a different investment prospective.

3.2.4 Tax management

Some researches imply that tax management is an argument for active risk management. For instance, Smith and Stulz (1985) meant that if the firm value volatility before tax is decreased, the expected corporate tax will decrease, as long as the costs for risk management do not exceed the tax savings.

Leland (1998) and Ross (1996) found that less volatile cash flows also increases the debt capacity of the firm. Since debt is tax deductible whilst equity is not, a higher leverage will reduce the company's tax rate.

These findings are highly relevant for our study, as lower tax will lead to lower costs and thereby higher firm value. Tax regulations vary worldwide and different accounting regimes have different regulations for cost deductions, but if the costs associated with a company's environmental performance, there is a possibility for tax deduction for such activities. If these activities also improve the operating efficiency, the likeliness for tax deduction will increase.

3.3 Selection of previous research

Although research on the potential relationship between environmental performance and financial performance is not entirely new, most researchers have used stock performance as a proxy for financial performance and few have investigate the potential relationship between environmental performance and firm value, measured as Tobin's Q. To give the reader a better understanding, we will present a small selection of the most relevant research and evidence, starting

with the earlier work when stock performance was used and then present the more recent studies where firm value is being used.

The evidence provided by Shane and Spicer (1985), Hamilton (1995) and Klassen and McLaughlin (1996) implies that there is a link between a company's amount of pollution discharge and its stock performance, though this is mostly asymmetric. Hence, positive news of the pollution figures will not necessarily increase the stock price, whereas negative news is more likely to decrease the stock price.

Portfolio research on the area has generated mixed results. Cohen et al (1997) found no evidence that would advocate for investing in companies that are at the cutting edge of environmental responsibility. However, White (1996) found significant evidence for market-risk adjusted return on "green" portfolios and Guenster's et al (2004) study of the period 1995-2003, suggest that eco-efficient companies together generate anomalously positive equity return compare to their less eco-efficient peers.

The more recent empirical studies of a firm's environmental performance and the linkage to firm value (most commonly measured as Tobin's Q) has, despite of its relatively limited research so far, earned the interest of many scholars as it adds to the debate of the potential benefits of taking an environmental responsibility. Dowell, Hart and Yeung (2000) have provided evidence of a strong correlation between environmental performance and firm value. In the study they look at American multinational companies and their application of environmental standards. The companies are divide into three groups; companies that apply local environmental standards, which are less strict than the U.S. standards; companies that apply U.S. environmental standards international; and companies that apply environmental standards that are more strict than required by U.S. law. The result suggests that companies who apply more strict environmental standards will generate higher firm value. This is in consistence with Konar and Cohen's (2001) study which indicates that companies who dispose less toxic waste and are less likely to face environmental lawsuits, have a higher Q. King and Lenox (2002) adds to these results by presenting evidence for how a proactive waste prevention

have a positive effect on Tobin's Q, whereas "end-of-pipe" pollution treatment does not effect Q.

In a recent study, somewhat similar to ours regarding the choice of Tobin's Q as a measurement of firm value and the usage of Innovestgroup's ranking as a measurement of environmental performance, Guenster et al (2005) comes to the conclusion that there is a positive but potential non-linear relationship between environmental performance (Eco-efficiency) and Tobin's Q. Companies with high eco-efficiency (high environmental performance) did not always show high firm value, but low eco-efficient companies consistently showed significantly low values compared to the high eco-efficient companies.

4. Empirical Findings

This chapter will describe our empirical findings as a result of the regressions as well as a few comments about the response on the CDP questionnaire and the Folksam questionnaire.

4.1 Response data

4.1.1 CDP

The CDP Nordic report's questionnaire had a response rate of 67%. The questionnaire was sent out to the 125 largest Nordic companies (Sweden 52, Denmark 24, Finland 25, and Norway 24), out of which 84 responded. The report does not display whom in the organization that answered the questions. Six per cent provided other information instead, 14% chose not to participate and 12% did not respond. Compared to the CDP FT500 report which covers the FTSE500 companies, the FT500 report had a better response rate in 2007 (77%), but a worse when they initially started in 2002. Among the Nordic companies, the Danish companies had a response rate of 50%, and the other three countries 70%. According to the CDP report, this is likely to be a consequence to that fewer Danish companies are members of the Signatory group.[12]

The highest scoring low emitters were Gunnebo and TeliaSonera, and the highest scoring high emitters were Fortum and Statoil. (For further details, see appendix)

[12] CDP Nordic report 2007

4.1.2 Folksam:

The questionnaire that Folksam sent out is based on the CDP questionnaire, although Folksam ranks the companies a bit differently. 49 out of 70 approached companies responded, which gives a response rate of 70%. Four per cent provided other information, nine per cent declined to participate and 16% did not respond at all.[13]

The highest scoring companies in Folksam's survey are AstraZeneca and SJ. (See appendix)

4.3 Testing the underlying assumptions for the OLS regression

The results from the different tests of the OLS regressions' underlying assumptions are presented below:

Assumption 1: $E(u_t) = 0$

The first assumption does not need to be tested according to Brooks (2003), since we have chosen to include an intercept in the regression. We can therefore assume that the assumption is fulfilled.

Assumption 2: $\text{var}(u_t) = \sigma^2 < \infty$

The second assumption is tested through White's (1980) heteroscedasticity test (no cross-terms). Five of the regressions show significant F probabilities and Chì-squared probabilities (see appendix); Low Emitters Plus (standard regression), High Emitters (standard regression), High Emitters Minus (both the basic regression and the reduced regression model) and finally the Folksam regression (standard regression). These regressions were therefore run again using White's

[13] Folksam's climate index 2007

(1980) heteroscedasticity-consistent standard error estimates to eliminate the effects of heteroscedasticity.

Assumption 3: $\text{cov}(u_i, u_j) = 0, i \neq j$

The Durbin-Watson test indicates that there is no proof for autocorrelation between the variables. (See appendix) This is however expected, since cross-functional regressions seldom show autocorrelation.

Assumption 4: The X-variables variables are non-stochastic

Since the OLS regression makes sure that the independent variables are non-stochastic, this is not tested further.

Assumption 5: $u_t \in N(0, \sigma^2)$

The Jarque-Bera test shows that the residuals are not normally distributed (see appendix).. The Jarque-Bera values are however relatively low and the probability relatively high, which means that we cannot completely reject the null-hypothesis of normal distribution. Though we still need to conduct another set of regressions performed by Wilcoxon's distribution free method.

Assumption 6: Linearity

Changing the independent variables to polynomials of these variables one by one tests the linearity. Since the explanatory degrees do not change largely when including these much higher values, we can assume linearity. Ramsey's RESET test does not show any significance either, which confirms our assumptions that the model should be linear.

Assumption 7. No multicollinearity

Only two of the regressions show multicollinearity between the variables, as identified in the correlation matrices (see appendix). By excluding one of the two correlated variables, the problem is solved. One of them is the Folksam regression, where the *size* variable is excluded due to its correlation with *bva*. The other regression is the one run for High Emitters Minus, where the *Finland*

dummy seems to be correlated with the *cli* parameter and is therefore excluded, and again the *size* variable that is eliminated due to the correlation with *bva*.

4.3 Regression results

The results from the different regressions have come out differently for different groups.

We remind the reader of the formed hypotheses:

H01: A high CLI score has a positive or negative impact on Tobin's Q

H02: A high Folksam score has a positive or negative impact on Tobin's Q

The following sections will in detail describe the outcomes of the regressions.

4.2.1 Low emitters

The table below shows the regression results for the group Low Emitters:

TABLE 1

OLS REGRESSION OUTPUT FOR LOW EMITTERS

Sample(adjusted): 2 40				
Included observations: 27				
Excluded observations: 12 after adjusting endpoints				
	Coefficient	Std. Error	t-Statistic	Prob.
intercept	0.404038	0.658822	0.613273	0.5474
Ln Cli	0.181266	0.091285	1.985717	0.0625
Sales growth	0.850949	0.595362	1.429298	0.1700
Ln age	-0.050199	0.107118	-0.468638	0.6450
Ln bva	-0.192817	0.055703	-3.461518	0.0028
Ln size	0.178788	0.069048	2.589321	0.0185
Denmark	0.377652	0.178025	2.121335	0.0480
Finland	-0.070745	0.141172	-0.501126	0.6224
Norway	-0.003210	0.178047	-0.018030	0.9858
R-squared	0.550379			
Adjusted R-squared	0.350547			

The *cli* score has a coefficient value of 0.181 and shows 10% significance with a probability of 0.0625. H01 can therefore not be rejected. The coefficient value indicates that a 100% higher CLI score will generate an 18% higher firm value. The control variables sales growth and age show no statistical significance, and neither do the dummy variables *Finland* or *Norway*. It seems however that in relation to Swedish companies (which is the reference dummy), being a Danish company does affect the firm value.

The changes in Tobin's *Q* can be explained to 35% by this regression, as is shown by the adjusted R-squared.

The same regression was conducted but this time excluding the non-significant variables:

TABLE 2

OLS REGRESSION OUTPUT FOR LOW EMITTERS – REDUCED MODEL

Sample(adjusted): 2 40				
Included observations: 30				
Excluded observations: 9 after adjusting endpoints				
	Coefficient	Std. Error	t-Statistic	Prob.
Intercept	0.426861	0.557198	0.766085	0.4508
Ln Cli	0.194243	0.078901	2.461866	0.0211
Ln bva	-0.158658	0.040571	-3.910644	0.0006
Ln Size	0.127989	0.048709	2.627609	0.0145
Denmark	0.259929	0.136255	1.907660	0.0680
R-squared	0.490261			
Adjusted R-squared	0.408703			

A coefficient value of 0.194 for the CLI variable is shown, which is a little bit higher than the original regression output. The p-value is lower, 0.0211, and H0 can be accepted with 5% significance. In other words, a 100% positive change in a firm's CLI score will increase the firm value with 19%. According to the adjusted R-squared, the regression can explain changes in *Q* by 41%, which is a higher explanatory degree than the original regression.

The next table shows the regression output from low emitters including the low emitters that answered both questionnaires:

TABLE 3

OLS REGRESSION OUTPUT FOR LOW EMITTERS PLUS

Sample(adjusted): 1 45				
Included observations: 30				
Excluded observations: 15 after adjusting endpoints				
White Heteroskedasticity-Consistent Standard Errors & Covariance				
	Coefficient	Std. Error	t-Statistic	Prob.
Intercept	0.206560	0.947065	0.218105	0.8295
Ln Cli	0.330503	0.158218	2.088908	0.0491
Sales growth	0.726754	1.131602	0.642235	0.5277
Ln Age	-0.100693	0.125906	-0.799747	0.4328
Ln Bva	-0.142221	0.074221	-1.916182	0.0691
Ln Size	0.090461	0.083043	1.089334	0.2884
Denmark	0.332415	0.167702	1.982173	0.0607
Finland	0.005019	0.199679	0.025138	0.9802
Norway	0.042704	0.280265	0.152370	0.8803
R-squared	0.323141			
Adjusted R-squared	0.065291			

Since the F-statistic probability and Chì-squared probability both are significant (see appendix), there is heteroscedasticity. We therefore have to run the regression with White's (1980) Heteroskedasticity-Consistent Standard Errors. The *cli* result shows a 5% significance and a coefficient value of 0.331, but the adjusted R-squared is as low as 6.5%, indicating a very small explanatory degree. To test if by excluding the non-significant variables will improve the explanatory degree, the regression is run again:

TABLE 4

OLS REGRESSION OUTPUT FOR LOW EMITTERS – REDUCED MODEL

Sample(adjusted): 1 45				
Included observations: 38				
Excluded observations: 7 after adjusting endpoints				
	Coefficient	Std. Error	t-Statistic	Prob.
intercept	0.611491	0.687392	0.889581	0.3799
Ln Cli	0.302201	0.123957	2.437960	0.0202
Ln Bva	-0.111213	0.044047	-2.524847	0.0164
Denmark	0.257200	0.137111	1.875851	0.0693
R-squared	0.316176			
Adjusted R-squared	0.255839			

The reduced regression model gives a higher explanatory degree of 26% instead of 6.5%. White's heteroscedasticity test also shows that there is no heteroscedasticity and his Heteroskedasticity-Consistent Standard Errors adjustment is not needed. In line with the regression that was run for Low Emitters, this estimation output indicates that *cli*, *bva* and the country dummy for *Denmark* all affect *Q*. However, in this regression, *size* is not a significant variable. A 100% change in CLI score will, according to the coefficient, change the firm value with as much as 30%.

4.2.2 High emitters

The high emitters show a different pattern. The first table displays the results from the regression with High Emitters:

TABLE 5

OLS REGRESSION OUTPUT FOR HIGH EMITTERS

Sample(adjusted): 2 32				
Included observations: 26				
Excluded observations: 5 after adjusting endpoints				
White Heteroskedasticity-Consistent Standard Errors & Covariance				
	Coefficient	Std. Error	t-Statistic	Prob.
Intercept	1.978554	1.502534	1.316812	0.2054
Ln Cli	0.039236	0.246175	0.159383	0.8752
Sales growth	-1.006223	2.211029	-0.455092	0.6548
Ln Age	-0.081150	0.116121	-0.698844	0.4941
Ln Bva	-0.226966	0.128571	-1.765306	0.0955
Ln Size	0.118868	0.162666	0.730750	0.4749
Denmark	0.369124	0.317882	1.161198	0.2616
Finland	-0.144996	0.240324	-0.603336	0.5543
Norway	0.414886	0.213987	1.938841	0.0693
R-squared	0.349070			
Adjusted R-squared	0.042749			

Since the Chì-squared and F-statistic probabilities indicate that there is heteroscedasticity (see appendix), White's (1980) Heteroskedasticity-Consistent Standard Errors are included in this regression. None of the independent variables, except for the *Norway* dummy, seem to show any statistical significance. This is supported by the low adjusted R-squared, which shows that the changes in Tobin's *Q* almost cannot be explained by this regression.

The next table shows the estimation output from High Emitters Minus:

TABLE 6

OLS REGRESSION OUTPUT FOR HIGH EMITTERS MINUS

Sample(adjusted): 2 26				
Included observations: 21				
Excluded observations: 4 after adjusting endpoints				
White Heteroskedasticity-Consistent Standard Errors & Covariance				
	Coefficient	Std. Error	t-Statistic	Prob.
Intercept	0.487880	1.028030	0.474578	0.6436
Ln Cli	0.013929	0.267804	0.052013	0.9594
Sales growth	2.004680	1.846814	1.085480	0.2990
Ln Age	-0.023871	0.065318	-0.365461	0.7211
Ln Bva	-0.154973	0.123633	-1.253492	0.2339
Ln Size	0.150643	0.120761	1.247441	0.2360
Denmark	0.343126	0.420031	0.816908	0.4299
Finland	0.106484	0.220813	0.482237	0.6383
Norway	0.399144	0.136915	2.915270	0.0130
R-squared	0.387609			
Adjusted R-squared	-0.020652			

The explanatory degree is even lower here and shows a negative adjusted R-squared value. It is still only *Norway* dummy that shows significance. Since White's heteroscedasticity test provided significant probabilities (see appendix), the regression is run including White Heteroskedasticity-Consistent Standard Errors. The variables are not autocorrelated, but since some of them indicate multicollinearity, this could be the reason for the negative adjusted R-squared and the regression is run again:

TABLE 7

OLS REGRESSION OUTPUT FOR HIGH EMITTERS MINUS – REDUCED MODEL

Sample(adjusted): 2 26				
Included observations: 21				
Excluded observations: 4 after adjusting endpoints				
White Heteroskedasticity-Consistent Standard Errors & Covariance				
	Coefficient	Std. Error	t-Statistic	Prob.
Intercept	1.202911	0.626187	1.921009	0.0753
Ln Cli	-0.088100	0.174767	-0.504102	0.6220
Sales growth	2.229441	1.689294	1.319748	0.2081
Ln Age	-0.000340	0.070117	-0.004851	0.9962
Ln Bva	-0.050066	0.059706	-0.838540	0.4158
Denmark	0.319047	0.384752	0.829228	0.4209
Norway	0.278052	0.083207	3.341686	0.0048
R-squared	0.358371			
Adjusted R-squared	0.083387			

As displayed in this table, the adjusted R-squared is now above zero, even though the explanatory degree is low. The only significant variables are the *intercept* and the *Norway* dummy. Even in this reduced model, there are indications on heteroscedasticity and White's Heteroskedasticity-Consistent Standard Errors are included.

4.2.3 Folksam's climate index

The next table shows the regression with Folksam's climate index rating as dependent variable:

TABLE 8

OLS REGRESSION OUTPUT FOR THE FOLKSAM REGRESSION

Sample(adjusted): 1 28				
Included observations: 21				
Excluded observations: 7 after adjusting endpoints				
White Heteroskedasticity-Consistent Standard Errors & Covariance				
	Coefficient	Std. Error	t-Statistic	Prob.
Intercept	2.035376	1.591362	1.279015	0.2203
Ln Folksam	-0.085159	0.318161	-0.267660	0.7926
Sales growth	-1.282535	2.410752	-0.532006	0.6025
Ln Age	-0.140967	0.147986	-0.952564	0.3559
Ln Bva	-0.141255	0.130375	-1.083452	0.2957
Ln Size	0.091787	0.169726	0.540798	0.5966
R-squared	0.163994			
Adjusted R-squared	-0.114674			

As the table shows, the Folksam variable shows no support for H02, which must be rejected. None of the variables show significance, something that also can be seen in the low adjusted R-squared, showing a negative explanatory degree of the regressions' effect on *Q*. Since the regression shows heteroscedasticity according to White's test (see appendix), the regression must be run with White Heteroskedasticity-Consistent Standard Errors.

The negative adjusted R-squared might be an effect of the multicollinearity between some of the variables (see appendix). In the following table, the result from a reduced regression model is displayed, where *size* has been excluded.

TABLE 9

OLS REGRESSION OUTPUT FOR THE FOLKSAM REGRESSION

Sample(adjusted): 1 28				
Included observations: 23				
Excluded observations: 5 after adjusting endpoints				
White Heteroskedasticity-Consistent Standard Errors & Covariance				
	Coefficient	Std. Error	t-Statistic	Prob.
Intercept	1.424684	1.196058	1.191149	0.2491
Ln Folksam	0.052285	0.232366	0.225013	0.8245
Sales growth	-0.261785	1.847236	-0.141717	0.8889
Ln Age	-0.073142	0.158235	-0.462238	0.6494
Ln Bva	-0.080500	0.042637	-1.888013	0.0753
R-squared	0.098519			
Adjusted R-squared	-0.101810			

The results are similar and the only significant variable is *bva*. Adjusted R-squared is still negative and the rinsing from multicollinearity apparently did not solve the problem. We can draw the conclusion that none of the variables have any implications on Tobin's *Q*.

The correlation matrix indicated that the variable *Folksam* was correlated to the intercept. Since *Folksam* is the independent variable we wish to examine, that was initially ignored. Thus, the correlation persisted and we finally removed *Folksam*, which solved the autocorrelation issue, but not the issue with the explanatory degree. This could mean two things; either that a change in Folksam's score does not generate any changes in firm value, or that the model is wrongly specified.

4.4 Non-parametric regression

Since none of the regression models "produced" normally distributed error terms, the regressions are run once again, now using Wilcoxon's non-parametric test for multiple regression models. The test results can be found in appendix 3.

The tests partly support our previous findings. For the group Low Emitters, however, the *cli* variable is not significant, in opposite to what the OLS regression points towards. The only significant variables in this regression are the *intercept*, *bva*, size and the country dummy for *Denmark*. Except for the intercept, these are the same significant variables as the OLS regression showed. The Wilcoxon test generates a higher explanatory degree (41%) than the OLS estimator (35%).

As for Low Emitters Plus, the non-parametric test shows significance for the *cli* variable, in line with the OLS regression. The probability is however higher, at 7.5% compared to the OLS probability of 4.9% (2.0% for the reduced regression model). This implies that we cannot reject the null-hypothesis that the cli score affects Tobin's *Q*. The explanatory degree of the regression model is 35%, compared to the parametric regression's explanatory degree of 6.5% (26% for the reduced regression model), which is a much better value. We can therefore conclude that cli has an impact on Tobin's *Q* when it comes to low carbon intensive-sector companies.

The regression outcome for the groups High Emitters, High Emitters Minus and Folksam are still not significant. The explanatory degrees are higher for the non-parametric regression outputs, but sine almost no variable show significance, this is not relevant to develop.

5. Analysis

This chapter will provide an analysing discussion of our results from the regression and lead up to the conclusions exfoliating in chapter 6.

The result is not crystal clear. But it does show something. The regression outputs for companies classified as, and belonging to the groups, Low Emitters and Low Emitters Plus show statistical significance on the 5% level from the OLS regression. Only Low Emitters Plus show statistical significance from the non-parametric regression on the 10% level. This is however enough to provide evidence for a relationship between a company's environmental performance and its firm value, measured as Tobin's *Q*. Concurrently, we could not find a statistical significance for the High Emitters or High Emitters Minus, nor for the Folksam's climate index group.

Naturally, the result is quit puzzling. How come companies classified as Low Emitters and Low Emitters Plus show statistical significance when the High Emitters and High Emitters Minus show absolutely no significance? What are the underlying factors, creating this result?
We will break down the analysis into two parts: the first part will explain why environmental performance among high emitters and Folksam's climate index *do not* affect Tobin's *Q* and the second part will present reasons for why environmental performance among low emitters *do* in fact affect Tobin's *Q* positively.

5.1 Why does environmental performance among high emitters and Folksam's climate index not have an effect on Tobin's *Q*?

The lack of support for the null-hypothesis between the two groups is in agreement with Cohen's et al. (1997) study on portfolio selection, which found no significant support for investing in companies that are high performers environmentally. One possible scenario explaining the dissimilarity in the result is the view on CSR (CSR as defined by Carroll in 1989, which includes and puts a lot of emphasize on environmental responsibility). Investors that are investing in companies with high emission rates might not believe in the alleged advantages created when adopting CSR and integrating it into the overall strategic business objective of the firm. Instead they might be more interested in *maximizing shareholder value*. If this is the case, companies will not gain from adopting CSR, instead they might be punched and disregarded as an investing opportunity, hence they will experience a decreasing *Q* value.

These type of companies are more likely to work reactively due to the lack of incitement to adopt CSR, and apply an "end-of-pipe" solution to their emissions, which will probably not be as beneficial for *Q* as a proactive approach. By using an "end-of-pipe" solution, a company will lose the ability to gain from the opportunities created when applying a proactive approach and the firm will miss out on the possibility to create value. For instance, improved production processes, logistics, product features and efficiency will decrease the company's affect on the environment but also cut costs. Hence the firm will create growth opportunities for its *Q* value and investors will reward them by realizing the growth of *Q*. This reasoning is in line with the research of King and Lenox (2002), proving that "end-of-pipe" solutions will not have an effect on *Q*.

The result can also be explained by looking at the associated risks in the high emitters companies. It is possible that the probability of an environmental catastrophe, being higher for high emitters, and the potential lawsuits and bad

reputations following it will limit the growth opportunity for *Q*, despite the environmental investments a company makes. This hypothesis follows the study of Shane and Spicer (1985), Hamilton (1995) and Klassen and McLaughlin (1996) who found evidence for a relationship between negative news and falling stock prices, and since investors are not only affecting stock prices but also the market value on assets, Q can be expected to follow a similar path.

Another possible reason is related to risk management. As Merton (2005) described, it is mostly financial industry companies that use the risk measure VAR, i.e. companies belonging to the low emitters groups. If, despite investing in risk management, the company does not realize that it can now free up more equity capital and invest it elsewhere, then no such investments will be done and firm value cannot increase – an *underinvestment* problem arises. Moreover, the equity capital is probably not substituted by cheaper debt either, which according to Myers and Majluf (1984) is one of the main reasons for why risk management should be employed in the first place.

The result of the study of the high emitters is however in line with Guenster's et al. (2005) statement that sustainable value only can be created when real changes are made. The questionnaire that the companies in this study answered consists of only two questions out of eleven regarding the actual implementation of environmental thinking into the organization and its strategy; questions that could have minor implications on the result. There is also a chance that a high scorer had low marks on those two questions, but high marks on the other questions, which would boost the result without really affecting the firm value.

Why the group *Folksam* shows no statistical significance could be explained by that the group contains both high emitters and low emitters, and since the high emitters do not show statistical significance, this will naturally affect the results for the group as a whole. In that case, the discussion above will be accountable for the companies belonging to the Folksam group, and then particularly the high emitting companies in Folksam's study, as well. Another possible reason is, as mentioned before, that the regression model is wrongly specified and there is no point discussing the outcome of those regressions.

The previous sections have focused on reasons for why the groups High Emitters, High Emitters Minus and Folksam showed no statistical support for the null-hypothesis. We have yet to try and explain why high emitters' environmental performance would *not* give any effect on Tobin's *Q*, when low emitters' investments do. As Merton (2005) argued, all non-core risks can be hedged or insured. Banks (2005) however clarified that only when the cost of hedging is lower than the benefits, it is worth engaging in risk management. The High Emitters group consists of only high carbon intensive-sector companies; would it really matter if they invested in environmental thinking if that only represents a small part of how much they really discharge? And how much will it cost to make a difference? The High Emitters can hardly ever make climate change risk a core risk, not within the limits of the CDP questionnaire that frames this study. The low emitters can however create such opportunities that could generate excess cash flow in the future.

The results also correspond with the study on eco-efficiency performed by Guenster et al. (2005) that illustrates that low eco-efficient companies always showed significantly low firm values in comparison to high eco-efficient companies.

It is however important to understand that we are just in the starting phase, and that the environmental awareness is a rapidly growing mass-movement. Although we see no correlation between carbon intensive companies' environmental performance and their financial performance as measured by Tobin's *Q*, investments in environmental performance might not pay off until later.

5.2 Why does environmental performance among low emitters have an effect on Tobin's *Q*?

Following the line of reasoning in the previous part, it is obvious that some investors consider incorporating CSR into the overall business objective as crucial, as they believe it will create value and increase Tobin's *Q*. When these investors assess companies and pick stocks, it is likely that they will first look at low emitters because they believe that these companies have already taken an environmental responsibility and incorporated CSR, even though this is not necessarily the case. Hence this group of companies will be valued and given a higher *Q*.

It was also stated in the previous part that carbon intensive-sector companies might be more prone to use a reactive approach to their emission problems instead of a proactive. Consequently, it is possible that low carbon intensive-sector companies more frequently apply a proactive approach, which will create a higher *Q* according to the results of King and Lenox's (2002) study.

Another reason why low emitter's environmental investments will improve their *Q* value is the competitive advantages created by an adoption of CSR and integration into the overall business objective. If we assume that it is true that low emitters, to a higher extent adopt and incorporate CSR into their strategy as the costs are not as high as for high emitters, than we might also assume that it will have a positive affect on their *Q* value, as CSR significantly improve goodwill, open up new market opportunities, help gain and retain key personal and probably increase sales. All of which has been established in the following researcher studies: Porter and van der Linde (1995), Hart and Ahuja (1996), Russo and Fouts (1997), Fombrun et al (2000), Fombrun and Shanley (1999), Smith and Stodghill (1994), and Creyer and Ross (1997).

Furthermore, the research by James Tobin (1969) himself; the gap between market value and replacement value could indeed be "filled" with the intangible asset of this study; the firm's environmental performance. Then Merton's (2005)

suggestion to identify possible upside risks and transfer them into core-risks lead to the identification of climate change as just such a risk. Since it is confirmed that most of the companies in the survey consider climate change as a risk factor, it is probable that this risk will be taken into consideration. If the company could also speculate on that risk, they will most probably try and do so. The cost of managing the environmental risk in a low emitting company is probably much lower than it is for companies who discharge more CO2, which increases the chances of gaining more on managing the risk than it costs. When risk management pays off, it has been very successful – a success that might be seen in a higher *Q* value. In addition, Dowell, Hart and Yeung's (2000) research shows that companies who apply stricter environmental regulations will enjoy a higher Q value, and since low emitters will find it easier to adopt the stricter and more costly regulations, they might be prone to do so, creating a higher *Q*.

6. Conclusion

In this last chapter we will present the conclusions drawn form our study, a policy implication and general criticism. We will also give suggestions on further research within the area.

The purpose of this study was to examine if there is a relationship between a company's environmental performance and the firm value. We conducted several regression analyses, both parametrical and non-parametrical, with the responding Nordic companies divided into four groups: High Emitters, High Emitters Minus, Low Emitters, Low Emitters Plus, and Folksam's study.

Our study gives us two answers: companies categorized as High Emitters, High Emitters Minus and Folksam show no significance that would explain a relationship between environmental performance and firm value. On the other hand, companies categorized as Low Emitters and Low Emitters Plus show, though not consistently, significance that would indicate a relationship between environmental performance and firm value.

So why do we get different results for the different groups?
We believe that high emitters show no significance because of insufficient, or incorrect, investments. The companies are not investing enough to translate climate change into a core risk, i.e. a risk they can gain from. Instead they invest only enough to hedge the risks associated with climate change, i.e. they will not lose but they cannot gain either. The reasons for the insufficient investments are probably based on a combination of tying up capital and not knowing if the investment will translate into a core risk instead of a non-core risk, and perhaps an unawareness of risk management and the concept of translating a non-core risk into a core risk and the benefits associated with the translation. A second reason that could explain the result is the fact that a high emitting company's minimum investment, barely covering the hedge, is so much greater than a low emitter's cost to hedge. If a low emitting company makes the same investment as the high

emitting company, the later will just hedge (i.e. not gain), whereas the first will have invested sufficiently to translate the risk into a non-core risk.

As according to Damodar (2006) the non-parametric test does not provide as strong explanatory degree as parametric tests, we would prioritize the result produced by the OLS regression, which in contrast with the non-parametric result shows significance for a relationship between environmental performance and firm value for the Low Emitters group. However, since we do not fulfill the requirements of the OLS regression, it looses some of its strength and we can therefore not provide uniformed evidence. Even though the non-parametric regression for the group Low Emitters does not support our findings, the extended regression including all Low Emitters (i.e. Low Emitters Plus) does. This might indicate that the central limit theorem has some substance, and that with a growing number of observations we move towards normal distribution and fulfillment of the OLS requirements – in other words, the parametric regression is a valid choice. And the message is clear; investing in environmental sustainability and taking an environmental responsibility will create value, at least if you are a low emitter.

The somewhat weak results are strengthened by a belief in the advantages created when "first mover advantage" is applied and that a more efficient usage of energy will ultimately have an affect on the overall efficiency of the firm, which will have a positive effect on firm value.

We are in the present of change and if one were to wait until everyone else has made a change or until regulations force you to change than you will lose the opportunity to improve your competitive advantages. Or as John Llewellyn puts it: "For firms, climate change, like globalization, technology change and ageing population, is likely to be another powerful force that inexorably shapes the economic environment."[14]

[14] "The business of climate change- challenges and opportunities", John Llewellyn, Lehamn Brothers, February 2007.

6.1 Policy Implications

We recommend both managers and investors to seriously start including environmental performance into their valuation models. Even if they do not necessarily believe in CSR and the associated advantages, they should acknowledge the "first mover advantage" strategy, the possibility of a spillover effect when the organization consumes energy more efficiently and the enormous opportunities created when turning a non-core risk into a core risk. These are all variables that firms are working with, some better than others, and they will most likely, if not certainly, generate firm value, increased cash flows and abnormal returns. Hence both managers and investors should take an interest.

6.3 Suggestions for further research

During the course of writing we have encountered several interesting fields to study, but due to the question and purpose of this thesis we have had to make some choices. The choices will now serve as suggestions for further research:

- Conduct a similar study with stock returns and/or ROA instead of Tobin's Q.
- Conduct a panel data regression to examine how the result changes over time.
- Create your own scoring system to define *environmental performance*.

7. References

Books:

1. Andreasen, A. R. (2001), *Ethics in Social Marketing,* Georgetown: Georgetown University Press.
2. Arnold, G. (2005) *Corporate Financial Management*, 3rd edition, London: Prentice Hall.
3. Brooks, C. (2005) *Introductory econometrics for finance*, Cambridge: Cambridge University Press.
4. Bryman, A., Bell, E. (2005) *Business Research Methods*, Oxford: Oxford University Press.
5. Bhaskar, R (1997) *A Realist Theory of Science*, London: Verso.
6. Bryman, A., Bell, E. (2005) *Företagsekonomiska forskningsmetoder*, Malmö: Liber.
7. Damodar, N. G. (2006) *Essentials of Econometrics*, 3rd edition, Singapore: McGraw-Hill.
8. Friedman, M. (1962) *Capitalism and Freedom*, Chicago: University of Chicago Press.
9. Gore, A., Jr. (2007) *An Inconvenient Truth: The Crisis of Global Warming.* USA: Viking Books.
10. Grant, R. M. (2007) *Contemporary Strategy Analysis: Concepts, Techniques, Applications*, 6th edition, Oxford: Blackwell Publishing.
11. Jacobsen, D. I. (2002) *Var, hur och varför? Om metodval i företagsekonomi och andra samhällsvetenskapliga ämnen*, Lund: Studentlitteratur.
12. Poincare, H. (1905) *Science and Hypothesis*, London and New York: Walter Scott.
13. Ryan, B., Scapens, R. W., Theobald, M. (2002) *Research Method & Methodology in Finance & Accounting*, 2nd edition, London: Thomson.
14. Westerlund, J. (2005) *Introduktion till ekonomi*. Lund: Studentlitteratur.

Articles:

15. Bharadwaj et al. (1999) Information Technology Effects on Firm Performance as Measured by Tobin's q, *Management Science* 45(7): 1008-1024.
16. Campbell, J. (2000) Asset pricing at the millennium, *Journal of Finance* 55: 1515-67.
17. Carroll, A (1991), The pyramid of corporate social responsibility, *Business Horizons,* 34(4): 39-49
18. Chung, K. H., Pruitt, S. (1994) A Simple Approximation of Tobin's q, *Financial Management* 23: 70-74.
19. Creyer, E. H., Ross, W. T., Jr. (1997) Tradeoffs between price and quality: How value index affects preference formation, *The Journal of Consumer Affairs,* 31(2): 280-302
20. Emanuel, K. (2005). Increasing destructiveness of tropical cyclones over the past 30 years. *Nature* 436: 686-688.
21. Fama, E., French, K. (1992) The cross-section of expected stock returns, *Journal of Finance* 46: 1575-617.
22. Fombrun, C., Shanley, M. (1990) What's in a name? Reputation building and corporate strategy, *Academy of Management Journal,* 33(2): 233-259.
23. Fombrun, C. et al. (2000) Opportunity platforms and safety nets: Corporate citizenship and reputation risk, *Business and Society Review,* 105(1) 85-106.
24. Henderson, D. (2002) Misguided virtue: False Notion of Corporate Social Responsibility, *Journal of Financial and Quantitative Analysis,* 36(4): 431-449.
25. Hart, S. L., Ahuja, G. (1996) Does It Pay To Be Green? The empirical examination of the relationship between emission reduction and firm performance, *Business Strategy and the Environment,* 5 30-37.
26. Hirsch, B. T. (1991) Union Coverage and Profitability Among U.S. Firms, *The Review of Economics and Statistics* 73(1): 69-77.
27. Griffin, J. J., Mahon, J. F. (1997) The Corporate Social Performance and Corporate Financial Performance Debate, *Business and Society,* 36(1): 5-31.

28. Guenster, N. et al. (2006) The Economic Value of Corporate Eco-Efficiency, Erasmus University Rotterdam.
29. Kaplan, R. S. (1986) The role of empirical research in management accounting, *Accounting, Organizations and Society* 11(4/5): 429-52.
30. Kaplan, R. S. (1998) Innovation action research: creating new management theory and practice, *Journal of Management Accounting Research* 10: 89-118.
31. Kaplan, S. N., Zingales, L. (1997) Do Investment-Cash Flow Sensitivities Provide Useful Measures of Financing Constrains? *Quarterly Journal of Economics* 112: 169-215.
32. Kothari, S., Shanken, J., Sloan, R. (1995) Another look at the cross section stock returns, *Journal of Finance* 50: 185-224.
33. Lo, A., MacKinlay, C. (1990) Data snooping biases in tests of financial asset pricing models, *Review of Financial Studies*, 3: 431-68.
34. Mann, M. E. et al (1998) Global Scale Temperatures Patters and Climate Forcing over the Past Six Centuries', *Nature*, 392: 779-787.
35. Mann, M. E. et al (1999) Northern Hemisphere Temperatures during the Past Millennium: Inferences, Uncertainties, and Limitations, *Geophysical Research Letters*, 26, pp. 759-762.
36. Merton, R. C. (2005) You have more capital that you think, *Harvard Business Review*: September 2005.
37. Myers, S. C., Majluf, N. S. (1984) Corporate finance and decisions when firms have information that investors do not have, *Journal of Financial Economics*, 13(2): 187-221
38. Perfect, S. B., Wiles, K. W. (1994) Alternative Constructions of Tobin's q: An Empirical Comparison, *Journal of Empirical Finance* 1(3): 313-341.
39. Petit, J. R. et al (1999) Climate and Atmospheric History of the past 420,000 years from the Vostok Ice Core, Antarctica, *Nature*, 399: 429-436.
40. Porter, M. E., van der Linde, C. (1995) Green and Competitive. Ending the Stalemate, *Harvard Business Review*, September- October 120-135.
41. Ross, S. A. (1976) The determination of financial structure – the incentive signaling approach, *Bell Journal of Economics* 8.

42. Russo, M.V., Fouts, P. A. (1997) A resource-based perspective on corporate environmental performance and profitability, *Academy of Management Journal,* 40(3): 534-559.
43. Shaw, J (2006) Fueling our Future, *Harvard Magazine,* (May-June 2006) 40-48.
44. Smith, G., Stodghill, R. (1994) Are good causes good marketing?, *Business Week,* 64-66.
45. Stulz, R., (1996), Rethinking risk management, *Journal of Applied Corporate Finance,* 9: 8-24
46. Tobin, J. (1969) A General Equilibrium Approach To Monetary Theory, *Journal of Money, Credit and Banking,* 1(1) 15-29.
47. Turban and Greening's (1996) Corporate social responsibility and organizational attractiveness to prospective employees, *Academy of Management Journal,* 40(3): 658-672.
48. Tyrrell, A. (2006) Corporate social responsibility: What's your view?, *Accountancy Ireland,* 38(1): 44-45
49. Vandermerwe, S., Oliff, M. D. (1996) Customers drive corporations green, *Long range planning,* 23(6): 3-9.
50. Walley, N., Whitehead, B. (1994) It's not easy being green, *Harvard Business Review*, May-June 46-52.
51. White, H. (1980) Nonlinear regression on cross-section data, *Econometrica*, 48(3): 721-746

Newspaper articles and other publications:

1. *Carbon Disclosure Project*, Report 2007, Global Fortune500.
2. *Folksam's Climate Index*, 2007
3. PriceWaterhouseCooper's *Global Automotive Financial Review-An overview of industry data, trends and financial reporting practices*, 2007 edition.
4. Washington Post, "*Debate on Climate Shifts to Issue of Irreparable Change,"* Juliet Eilperin, January 29, 2006, Page A1.

5. Lord Bowen (1883) Hutton v West Cork Railway Company 23 Chancery Division 654. See for example 41 Canadian Business Law Journal 212 (2005)
6. Intergovernmental Panel on Climate Change's (IPCC) research from 2001

Internet sources:

1. http://www.worldwatch.org/node/4529
2. https://www.cia.gov/library/publications/the-world-factbook/geos/ch.html#Econ
3. http://www.nottingham.ac.uk/china-policy-institute/events/documents/Shujie_YAo_Inaugural_Lecture_Press_Release.pdf
4. http://www.worldbusinesslive.com/article/609473/world-bank-predicts-rise-global-middle-class/

8. Appendix

Appendix 1. Ratings and rankings

TABLE 10

LOW EMITTERS

Company	Country	Parent sector industry	CLI score	CLI ranking
Gunnebo	Sweden	Industrial Products and Services	86	1
Teliasonera	Sweden	Telecommunications	86	1
Ericsson	Sweden	Telecommunications	82	3
Nokia Group	Finland	Telecommunications	82	3
Cloetta Fazer A/S	Sweden	Retail	73	5
Kesko Corporation	Finland	Retail	73	5
Coloplast A/S	Denmark	Healthcare	68	7
Getinge	Sweden	Healthcare	68	7
Nobia	Sweden	Retail	68	7
Telenor ASA	Norway	Telecommunications	68	7
Metso	Finland	Paper & Forest Products	64	11
Lundbeck A/S	Denmark	Pharmaceuticals & Biotechnology	59	12
SanomaWSOY Corporation	Finland	Other Services	59	12
TOMRA Systems	Norway	Other Services	59	12
Codan A/S	Denmark	Finance & Insurance	55	15
Danske Bank	Denmark	Finance & Insurance	55	15
Marine Harvest Group	Norway	Retail	50	17
NCC	Sweden	Construction, Engineering & Machinery	50	17
Skandinaviska Enskilda Banken	Sweden	Finance & Insurance	50	17
Stockmann Group	Finland	Retail	50	17
Atlas Copco	Sweden	Industrial Products and Services	45	21
Castellum	Sweden	Real Estate Management & Development	45	21
Copenhagen Airports	Denmark	Airlines and Airports	45	21
Alfa Laval	Sweden	Industrial Products and Services	41	24
Hennes & Mauritz	Sweden	Retail	41	24

Hufvudstaden	Sweden	Real Estate Management & Development	41	24
StoreBrand	Norway	Finance & Insurance	36	27
TietoEnator	Finland	Electronics & IT	36	27
DnB Nor	Norway	Finance & Insurance	32	29
OP Bank Group	Finland	Finance & Insurance	32	29
Oriflame Cosmetics	Sweden	Retail	32	29
REC Group	Norway	Energy	32	29
Svenska Handelsbanken	Sweden	Other Services	32	29
Swedbank	Sweden	Finance & Insurance	32	29
Electrolux	Sweden	Finance & Insurance	27	35
Tandberg Television	Norway	Construction, Engineering & Machinery	27	35
Ratos	Sweden	Telecommunications	23	37
TrygVesta	Denmark	Industrial Products and Services	23	37
KCI Konecranes	Finland	Construction, Engineering & Machinery	18	39
Eniro	Sweden	Telecommunications	14	40
Aker	Norway	Industrial Products and Services	9	41
Skanska	Sweden	Construction, Engineering & Machinery	9	41
Hexagon	Sweden	Industrial Products and Services	5	43
Tandberg	Norway	Telecommunications	5	43
Industrivärden	Sweden	Finance & Insurance	0	45
Schibsted	Norway	Other Services	0	45
Tele2	Sweden	Telecommunications	0	45

TABLE 11

HIGH EMITTERS

Company	Country	Parent sector industry	CLI score	CLI ranking
Statoil	Norway	Energy	94	2
Norsk Hydro	Norway	Energy	84	3
Stora Enso	Sweden	Paper & Forest Products	82	4
Holmen	Sweden	Paper & Forest Products	75	5
SAAB	Sweden	Industrial Products and Services	75	5
Trelleborg AB	Sweden	Industrial Products and Services	75	5
Novozymes A/S*	Denmark	Pharmaceuticals & Biotechnology	72	8

Outokumpu Oyj	Finland	Metals and Mining	72	10
Neste Oil Oyj	Finland	Energy	69	10
SKF	Sweden	Industrial Products and Services	69	12
Novo Nordisk	Denmark	Pharmaceuticals & Biotechnology	66	13
Scania	Sweden	Construction, Engineering & Machinery	63	13
Volvo	Sweden	Construction, Engineering & Machinery	63	15
Fabege*	Sweden	Real Estate Management & Development	59	15
Investment AB Kinnevik*	Sweden	Finance & Insurance	59	15
Swedish Match*	Sweden	Retail	59	18
Huhtamäki Oyj*	Finland	Retail	56	18
M-real Corporation	Finland	Paper & Forest Products	56	18
SCA	Sweden	Paper & Forest Products	56	18
Carlsberg A/S	Denmark	Retail	53	21
Boliden Broup	Sweden	Metals and Mining	50	22
Teekay Petrojarl	Norway	Energy	50	22
Vestas Wind Systems A/S	Denmark	Energy	50	22
Yara International ASA	Norway	Industrial Products and Services	50	22
Orion Group*	Finland	Pharmaceuticals & Biotechnology	44	26
Assa Abloy	Sweden	Industrial Products and Services	41	27
Sandvik	Sweden	Metals and Mining	41	27
Danisco A/C*	Denmark	Retail	34	29
Finnair	Finland	Airlines and Airports	34	29
SAS	Sweden	Airlines and Airports	34	29
UPM-Kymmene Corporation	Finland	Paper & Forest Products	31	32
Wärtsilä Corporation	Finland	Industrial Products and Services	28	33
Petrolium Geo-Services ASA	Norway	Energy	25	34
Prosafe ASA	Norway	Energy	22	35
TDC A/S*	Denmark	Telecommunications	19	36
Kemira Corporation	Finland	Industrial Products and Services	16	37

TABLE 12

LOW EMITTERS THAT ANSWERED BOTH QUESTIONNAIRES

Company	Country	Parent sector industry	CLI score
Danisco A/C	Denmark	Retail	36
Fabege	Sweden	Real Estate Management & Development	77
Huhtamäki Oyj	Finland	Retail	50
Investment AB Kinnevik	Sweden	Finance & Insurance	45
Novozymes A/S	Denmark	Pharmaceuticals & Biotechnology	68
Orion Group	Finland	Pharmaceuticals & Biotechnology	50
Swedish Match	Sweden	Retail	73
TDC A/S	Denmark	Telecommunications	23

TABLE 13

FOLKSAM'S CLIMATE INDEX

Company	Parent sector industry	Folksam score	Folksam ranking
Astra Zeneka	*Pharmaceuticals & Biotechnology*	*91*	*1*
SJ AB	*Yttransport*	*91*	*1*
Scandic Hotels	*Hotel & Turism*	*86*	*3*
Gunnebo	Industrial Products and Services	86	3
Haldex	*Industrial Products and Services*	*86*	*3*
SAAB	Industrial Products and Services	86	3
TeliaSonera	Telecommunications	86	3
Wihlborgs fastigheter	*Real Estate Management & Development*	*77*	*10*
SKF	Industrial Products and Services	73	11
Trelleborg AB	Industrial Products and Services	73	11
Stora Enso	Paper & Forest Products	73	11
Cloetta Fazer AB	Retail	73	11
Swedish Match	Retail	73	11
Scania	Construction, Engineering & Machinery	68	16
Getinge	Healthcare	68	16
Holmen	Paper & Forest Products	68	16
Nobia	Retail	68	16

ICA Sverige	*Retail*	*64*	*20*
TetraPak	*Retail*	*60*	*21*
Sveaskog	*Paper & Forest Products*	*59*	*22*
Volvo	Construction, Engineering & Machinery	55	23
Boliden Group	Metals and Mining	55	23
SCA	Paper & Forest Products	55	23
COOP	*Retail*	*55*	*23*
NCC	Construction, Engineering & Machinery	50	27
Skandinaviska Enskilda Banken	Finance & Insurance	50	27
Sandvik	Metals and Mining	50	27
ABB	*Construction, Engineering & Machinery*	*45*	*30*
Autoliv	*Construction, Engineering & Machinery*	*45*	*30*
Investment AB Kinnevik	Finance & Insurance	45	30
Assa Abloy	Industrial Products and Services	45	30
Atlas Copco	Industrial Products and Services	45	30
Castellum	Real Estate Management & Development	45	30
Alfa Laval	Industrial Products and Services	41	36
Hufvudstaden	Real Estate Management & Development	41	36
Hennes & Mauritz	Retail	41	36
Swedbank	Finance & Insurance	32	39
Oriflame Cosmetics AB	Retail	32	39
SAS	Airlines and Airports	27	42
Electrolux	Retail	27	42
Ratos AB	Finance & Insurance	23	44
Eniro AB	Telecommunications	14	45
Skanska AB	Construction, Engineering & Machinery	9	46
Hexagon	Industrial Products and Services	5	47
Industrivärden	Finance & Insurance	0	48
Tele2 AB	Telecommunications	0	48

Appendix 2. Correlation matrices

TABLE 14

CORRELATION MATRIX FOR LOW EMITTERS

	intercept	cli	sales growth	age	bva	Size	*Denmark*	*Finland*	*Norway*
Intercept	1,000	-0,501	-0,189	-0,222	-0,062	-0,552	-0,169	0,043	-0,172
Cli	-0,501	1,000	0,014	-0,149	-0,036	0,077	-0,097	-0,039	0,120
sales growth	-0,189	0,014	1,000	-0,030	-0,545	0,593	0,159	-0,301	-0,231
Age	-0,222	-0,149	-0,030	1,000	-0,228	0,072	-0,126	-0,171	0,097
Bva	-0,062	-0,036	-0,545	-0,228	1,000	-0,653	-0,115	0,180	-0,044
Size	-0,552	0,077	0,593	0,072	-0,653	1,000	0,297	-0,162	0,061
Denmark	-0,169	-0,097	0,159	-0,126	-0,115	0,297	1,000	0,284	0,224
Finland	0,043	-0,039	-0,301	-0,171	0,180	-0,162	0,284	1,000	0,347
Norway	-0,172	0,120	-0,231	0,097	-0,044	0,061	0,224	0,347	1,000

TABLE 15

CORRELATION MATRIX FOR LOW EMITTERS – REDUCED MODEL

	intercept	Cli	Bva	size	*Denmark*
Intercept	1,000	-0,541	-0,377	-0,505	-0,178
Cli	-0,541	1,000	-0,024	0,039	-0,062
Bva	-0,377	-0,024	1,000	-0,450	-0,089
Size	-0,505	0,039	-0,450	1,000	0,292
Denmark	-0,178	-0,062	-0,089	0,292	1,000

TABLE 16

CORRELATION MATRIX FOR LOW EMITTERS PLUS

	intercept	cli	sales growth	Age	Bva	size	*Denmark*	*Finland*	*Norway*
Intercept	1,000	-0,760	0,114	-0,344	-0,050	-0,418	-0,182	-0,022	-0,051
Cli	-0,760	1,000	-0,246	0,009	-0,175	0,326	0,135	-0,021	0,042
sales growth	0,114	-0,246	1,000	0,021	0,374	-0,409	-0,293	0,198	-0,683
Age	-0,344	0,009	0,021	1,000	-0,119	0,134	-0,316	-0,409	-0,091
Bva	-0,050	-0,175	0,374	-0,119	1,000	-0,779	-0,117	0,417	-0,220
Size	-0,418	0,326	-0,409	0,134	-0,779	1,000	0,283	-0,312	0,282
Denmark	-0,182	0,135	-0,293	-0,316	-0,117	0,283	1,000	0,441	0,500
Finland	-0,022	-0,021	0,198	-0,409	0,417	-0,312	0,441	1,000	0,137
Norway	-0,051	0,042	-0,683	-0,091	-0,220	0,282	0,500	0,137	1,000

TABLE 17

CORRELATION MATRIX FOR LOW EMITTERS PLUS – REDUCED MODEL

	Intercept	cli	bva	*Denmark*
Intercept	1,000	-0,746	-0,707	-0,123
Cli	-0,746	1,000	0,065	0,114
Bva	-0,707	0,065	1,000	0,002
Denmark	-0,123	0,114	0,002	1,000

TABLE 18

CORRELATION MATRIX FOR HIGH EMITTERS

	intercept	cli	sales growth	age	bva	size	*Denmark*	*Finland*	*Norway*
Intercept	1,000	-0,711	-0,385	0,003	0,068	-0,464	-0,557	-0,782	-0,024
Cli	-0,711	1,000	0,294	-0,008	-0,271	0,219	0,282	0,613	-0,036
sales growth	-0,385	0,294	1,000	-0,100	0,140	-0,055	0,156	0,563	-0,359
Age	0,003	-0,008	-0,100	1,000	0,025	-0,194	-0,031	-0,268	0,061
Bva	0,068	-0,271	0,140	0,025	1,000	-0,783	0,078	-0,041	-0,656
Size	-0,464	0,219	-0,055	-0,194	-0,783	1,000	0,233	0,325	0,624
Denmark	-0,557	0,282	0,156	-0,031	0,078	0,233	1,000	0,436	0,089
Finland	-0,782	0,613	0,563	-0,268	-0,041	0,325	0,436	1,000	0,006
Norway	-0,024	-0,036	-0,359	0,061	-0,656	0,624	0,089	0,006	1,000

TABLE 19

CORRELATION MATRIX FOR HIGH EMITTERS MINUS

	intercept	cli	sales growth	age	bva	size	*Denmark*	*Finland*	*Norway*
Intercept	1,000	**-0,852**	-0,069	0,164	0,175	-0,266	-0,077	-0,750	0,032
Cli	**-0,852**	1,000	0,032	-0,122	-0,410	0,276	0,060	**0,806**	0,086
sales growth	-0,069	0,032	1,000	-0,057	-0,034	-0,067	-0,035	0,180	-0,172
Age	0,164	-0,122	-0,057	1,000	-0,062	-0,094	-0,129	-0,172	0,068
Bva	0,175	-0,410	-0,034	-0,062	1,000	**-0,889**	0,051	-0,251	-0,743
Size	-0,266	0,276	-0,067	-0,094	**-0,889**	1,000	-0,033	0,166	0,727
Denmark	-0,077	0,060	-0,035	-0,129	0,051	-0,033	1,000	0,077	0,016
Finland	-0,750	**0,806**	0,180	-0,172	-0,251	0,166	0,077	1,000	0,035
Norway	0,032	0,086	-0,172	0,068	-0,743	0,727	0,016	0,035	1,000

TABLE 20

CORRELATION MATRIX FOR HIGH EMITTERS MINUS– REDUCED MODEL

	intercept	cli	sales growth	age	bva	*Denmark*	*Norway*
Intercept	1,000	-0,598	0,154	-0,062	-0,299	-0,037	0,229
Cli	-0,598	1,000	-0,232	0,271	-0,528	-0,045	-0,053
sales growth	0,154	-0,232	1,000	-0,023	-0,117	-0,064	-0,167
Age	-0,062	0,271	-0,023	1,000	-0,503	-0,175	0,157
Bva	-0,299	-0,528	-0,117	-0,503	1,000	0,131	-0,215
Denmark	-0,037	-0,045	-0,064	-0,175	0,131	1,000	0,069
Norway	0,229	-0,053	-0,167	0,157	-0,215	0,069	1,000

TABLE 21

CORRELATION MATRIX FOR THE FOLKSAM REGRESSION

	intercept	folksam	sales growth	age	bva	size
Intercept	1,000	**-0,898**	-0,395	-0,410	0,270	-0,311
Folksam	**-0,898**	1,000	0,287	0,297	-0,239	0,153
sales growth	-0,395	0,287	1,000	0,533	0,074	-0,168
Age	-0,410	0,297	0,533	1,000	0,025	-0,157
Bva	0,270	-0,239	0,074	0,025	1,000	**-0,922**
Size	-0,311	0,153	-0,168	-0,157	**-0,922**	1,000

TABLE 22

CORRELATION MATRIX FOR THE FOLKSAM REGRESSION – REDUCED MODEL

	intercept	Folksam	sales growth	age	bva
Intercept	1,000	**-0,883**	0,022	-0,631	-0,141
Folksam	**-0,883**	1,000	-0,098	0,406	-0,159
sales growth	0,022	-0,098	1,000	0,336	-0,454
Age	-0,631	0,406	0,336	1,000	-0,224
Bva	-0,141	-0,159	-0,454	-0,224	1,000

Appendix 3. Non-parametric regression outputs

TABLE 23

NON-PARAMETRIC REGRESSION OUTPUT FOR LOW EMITTERS

	Wilcoxon R **R-squared = 0,410**			
	Estimate	**SE**	**t-ratio**	**p-values**
Intercept	1,248	0,476	2,622	0,012
cli	0,049	0,063	0,769	0,446
Sales growth	0,727	0,473	1,536	0,131
age	0,020	0,082	0,239	0,812
bva	-0,207	0,044	-4,712	0,000
size	0,131	0,055	2,384	0,021
Denmark	0,410	0,140	2,924	0,005
Finland	-0,057	0,113	-0,505	0,616
Norwy	0,108	0,139	0,777	0,441

TABLE 24

NON-PARAMETRIC REGRESSION OUTPUT FOR LOW EMITTERS PLUS

	Wilcoxon R **R-squared = 0,345**			
	Estimate	**SE**	**t-ratio**	**p-values**
Intercept	0,422	0,954	0,442	0,663
cli	0,313	0,167	1,872	0,075
Sales growth	0,792	1,001	0,792	0,437
age	-0,131	0,151	-0,868	0,395
bva	-0,148	0,073	-2,027	0,056
size	0,096	0,071	1,360	0,188
Denmark	0,328	0,175	1,871	0,075
Finland	-0,032	0,191	-0,168	0,868
Norwy	0,036	0,324	0,111	0,912

TABLE 25

NON-PARAMETRIC REGRESSION OUTPUT FOR HIGH EMITTERS

	Wilcoxon R **R-squared = 0,305**			
	Estimate	**SE**	**t-ratio**	**p-values**
Intercept	1,101	1,206	0,913	0,373
cli	0,117	0,183	0,637	0,532
Sales growth	-0,721	1,556	-0,463	0,648
age	-0,062	0,160	-0,389	0,701
bva	-0,240	0,122	-1,963	0,064
size	0,173	0,103	1,669	0,111
Denmark	0,288	0,207	1,391	0,180
Finland	-0,029	0,211	-0,135	0,894

Norwy	0,443	0,279	1,585	0,129

TABLE 26

NON-PARAMETRIC REGRESSION OUTPUT FOR HIGH EMITTERS MINUS

	Wilcoxon R **R-squared = 0,371**			
	Estimate	**SE**	**t-ratio**	**p-values**
Intercept	0,507	1,726	0,294	0,774
cli	-0,027	0,300	-0,092	0,929
Sales growth	1,556	1,820	0,855	0,409
age	0,004	0,173	0,026	0,980
bva	-0,153	0,185	-0,824	0,426
size	0,153	0,217	0,703	0,495
Denmark	0,331	0,279	1,188	0,258
Finland	0,059	0,275	0,214	0,834
Norwy	0,465	0,318	1,463	0,169

TABLE 27

NON-PARAMETRIC REGRESSION OUTPUT FOR THE FOLKSAM STUDY

	Wilcoxon R **R-squared = 0,115**			
	Estimate	**SE**	**t-ratio**	**p-values**
Intercept	2,118	2,227	0,951	0,357
folksam	-0,099	0,417	-0,237	0,816
Sales growth	-0,942	2,447	-0,385	0,706
age	-0,172	0,263	-0,655	0,523
bva	-0,143	0,144	-0,998	0,334
size	0,097	0,137	0,708	0,490

Appendix 4. OLS Regression Outputs

TABLE 28

OLS REGRESSION OUTPUTS

	Low Emitters	Low Emitters – reduced	Low Emitters Plus	Low Emitters Plus reduced	High Emitters	High Emitters Minus	High Emitters Minus reduced	Folksam	Folksam reduced
R-squared	0.550379	0.490261	0.323141	0.316176	0.349070	0.387609	0.358371	0.163994	0.098519
Adjusted R-squared	0.350547	0.408703	0.065291	0.255839	0.042749	-0.020652	0.083387	-0.114674	-0.101810
Durbin-Watson stat	1.842783	2.073466	2.199790	2.005419	2.193213	1.733230	1.539069	2.261149	2.891752
Prob(F-statistic)	0.933899	0.578279	0.056737	0.653519	0.010831	0.004986	0.009804	0.013321	0.081292
Prob(Chì-squared)	0.843207	0.513134	0.105810	0.612689	0.070114	0.103171	0.065452	0.070826	0.108679
Jarque-Bera	0.443487	0.006502	0.269076	0.051338	0.702617	0.812141	1.032478	0.581380	0.036098
Jarque-Bera prob	0.801121	0.996754	0.874120	0.974658	0.703767	0.666263	0.595761	0.747747	0.982113