Lund University

School of Economics and Management

Department of Business Administration

Master's thesis

ESG performance and corporate financial performance
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An empirical study of the US technology sector

BUSN89 – Degree project in Corporate and Financial Management

Spring 2014

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Abstract

Title:	ESG performance and corporate financial performance: an empirical study of the US technology sector
Submission date:	26 May 2014
Course:	BUSN89 – Degree Project in Corporate and Financial Management
Authors:	Nina Breuer Cyrielle Nau
Advisor:	Susanne Arvidsson
Key words:	ESG, corporate social responsibility, corporate governance, corporate financial performance, technology sector
Purpose:	The purpose of this research is to investigate the link between ESG performance and corporate financial performance, both from a management and a market perspective, for the technology industry in the US. Focusing on one industry leads to more conclusive results than previous research conducted across-industry. The approach used also helps to give a broad picture of the relationship between the overall ESG performance and corporate financial performance.
Methodology:	Quantitative approach using panel data method
Literature review:	This study is based on theories of corporate governance and corporate social responsibility, as well as on previous findings about their relationship with corporate financial performance.
Empirical framework:	The quantitative study is based on a sample of a 100 listed US companies belonging to the technology sector, over the period from 2009 to 2012.
Findings:	We find that overall ESG performance is positively associated with corporate financial performance, which is in line with previous research. We show that the results have different implications according to the perspective considered (market or accounting perspective). Moreover, results outline that not all three ESG pillars are significantly linked with corporate financial performance.

Acknowledgements

First, we would like to thank our supervisor, Susanne Arvidsson, for her precious help and input to our thesis. Moreover, we would like to thank all our friends who have given us valuable feedbacks and who have helped us.

TABLE OF CONTENTS

List of exhibits

List of appendices

List of abbreviations

CFP: corporate financial performance

CSP: corporate social performance

E-score: environmental score

ESG: environmental, social, and governance

G-score: governance score

KLD: Kinder, Lydenberg and Domini

OLS: ordinary least squares

Q: Tobin's q

ROA: return on assets

S-score: social score

SRI: socially responsible investment

1. Introduction

Environmental, social, and governance (ESG) issues are a growing concern for investors, who are more drawn towards socially responsible investments (SRI) and believe in the intrinsic value of such criteria (Global Investor, 2013). Not only have concerns about environmental and social issues, such as global warming and child labour, grown among the public over the last decades, but scandals such as in Enron or WorldCom have highlighted the importance of strong governance.

The Forum for Sustainable and Responsible Investment underlines this trend in its annually published SRI report for the US market. In 2012, $3.74 trillion assets were SRIs compared to $2.71 trillion in 2010, thus an increase of 38%. Hereby, the market for SRI is growing at a higher rate than the general volume of invested assets under professional management. From the $3.74 trillion investments following SRI strategies, $3.31 trillion are invested by taking into account environmental, social and governance data for the investment decision (US SIF Foundation, 2012). These developments show how ESG indicators are increasingly taken into consideration by investors.

Companies are aware of this evolution and are strengthening their efforts to provide investors with extra-financial data. ESG indicators are created to capture additional dimensions of corporate performance, which are not reflected in accounting data (Bassen & Kovacs, 2008). Thus, this kind of information is getting gradually more included into corporate communication (Arvidsson, 2010; Ihlen, 2008). *"The concept of ESG issues refers to extra-financial material information about the challenges and performance of a company on these matters. It thus delivers additional relevant information, allowing more differentiated investment judgements by enabling investors to better assess risks and opportunities"* (Bassen & Kovacs, 2008, p.184). Not only have ESG indicators become key indicators for the non-financial firm performance, but they are also commonly used to assess competencies of a company's management as well as to support risk management (Galbreath, 2013).

In the same manner, stock markets seem to grant more and more importance to ESG data, being seen as a support to SRI decisions. For example, in 2013 the New York Stock Exchange Euronext launched several ESG indices to be used as a benchmark for fund managers and companies, as the demand for responsible investments keeps on growing

(NYSE Euronext, 2013). Not only has it become more common in the United States, but it is also an observable worldwide trend.

This paper aims to complement previous research done in the field of linking environmental, social, and governance performance to corporate financial performance (CFP). The prevailing questions are if socially responsible companies are destroying or creating value and how their operating performance is affected. Although there is much existing literature on firm's financial performance in relation to socially responsible aspects (Margolis & Walsh, 2003; Orlitzky, Schmidt & Rynes, 2003; Viviers & Eccles, 2011), we still find that existing studies lack the following points.

First, a lot of previous research is done in the form of event-studies. Events, such as corporate social responsibility (CSR) announcements, newspaper articles releases, and environmental performance awards are investigated. The market reaction to such events is tested by analysing stock market performance, but these studies do not consider the influence on performance in the long run (Arya & Zhang, 2009; Flammer, 2013; Klassen & McLaughlin, 1996; Robinson, Kleffner & Bertels, 2011).

Second, many studies focus on the performance of SRI indices and SRI funds in comparison to conventional indices (Derwall, 2007; Renneboog, Horst & Zhang, 2008b; Robinson, Kleffner & Bertels, 2011; Schröder, 2007). When investigating stock market returns of SRI funds/indices, a common shortcoming is the lack of clarity about which, how many, and to what extent the three different ESG aspects are considered for the composition of the funds/indices (Derwall, 2007).

Third, we find that there are limited studies taking into account all the dimensions of ESG, thus, not giving a broad picture of the overall ESG score's impact (Galbreath, 2013). There are many studies focusing only on CSR aspects (including social and environmental aspects), and often neglecting the governance factor. As an illustration, previous studies commonly use the Kinder, Lydenberg and Domini (KLD) database to assess corporate social performance (Derwall, 2007; Manescu, 2011, McWilliams & Siegel, 2001), but KLD indicators can be criticised as they barely capture corporate governance issues (Galbreath, 2013). Other common independent variables are eco-efficiency scores, participation in corporate environmental standards, corporate governance provisions, compliance with the Global

Reporting Initiative, etc. (Derwall, 2007; Dowell, Hart & Yeung, 2000; Gompers, Ishii & Metrick, 2003; Nuryaman, 2013).

Fourth, some researchers claim that there is a lack of studies focusing on one specific industry (Barnett, 2007; Soana, 2011). Scholars highlight the fact that strategies and the influence of environmental, social, and governance aspects vary across industries and are difficult to compare (Bauer et al., 2008; Bertoletti, 2010; Johnson, Moorman & Sorescu, 2009; McWilliams & Siegel, 2000; Moura-Leite, Padgett & Galan, 2012).

To complement previous research done, this study addresses questions on how the overall ESG performance is related to CFP. ESG indicators allow to capture and measure the extra-financial performance in all three dimensions of ESG issues (Bassen & Kovacs, 2008). Thus, we investigate if firms which are putting effort into having high ESG indicators are performing better financially. Contrary to previous studies in this field, this paper takes all three aspects (environmental, social, and governance), equally weighted, into consideration. Thereby, financial performance is analysed on the one hand through operating performance and on the other hand through firm value in order to study both accounting-based and market-based measures. Thus, we are able to give a management as well as a market perspective on the topic. In the second step, we are interested in testing if each pillar of the ESG concept is equally important concerning its impact on financial performance.

The study is conducted on the US technology sector between the years 2009 and 2012. This allows to study the performance over time and to highlight the post crisis period. The financial crisis has deeply affected corporate performance and emphasises the importance of long-term value creation, to which ESG performance could represent a decisive value driver (KPMG, 2011; Porter & Kramer, 2011).

Due to the lack of industry studies, we specifically decide to focus on the technology sector, which is of particular interest looking at current ESG issues surrounding the industry, e.g. social issues with child labour, environmental issues with product life-cycle problems, and even corporate governance scandals with polemic around CEO remuneration and the non-respect of shareholders rights (MacLeans, 2013). Previous research highlights the relevance of country level studies because differences in culture and regulations affect CSR intensity (Doh & Guay, 2006), and because they create a less noisy and more homogenous dataset (Orlitzky, Schmidt & Rynes, 2003). Considering these factors and data availability, we

choose the US market which leaves us with the broadest sample for the empirical research. Moreover, the US is of particular interest as SRI and ESG issues are a rising concern due to the past corporate scandals, the recent financial crisis and the high degree of environmental pollution (Worldbank, 2014).

This paper is structured as follows. First, we define CSR and corporate governance as the underlying concepts of ESG issues, and we give an overview of the technology sector. Second, the theoretical framework is presented, on which we build our hypotheses. The following section outlines the methodology applied for the empirical analysis. Finally, we analyse the empirical findings and highlight their contribution to the existing literature as well as the implications for practitioners and possible future research.

2. Definitions of concepts

2.1 The roots of the ESG concept

The origin of the ESG notion is grounded in the field of SRI. SRI strategies are not only taking into account economic aspects, but also environmental, social, and governance issues. ESG aspects are also called the three pillars of sustainability (Staub-Bisnang, 2012). The Brundtland report published by the World Commission on Environment and Development (1987) is one of the first definitions of sustainability (Barkemeyer et al., 2014). It outlines three dimensions of sustainability: environmental, social and economic. Similar is the concept of the Triple Bottom Line – People, Planet, Profit – by Elkington (1997). Whereas the notion of 'Planet' refers to a company's environmental responsibility, the term 'People' denotes a company's social responsibility towards their employees and the community it is operating in. The third element, 'Profit', represents the economic value and benefits a company is creating (Elkington, 1997). These are two of many concepts on which companies base their CSR policies (Hopkins, 2007). In both definitions one can see that the notion of corporate governance is left out. Contrarily, recent studies claim that good governance and sustainability cannot be treated separately and that corporate governance should be included in the concept of sustainability (Galbreath, 2013; Saltaji 2013). Likewise, besides environmental and social aspects, institutional investors are more and more taking corporate governance criteria into consideration in their SRI analysis (US SIF Foundation, 2012).

Thus, the ESG indicators capture a wider range of companies' socially responsible behaviour. They are not only considering environmental and social performance that is part of classical CSR, but also the third pillar of corporate governance. In the following sections, CSR and corporate governance, the concepts behind the three pillars of ESG, are presented in more detail.

2.2 Corporate social responsibility

Carroll (1979, p.40) describes CSR as follows: *"the social responsibility of business encompasses the economic, legal, ethical, discretionary (philanthropic) expectations that society has of organizations at a given point in time"*. This definition is the foundation of Carroll's pyramid of CSR (1991), which uses a 4-part conceptualisation based on the idea that a company has obligations towards society, these obligations being not only legal and economic, but also ethical and discretionary (philanthropic).
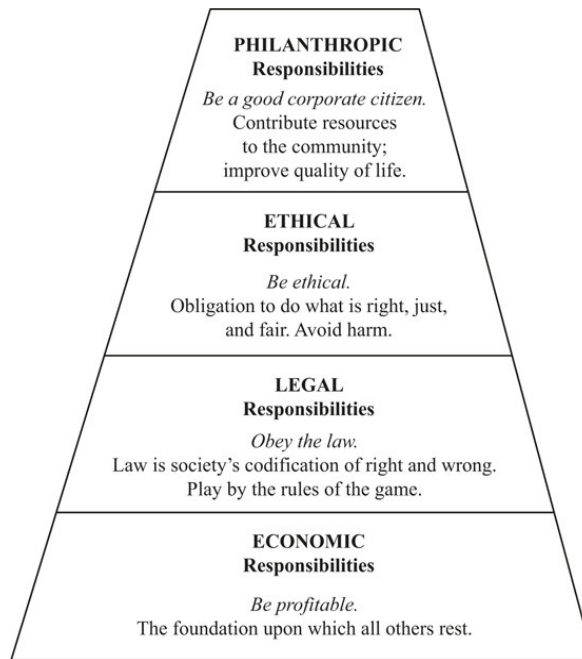
Exhibit 2.1: The pyramid of CSR
Source: Carroll (1991, p.42)

CSR has been studied for more than four decades. Dalhsrud (2007) identifies no less than 37 different definitions, and the concept of CSR is constantly evolving (Carroll & Shabana, 2010; Vogel, 2005). Garriga and Melé (2004) propose a classification of the different approaches into four theoretical categories: instrumental theories, political theories, integrative theories and ethical theories (See section 4.1.1).

The CSR practices mainly cover two pillars of the ESG concept: environmental and social issues. Companies aim to reduce their business' impact on the environment. Due to the climate change and the growing world population, main issues for companies are to reduce their CO_2-emissions as well as their water consumption (Dolique, 2007). The concept of eco-efficiency is a tool used by companies to measure and monitor their environmental impact throughout the whole life-cycle of their products. The objective is to reduce consumption of resources and waste as well as to use renewable materials and to enhance the multi-functionality of products (Melquiot, 2003). Social issues are covering topics like the healthcare policies of companies, human rights issues such as the prohibition of child labour and forced labour, healthy and safe working conditions, regulation of working hours and salaries, diversity without discrimination of race, gender or religion as well as the promotion of training and development programs (Laville, 2009; Stellmann, 2000).

2.3 Corporate Governance

Corporate governance is defined as the *"rules and practices by which companies are governed or run"* (Encyclopædia Britannica, 2014). The roots of corporate governance lie in different theories. One of the underlying theories is the agency theory. Jensen and Meckling (1976, p.308) define *"an agency relationship as a contract under which one or more persons (the principal(s)) engage another person (the agent) to perform some service on their behalf which involves delegating some decision making authority to the agent."* If both parties of the contract aim to maximise their own welfare, it can be assumed that decisions made by the agent are not always in the best interest of the principal. The theory is based on a dilemma defined by Adam Smith in 1776 (cited in Tricker, 2012): It cannot be expected from a firm's directors (agents) who are managing other people's money that they are taking care of it in the same way as they would do it with their own money. Thus, in order to make agents act in the interests of the shareholders (principals), the latter has to give the right incentives and/or bear costs to monitor the agent, the so-called agency costs (Jensen & Meckling, 1976).

Based on this theory, Fama and Jensen (1983, p.302) propose that firms should *"separate the ratification and monitoring of decisions from initiation and implementation of the decisions."* In a company this is achieved by separating the management from the board of directors. Hereby, the management has the executive function and delegates tasks throughout the organisation, whereas the board's task is to supervise those executive activities. In the US, this is generally realised by establishing unitary boards with executive directors and non-executive outside directors (Tricker, 2012).

In order to protect shareholders, there is also legal coverage. La Porta et al. (1998) find that common-law countries like the US have the strongest shareholder protection compared to other legal systems. In the rule-based US model, companies have to follow the company law which is based on case laws and varies for the different states in the country. The investor protection is supervised on the federal level by the US Securities and Exchange Commission (SEC) which for example requires listed firms to form a board audit, nomination and remuneration committee. Protection is also strengthened by the Sarbanes-Oxley Act in 2002 which increases the disclosure requirements for companies towards their stakeholders. Additionally, guidelines and principles in corporate governance codes, published by international agencies or the companies themselves, encourage firms to implement on a voluntarily basis good governance practices (Tricker, 2012).

2.4 The convergence of CSR and corporate governance

Both concepts, CSR and corporate governance, are concerned with how companies run their business and how they wish to impact the business environment they are operating in. Hence, both can be seen as a strategic management tool. Yet, the two concepts cover different topics, but they can be merged together as they offer a complementary view on issues surrounding business activities (Rosam & Peddle, 2004). This convergence is mainly influenced by the increased regulatory pressure, the demand for business ethics after the occurrence of several corporate scandals as well as through the request of SRI investors (Money & Schepers, 2007). In the 21st century, corporate governance focuses on new issues such as ethics, accountability, transparency and disclosure. Moreover, CSR uses corporate governance as a tool to integrate environmental and social issues in business strategy and decision making, not only to benefit shareholders, but also to benefit other stakeholders (Gill, 2008). This is for example reflected in the creation of board functions and committees for CSR topics. Money and Schepers (2007) show that directors believe in a connection between responsibility and performance and they think that it is impossible to achieve shareholder value without simultaneously creating stakeholder value. *"Both CSR and CG [corporate governance] are concepts that allow organizations to operate profitably yet in a socially and environmentally responsible manner to achieve business sustainability and stakeholder satisfaction"* (Rosam & Peddle, 2004, p.3). In addition, the convergence of the two approaches serves as a driver for long-term performance and provides an efficient tool for risk management and to improve reputation by avoiding corporate scandals (Money & Schepers, 2007).

3. The US technology sector

As mentioned, the focus of this study is on the technology sector. According to Thomson Reuters (2012b) business classification, the technology sector covers technology equipment (hardware), software and IT services as outlined in the exhibit below.

Technology	Technology Equipment	Semiconductors & Semiconductor Equipment Communications & Networking Office Equipment Electronic Equipment and Parts Computers, Phones & Household Electronics
	Software & IT Services	IT Services & Consulting Software Internet Services

Exhibit 3.1: The technology sector
Source: Thomson Reuters (2012b)

The technology industry is highly competitive, which leaves technology firms with few possible strategic options in order to increase profit, e.g. internationalisation, innovation or pricing strategies (Xerfi, 2012). Indeed, innovation and R&D investments are a key value driver due to the obsolescence of products, but also because it is a way to create market differentiation as well as to stimulate replacement purchases, e.g. tablets. In addition, brand image is also an important factor for the technology industry (Xerfi, 2012). At the same time, the fierce competition has put pressure on prices, leading technology firms to manufacture or to outsource their production in "low-cost areas", like South-East Asia. This strategic choice offers opportunities in terms of cost savings, but it has exposed firms to criticism linked with labour conditions such as the abuse of child labour (Van Liemt, 2007).

Companies of the technology sector have shown very different commitments to ESG issues. Some companies of the sector benefit from good reputation, like Google and Microsoft. Both are ranked among the companies with the best reputation in the world (Reputation Institute, 2014). However, concerns and controversies have also been raised on subjects such as the working conditions in China (e.g. Foxconn as a supplier of Apple), the environmental impact of electronics throughout their product life cycle as well as the huge energy consumption of data centres (Martinuzzi et al., 2011). More recently, governance issues such as the respect of shareholders rights have been a concern in the technology industry (MacLeans, 2013). At the same time, "green products"[1] are seen as a new way to differentiate products (Xerfi, 2012).

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[1] 'green products' are *"goods or services that minimize their impact on the environment at each phase of their life cycle"* (Albino, Balice and Dangelico, 2009)

4. Theoretical framework and hypotheses

The purpose of this study is to link the ESG concept, thus both the concept of CSR and corporate governance, to CFP. As there is little research on this combined concept, we base our study on the existing research linking CSR to CFP, as well as studies on corporate governance and its impact on firm value and performance.

4.1 The business case of ESG: from a management to a market perspective

As noted by Carroll (1999), CSR could be considered as the building block of the theory of corporate social performance (CSP). Wood (1991, p.693) proposes a model for CSP that she defines as *'a business organization's configuration of principles of social responsibility, processes of social responsiveness and policies programs and observable outcomes as they relate to the firm's societal relationships'*. Following this definition and the challenges of CSP, the principal argument for a company to engage in CSR (and to improve its CSP), lies in the concern of improving society (Carroll & Shabana, 2010). However, the development of CSR has raised the question whether improving CSP "pays off" or not, implying the need of a rationale and business justification to CSR investment. Kurucz, Colbert and Wheeler (2008) summarise the issue of the business case of CSR by asking if companies do perform better financially when they address both their core business and their responsibility to the broader society. As highlighted by Carroll and Shabana (2010), managers need to know if investing in CSR activities benefit their business, thus whether it helps them or not to meet the first responsibility of a business: the economic responsibility. As we will explain in further details in the next section, there have been arguments in favour and against CSR.

4.1.1 CSR and financial performance: a management perspective

When studying the link between CSP and CFP, academics have focused on two issues: the type of the relationship and the direction of causation (Waddock & Graves, 1997). It lacks of a clear conclusion when it comes to the nature of the link, may it be correlation or causality. Soana (2011) describes the four types of possible relationships between CSR and CFP: positive, negative, no-relationship (also known as neutral) and mixed relationship. Waddock and Graves (1997) present the two possible causal directions: changes in CSP influence financial performance (good management theory) or changes in financial performance influence CSP (slack resource theory).

The possible types of relationships between CSP and CFP have been deeply investigated (Orlitzky, Schmidt & Rynes, 2003). Margolis and Walsh (2003) count no less than 109 studies that use CSP as independent variable. Out of these 109 studies, 54 find a positive relationship between CSP and CFP, 7 a negative relationship, 28 find non-significance, and 20 mixed results. This inconsistency in results further supports the divergent beliefs and views concerning the CSP and CFP relationship.

Negative relationship

Theorists defending the theory of shareholder wealth maximisation argue for a negative relationship between CSR and CFP (Barnett, 2007). Friedman (1970, p.1) states that the only *"social responsibility of business is to increase profit"*. Friedman argues that CSR is costly and the costs to implement CSR improvements are likely to outweigh the financial benefits. Hence, it reduces shareholders welfare by decreasing financial performance. Neo-classicists also believe that too few available measures of economic benefits from CSR exist while costs are numerous (Waddock & Graves, 1997).

Moreover, Aupperle, Carroll and Hatfield (1985) argue that firms that are socially responsible incur a competitive disadvantage by bearing costs that are not necessary or that should be borne by other agents, such as the government. Gray and Shadbegian (1993) find that environmental regulations are negatively associated with productivity, implying that CSR measures, in particular environmental ones, would have a negative impact on the firm financial and operating performance. More recently, Orlitzky (2013) suggests that CSR may have a negative impact on stock performance by increasing market volatility and creating a stock price bubble due to information asymmetry and the lack of a relationship between CSR and a firm's economic fundamentals.

Positive relationship

Academics and practitioners defending the positive relationship theory argue for a positive link between CSR and financial performance of a firm, though the causal link is not obvious (Soana, 2011). According to Garriga and Melé (2004) and Vogel (2005), arguments for the positive relationship strongly differ between theorists supporting the ethical and integrative theories (Freeman, 1984; Donaldson and Preston, 1995) and theorists supporting instrumental theories (Porter & Kramer, 2006, 2011; Varadajaran & Menon, 1988).

Ethical and integrative theories – 'doing good to do good'

Ethical and integrative theories are based on the idea that businesses should do the right things to improve societal conditions and that they should integrate social demands (Garriga & Melé, 2004). Following these views, CSR is seen as the moral condition of the business' existence.

The flagship of these theories is the stakeholder theory proposed by Freeman (1984). He bases the stakeholder theory on the idea that managers should have a fiduciary relationship to stakeholders implying that the scope of managers' responsibility goes beyond the pure welfare of shareholders. Donaldson and Preston (1995) claim that an efficient stakeholder-management relationship can be key to improve CFP. Jones (1995) explains this positive relationship by arguing that a strong stakeholder-management relationship serves as monitoring managers so they do not divert the attention from a firm's financial goals. In addition, Freeman and Evan (1990) motivate the positive effect of this relationship by claiming that it can increase a firm's capacity to adapt to changes in external demand, which is essential to sustain firm's operating performance. Jensen (2002, cited in Koehler & Hespenheide, 2012) argues that when the focus is on long-term performance, ignoring or neglecting any important stakeholders of a firm affects negatively long-term market value. Thus, he implies that the maximisation of shareholder value is not enough.

Alexander and Buchholz (1978, cited in Barnett & Salomon, 2006) and Bowman and Haire (1975) argue that CSP is a proxy for management quality. Improving social performance indicates that a firm has a high quality management because it is a sign of their understanding on how to improve a firm's relationship with its environment, whether internal and external.

Instrumental theories – 'doing good to do well'

CSR instrumental theories, such as strategies for achieving competitive advantage (Porter & Kramer, 2006, 2011) and cause-related marketing (Varadajaran & Menon, 1988), highlight the idea that CSR and CFP can be positively related if a company uses CSR strategically. Thus, CSR is seen as a tool to maximise shareholder value. Kurucz, Colbert and Wheeler (2008) point out four main reasons for companies to embrace CSR: cost and risk reduction, gaining competitive advantage, developing reputation and legitimacy and seeking win-win outcomes through synergistic value creation.

17

Porter and Kramer (2006) argue that rather than focusing on responsive CSR, seen as a source of costs and based on the idea that economic growth comes at the expense of social welfare or vice versa (Friedman, 1970), companies should think of CSR as a strategic tool. In this view, CSR can benefit both society and a company's performance and be a source of competitive advantage, even innovation. In this way, they defend both the argument of synergistic value creation, as well as the argument of gaining competitive advantage. Porter and Kramer (2011) later refer to the process of strategic CSR as a way to create "shared value". They argue that pro-active CSR management is a tool that can increase a firm's competitive position, and is therefore positively affecting its operating and financial performance. Porter and Kramer's arguments (2006) can be supported by the findings of Hillman and Keim (2001). They split social performance in two components: stakeholder management, including primary stakeholders (shareholders, employees and customers) and social issue participation which refers to the use of corporate resources for social issues outside of firm strategy. They find that social performance through stakeholder management is directly associated to shareholder value creation whereas social issue participation is not.

A second possible benefit of ESG comes from reputational benefits. Varadajaran and Menon (1988) argue that CSR, even philanthropic CSR, can be a powerful marketing tool for a company. It can help increase a company's revenue by building a brand in a socially responsible dimension. They define cause-related marketing as *"the process of formulating and implementing marketing activities that are characterized by an offer from the firm to contribute a specified amount to a designated cause when customers engage in a revenue-providing exchange that satisfy organizational and individual objectives"* (Varadajaran & Menon, 1998, p.60). This line of reasoning, linking CSR with reputational benefits, can be supported by empirical evidence from Turban and Greening (1996). Furthermore, Fisman, Heal and Nair (2005) find that social issue participation is positively associated to firm financial performance, but only in advertising-intensive industries.

Another approach is that ESG performance can relate to operating performance through cost and risk reduction. Koelher and Hespenheide (2013) identify ESG issues which can directly impact a company's financial performance by affecting its operations and sales. Examples of negative impacts are linked with product risks (toxic chemicals, boycotts, recalls), supply chain risks (child labour, natural resource use) or even operational risks (employee strikes, penalties and fine linked with environmental and social concerns). Barnett (2007) supports the importance of stakeholder management in the same perspective, arguing that improving

trustworthiness and strengthening the relationship with stakeholders lead to reduced transaction costs (decreasing employee turnover, improved talent pool, union avoidance), thus to financial gain. On the environmental level, Porter and Van der Linde (1995) and King and Lenox (2000) argue that low environmental performance leads to competitive disadvantage, as it is a sign of operational inefficiency.

Orlitzky, Schmidt and Rynes (2003) conduct a meta-analysis of the relationship between CSP and CFP based on 52 existing studies to conclude that social responsibility, and to a lesser extent, environmental responsibility, is financially rewarded. This further strengthens previous empirical findings from Waddock and Graves (1997), Hillman and Keim (2001) and Nelling and Webb (2009) who find the existence of a 'virtuous circle': increasing CSR leads to improvement of financial performance and vice-versa.

Neutral relationship

The neutral relationship implies that CSR and CFP are not related. The body of research defending this theory argues that no relationship can be found because too many variables are involved when explaining the potential link between social and financial performance (Waddock & Graves, 1997).

Ullman (1985) highlights the fact that the lack of significant results may be due to measurement problems and deficiencies in the theoretical framework. In addition, Aupperle, Carroll and Hatfield (1985) do not find any relationship between CSR and profitability, using Carroll's conceptual framework of CSR (1979).

Mixed relationship

The mixed relationship theory defines the link between CSR and CFP as inconsistent overtime. Soana (2011) argues that this relationship can take two forms: "U" or "inverted U". The former implies that the effect of CSR is not immediately observable; meaning that CSR can first result in a bigger increase in costs than profit but that this tendency reverses over time. The "inverted U" theory suggests that there is an optimum level of CSR. Mintzberg (1983) argues that CSR is rewarded only to a certain extent.

As we can see, neither empirical findings supporting theory of value creation through CSR lead to a clearly positive relationship between CSR and CFP, nor does research support the value destruction theory (Nelling & Webb, 2009). In other words, empirical findings are highly inconsistent.

4.1.2   Corporate governance and financial performance

Corporate governance - a way to promote firm value and performance

Most of the literature linking corporate governance and financial performance is based on the agency problem introduced in section 2.3: managers are responsible for other people's money. Shleifer and Vishny (1997, p.737) outline *"corporate governance deals with the ways in which suppliers of finance to corporations assure themselves of getting a return on their investment."* This is achieved by a well-functioning system of corporate governance mechanisms protecting the investors from self-interested managers and by the repatriation of the firm's income to the financial investors. Thus, good governance is an instrument to increase firm value and performance. Efficient ways to achieve good governance are given by legal protection, the alignment of investor's and manager's interests through incentives, a concentrated ownership, better monitoring, and transparency (Shleifer & Vishny, 1997).

Several empirical studies have been conducted in order to investigate how corporate governance affects financial performance. Three different measures have been mainly used to conduct the research: stock return, firm value and operating performance. The interrelation between the different measures is explained as follows. Good corporate governance mechanisms lead to higher investor trust. Thus, investors might assess well-governed firms as less risky and might expect a lower rate of return leading to higher firm value (Bauer, Guenster & Otten, 2004). Jensen and Meckling (1976) state that well-governed firms might have a more efficient operating performance and therefore, expected future cash-flows are higher compared to poorly governed companies, leading to higher firm value in the long-run.

Positive relationship between corporate governance and financial performance

Most of the existing research is empirically showing the positive relationship between corporate governance and firm value as well as performance. La Porta et al. (2002) find empirical evidence that firm value is higher in countries where the legal system ensures the protection of minority shareholders. Other research investigates this relationship by focusing on corporate governance standards on a firm level. For the US market, Core, Holthausen and Larcker (1999) find that companies with weaker governance mechanisms, measured by board and ownership structure, have stronger agency problems and therefore perform worse.

Gompers, Ishii and Metrick (2003) study US companies in the 1990s by constructing an index which measures governance performance on a firm level. They show that firms with weak corporate governance (e.g. less shareholder rights) have a significant lower firm value and

lower subsequent share returns. As an explanation for the relationship between stock returns and governance they outline that weak governance mechanisms lead to agency costs which are underestimated by investors. Thus, expectations about cash flows are lowered, leading to a decrease in stock price. In addition, Gompers, Ishii and Metrick (2003) state that a part of their results can be explained by industry classifications being another factor influencing stock returns. In terms of operating performance, strong governance has a positive and significant relationship with net profit margin, one-year sales growth, and a positive but insignificant relationship with return on equity.

Bebchuk, Cohen and Ferrell (2008) find consistent results with the study of Gompers, Ischii and Metrick (2003). Furthermore, they identify that only six out of the 24 entrenchments[2] Gompers, Ischii and Metrick build their index on are driving empirical results. They highlight that the other 18 provisions are related to neither firm value nor abnormal returns.

Cremers and Nair (2005) and Brown and Caylor (2006) complement previous research by separating corporate governance into internal (e.g. blockholders and board of directors) and external mechanisms (e.g. takeovers and market for corporate control). They confirm previous positive relationships of abnormal returns and good corporate governance by showing the importance of two governance mechanisms: takeover vulnerability and shareholder activism.

Complementing and opposing research

Core, Guay and Rusticus (2006) find that companies with weak shareholder rights are showing feeble operating performance, but also that the market is aware of this fact and not surprised by the underperformance. Contrary to Gompers, Ishii and Metrick (2003), Core, Guay and Rusticus (2006) as well as Bhagat and Bolton (2008) cannot confirm that poor governance also indicates low stock returns. Core, Guay and Rusticus (2006) justify this result by claiming that the time period used in Gompers, Ishii and Metrick's study might be influenced by a period-specific factor, as for example the "New Economy" in the 90s. This assumption is made as they find that firms with poor governance have slightly higher returns than firms with strong governance in the period subsequent to Gompers, Ishii and Metrick's study. Bhagat and Bolton (2008) give two additional explanations. First, they claim that studies finding a positive relationship between governance and stock return might not have

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[2] The six relevant entrenchments are: staggered boards, limits to shareholder bylaw amendments, poison pills, golden parachutes, supermajority requirements for mergers and charter amendments

properly adjusted their results for unobservable risk components. Second, the relationship between corporate governance and firm performance might be endogenous, possibly weakening the explanatory power of the results. Johnson, Moorman and Sorescu (2009) test the robustness of Grompers, Ishii and Metrick's results by adjusting more precisely for industry clustering in the different portfolios. Unlike Gompers, Ishii and Metrick (2003), they find statistically zero long-term abnormal returns by applying the same investment strategy.

Research has also been done in other markets than the US. Bauer, Guenster and Otten (2004) study the European market by applying Gompers, Ishii and Metrick's (2003) methodology. Consistent with Gompers, Ishii and Metrick (2003), their results show that governance is positively related to firm value and stock returns, but contrarily, they find a significant negative relationship between governance and firm performance, when measured by net profit margin and return on equity. As an explanation they assume that accounting numbers might be biased and that the negative relationship found is possibly explained through less conservative earnings estimates of badly governed companies.

Adapting country specific governance standards

The less elaborated a country's corporate governance standards are, the stronger is the relationship between governance and firm value as well as abnormal stock returns (Bauer, Guenster & Otten, 2004; Chira, 2014). Krafft et al. (2013) investigate the influence of corporate governance on firm value and performance with focus on convergence of corporate governance systems, with the example of non-US companies which are adopting US corporate governance standards. They find a significant and positive relationship between corporate governance and both firm value and operating performance. Similar results are found by Chira (2014) who studies the implication of cross-listing of foreign companies on the US stock markets. Her study shows significant higher abnormal returns for these companies, both in the short- and long-term. The lower the governance standards in the country of origin, the higher the abnormal returns yielded. This can be explained by Coffee's bonding hypothesis (1999, 2002 cited in Chira 2014) stating that foreign companies starting to operate on the US market are adopting higher governance standards due to the stronger regulatory system enforced by the SEC. Similarly, Klapper and Love (2004) assume that improvements in the efficiency of the country's legal system lead also to an improvement of firm level governance standards.

The importance of specific corporate governance criteria

Overall, the different studies imply that changes in the factors determining good governance can lead to different results. Bebchuk, Cohen and Ferrel (2008), Brown and Caylor (2006) and Bauer et al. (2008) show that only a small subset of factors provided by different databases and indices are positively linked to firm value and performance. Thus, they conclude that not all criteria of indices are driving the positive relationship. Bebchuk, Cohen and Ferrel (2008) suppose that indices granting weight to too many irrelevant factors might be an inaccurate measure of corporate governance. Additionally, companies might be misguided and are improving mechanisms which are not worthwhile improving them just to score better in a specific rating.

4.1.3   ESG and financial performance: a market perspective

We previously developed a view on CSR from a management perspective. As we mentioned, ESG indicators are mostly created as a benchmark for investors to assess the social, environmental, and governance performance of a company. The increasing concern toward ESG issues has led to a rapid growth of SRI, fulfilling both financial and social goals of investors (Renneboog, Horst & Zhang, 2008a).

On investor reaction to CSR performance, Flammer (2013) conducts an event study on the stock market reaction to the announcement of eco-friendly and eco-harmful corporate news in the US, and her findings confirm that shareholders react positively to eco-friendly initiatives and negatively to harmful behaviour. Hamilton, Jo and Statman (1993) claim that financial market's reactions (and investors' reactions) to CSR can take three different forms: the market does not value CSR, the market values CSR, and there is disequilibrium because of inefficient pricing of CSR. Barnett and Salomon (2006) demonstrate that excess performance of SRI funds compared to traditional funds have not been clearly proven, with empirical research supporting the three possible results.

From an investor point of view, benefits of CSR activities for a company can be considered from the risk-return perspective (Derwall, 2007). Indeed, companies with high ESG scores have been regarded as less risky because they are seen as more sustainable in the long-term. Consistent with the risk-return relationship, investors ask a lower return on ESG companies, which makes these companies benefit from higher firm value due to a lower discount rate (Derwall, 2007).

The mispricing scenario implies that ESG performance does affect firm performance, but stock performance does not reflect it efficiently because of the lack of information availability (Manescu, 2011). Moreover, Flammer (2013) argues that bad news related to CSR performance is more harmful to a company than positive news is rewarding. She argues that *'CSR is a resource with decreasing marginal returns and insurance-like features'* (Flammer, 2013, p.758). Derwall (2007) explains this mispricing by the difficulty encountered by investors when it comes to assessing ESG performance, which is sometimes highly intangible. Mintzberg (1983) argues that CSR is rewarded only to a certain extent by the financial markets: *"the stock market is willing to reward social responsibility only to a point. It pays to be good but not too good"* (Mintzberg, 1983, p.10).

4.2 Construction of hypotheses

In the previous parts, we outline the different theories behind the relationship between CSR and the financial performance of companies as well as the concepts about governance and its impact on firm value and firm performance. Several researchers show that the concepts of corporate governance and CSR should not be treated separately, as both mutually influence long-term performance (Galbreath, 2013; Gill, 2008; Money & Schepers, 2007; Rosam & Peddle, 2004; Saltaji, 2013).

Thus, the aim of this paper is to combine environmental, social, and governance performance and to illustrate the link to a firm's financial performance. Social performance can be measured by indicators and ethical ratings, (Soana, 2011) and consequently, we are looking for such measures to capture all three dimensions. ESG indicators have been introduced as a way to measure this kind of extra-financial information and to illustrate a part of firm value which cannot be explained by traditional financial reporting (Bassen & Kovacs, 2008). The problem that most of the stakeholders are facing is that the disclosure of non-financial performance varies from company to company and is difficult to compare (Eccles et al., 2012). Bassen and Kovacs (2008) argue that ESG indicators are potential solutions to the issues presented above, and they urge the need for further research studying the link between ESG issues and CFP. This will be one of the most crucial factors determining the use and proliferation of ESG information and metrics (Bassen & Kovacs, 2008). Supporting this argument, we have recently seen an increased number of studies in the field of corporate finance using the ESG indicators (Attig et al., 2013; Galbreath, 2013; Oikonomou, Brooks &

Pavelin; 2014; Siew, Balabat & Carmichael, 2013), which we want to complement by linking ESG indicators to financial performance.

To build the hypotheses, a deductive approach is used, referring to previous research about financial performance done in the area of CSR, CSP and corporate governance. As outlined above, the business case for ESG can be analysed under two complementary perspectives: a management perspective, related to operating performance, and a market perspective, focusing on investors' perception and belief about ESG performance reflected in firm value.

There are different theories that positively link CSR to operating performance explained by several approaches; for example improving operating performance through the management-stakeholder relationship, through the increased demand for ethical companies products, or through the use of CSR as risk management tool (Donaldson & Preston, 1995; Freeman & Evan, 1990; Jones, 1995, Koehler & Hespenheide, 2012). Similarly, governance is linked positively to operating performance, as well-governed firms experience less agency problems which could translate into better operating performance (Jensen & Meckling, 1976). For both concepts several empirical studies confirm a positive relationship between environmental (Derwall, 2007; Flammer, 2013), social (Orlitzky, Schmidt and Rynes, 2003) and governance (Bauer, Guenster and Otten, 2004; Core, Guay & Rusticus, 2006; Gompers, Ishii & Metrick, 2003) measures to operating performance.

Our purpose is to test the same relationship taking into account not only a single dimension of ESG, but to test for the overall impact of these indicators. Acknowledging that the concepts of CSR as well as corporate governance and ESG are closely related, we also expect a positive relationship between ESG scores and firm's operating performance.

Hypothesis 1: ESG scores relate positively to operating performance, ceteris paribus.

Hypothesis 1.0: Companies with high ESG scores are associated with higher operating performance than companies with lower ESG scores, ceteris paribus

Hypothesis 1.1: Companies with low ESG scores are associated with lower operating performance than companies with higher ESG scores, ceteris paribus

In the long run, good operating performance should translate in higher firm value. In addition, extra-financial performance and investor's perspectives and expectations are reflected in the valuation of listed firms. (Bassen & Kovacs, 2008). In the corporate governance literature, it

is argued that good governance increases investor's trust which results in higher firm value (Bauer, Guenster & Otten, 2004). In the field of CSR, especially instrumental theories argue for value creation through environmental and social performance (Porter & Kramer 2006, 2011; Varadajaran & Menon, 1988). Empirically, studies also confirm a positive link between value creation and corporate governance (Bebchuk, Cohen & Ferrell, 2008, Gompers, Ishii & Metrick, 2003) as well as value creation between environmental and social performance (Al-Najjar & Anfimiadou, 2012; Derwall, 2007; Margolis & Walsh, 2003; Sinkin, Wright & Burnett, 2008). Concerning the overall performance of the three dimensions, there is a growing belief that ESG performance and long-term value creation are related (KPMG, 2011). Consistent with this belief and previous research about environmental, social and governance performance, we expect a positive relationship between the overall ESG scores and value creation.

Hypothesis 2: ESG scores relate positively to firm value, ceteris paribus.

Hypothesis 2.0: Companies with high ESG scores are associated with higher firm value than companies with lower ESG scores, ceteris paribus

Hypothesis 2.1: Companies with low ESG scores are associated with lower firm value than companies with higher ESG scores, ceteris paribus

Several corporate governance studies outline that not all components of governance scores and indices are equally driving the impact on financial performance. In the same manner, it is interesting to decompose the overall ESG scores. Thus, the last hypothesis is built to assess the link of each ESG pillar with CFP. Practitioners outline that ESG aspects form the three pillars of sustainability (Staub-Bisnang, 2013), for this reason, it is expected that each pillar is of equal importance. This hypothesis provides a deeper understanding of the characteristics of the overall ESG performance for the technology industry.

Hypothesis 3.0: E, S and G scores are equally important for operating performance, ceteris paribus.

Hypothesis 3.1: E, S and G scores are equally important for firm value, ceteris paribus.

These hypotheses lay the foundation of this study, and they will be investigated using the methodology described in the following section.

5. Methodology and Data

The previous section outlines the hypotheses to be tested in this study. To do so, quantitative research methods are used. Henceforth, this section provides a detailed description of the statistical method, the data and the variables used in this thesis.

5.1 Methodology approach

Looking at prior literature, there is a clear deficit in longitudinal studies investigating the link between ESG scores and financial performance from an industry perspective and over time. As there are plenty of event studies (Waddock & Graves, 1997), this study investigates the relationship between variables over the years 2009 to 2012 in the form of a panel data study. Panel data has the advantage to take into consideration both cross-sectional variations and variations over time in a time series dimension. Not only is it more informative than one-dimensional methods, but results can also more easily be generalised as it reduces possible impacts of temporal errors that could affect the data (Bryman & Bell, 2011).

The empirical analysis is based on the methodology used by Derwall (2007) for studying the link between eco-efficiency and financial performance, using both accounting and market perspectives. While Derwall (2007) uses the Fama-Macbeth model for the analysis, this research uses the ordinary least squares (OLS)[3] estimation technique, which is also used by Waddock and Graves (1997) when studying the link between CSP and CFP. Compared to previous studies, variables are not lagged because previous findings show that there is no clear direction of causality between ESG performance and CFP, but rather a "virtuous circle" (Nelling & Webb, 2009; Soana, 2011).

5.2 Data

5.2.1 Sample

This research is based on a final sample of 100 listed US companies belonging to the technology sector (Appendix I). Selection criteria are presented later in this section. A non-probability sampling method is used to be able to have the most representative sample, which should include the highest possible number of listed US companies being part of the technology sector.

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[3] Skoulakis (2008) shows that in presence of a large number of cross-sections, both Fama-Macbeth and OLS provide reliable results (see section 5.6).

A shortcoming in previous literature is the lack of industry level studies. Soana (2011), who carried out a study on the CSP-CFP link in the banking sector in the US, motivates the relevance of industry level studies, as CSP characteristics can vary a lot from an industry to another. Barnett (2007) also argues that industry level studies may be a first step into better understanding the business case for CSR, on a more specific level, as it seems obvious that empirical findings have, so far, failed in generalising it on a universal level.

This study focuses on only one country, the United States. First, focusing on a single country reduces possible noise that could affect the results, coming from differences in regulatory backgrounds, cultural factors or macroeconomics tendencies (Renneboog, Ter Horst, & Zhang, 2008a), i.e. the high listing requirements of the SEC for the US stock markets. Second, Holder-Webb et al. (2009) notice that cross-country studies agree to the existence of differences in disclosure of information concerning ESG. This study focuses on the US for two main reasons. First, due to the size of the country and the importance of its financial markets, it eases the access to a larger sample of listed companies belonging to the same industry (Datastream, 2014). For instance, the technology sector is well developed in the US. The country is home to the industry leaders in hardware (e.g. HP, Dell, Apple), software (e.g. Microsoft, Oracle) and Internet companies (e.g. Google, Yahoo, Facebook) (Xerfi, 2012). Second, the US market is one of the most developed in terms of SRI with no less than $3.74 trillion of assets under management of SRI mutual funds in 2012 (US SIF Foundation, 2012).

The use of a longitudinal study impacts directly the size of the sample. To determine the companies that should be part of the sample, Thomson Reuters (2012b) business classification is used to select companies classified in the technology sector. The sample is reduced to companies for which ESG data is available for the period from 2009 to 2012 and to companies being listed on the stock market prior to 2009. This leads to a sample of 102 companies, from which two companies are deliberately excluded: Motorola Solutions and Eastman Kodak. Both are currently belonging to the technology sector; however those two companies have undertaken deep restructuring and paradigm changes in the last years[4].

A first limitation with the sample is the limited information available, which leads us to carry out the study only on 100 companies of the technology sector (Thomson Reuters, 2012b).

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[4] Eastman Kodak has belonged to electronic goods prior to the company's restructuring after filing for Chapter 11 bankruptcy in 2012 (Eastman Kodak, 2014). In the same manner, Motorola Solutions is traded as an independent entity only since 2011, after the company was split in the same year (Motorola Solutions, 2014).

5.2.2 Time period

Based on data availability, the study period is set to a relatively short period of only four years, spanning from 2009 to 2012. This is mainly due to the following facts. First, the ESG data on Thomson Reuters Datastream has not completely been published for the year 2013 by the time of carrying out this study. Second, most of the companies' ESG historical performance is limited to four or five years of data. Third, this research is using a balanced data set including only companies which have been listed prior to 2009 and for which data is available over the four-year period. Considering the given limitations, the time period from 2009 to 2012 allows us to study a maximal number of companies possible, so that our sample is more representative. In addition, this time period is of particular interest as the rise of the financial crisis has increased companies' attention to ESG policies, due to the growing belief that ESG performance and long-term value creation are related (KPMG, 2011).

5.3 Regression

5.3.1 Regression equations

This research uses a panel data method as the variables contain data that varies over cross-sections and in the time-series dimension. All the regressions are run using OLS estimation technique.

To study the link between ESG performance and CFP, a three-step approach is used, from both a management and a market perspective. Following the hypotheses of this research, operating performance and firm value are regressed against ESG performance separately, measured by return on assets (ROA) and Tobin's q (Q) respectively. Each perspective is tested following the same methodology. A second equation investigates the non-linearity of the relationship using dummy variables for low and high ESG scores. Equation a_1 and b_1 use the overall ESG score of each firm to respectively study their relationship with operating performance and firm value. Equations a_2 and b_2 represent a complementary result to assess a possible disequilibrium, and give more information about the financial performance of the *top-performers* and *laggards* (Derwall, 2007). Finally, and to complement previous findings, the last regressions (Equations a_3 and b_3) use ESG performance of each pillar as three distinct independent variables.

This study spanning over four years (2009-2012) and using quarterly data for 100 companies, the panel data has 1600 entries. The general equations are as follows:

ESG performance and operating performance (ROA):

$$ROA_{it} = \alpha_i + \beta_0 ESGscore_{it} + \gamma_{it} X_{it} + \varepsilon_{it} \quad (a_1)$$

$$ROA_{it} = \alpha_i + \beta_0 HighESGscore_{it} + \beta_1 LowESGscore_{it} + \gamma_{it} X_{it} + \varepsilon_{it} \quad (a_2)$$

$$ROA_{it} = \alpha_i + \beta_0 Environmental\_score_{it} + \beta_1 Social\_score_{it} + \beta_2 Governance\_score_{it} + \gamma_{it} X_{it} + \varepsilon_{it}$$

$$(a_3)$$

ESG performance and firm value (Q):

$$Q_{it} = \alpha_i + \beta_0 ESGscore_{it} + \gamma_{it} X_{it} + \varepsilon_{it} \quad (b_1)$$

$$Q_{it} = \alpha_i + \beta_0 HighESGscore_{it} + \beta_1 LowESGscore_{it} + \gamma_{it} X_{it} + \varepsilon_{it} \quad (b_2)$$

$$Q_{it} = \alpha_i + \beta_0 Environmental\_score_{it} + \beta_1 Social\_score_{it} + \beta_2 Governance\_score_{it} + \gamma_{it} X_{it} + \varepsilon_{it}$$

$$(b_3)$$

Variable	Description
ROA_{it}	Return on assets, at time t for each cross-sectional unit i
Q_{it}	Tobin's q, at time t for each cross-sectional unit i
α_i	The intercept term, varying across-section
$ESGscore$	Overall ESG score, at time t for each cross-sectional unit i
$HighESGscore$	Dummy variable taking the value of 1 if overall ESG score is over or equal to 90, otherwise it takes the value of 0 for scores below 90
$LowESGscore$	Dummy variable taking the value of 1 if overall ESG score is below or equal to 20, otherwise it takes the value of 0 for scores over 20
$Environmental\_score$	Environmental score, at time t for each cross-sectional unit i
$Social\_score$	Social score, at time t for each cross-sectional unit i
$Governance\_score$	Governance score, at time t for each cross-sectional unit i
B_n	Coefficient
X_{it}	A vector for control variables, varying over time t and across-section i
γ_{it}	A vector of coefficients
ε_{it}	The error term, varying over time and across-section

Exhibit 5.1: Regression variables

5.3.2 Robustness test

In order to ensure that the relationships generated by the model are robust and not the results of spurious relationships, robustness checks similar to the one used in Derwall (2007) are run. For equations a_1, a_2, and a_3 a robustness check is run using a different variable to account for firm size, being one time the book value of assets and another time total sales. The robustness check for equation b_1, b_2, and b_3 is done by adding R&D expenditures on sales as a control variable.

5.3.3 Regression assumptions

OLS estimation technique is used in this study. To ensure that the model used is well specified and that the results are unbiased, the five OLS assumptions need to hold (Brooks, 2008).

First, endogeneity is a common issue when dealing with corporate financial data. The error-term should not be correlated with the independent and control variables in order to obtain unbiased estimates of regression coefficients. We check that residuals of the equations are not correlated with any independent variables. Using the commonly used rule of thumb, results with no value over 0.8 or under -0.8 indicate that there is no sign of co-linearity, what strengthens our model. Moreover, we include fixed effects to control for the impact of omitted variables (Brooks, 2008).

The second test checks for multicolinearity. Using a correlation matrix, it is controlled that there is no linear relationship between the independent and control variables (Appendix II). The results show no value over 0.8 or under -0.8, the common rule of thumb, indicating that there is no co-linearity; thus, the regression model can be accepted (Brooks, 2008).

Third, heteroscedasticity is tested using a manual Breusch-Pagan-Godfrey test. The squared residuals from the regression are run against the independent and control variables. Finding a p-value of 0 using a F-test, the null-hypothesis for homoscedasticity is rejected. Taking this result into account, a White robust standard error is used to reduce the variance to generate optimal results (Brooks, 2008).

Autocorrelation should be tested as it generates biased coefficients that could affect the accuracy of the results. However, testing for autocorrelation is mainly relevant when using

time series data, and is rarely tested for panel data. Moreover, as the time-dimension of this study is also relatively short, autocorrelation is not tested in this study (Brooks, 2008).

Finally, the null-hypothesis is rejected for the Jarque-Bera test, implying that the residuals are not normally distributed. This limitation should be taken into account when interpreting the results of the study because we do not want to exclude outliers. First, excluding outliers would significantly reduce the size of the sample. Second, it would affect the representativeness of the results. Moreover, Brooks (2008) highlights the fact the violation of this assumption is left without impact when studies are carried on a large sample, which is the case for this study.

5.4 Variables

All the variables (dependent, independent and control variables) are built based on data retrieved from Thomson Reuters Datastream, at the exception of firm age which is directly retrieved from company's websites. A limitation to this study comes from the use of secondary data. Even though they are useful when conducting longitudinal/cross-sectional studies, the use of secondary data presents some shortcomings, such as the lack of control on the quality of the available data (Saunders, Lewis and Thornhill, 2009). However, Datastream is a database widely used by practitioners and academics, implying data of good quality.

5.4.1 Dependent variables

As ESG performance is considered to be an intangible asset for a company (e.g. socially responsible performance resulting in higher reputation), practitioners are looking for extra-financial indicators as a way to reflect the ESG impact on CFP. Both market and accounting variables have been used when studying the relationship between CSR and financial performance (Orlitzky, Schmidt & Rynes, 2003), thus the same approach is taken in this study. We choose Q and ROA as our dependent variables.

As this research tests market perception of a company's ESG performance, a market-based variable is used to test how ESG can create or destroy shareholder wealth (Mackey, Mackey & Barney, 2007). Derwall (2007) chooses Q for this matter.[5] First, Q is a forward-looking ratio measuring stock valuation, thus reflecting firm value (Derwall, 2007). Second, it is a

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[5] Q is defined as follows: $Q = \frac{Market\ value\ of\ firm}{Replacement\ value\ of\ the\ firm's\ assets}$ (Lewellen & Badrinath, 1996)

ratio commonly used in empirical research as a proxy for firm value (Erikson & Whited, 2006). As the replacement value of a firm's assets is difficult to assess, the market-to-book ratio is used as a proxy for Q.[6] According to Erikson and Whited (2006), market-to-book ratio is the most commonly used proxy for Q.

To get a broader view and another perspective on financial performance, the use of accounting ratios is considered as well. In addition, accounting data is considered to be less noisy compared to market-based measures, as it captures better what is actually happening within a company (Lopez, Garcia & Rodriguez, 2007). We will use ROA to measure the link between ESG and operating performance as ROA is one of the broadest measures of firm operating performance (Derwall, 2007).[7] McGuire, Sundgren and Schneeweis (1988, cited in Derwall, 2007) find that ROA relates better with CSP compared to alternative measures. Waddock and Graves (1997) show that ROA is strongly related with CSR. They also test return on equity as well as return on sales, but they find that they are less related with CSR.

5.4.2 Independent variable

For the purpose of this study it is necessary to capture environmental, social, and governance issues over a certain period of time. In order to evaluate the overall ESG performance of companies, it is required to set certain parameters and criteria, which bring transparency and show how a company performs in the three different ESG areas (Kocmanova & Simberova, 2012). ESG indicators can fulfil these requirements and are commonly used as extra-financial information. They capture and evaluate a company's socially responsible performance in these three areas (Bassen & Kovacs, 2008). Therefore, this study uses ESG indicators as an independent variable, allowing us to compare companies' ESG performance over a specific period of time.

A first drawback of the data is that the ESG indicators are difficultly comparable across industries. The components for each industry might be different, as for example the environmental impact of a service industry is different from one in the energy sector (Bertoletti 2010). The level of corporate governance might also be influenced by industry-

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[6] Market-to-book ratio is defined as follows: $Market\text{-}to\text{-}book = \frac{Market\ value\ of\ assets}{Book\ value\ of\ assets}$, with *"market value of assets being the sum of the book value of assets and the market value of common stock outstanding minus the sum of book value of common stock and balance sheet deferred taxes"* (Kaplan & Zingales, 1997 cited in Derwall, 2007).

[7] ROA is defined as follow: $ROA = \frac{Net\ income}{Total\ assets}$ (Datastream, 2014)

specific factors (Bauer et al., 2008; Johnson, Moorman & Sorescu 2009). To overcome this problematic, the sample is created within one industry, the technology industry, in order to be able to compare the performance to peers in the same industry.

A second and very common drawback is the non-existence of any standards concerning ESG and sustainability reporting. Thus, companies have different approaches to publish their data, what makes a comparison of the company's performance to peers difficult. Therefore, widely accepted reporting standards and frameworks are needed (Eccles et al. 2012).

To address this second drawback, a set of data based on a single framework with comparable benchmarks is used. The study is built on Thomson Reuters' DataStream - ASSET4 ESG, Environmental, Social, and Corporate Governance Data. ASSET4 is a leading provider of objective, comparable, and auditable extra-financial information. The data is comparable as it is evaluated within the ASSET4 ESG framework where 750 individual data points and 250 key performance indicators (KPI) are analysed. The KPIs are grouped in 18 categories which are part of four pillars (Thomson Reuters, 2012a).

The four pillars are the following: Economic Performance, Environmental Performance, Social Performance, and Corporate Governance Performance. We exclude the first pillar 'Economic performance' as this pillar will be partly reflected in our dependent variables. This leaves us with three pillars and 14 categories presented in exhibit 5.2.

Environmental Performance	Social Performance	Corp. Governance Performance
• Resource Reduction • Emission Reduction • Product Innovation	• Employment Quality • Health & Safety • Training & Develop. • Human Rights • Community • Product Responsibility	• Board Structure • Compensation Policy • Board Functions • Shareholder Rights • Vision and Strategy

Exhibit 5.2: The three pillars of the ESG framework
Source: Thomson Reuters, 2012a

Several KPIs are grouped under each category (Appendix III). Based on the evaluation of each KPI, an overall score is calculated for each pillar.[8] The data input for the different KPIs is taken from publicly available sources, for example sustainability/CSR reports, company websites, annual reports and proxy filings (Thomson Reuters, 2012a).

As pointed out by Soana (2011) and Orlitzky, Schmidt and Rynes (2003), a clear weakness in measuring CSR performance is that most of the available data is based on information given out by the companies themselves. Thus, in most of the cases there is no independent third party confirming the correctness of these scores.

ASSET4 aims to overcome this issue by also conducting an ethical screening on companies. If controversial information about a company, published by NGO as well as news reports, is detected, this might lead to the attribution of a lower score for specific criteria.[9] In addition to that, the rating for each pillar is weighted by a transparency factor. This means that the more a company is providing relevant information the better it will be ranked compared to a company of similar quality but with less reported information (Thomson Reuters, 2012a).

Studying ESG scores of companies, we retrieved individual scores for Environmental, Social and Governance. An equally weighted overall score was calculated for ESG performance (*ESGscore*). The study also accounts for the possible non-linearity between financial performance and ESG scores using an alternative model (Derwall, 2007). In this second model, the absolute ESG scores are replaced by two dummy variables, *HighESGscore* and *LowESGscore*. The dummy *HighESGscore* takes the value 1 for high ESG performance (scores over 90) and the value 0 for scores under or equal to 89. The dummy *LowESGscore* takes the value 1 for low ESG performance (scores under 20), and the value 0 for scores over or equal to 21. The thresholds of 90 and 20 were chosen considering the distribution of the sample, to ensure that the group tested are significant enough for the results to be representative. Finally, for the third step of the regression, we consider the individual scores on each pillar to regress them against our dependent variables.

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[8] Details for the calculations are available at:
http://extranet.datastream.com/data/ASSET4%20ESG/documents/ASSET4_ESG_Methdology_FAQ_0612.pdf
[9] Details for the ethical screeening criteria are available at :
http://extranet.datastream.com/data/ASSET4%20ESG/documents/EthicalScreening_DS_QuickGuide.pdf

5.4.3 Control variables

As we use two different dependent variables, we need to select the relevant control variables to include in our regression.

Control variables for measuring the link between ESG performance and ROA

Consistent with Derwall (2007), Nelling and Webb (2009) and Waddock and Graves (1997), we control for firm size using the book value of assets[10] and total sales,[11] and for risk using the debt to asset ratio.[12] Size, risk, and industry are the most frequently used control variables when studying CSP and financial performance (Ullman, 1985; Vogel, 2005; Waddock & Graves, 1997). As we study one industry, we do not need to control for industry factors.

Size is of particular relevance as it has been proven that smaller firms do not exhibit CSR behaviour to the same extent as larger firms do. Burke et al. (1986 cited in Waddock & Graves, 1997) explain this difference by stating that growing and bigger firms attract more attention that lead them to disclose more information to respond to stakeholder demands. To account for size, we first use book value of assets, and sales are used to perform a robustness check to confirm our results. Consistent with previous empirical findings, we expect size to affect ROA positively.

Waddock and Graves (1997) highlight the fact that risk is another relevant proxy because management's attitude toward risk may impact directly the firm performance through decisions related to investment opportunities (building or destroy markets) and cost management (incurring cost for controlling pollution, improving working conditions, etc.). This is why the ratio debt on asset is used to control for risk. Hence, debt on asset is expected to affect ROA negatively.

Control variables for measuring the link between ESG performance and Q

Other factors than ESG performance are possibly influencing firm value, what needs to be controlled for. The control variables chosen are the same as used by Derwall (2007) and

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[10] Book value of assets is defined as *"the sum of total current assets, long term receivables, investment in unconsolidated subsidiaries, other investments, net property plant and equipment and other assets."* (Datastream, 2014)

[11] Sales are defined as *"gross sales and other operating revenue less discounts, returns and allowances."* (Datastream, 2014)

[12] Debt to asset ratio is calculated as follows: (Short Term Debt & Current Portion of Long Term Debt + Long Term Debt) / Total Assets * 100 (Datastream, 2014)

Waddock and Graves (1997): yearly sales growth,[13] ROA, firm age, firm size (using book value of assets), and R&D expenditures on sales. These are control variables commonly used when studying either the link between CSR and CFP (Derwall, 2007; Waddock & Graves, 1997) or the link between corporate governance and CFP (Gompers, Ishii & Metrick, 2003). Sales growth is a commonly used control variable as good growth opportunities usually result in higher Q (Krafft et al., 2013). To account for the firm size, we use the natural logarithm of the book value of assets (Derwall, 2007). Consistent with empirical findings, both sales growth and firm size are expected to positively affect Q. Previous research finds that ROA, controlling for the firm's operating performance, affects Q positively, whereas firm age impacts Q negatively. Q is a forward-looking measure taking into account growth opportunity and younger firms usually exhibit higher growth opportunities (Czarnitzki & Delanote, 2013)

McWilliams and Siegel (2000) argue that the inconsistency in research linking CSP and CFP comes from flawed empirical analysis. They defend that most of the models are misspecified because academics ignore the positive link between R&D investments and firm's financial performance. Not only do they demonstrate the necessity of introducing investment in R&D as a control variable, but they also show a strong positive relationship between R&D intensity and CSP. For this reason, R&D expenditure on total sales is used as a control variable in order to check the robustness of the results. Especially in the technology industry, R&D and innovation are seen as drivers of form performance (Xerfi, 2012). Thus, we expect R&D to have a positive impact on Q.

5.5 Reliability & Validity

To ensure that the results of the empirical research are reliable, some points need to be taken into consideration (Bryman & Bell, 2011). To do so, we need to be sure that we minimise all sorts of errors in our study.

A first possible concern comes from the consistency in data collection. First, most of the data used comes from companies' financial statements. Second, Datastream is used to collect data and to select companies. This is a database widely used by academics and practitioners, therefore it can be considered as a reliable source. Concerning the ESG scores, shortcomings of these scores are presented in section 4.3.3. Considering that the construction of the data

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[13] Sales growth is calculated as follows: (Current Year's Net Sales or Revenues / Last Year's Total Net Sales or Revenues - 1) * 100 (Datastream, 2014)

follows a specific framework and comes from a reliable institution, we believe they are one of the most reliable data available at the moment for measuring non-financial performance of companies. By using data from the same source and ensuring that these data are right, we believe to be consistent in data collection, hence minimising issues with internal reliability. For this reason, we believe our results to be reliable.

The use of a four-year time period enables us to minimise the risk of temporal errors affecting our data (Bryman & Bell, 2011), but it also strengthens the stability of the results of our study, thus impacting positively on the reliability. Finally, to analyse the data, we run regressions using Eviews 8, and, as mentioned before, residual diagnostic tests were done to check for possible biases that could affect the results of our study.

Validity states whether the results of the study can be trusted or not. We especially pay attention to three different types of validity: measurement validity, internal and external validity (Bryman & Bell, 2011). Concerning internal validity, which relates to the issue of causality (Bryman & Bell, 2011), it is important to highlight that we are aware that other variables do impact ROA and Q. This study does not aim to explain all the variation of the dependent variables, which is why a modest R-squared is found when running the regressions. Moreover, we are aware of possible endogeneity problems, especially as researchers have argued for a virtuous circle rather than a direct causal link between CSR and CFP (Nelling & Webb, 2009). External validity is concerned by whether our result can be generalised or not (Bryman & Bell, 2011). It is therefore important that this study reflects listed companies of the US technology sector. We earlier discussed the selection process of our sample. As mentioned, the research is based on the belief that ESG characteristics do vary across industries, which is why these results cannot be applied to other industries. The same reasoning applies for generalisation across countries as regulations and culture influence ESG performance (Doh & Guay, 2006). Thus, the purpose of this study is to set a base for further studies. In addition, readers may be aware of limitations due to the time period studied. The time period studied includes the financial crisis, which could affect results, thus further studies should be conducted over a longer time period when data will be available, to improve the validity of the results. Finally, measurement validity analyses whether the measure of a concept does reflect this concept or not. The variables used in this study are commonly used in previous research carried out on the topic (Derwall, 2007; Nelling & Webb; 2009; Waddock & Graves, 1997). We also take into consideration McWilliams and Siegel's (2000) findings about the importance of R&D that we include as a control variable for market

performance. In addition, ESG scores have been used to conduct different studies in the field of corporate finance, but we acknowledge that they might not always be objective measures, as highlighted in section 3.3.2.

We thoroughly present the methodology of our study, based upon theoretical findings and previous empirical research. Therefore, we believe it can be easily repeated and applied to other industries as well countries.

5.6 Alternative approaches

As mentioned in section 5.1, we decide to run a panel data regression using OLS method rather than Fama-Macbeth model. Skoulakis (2008) shows that in presence of a large number of cross-sections, both Fama-Macbeth and OLS provide reliable results. We suggest that further research should use both OLS and Fama-Macbeth as a robustness check (Skoulakis, 2008).

Using a portfolio approach (Fama & French, 1993) is an alternative method commonly used to investigate the link between CSP and CFP. For instance, previous studies have analysed the return of socially responsible mutual funds compared to conventional funds in order to draw conclusion on the relevance of CSR. However, these studies often lack of a clear conclusion (Viviers & Eccles, 2012). Derwall (2007) points out that the lack of significant results might come from two shortcomings. First, mutual fund performance can be biased by omitted variables or variables that are hard to quantify, such as fund manager skills or screening methods. Second, proving the existence of a premium for socially responsible funds may be difficult as CSR funds and conventional funds are not mutually exclusive. Moreover, socially responsible firms are seen as less risky (Kurucz, Colbert & Wheeler, 2008). Thus, investors claim lower returns from firms with high ESG performance (Aman & Nguyen, 2008). Therefore, using the portfolio approach causes the difficulty to adjust correctly for risk in order to make abnormal returns comparable and results reliable.

6. Empirical findings

This section outlines the results of the regression analysis. After explaining the descriptive statistics of the data used, the results of the regressions are presented and interpreted for the investigation of the hypotheses mentioned in section 4.

6.1 Descriptive statistics of the sample

6.1.1 ESG scores

This section analyses the descriptive statistics of the independent variable, the ESG score. It is interesting to analyse these results to observe if the developments of the scores reflect the main belief that companies improve their ESG performance due to rising concerns about these issues (Koelher & Hespenheide, 2013).

As presented in exhibit 6.1, the mean of the overall score increases from 2009 to 2010 by 4 percentage points and then remains stable at 63%, while the standard deviation remains nearly constant over the four years. Both the first quartile and the median increase by 8 percentage points over the four years, what shows that ESG performance has improved, especially for the lower half of the sample. In 2009, 43 companies have a score under 50% compared to only 30 companies in 2012.

					(all values are end of year values)
Overall ESG score	**2009**	**2010**	**2011**	**2012**	**Change 09/12**
Mean	0.59	0.63	0.63	0.63	0.05
Median	0.56	0.62	0.63	0.64	0.08
Standard deviation	0.22	0.21	0.22	0.22	-0.00
Quartile (first 25%)	0.41	0.44	0.46	0.49	0.08
Quartile (third 75%)	0.77	0.84	0.83	0.83	0.05

Number of companies

Overall ESG score	**2009**	**2010**	**2011**	**2012**	**Average**
0%-10%	0	0	0	0	0
11%-20%	2	1	2	0	1
21%-30%	4	3	4	8	5
31%-40%	19	14	15	12	15
41%-50%	18	14	12	10	14
51%-60%	13	13	10	17	13
61%-70%	11	20	15	11	14
71%-80%	12	8	11	13	11
81%-90%	10	15	19	15	15
91%-100%	11	12	12	14	12

Exhibit 6.1: Descriptive statistics of the overall ESG score

Looking at the third quartile, ESG scores improve by 5 percentage points over the studied time period. Considering the individual performance of the companies, it can be stated that for 70 out of a 100 companies the score has improved comparing 2012 data to 2009 data. But only 8 out of a 100 companies have improved their score constantly over the four years.

Exhibit 6.2 shows the statistics for the scores of each pillar. Comparing the scores of 2012 to the ones of 2009, the environmental score (E-score) has improved the most, with an increase of 7 percentage points for the mean and of 18 percentage points for the median. The social score (S-score), increasing by 6 and 11 percentage points respectively, also follows this growing trend. For both scores, the standard deviation remains stable. The mean and median for the governance score (G-score) is barely developing over the studied time period. But the average performance on this pillar is already higher with a mean G-score of 78% in 2012, compared to a mean S-score of 55% and a mean E-score of 57%. Moreover, the G-score is the only score for which the first quartile is decreasing by 3 percentage points from 2009 to 2012.

				(all values are end of year values)	
Environmental Score	**2009**	**2010**	**2011**	**2012**	**Change 09/12**
Mean	0.51	0.55	0.56	0.57	0.07
Median	0.47	0.58	0.67	0.65	0.18
Standard deviation	0.31	0.31	0.31	0.31	-0.00
Quartile (first 25%)	0.20	0.23	0.22	0.29	0.10
Quartile (third 75%)	0.83	0.86	0.88	0.87	0.04

Social Score	**2009**	**2010**	**2011**	**2012**	**Change 09/12**
Mean	0.49	0.54	0.56	0.55	0.06
Median	0.43	0.54	0.57	0.54	0.11
Standard deviation	0.28	0.27	0.27	0.27	-0.00
Quartile (first 25%)	0.26	0.30	0.30	0.34	0.09
Quartile (third 75%)	0.75	0.77	0.79	0.79	0.04

Governance Score	**2009**	**2010**	**2011**	**2012**	**Change 09/12**
Mean	0.77	0.79	0.78	0.78	0.01
Median	0.80	0.80	0.82	0.80	0.00
Standard deviation	0.14	0.12	0.13	0.12	-0.02
Quartile (first 25%)	0.74	0.72	0.69	0.71	-0.03
Quartile (third 75%)	0.85	0.88	0.85	0.87	0.02

Exhibit 6.2: Descriptive statistics of the individual ESG scores

6.1.2 *ROA and Q*

This section analyses the descriptive statistics of the dependent variables to better understand the characteristics of the sample.

	2009	**2010**	**2011**	**2012**
Return on Assets (ROA)				
Mean	0.05	0.10	0.09	0.07
Median	0.06	0.09	0.09	0.07
Standard deviation	0.11	0.09	0.09	0.11
Kurtosis	4.53	5.72	5.50	8.22
Skewness	-1.38	-0.74	-0.83	-1.39
Tobin's q (Q)				
Mean	6.93	3.41	1.42	-3.64
Median	2.23	2.49	2.53	2.46
Standard deviation	38.10	11.23	13.14	67.92
Kurtosis	86.95	65.67	57.39	99.52
Skewness	9.19	1.57	-7.29	-9.96

Exhibit 6.3: Descriptive statistics of ROA and Q

Looking at the descriptive statistics, both the mean and the median of ROA are stable over the four-year period studied. Q presents less stable results: the median is quite stable, but the mean values are varying substantially from a year to another. The kurtosis values are high, indicating that the sample is leptokurtic. We are aware that some values are extreme (e.g. standard deviation), but this may be explained by the characteristics of the industry studied, for instance the difficulty for the market to properly valuate some intangible assets, e.g. network effects, or growth opportunities.

6.2 Regression results

6.2.1 ESG scores and operating performance

Hypothesis 1: ESG scores relate positively to operating performance, ceteris paribus.

In order to test the relationship between the overall ESG score and operating performance measured by ROA, the regression a_1 is run. Exhibit 6.4 shows the empirical results the analysis provided.

Equation a_1

The table reports the OLS coefficients and the corresponding t-statistic (in parentheses), for the period 2009 to 2012. ROA (2) is the robustness check including sales as a control variable. Note that the significance levels correspond to two-sided probabilities.

	ROA (1)	ROA (2)
Intercept	0.06 ***	0.06 ***
	(2.96)	(2.88)
ESGscore	0.05 *	0.05 *
	(1.65)	(1.63)
Control variables:		
Book value of Assets	5.72E-10 **	
	(2.07)	
Debt on Assets	-0.18 ***	-0.18 ***
	(-5.76)	(-5.75)
Sales		9.77E-10 ***
		(2.71)
R-squared	0.527	0.528
Adjusted R-squared	0.494	0.496
F-test	16.330	16.390
Prob (F-test)	0.000	0.000

***significant at 1% level **significant at 5% level *significant at 10% level

Exhibit 6.4: Regression results for equation a_1 and the robustness test

Analysing the results, the most significant determinants of ROA are debt on assets and book value of assets. The former is significant at the 1% level, while the latter is significant at the 5% level, which confirms the relevance of using these two variables as control variables. More specifically, book value of assets affects positively ROA, even though the coefficient associated is quite small. Debt on assets, controlling for firm risk, is negatively associated with ROA. Both these results are expected, and fall in line with previous empirical findings (Derwall, 2007; Waddock & Graves, 1997).

Looking at the variable of interest, ESG performance, we can statistically determine the relationship between ESG performance and ROA at the 10% level. To be consistent with the hypothesis, this study is interested in confirming the positive relationship between ROA and ESG performance, thus only considering results on the positive tail of the distribution. The coefficient of ESG is positive, meaning that ROA and ESG scores are positively associated. The first result comes to support hypothesis 1.

As mentioned in section 5.3.2, a robustness test using firms' sales as the variable controlling for firm size is run to strengthen the previous results. Consistent with previous results, debt on assets is negatively associated with ROA, whereas sales are positively linked with ROA. Once again, the statistical relationship between ESG performance and ROA is determined at the 10% level. These results confirm hypothesis 1.

Hypothesis 1.0: Companies with high ESG scores are associated with higher operating performance than companies with lower ESG scores, ceteris paribus

Hypothesis 1.1: Companies with low ESG scores are associated with lower operating performance than companies with higher ESG scores, ceteris paribus

Consistent with hypothesis 1.0 and 1.1, potential non-linearity in the relationship between ROA and ESG performance is tested by running equation a_2. Exhibit 6.5 presents the results of the conducted analysis.

Once again, both book value of assets and debt on assets are found to be statistically associated with ROA, respectively at the 5% and 1% levels. Similarly, debt on assets affects ROA negatively, whereas book value of assets affects it positively. The results show that a high ESG score is also significant at the 5% level, which proves that the overall ESG score affects ROA. As the coefficient of high ESG performance is positive, high ESG performance is positively associated with ROA. However, we cannot prove any statistical relationship between ROA and low ESG performance.

The same robustness check is run as for equation a_1, using sales to control for firm size. The robustness check upholds the previous findings: the positive relationship between high ESG performance and operating performance is statistically determined, whereas no statistical relationship is found between low ESG scores and operating performance.

Having said that, the goodness of fit of the model is reasonable, with 53% of the variability explained by the included variables.

These results support the hypothesis 1.0 that high ESG performance is positively associated with ROA, thus operating performance. The regression testing for non-linearity is in line with hypothesis 1, but we do not find any evidence of a negative relationship between low ESG scores and ROA. This shows proof of non-linearity in the relationship between ESG scores and operating performance, and leads to the rejection of hypothesis 1.1.

Equation a_2

The table reports the OLS coefficients and the corresponding t-statistic (in parentheses), for the period 2009 to 2012. Note: HighESGscore=1 if ESGscore>89 and LowESGscore=1 if ESGscore<21. ROA (2) is the robustness check using sales as an extra control variable. To calculate the difference between coefficients, the coefficient of the dummy LowESGscore is subtracted from the coefficient of the dummy HighESGscore. Note that the significance levels correspond to two-sided probabilities.

	ROA (1)	ROA (2)
Intercept	0.09 ***	0.09 ***
	(8.20)	(7.98)
LowESGscore	0.01	0.01
	(0.46)	(0.46)
HighESGscore	0.02 **	0.02 **
	(2.02)	(1.96)
Difference High-Low ESG score	0.01	0.01
Control variables:		
Book value of Assets	5.53E-10 **	
	(2.49)	
Debt on Assets	-0.19 ***	-0.18 ***
	(-7.74)	(-7.80)
Sales		9.61E-10 ***
		(3.36)
R-squared	0.527	0.528
Adjusted R-squared	0.494	0.495
F-test	16.180	16.250
Prob (F-test)	0.000	0.000

***significant at 1% level **significant at 5% level *significant at 10% level

Exhibit 6.5: Regression results for equation a_2 and the robustness test

6.2.2 ESG scores and firm value

Hypothesis 2: ESG scores relate positively to firm value, ceteris paribus.

Consistent with the second hypothesis, we run the equation b_1 to test for the nature of the relationship between Q, used as a proxy for firm value, and ESG performance. The results are shown in the following table.

Equation b_1

The table reports the OLS coefficients and the corresponding t-statistic (in parentheses), for the period 2009 to 2012. Q (2) is the robustness check including R&D expenditures on sales. Note that the significance levels correspond to two-sided probabilities.

	Q (1)	Q (2)
Intercept	-112.67 **	-116.00 ***
	(-3.20)	(-3.26)
ESGscore	9.11	10.35 *
	(1.47)	(1.73)
Control variables:		
Ln (Book value of Assets)	18.67 ***	19.31 ***
	(6.30)	(6.45)
Sales growth	-4.12	-2.84
	(-1.05)	(-0.79)
Firm Age	-5.23 ***	-5.56 ***
	(-12.78)	(-13.22)
Return on Assets	9.09	15.21
	(0.68)	(0.96)
R&D expenditures/sales		34.64 **
		(2.42)
R-squared	0.256	0.257
Adjusted R-squared	0.204	0.204
F-test	4.945	4.840
Prob (F-test)	0.000	0.000

***significant at 1% level **significant at 5% level *significant at 10% level

Exhibit 6.6: Regression results for equation b_1 and the robustness test

Consistent with Derwall (2007), equation b_1 is first run without taking into account R&D expenditures on sales, and then a robustness check is run using R&D expenditures on sales, a proxy to measure R&D intensity and the innovation capability of a company.

On the one hand, firm age and the logarithm of book value of assets are found to be statistically significant control variables, the former affecting negatively Q whereas the latter impacts Q positively. The nature of the relationship between both variables and Q is in line with expectations and previous empirical findings. On the other hand, both ROA and sales growth are found to not be significant, which is a more surprising result.

Both these results are confirmed and strengthened when adding R&D on sales as a control variable. Indeed, R&D expenditures on sales are found to statistically affect Q at the 5% level. Results show a positive relationship between R&D spending and Q, with a coefficient being the highest of all the coefficients. Looking at the variable of interest, ESG score, it is found to impact Q positively, when using R&D as a control variable. Without using R&D, the statistical significance of ESG performance is not determined because of a p-value superior to 10%, yet relatively close to 10% (p=10.20%). Nonetheless, in both cases, the coefficient associated with ESG score is positive, which confirms the first hypothesis of a positive relationship between firm financial performance and ESG scores.

For this model, the goodness of fit is inferior to the one for operating performance, with only 26% of the variability in Q being explained by the independent and control variables. This is consistent with the idea that market-based measures are noisier.

To test for non-linearity, and for hypothesis 2.0 and 2.1, equation b_2 is run, using dummy variables for high-ESG performing and low-ESG performing firms. The results are presented in exhibit 6.7.

Hypothesis 2.0: Companies with high ESG scores are associated with higher firm value than companies with lower ESG scores, ceteris paribus

Hypothesis 2.1: Companies with low ESG scores are associated with lower firm value than companies with higher ESG scores, ceteris paribus

Equation b$_2$

The table reports the OLS coefficients and the corresponding t-statistic (in parentheses), for the period 2009 to 2012. Note: HighESGscore=1 if ESGscore>89 and LowESGscore=1 if ESGscore<21. Q (2) is the robustness check using R&D expenditures on sales as an extra control variable. To calculate the difference between coefficients, the coefficient of the dummy LowESGscore is subtracted from the coefficient of the dummy HighESGscore. Note that the significance levels correspond to two-sided probabilities.

	Q (1)	Q (2)
Intercept	-116.91 ***	-120.36 ***
	(-3.34)	(-3.48)
LowESGscore	-8.05 ***	-9.10 ***
	(-3.23)	(-3.58)
HighESGscore	1.74 ***	1.91 ***
	(2.78)	(2.71)
Difference High-Low ESG score	9.79	11.01
Control variables:		
Ln (Book value of Assets)	19.28 ***	19.99 ***
	(6.48)	(6.72)
Sales growth	-3.80	-2.50
	(-0.92)	(-0.66)
Firm Age	-5.22 ***	-5.56 ***
	(-13.81)	(-13.61)
Return on Assets	8.78	14.93
	(0.65)	(0.93)
R&D expenditures/sales		34.67 **
		(2.33)
R-squared	0.256	0.257
Adjusted R-squared	0.204	0.204
F-test	4.897	4.793
Prob (F-test)	0.000	0.000

***significant at 1% level **significant at 5% level *significant at 10% level

Exhibit 6.7: Regression results for equation b$_2$ and the robustness test

First, the results found for the control variables are in line with the previous regression. Both ROA and sales growth are not significant, whereas the logarithm of the book value of assets impacts positively Q and firm age impacts it negatively.

Regarding ESG scores, we can statistically determine the relationship between high ESG scores and Q, but also between low ESG scores and Q, both at the 1% level. More specifically, low ESG scores are negatively associated with Q, and high ESG scores are positively associated with Q. Moreover, the dummy variable low ESG score shows an extremely low coefficient compared to the other dummy, high ESG score. These results are confirmed when running the robustness test using R&D expenditures on sales as a control variable. As expected, high ESG-performing companies are associated with higher Q, thus higher firm value, whereas low ESG-performing companies are associated with lower Q, thus lower firm value, confirming both hypothesis 2.0 and 2.1.

6.2.3 Individual scores and financial performance

Hypothesis 3.0: E, S and G scores are equally important for operating performance,
ceteris paribus.

Hypothesis 3.1: E, S and G scores are equally important for firm value,
ceteris paribus.

Consistent with the third hypothesis, we are interested in studying the impact of each ESG score on financial performance.

Regarding the results found for ROA, shown in exhibit 6.8, all the control variables are significant (debt on assets, book value of assets, and sales). The governance factor is statistically significant at the 1% level, and associated with a positive coefficient. On the other hand, we cannot statistically determine the impact of the social factor on ROA. Environmental performance is not found to be statistically significant at the 10% level. But as the p-value is relatively close to 10%, one should consider the coefficient, which is negative. These results are confirmed when running the robustness check using sales as a control variable.

Equation a₃

The table reports the OLS coefficients and the corresponding t-statistic (in parentheses), for the period 2009 to 2012. ROA (2) is the robustness check including sales as a control variable. Note that the significance levels correspond to two-sided probabilities.

	ROA (1)	ROA (2)
Intercept	0.013	0.011
	(0.58)	(0.50)
E score	-0.029	-0.029
	(-1.52)	(-1.54)
S score	0.036	0.036
	(0.85)	(0.85)
G score	0.096 ***	0.096 ***
	(2.62)	(2.66)
Control variables:		
Book value of Assets	5.77E-10 **	
	(2.47)	
Debt on Assets	-0.19 ***	-0.18 ***
	(-8.79)	(-8.93)
Sales		9.81E-10 ***
		(3.26)
R-squared	0.529	0.531
Adjusted R-squared	0.497	0.498
F-test	16.180	16.250
Prob (F-test)	0.000	0.000

***significant at 1% level **significant at 5% level *significant at 10% level

Exhibit 6.8: Regression results for equation a₃ and the robustness test

Studying the link between each ESG score and Q, results are different as presented in exhibit 6.9. Firm age, book value of assets, and R&D on sales prove to be significant, with similar statistical significance and coefficient as in the previous regression. Likewise, we cannot determine statistically the impact of the S-score, whereas both E- and G-scores are proven to be statistically significant at the 1% level. Nevertheless, coefficients show different patterns compared to the coefficients of the above regression with ROA as the dependent variable. For instance, environmental performance is positively associated with Q, whereas governance is negatively associated with Q.

Equation b₃

The table reports the OLS coefficients and the corresponding t-statistic (in parentheses), for the period 2009 to 2012. Q (2) is the robustness check including R&D expenditures on sales. Note that the significance levels correspond to two-sided probabilities.

	Q (1)	Q (2)
Intercept	-86.79 **	-86.64 **
	(-2.05)	(-2.05)
E score	25.65	26.86 ***
	(3.49)	(3.36)
S score	-12.96	-13.91
	(-1.32)	(-1.29)
G score	-21.83 ***	-22.37 ***
	(-2.95)	(-2.87)
Control variables:		
Ln (Book value of Assets)	18.14 ***	18.54 ***
	(5.28)	(5.40)
Sales growth	-3.49	-2.22
	(-1.00)	(-0.70)
Firm Age	-5.31 ***	-5.60 ***
	(-12.42)	(-12.92)
Return on Assets	10.69	17.19
	(0.80)	(1.08)
R&D expenditures/sales		34.71 **
		(2.42)
R-squared	0.260	0.260
Adjusted R-squared	0.206	0.206
F-statistic	4.921	4.817
Prob (F-test)	0.000	0.000

***significant at 1% level **significant at 5% level *significant at 10% level

Exhibit 6.9: Regression results for equation b3 and the robustness test

First, these results are inconsistent with the predictions of hypotheses 3.0 and 3.1 as we find discrepancies in the statistical significance of each factor. Second, the accounting-based and the market-based perspectives exhibit different results. While the environmental factor is statistically significant and is positively impacting Q, it shows a low significance level and has a negative impact on ROA. The G-score also exhibits different results: in both case, the governance factor is statistically significant but it impacts ROA positively whereas it impacts Q negatively. Therefore, hypotheses 3.0 and 3.1 cannot be confirmed.

7. Discussion

The overall ESG concept

As expected, we find that ESG scores are positively associated with operating performance and firm value. These results are in line with most of previous studies and meta-studies analysing CFP and CSP (Margolis & Walsh, 2003; Orlitzky, Schmidt & Rynes, 2003). Thus we can conclude that the overall ESG concept tested in the technology industry is no exception to these findings.

The results imply that strong ESG performance relates positively to operating performance for the technology industry. This is consistent with researchers arguing that good ESG performance can impact positively operating performance through different channels, like for example by increasing revenues through reputational benefits consistent with the concept of cause-related marketing (Varadajara & Menon, 1988), through competitive advantage (Porter & Kramer, 2006; 2011) and even through cost reduction and risk reduction (Koelher & Hespenheide, 2012; 2013). This is also in line with Orlitzky, Schmidt and Rynes (2003) who find that CSP and operating performance are positively associated.

In the same manner, ESG performance relates positively to firm value. This result is expected as both measures are supposed to reflect a firm's financial performance. In addition, firm value also reflects investor perception (Derwall, 2007). Thus, companies with high ESG performance benefit from higher market valuation. This is in line with previous findings from Waddock and Graves (1997), Derwall (2007), and Flammer (2013). The positive relationship is explained by the investor's belief that firms with high ESG scores are less risky leading to a lower discount rate, and thus, they benefit from higher valuations (Derwall, 2007).

Top-performers and laggards

This study provides deeper insights into the ESG concept when analysing the financial performance of companies with very high ESG scores and companies with extremely low ESG scores. As expected in hypothesis 1.0, companies with high ESG performance are associated with better operating performance. Contrarily, hypothesis 1.1 is not confirmed, meaning that companies with extremely low ESG scores are not associated with lower operating performance than companies with higher scores. First of all, implications of the results for operating performance support the mixed relationship theory (Mintzberg, 1983;

Soana, 2011), as there is a clear proof of asymmetry when looking at the difference in coefficients between low and high ESG performance.

Hypothesis 1.1 expects a negative relationship between low ESG scores and operating performance, consistent with arguments from Barnett (2007), Porter and Van der Linde (1995) and King and Lenox (2000) that poor ESG performance is a sign of operating inefficiency. Same is stated by Derwall (2007), who finds that a low eco-efficiency score decreases operating performance and explains this by saying that poor environmental governance is mostly of tangible nature; thus it is reflected directly in operating performance through costs such as clean-up costs from oil spills, or hazardous waste management costs.

The discrepancy in results might be explained by the industry considered in this paper. As plenty of the technology companies outsource the manufacturing of products (HfS Research, 2012), low ESG performance might affect operating costs less than it does for other industries. Many of the costs occurring through bad social and environmental performance are borne by sub-contractors and suppliers; as for example, production downtimes through strikes or bad working conditions as well as costs incurred by environmental accidents and pollution throughout the production process. Nevertheless, we still expect a negative impact as low ESG performance of subcontractors and suppliers might negatively affect a company's reputation, and thus sales and operating performance (Varadajara & Menon, 1988). However, it is difficult to generalise this assumptions to the overall industry, but we consider it to be an explanation on firm level.

Regarding firm value, the implications are slightly different. The hypotheses that high ESG performers have higher firm value than others and that low ESG performers have a lower firm value can be confirmed. Moreover, the magnitude of coefficients related to good ESG performance and poor ESG performance are quite different. The absolute value of the negative coefficient is clearly higher than the one of the positive coefficient. These findings are in line with Derwall (2007) who also finds large discrepancies between high eco-efficient performers and low eco-efficient performers. Flammer (2013) proposes several arguments supporting these findings for environmental CSR. First, she argues that the more environmental CSR becomes the norm to follow, the more eco-harmful behaviour is punished by the market. Companies seem to be aware of this fact. According to the descriptive statistics, companies with scores in the lower half of our sample put more effort into improving their overall ESG scores. Second, Flammer (2013) argues that environmental CSR

is a resource with decreasing marginal returns. Thus, it is normal that companies with extremely high scores have a smaller coefficient than the ones with extremely low scores. Moreover, the large difference in magnitude of coefficients may come to support the arguments that efficient ESG management does make a difference when a company is facing a crisis (Koelher & Hespenheide, 2013). As our empirical study spans over the financial crisis, the low coefficient may be the result of the weak resilience of companies with lower ESG performance, considered to be more exposed to risk.

An explanation of the difference in results between market and accounting perspectives on the negative impact of bad ESG scores is seen in the forward-looking behaviour of markets (Derwall, 2007). Thus, the market might perceive the long-term consequences of poor performance, which may not yet be reflected in operating performance.

Breaking down ESG performance
The overall ESG concept matters in terms of operating performance as well as for firm value. To strengthen the previous hypotheses, we test if all three pillars are contributing to the same extent to the results of the overall score. The results show that these hypotheses cannot be confirmed.

Looking at operating performance we only find a significant and positive relationship for the G-score. Thus, well-formed governance mechanisms are contributing positively to operating performance. This is consistent with what most scholars find in previous corporate governance research (Bauer, Guenster & Otten, 2004; Core, Guay & Rusticus, 2006; Core, Holthausen & Larcker, 1999; Gompers, Ishii & Metrick, 2003). These results are explained by the fact that well-governed firms have less agency problems, meaning that manager's interests are aligned with the objectives of the firm (Jensen & Meckling, 1976). The findings also underline the recent SRI trend that the incorporation of corporate governance criteria has become increasingly important (US SIF Foundation, 2012).

The E-score is close to the 10% significance level and shows a slightly negative relationship with operating performance. Even if the score is not significant, these findings have a tendency to follow the strand of literature arguing that the implementation of CSR practices is costly and does not lead to improved financial performance (Aupperle, Carroll and Hatfield, 1985; Barnett, 2007; Gray & Shadbegian, 1993).

Just like the E-score, the S-score is also shown to be insignificant in our empirical analysis. In addition, results for both scores show very low coefficients. These findings might be explained in several ways. First, there is simply no evidence of a consistent relationship between CSR and firm performance for the technology sector. This would support the work by Waddock and Graves (1997) who find a neutral relationship meaning that there are too many other factors influencing the relationship between ESG and CFP. Consistent with that, we could also argue for an occurring net effect which leads to the inconsistency in results. This is also in line with the fact that previous studies in the field of CSP find diverting results and that the link between ESG and CFP might be different from company to company. Thus, the relationship should not only be studied on an industry level, but also on a firm level with a resource-based view framework (Moura-Leite, Padgett & Galan, 2012). Second, these results might be in accordance with the above-mentioned fact that a lot of the costs related to weak environmental and social performance are borne by the manufacturing suppliers, thus not affecting costs and operating performance directly.

In terms of market value, the results are more striking. The relationship between the E-score and firm value is positive and highly significant. So being environmental friendly seems to have a high intangible value and is appreciated by the market. Many previous studies focusing on environmental issues related to firm value find positive results (Al-Najjar & Anfimiadou, 2012; Derwall, 2007; Sinkin, Wright & Burnett, 2008). Recent trends in the technology sector show that environmental issues are playing a more and more important role. Companies launch environmentally friendly products such as green cell phones, reduce packaging and shipping waste, invent apps which contribute to a green lifestyle, and introduce recycling programmes for their obsolete products (Tech News Daily, 2011).

According to our empirical analysis, the G-score is strongly negatively associated with firm value. These results are unexpected as most of the previous research find a positive relationship. Some scholars argue that the relationship is getting less strong when legal and regulatory governance standards are already high in a country which is the case for the US. Yet, their findings still show a positive relationship (Bauer, Guenster & Otten, 2004; Chira, 2014). Our completely opposing results might be explained as follows. First, in previous studies, scholars show that only few corporate governance criteria included in indices are driving the results, while the other components do not seem to be associated with financial performance (Bebchuk, Cohen & Ferrel, 2008; Brown & Caylor, 2006; Bauer et al., 2008). Thus, the overall G-score might not take into account or not weigh enough the value driving

criteria what might lead to falsified results. Second, governance might have a negative relationship to firm value because of the innovation specificity of the industry. The technology sector faces a high amount of disruptive innovation which makes existent products obsolete. Therefore, companies have to do large investments which are highly uncertain in order to create pathbreaking innovations. Thereby, corporate governance could be seen as counterproductive. Companies with high governance standards usually present well-founded investment decisions that are communicated with transparency to their shareholders. In contrast, entrepreneurial and managerial freedom might be a crucial success factor in the technology sector, whereby high information and disclosure requirements might impede innovation (Bhattacharya, 2009), what should be further investigated in future research.

The relationship between the S-score and firm value is not significant. This is quite unexpected when considering data published by the US SIF Foundation. In 2012, assets worth $1.2 trillion were invested under professional management by taking into account social aspects. This number is by far the highest compared to $240 billion in assets for environmental aspects and $623 billion for governance aspects. This might be explained by the fact that the S-score might not reflect properly the criteria that investors judge the most important. The score is mainly based on internal social aspects (Employment Quality, Health and Safety, Training and Development, Diversity) while external aspects including societal and community issues play only partial roles (See Appendix III). Referring to the trends outlined by the US SIF Foundation (2012), SRI investors especially care about such external aspects as well as fundamental ethical questions, e.g. Sudan-avoidance policies, which are often used to sort out companies in a primordial ethical screening. Thus, our results might indicate that the criteria composing the S-score are not the ones investors are showing the most interest in, supporting Ullman (1985) arguing for a neutral relationship due to measurement problems.

We could neither for operating performance nor for firm value show that all three pillars are driving the overall score to the same extent. The results are especially diverting for firm value. The G-score is negatively related to firm value whereas the E-score shows a positive relationship. Our study contributes to the fact that the G-score matters for operating performance, but shows a strong negative relationship with firm value what should not be disregarded neither by management nor investors. Nevertheless, it is shown that companies with extremely high scores have better operating performance and higher firm value than

other companies. Thus, high ESG performance seems to be rewarded from an accounting as well as market perspective.

Implications related to control variables

Concerning the used control variables, two important findings need to be considered. First, and as a limitation to our study, we want to highlight that firm value results should be interpreted with caution. ROA and sales growth are shown to be insignificant in any firm value regression. This might be a sign that market values in the technology are highly affected by other aspects and investors' expectations. Several market experts are claiming that a tech bubble is building up in the sector similar to the dot-com bubble around the turn of the millennium (Edward, 2013; Steiner, 2014). The bubble is explained by the low-interest rates after the financial crisis. Investors tend to invest in stocks as the risk-free alternative is not yielding any return, what drives the stock market up. Moreover, the technology sector shows high firm valuations for companies that only have small incomes (Edward, 2013). These high valuations are often due to the over-estimation of network effects, which are not always sustainable in the long-term (Koller, Goedhard, & Wessels, 2010). Second, McWilliams and Siegel (2000) find that including R&D as a control variable yields no significant results between firm financial performance and CSR performance. We find different results, as including it as control variable strengthens the relationship between our variables. Thus, this study comes to confirm the need to include R&D intensity as a control variable.

8. Conclusion

This paper provides a first contribution to the study of the relationship between ESG and CFP for the US technology sector. Thus, this study adds valuable findings to existing literature by analysing overall ESG scores, rather than studying only one pillar, or two, as common in previous research. Investigating the business case for ESG for the technology sector, we find a positive relationship between ESG performance and financial performance, from both an accounting and a market perspective. Nevertheless, the characteristics of the relationship between ESG and financial performance do differ whether one considers operating performance or firm value. This should be taken into consideration when deriving the implications of our findings.

The implications of our results may be of interest for practitioners, for instance investors and managers of listed companies. First, our findings support investors in their investment decisions. This study outlines that firms with high ESG scores have higher market values, consistent with the idea that these companies are seen as less risky. Therefore, a certain type of investors which usually look for less risky investment, should consider ESG scores as a proxy for firm risk. Moreover, we demonstrate that ESG investment is not value destroying, and rather value creating, both from a market and an accounting perspective. Nevertheless, it might be beneficial for investors to decompose the ESG score in order to optimise investments as we showed that single scores are not equally important and that some of them could be counterproductive.

This study may also have implications for managers of listed technology firms. First, our findings give reasons for managers to focus on improving ESG performance, since it seems to benefit CFP. Second, the market does value ESG performance, thus it is important to improve the disclosure of non-financial indicators such as ESG, as a lack of transparency usually lowers the ESG rating. In addition, we have seen that not all the three different pillars have the same significance. Even though we pointed out some limitations in these results due to measurement issues, these findings imply that managers need to understand what the score captures in order to tailor the best possible strategy. Moreover, managers should not be misled by the findings that bad ESG performance is not reflected in operating performance. Considering forward-looking market measures, it is shown that bad ESG performance is penalised by the market, reflected in lower firm values.

As mentioned, it might be helpful for both managers and investors to decompose the scores not only into the three pillars, but also in different subcategories in order to understand the crucial aspects of ESG for achieving better CFP. This is consistent with Carroll and Shabana's (2010) argument that firms need to focus on the CSR activities that show a convergence between the social objectives of society and the firm's economic objectives. Therefore, the ESG scores should also include all the crucial elements driving financial performance. For instance, we assume that the S-score, including mostly social aspects on a firm level, does not capture all the issues considered important by investors, for example the company's attitude to fundamental societal and ethical issues. Thus, further research should be conducted in order to find out which of the ESG elements composing the scores are the key factors influencing financial performance. This will also help to make the ESG concept more transparent and might strengthen a common ESG model which is better comparable across companies.

This study provides a foundation for future research on the ESG concept in the technology sector. Industry level studies seem to deliver more accurate results. The key ESG factors influencing the CFP on an industry level should be investigated for other industries. This will allow investors and managers to understand industry-specific features and differences concerning ESG performance. Moura-Leite, Padgett and Galan (2012) argue that studies should combine industry level studies and firm level studies on a resource-based view to better understand the challenges and characteristics of ESG. Therefore, we believe our study is a basis for further qualitative research at industry and firm level to understand the drivers of the concept and to better highlight the key factors affecting CFP positively or negatively.

When conducting this study, little research was available on the key factors affecting firm value of the technology firms in the US. We find that some traditionally used control variables such as ROA or sales are not significant in conducting a market-based analysis for the technology industry, calling for further explanation. It also highlights the fact that one should adapt and understand which variables drive financial performance on industry level, such as R&D intensity for the technology sector. Further research could investigate this question, especially as there is a concern about the existence of a bubble in this sector.

Companies with high ESG performance have higher financial performance compared to their peers. Nevertheless, the study does not show if better CFP is achieved through high ESG performance or if well performing companies have more resources to invest in ESG

performance. Thus, we do not draw any conclusion regarding the direction of the causality. Past studies have failed to clearly distinguish the causality between ESG/CSP and financial performance, though arguing for a "virtuous circle" (Nelling & Webb, 2009). The improvement of measurement standards, such as ESG indicators, over time may help to understand the causality of the link between ESG and financial performance and should be investigated in the future.

In this study, we conduct our analysis over four years, and find a positive relationship between ESG performance and financial performance. It would be interesting to carry out a similar study over a longer period, to strengthen the results of this study, especially as ESG aspects are considered being important for long-term value creation and sustainability.

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Appendices

Appendix I: Sample of listed US companies in the technology sector

ACXIOM
ADOBE SYSTEMS
ADVANCED MICRO DEVICES
AKAMAI TECHNOLOGIES
ALTERA
AMDOCS
AMPHENOL
APPLE
APPLIED MATERIALS
APPLIED MICRO CIRCUITS
ARROW ELECTRONICS
ATMEL
AUTODESK
AVNET
BMC SOFTWARE
BROADCOM
BROCADE COMM. SYSTEMS
CA TECHNOLOGIES
CHECK POINT SOFTWARE TECH.
CISCO SYSTEMS
CITRIX SYSTEMS
COGNIZANT TECH. SOLUTIONS
CSC - COMPUTER SCIENCES CORP.
COMPUWARE
CONVERGYS
CREE
CYPRESS SEMICONDUCTOR
DELL
DIEBOLD
DST SYSTEMS
EBAY
EMC
EQUINIX
F5 NETWORKS
FAIR ISAAC
FAIRCHILD SEMICONDUCTOR INTL.
FISERV
FLIR SYSTEMS
FORMFACTOR
GARMIN
GOOGLE
HARRIS
HEWLETT-PACKARD
IAC/INTERACTIVECORP
INTEGRATED DEVICE TECHNOLOGY
INTEL
IBM
INTERSIL
INTERNATIONAL RECTIFIER
INTUIT

JABIL CIRCUIT
JDS UNIPHASE
JUNIPER NETWORKS
KLA TENCOR
LAM RESEARCH
LEIDOS HOLDINGS
LEXMARK INTERNATIONAL
LINEAR TECHNOLOGY
MARVELL TECHNOLOGY GROUP
MAXIM INTEGRATED PRODUCTS
MICROCHIP TECHNOLOGY
MICRON TECHNOLOGY
MICROS SYSTEMS
MICROSOFT
NATIONAL INSTTRUMENTS
NCR
NETAPP
NETFLIX
NUANCE COMMUNICATIONS
NVIDIA
ON SEMICONDUCTOR
ORACLE
PITNEY-BOWES
PMC-SIERRA
PTC
QLOGIC
QUALCOMM
RAMBUS
RED HAT
ROVI
SALESFORCE.COM
SANDISK
SEAGATE TECHNOLOGY
SILICON LABORATORIES
SYMANTEC
TERADATA
TERADYNE
TEXAS INSTRUMENTS
TOTAL SYSTEM SERVICES
TRIMBLE NAVIGATION
TYCO INTERNATIONAL
UNISYS
VERISIGN
VMWARE
WEBMD HEALTH
WESTERN DIGITAL
XEROX
XILINX
YAHOO
ZEBRA TECHNOLOGIES

Appendix II: Correlation matrices

Correlation for equations a

Correlation	ROA	ESG	Sales	BV of assets	Debt/assets
ROA	1.00				
ESG	0.16	1.00			
Sales	0.18	0.39	1.00		
BV of assets	0.22	0.40	0.98	1.00	
Debt/assets	-0.02	0.06	0.02	0.00	1.00

Correlation for equations b

Correlation	Q	ESG	Firm age	ln(BV of assets)	ROA	Sales growth	R&D/sales
Q	1.00						
ESG	0.58	1.00					
Firm age	0.05	0.24	1.00				
ln (BV of assets)	0.03	0.58	0.18	1.00			
ROA	0.02	0.17	-0.02	0.27	1.00		
Sales growth	0.01	0.06	-0.11	0.08	0.36	1.00	
R&D/sales	0.02	0.09	-0.30	-0.35	-0.32	-0.11	1.00

Appendix III: Asset4 ESG Framework

ENVIRONMENTAL SCORE

Emission Reduction -Premium
Emissions Reduction Policy
CO2 Equivalents Emission Total
CO2 Equivalents Emission Direct
CO2 Equivalents Emission Indirect
CO2 Equivalent Indirect Emissions, Scope Three
Commercial Risks and/or Opportunities Due to
   Climate Change
CO2 Reduction
Ozone-Depleting Substances Reduction
NOx and SOx Emissions Reduction
NOx Emissions
SOx Emissions
VOC Emissions Reduction
VOC Emissions
Waste Total
Non-Hazardous Waste
Hazardous Waste
Waste Recycling Ratio
Water Pollutant Emissions
Waste Reduction Initiatives
Environmental Management System Certified
Sustainable Transportation
Environmental Expenditures

Resource Reduction – Premium
Energy Efficiency Policy
Toxic Chemicals or Substances Reduction
Energy Use Total
Direct Energy Purchased
Direct Energy Produced
Coal Energy Purchased
Coal Energy Produced
Natural Gas Energy Purchased
Natural Gas Energy Produced
Oil Energy Purchased
Oil Energy Produced
Electricity Purchased
Electricity Produced
Renewable Energy Use
Green Buildings
Water Efficiency Policy
Water Use Total
Water Recycled
Environmental Supply Chain Management

Product Innovation - Premium
Energy Footprint Reduction
Environmental R&D Expenditures
Renewable/Clean Energy Products
Water Technologies
Product Innovation/ Product Impact Minimization

SOCIAL SCORE

Employment Quality Premium
Employment Quality/ Policy
Employee Satisfaction
Employment Quality/ Salaries
Employment Quality/ Salaries Distribution
Bonus Plan for Employees
Generous Fringe Benefits
Employment Quality/ Employment Awards
Trade Union Representation
Employees Leaving
Turnover of Employees

Health & Safety Premium
Health & Safety / Policy
Total Injury Rate
Lost Time Injury Rate
Lost Days
HIV-AIDS Programme

Training & Development Premium
Training and Development/ Policy
Average Training Hours
Training Costs Total
Internal Promotion
Management Training

Diversity - Premium
Diversity and Opportunity/ Policy
Women Employees
Women Managers
Positive Discrimination
Flexible Working Hours
Day Care Services

Human Rights - Premium
Human Rights/ Policy
Human Rights Contractor
Human Rights Breaches Contractor

Community - Premium
Community/ Policy
Donations Total
Cash Donations
In-Kind Donations
Donations
Crisis Management Systems

Product Responsibility Premium
Product Responsibility/ Policy
Customer Satisfaction
Product Access Low Price
Healthy Food or Products

CORPORATE GOVERNANCE SCORE

Board Structure - Premium
Board Structure/ Policy
Board Structure/ Experienced Board
Board Structure/ Non-Executive Board Members
Board Structure/ Percentage of Independent Board Members
Board Structure/ CEO-Chairman Separation
Board Structure/ Background and Skills
Board Structure/Size of Board
Board Structure/Board Diversity

Board Function- Premium
Board Functions/ Audit Committee Independence
Board Functions/ Audit Committee Management Independence
Board Functions/ Audit Committee Expertise
Board Functions/ Compensation Committee Independence
Board Functions/ Compensation Committee Management Independence
Board Functions/ Nomination Committee Independence
Board Functions/ Nomination Committee Management Independence
Number of Board Meetings
Board Meeting Attendance Average

Compensation Policy - Premium
Compensation Policy/ Policy
Compensation Policy/ Highest Remuneration Package
Compensation Policy/ Board Member Compensation
Compensation Policy/ Stock Option Program
Senior Executive Long-term Compensation incentives
Vesting of Stock Options/Restricted Stock

Shareholder Rights - Premium
Shareholder Rights/ Policy
Voting Rights
Ownership
Classified Board Structure
Staggered Board Structure

Vision & Strategy - Premium
Integrated Vision and Strategy Challenges and Opportunities
CSR Sustainability Committee
GRI Report Guidelines
CSR Sustainability Report Global Activities
CSR Sustainability External Audit