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Is sustainable behavior profitable or is it just a necessity?

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Abstract: This thesis investigates the relationship between a firm's share price and Greenhouse Gas (GHG) disclosure. Using a sample of Swedish listed firms from 2013 - 2019, I observe that there exist no significant relationship between share price and GHG disclosure. Although, there is an increasing trend of the amount of reported GHG disclosures, which could be explained by the legitimacy theory. Furthermore, I test and find that firms who follow the GRI framework, experiencing a positive increase in their share price. Finally, I show that the size of the firm, return on assets and earnings per share has a significant effect on the share price.

Keywords: Share price; disclosure of emissions; GHG; legitimacy theory; GRI

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1. Introduction

One of the greatest challenges for today's society is climate change (Solomon et al., 2011). Global Greenhouse Gas (GHG) emissions are a substantial contributor to global warming and consequences are expected (Alessi et al., n.d). Over the past decade, a growing number of organizations have begun including climate change performance into its reporting. In order to establish a new sustainable economic model worldwide, sustainability reporting is crucial (European Council and Parliament, 2014; IIRC, 2013). The reporting of GHG emissions is important to this endeavor. According to Kauffmann et al. (2012), the capital market has driven GHG emissions reporting forward since this information increasingly is part of investment decision-making. Kolk, Levy and Pinkse (2008) identifies that investors are one of the key drivers in the development of carbon accounting and reporting. As an answer to this, "Companies typically report their *absolute* GHG emissions annually in their sustainability reports" (European Commission, 2010, p.28).

Carbon emissions have received a large amount of attention in recent years as a result of the heated debate about global climate change. At both national and international levels, policies have been implemented with the aim to turn the development. The importance and development with sustainability reporting is globally considered to be an emerging trend (Zhou, Simnett & Green, 2017). Similarly, as it is becoming a more serious matter for many individuals that we act in a sustainable manner, some investors are more inclined to acquire equities that display sustainability disclosures. The allocation of a firm's resources are increasingly impacted by investors' preferences for Corporate Social Responsibility (CSR) (Friedman & Heinle, 2016). A large amount of money is yearly invested in firms that act in socially responsible ways. As a result of the increased importance for investors to examine a firm's work on sustainability, it is naturally becoming more common to corporations to disclose this information. A study by KPMG (2020) shows that 80 percent of the largest firms in the global market were found to disclose their work towards sustainability. Similarly, the study also revealed that by the beginning of 2000, only 20 percent disclosed this type of information. However, it is also evident that the content of the reports varies between countries since the legislation differs (Shuili et al., 2017). Considering that there has been a significant increase in the use of sustainability reports in the last decades, it is noticeable that the demand from policy makers of disclosing information about activities related to sustainability is and should increase.

The attention from the capital market has driven a number of studies who examine the market valuation implications of firm's environmentally related activities. Belkaoui did the first study in 1976 of the relationship between environmental voluntary disclosures and how the market responded. He found that American firms who were disclosing pollution control information in their annual reports in 1970, were favorably affected by the market. Since then, several studies have been conducted on the area. Recent studies have shown that the association between a firm's GHG emissions and its market valuation is significantly negative (Chapple, Clarkson, & Gold, 2013; Matsumura, Prakash, & Vera-Muñoz, 2014; Clarkson et al., 2015). Further to these studies, Baboukardos (2017) provides evidence that since the UK has instituted regulations that require firms to report their annual GHG emissions, the negative association between GHG emissions and market valuation has decreased. Fazzini and Del Maso (2016) however asserts that the relationship between GHG disclosures and share price is positive, while Kolk et al. (2008) does on the other hand doubt about the relevance of disclosures of GHG emissions for investors. Both Laswad, Fisher, and Oyelere (2003) and Marston and Polei (2004) do not find a relationship between the extent of voluntary disclosures and profitability, leading to inconsistent results among the existent studies.

This study will extend current research and analyze the Swedish market. The aim of this thesis is to determine whether it is profitable or not to be sustainable by examining how stock prices are affected by a firm's disclosure of their emissions. The study further aims to contribute to the empirical research on the relation between GHG emissions and market reactions since there exist inconclusive findings. A sample was selected consisting of Swedish listed firms. The reported amount of GHG disclosures was used as a proxy of the firm's level of sustainability during the period 2013-2019.

The Swedish market is an interesting market to look at for the empirical examination since Sweden is considered to be among the top 10 countries, with a reporting rate of 98 percent regarding the rate of sustainability reporting among the 100 largest firms in the country (KPMG, 2020). Since 2017, Swedish large firms who fulfills two out of three of the criterias for the last year are required to disclose a sustainability report where GHG-emissions should be considered. One, the first criteria includes that the average number of employees has been more than 250 people. Two, the reported total assets have been more than SEK 175 million.

Three, the reported net sales have been more than SEK 350 million (Bolagsverket, 2019). Approximately 1,600 corporations are covered by the requirement which includes a set of guidelines as well as expectations on what to include in the sustainability report (KPMG, 2019). Swedish companies can follow the Global Reporting Initiative (GRI) guidelines (PwC, n.d). GRI is an international independent organization who produces standardized frameworks for organizations to follow in their reporting in order to make them more applicable towards climate change.

Another prevailing and essential discussion today on sustainability reports is what additional benefits firms achieve than only depicting the firm's respective pollution. For instance, a study by Mori, Best, and Cotter (2013) revealed that sustainability reporting enhances stakeholder's loyalty, and could improve the firm's trustworthiness. Hence, the authors argue that the sustainability report did have an impact on financial performance since sustainability reports worked as good marketing tools to increase or keep the customer base. Furthermore, these findings on sustainability reports are equivalent to the legitimacy theory seeing that the theory suggests that a firm's relationship with stakeholders can be influenced by the disclosure of sustainability information (Freeman, 1984). However, it is also evident that stakeholders find it difficult to value the reliability of the reports since the sustainability reports are surprisingly different in various countries as a result of the different legislation and the willingness of disclosing information (Lackmann, Ernstberger, & Stich, 2011). Continuously, Barnett and Salomon (2006) argue that sustainability activities incur direct cost on the firms leading to reduced financial performance. Considering this, is sustainable behavior actually profitable or is it merely a necessity?

The following question will be answered in this study:

What impact does the reported amount of GHG emissions have on a firm's stock price?

This paper is structured as follows. The next section presents previous research and develops two hypotheses. The third section describes the empirical model and the sample selection process. The fourth section presents the results while the final section discusses the findings.

2. Theoretical framework and prior research

2.1 Legitimacy Theory

Legitimacy theory deems that organizations are shaped by its social context'. Hence, firms are affected by society's expectations (Deephouse & Carter, 2005). Reputation and a firm's legitimacy could be comparable with each other. A social contract exists between businesses and society and legitimacy operates as an organizational resource (Hearit, 1995). Organizations in a dynamic society cannot thrive without the support of society members (Patten, 1992). When the social compact is broken, society's expectations are not met (Mitchell, Percy, & McKinlay, 2006), resulting in a legitimacy gap. The legitimacy gap could jeopardize the firm's ability to continue operating.

The relationship between stakeholders and a firm can be influenced by disclosures (Freeman, 1984), and firms can use annual reports as a tool to legitimize themselves (Guthrie & Parker, 1990). Salanick and Meindl (1984) states that voluntary disclosures are used to send signals to the public. Prior literature within the field of corporate environmental reporting states that one principal reason behind sustainability reporting is to gain legitimacy (Deegan & Rankin, 1996; Brown & Deegan, 1998; Campbell, 2003; Tilling & Tilt, 2010; Chu, Chatterjee, & Brown, 2013). By disclosing sustainability information, a firm can improve its public perception (Prado-Lorenzo et al., 2009; Hummel & Schlick, 2016).

Bae Choi, Lee and Psaros (2010) looked into the quantity and quality of carbon emissions reporting by 100 Australian businesses. These authors reported that firms utilized carbon reporting to acquire legitimacy, which is consistent with legitimacy theory predictions. O'Donovan concludes the same, also investigating the Australian market through interviews (2002). The reason behind disclosing environmental information was to gain a positive approach towards the firm.

2.2 Sustainability in relation to share price

Different works of literature have investigated whether the market reacts to Corporate Social Responsibility (CSR) related activities, where mixed results have been found. Hawn, Chatterji, and Mitchell (2017) studied how investors reacted to the Dow Jones Sustainability Index (DJSI). The reactions were examined for the past 17 years, of firms from 27 different countries. The study displayed that there was a limited significance of how the activities affected the investors. They reacted somewhat negatively to several of the events in DJSI, where the investors could assume that more value was laid on these activities, rather than profitable projects. In other words the result of this study shows that investors' behavior rather punishes the activities prescribed by the DJSI rather than sustainable companies. Green investments are not always generating cash flows, despite this Martin and Moser (2016) finds that investors respond positively. The investment cost often exceeds the benefit of the response, meaning that managers are pleased with the tradeoff of wealth for societal benefits, which also could be explained by the legitimacy theory. Both these studies back the potential of sustainability in public firms, but they also show that to the investors, it is as important that appropriate and not costly measures are taken. But judging which measures that are to be taken can also be problematic, since there are CSR-activities that are beneficial for firms even though they are not directly linked to cash flow. Friedman and Heinle (2016) provides evidence that CSR is reflected in stock prices and state that firms often underestimate activities that are not directly related to cash flow.

A firm's profitability can be impacted positively by corporate sustainability according to a study from India by Bodhanwala and Bodhanwala (2018). The authors looked at performance measures as return on invested capital, return on equity, return on assets and earnings per share. In alignment with Bodhanwala and Bodhanwala, Ameer and Othman (2012) did a study based on the top 100 sustainable global corporations and found the same result. Another study from 2013 by Flammer, examines investors' environmental awareness between 1980 and 2009. Flammer finds that firms who report responsible behavior towards the environment are experiencing a significant increase in their stock prices, whereas those who act irresponsible experience a decrease. Several studies have also looked into the relation between market valuation and the degree of pollution. Cormier and Magnan (1997) focused on water pollution, Hughes (2000) on sulfur dioxide emissions, and Clarkson, Li and Richardson (2004) on toxic releases. Cormier and Magnan find that the level of water

pollution associates negatively with a firm's market value. Similar states Hughes with the level of sulfur dioxide. Clarkson et al. presents evidence that high levels of toxic releases in a firm, penalize their market capitalization.

Informativeness from stock prices is positively affected by ESG sustainability performance factors according to Ng and Razaee (2020). Private information about the company's financial performance, development potential, and even non-financial ESG sustainability elements are likely to influence investor behavior. The correlation is greater in step with higher ESG sustainability disclosure. Lackmann, Ernstberger and Stich (2011) are looking at market reactions in the largest firms in Europe between 2001 and 2008. They concluded that investors take sustainability information into account when valuing a firm, however, the benefits of it vary. Investors in a high-risk firm react more strongly than to a low-risk firm. This is due to the reliability of the sustainability information. A higher reliability of the information provided is getting a stronger reaction in high-risk firms. The global economic situation is also a factor that affects how greatly the reaction of sustainability information is. Mao, Zhang and Li (2017) analyses the relationship between low carbon integration and firm performance. The impact of such integration is shown to be positive for a firm's environmental performance. However it can hinder financial performance due to higher costs and increasing investments to lower the carbon emission. In another study, Artiach et al. (2010) finds that corporate sustainability performance is higher among larger firms with high levels of growth and return on equity.

2.3 Greenhouse gas emissions in relation to share price

In recent years, the interest in GHG emission's influence has been paid attention. Fazzini and Dal Maso (2016) are looking at voluntary disclosures at the Italian market where the result proclaims that a positive correlation exists between GHG disclosures and market value. Kolk et al. (2008) doubt about the relevance of disclosures of GHG emissions for investors. Meanwhile, other studies assert that a negative correlation exists (Chapple, Clarkson, & Gold, 2013; Matsumura, Prakash, & Vera-Muñoz, 2014; Clarkson et al., 2015). Chapple et al. (2013) examines the Australian market after the government introduced a national trading scheme for all listed firms. They found that the firms who reported the largest amount of emissions also received a market value penalty, indicating that there exists a negative association between GHG emissions and stock prices. As did the European market, where

Clarkson et al. (2015) drew the same conclusion as Matsumura et al. (2014), where they found similar results looking at the voluntary disclosures of carbon by the S&P 500 firms. Between 2006 and 2008, the firm value decreased with an average of \$212,000 for every thousand tons of reported carbon emissions. Though the penalty is high for those firms with a large amount of emissions, the firms that do not disclose any carbon emissions are penalized even harder by the market. Cho, Chatterjee and Brown (2013) investigated the Chinese market and found that most Chinese firms disclose some greenhouse gas information. The motivation according to the authors is that the Chinese Government actively works to reduce greenhouse gas emissions through different policies and programs, leading firms to reveal such information in order to gain a better reputation and legitimize themselves consistent with the legitimacy theory.

With regards of above discussion, the following hypothesis have been constructed:

H0: There is no correlation between firms GHG emissions and share prices.

2.4 Voluntary vs. mandatory GHG disclosure

In 2016, GRI standards for GHG emission disclosures were produced to fully be applied in 2018 (GRI, 2016). This guideline is optional for Swedish firms to follow, however, larger Swedish firms must disclose a sustainability report. No recommended guidelines or regulation is provided by the Swedish government, however GRI is a recognized framework and is commonly used (FAR, n.d.). Several studies have examined if there is any difference between voluntary and mandatory GHG disclosures regarding the effect on the stock prices. Some are indicating that voluntary disclosures suffer from high penalties by the market in the form of market value. Andrew and Cortese (2011) finds that voluntary disclosures on carbon data often are of low quality. Reporting that is not understandable or reliable can have a negative impact on the decisions done by investors. Sullivan and Gouldson (2012) implies that investors find it difficult to assess emission-related risks under firms' voluntary disclosure, concluding that voluntary carbon reporting does not meet the investors' needs.

Kolk, Levy and Pinkse (2008) finds that regulations of carbon disclosures makes firms to extend their information regarding their climate change activities. After the Kyoto Protocol in 2005 was signed by a great number of the world's countries, the ratified countries are associated with a larger amount of disclosures related to emissions (Freedman & Jaggi,

2010). Freedman and Park (2014) did also examine how a regional greenhouse gas initiative affected the GHG disclosures in the US, finding positive results. A theory to this result is that regulations reduce shareholders' environmental concerns about a firm (Unerman & O'Dwyer, 2007). This leads to an increase in trust in a firm's disclosure, and consequently the firm's value, which could also be explained by the legitimacy theory. Plausible, following the GRI standards in the Swedish market can be expected to decline the negative relationship between stock prices and the amount of GHG emissions disclosed. This theory is justified by Baboukardos (2017), who investigates the UK market. The UK recently introduced a regulation that requires all listed firms to report their annual GHG emissions in the firm's annual report. They noted that since the imposition of the regulation, the negative relationship between a firm's GHG disclosure and their market value decreased. Further, de Villiers and van Staden (2011) did a survey in the UK, US, and Australia where they concluded that investors prefer compulsory disclosures in annual reports. Based on this discussion, a second hypothesis is formulated as follows:

H0: Compliance towards the GRI framework has no impact on a firm's share price.

3. Research design

3.1 Sample selection

This study examines the relation between reporting of GHG-emissions and stock prices. The sample consists of Swedish listed firms who are publicly traded on the Stockholm market between 2013 and 2019. 310 unique firms were observed with an initial sample of 2,170 firm-year observations. Firm-year observations that do not have available annual reports in English, or are not listed in a given year were being excluded. The annual reports were provided by my supervisor. Financial firms were excluded from the sample since the accounting in these firms differ from others. Data was being collected from annual reports and S&P Capital IQ, hence, some observations were being lost due to missing data in public databases. The financial part of the annual reports are removed, only remaining the corporate governance report. Further, additional data of stock prices were added for the years 2012 and 2020. The final sample consists of 1,651 observations.

	Firm-year observations	Number of firms
Sample frame: Swedish listed firms except for banks and insurance companies	2,170	310
After missing observations from databases	1,651	310

Table 1, Sample selection and breakdown of it.

3.2 Collection of greenhouse gas emission disclosure data

The GRI framework contains standards and rules both for sustainability reporting, measuring and categorizing of emissions and other impacts on the environment and society (GRI, 2016). Two GRI standards that are common within financial and/or sustainability reports are disclosure 305-1 and 305-2, also called scope 1 and 2. The scopes measure gross direct GHG emissions in metric tons of CO₂ equivalent. GHG emissions include CO₂, CH₄, N₂O, HFCs, PFCs, SF₆, and NF₃. Scope 1 measures direct emissions including all emissions caused by the firm itself and scope 2 measures all the indirect emissions caused from energy consumption by the firm.

Two GHG variables are collected through a textual analysis of each firm's annual reports between year 2013 and 2019 in order to test the first hypothesis. The words “emission”, “greenhouse gas”, “GHG”, “scope 1”, and “scope 2” have been searched for through the data analysis software Nvivo. The words from each annual report generates a percentage and a number of how many times the recounted words are mentioned for each firm-year. All words are being equally weighted. When searching for the coverage rate, a broad view has been applied meaning that whole paragraphs are taken into account. This has led to two GHG variables; GHGcoverage and GHGreferences, where GHGcoverage stands for the percentage of how much the GHG related words are mentioned in the reports, while GHGreferences stands for how many times the GHG related words are mentioned in the reports. According to the Swedish law that is regulating the sustainability report, firms can either disclose through the annual report, or to a separate sustainability report (FAR, n.d). In this study, only the annual reports have been used and analyzed.

To test the second hypothesis, a dummy variable of which firms who follow the GRI guidelines or not were produced. Through wordsearch in Nvivo, a dummy variable that equals one was added for these reports that state that they use the GRI guidelines, respectively a dummy variable that equals zero for those who do not use the GRI guidelines.

3.3 Control variables

In order to construct a reliable model that tests the hypothesis, other factors than the GHG variables that can affect the stock prices are also included. *Price-to-book (P/B)* is one of the most important explanatory variables in the price-earnings relationship according to Starica and Marton (2021). The variable is a proxy for risk (Fama & French, 1992) and is commonly used as a proxy for growth. Penman et al. (2018) concludes that P/B can be used to forecast earnings growth and therefore could indicate expected returns.

Basu (1983) examined the relationship between the return of stocks and the firm size and earnings. Previous research concludes that there is a pertinence between stock returns and earnings to price ratio, where a higher ratio yields a higher return. The size of the firm is crucial according to his study. Hence, the size in the form of *market capitalization* is being used in this study. Several studies have looked into the link between firm size and CSR. A substantial association between firm size and CSR has been observed in previous publications

(Cormier, Magnan, & Velthoven, 2005; Mohd Ghazali, 2007). Further, associations between firm size and greenhouse gas reporting have also been reported in previous literature (Brammer & Pavelin, 2006; Freedman & Jaggi, 2011; Prado-Lorenzo et al., 2009; Stanny & Ely, 2008). This is because larger firms are often more visible with a higher public pressure to act in a sustainable manner and to maintain legitimacy.

Firm performance in the form of *return on assets (ROA)* are other variables added which are serving as control inspired by Baboukardos (2012, Bae Choi et al., 2010, and Lourenço et al. (2012). Besides the GHG variables and the other control variables, earnings and share price will also be included as variables where share price will serve as the dependent variable.

Variable name	Definition
Mid Price30	Average daily share price 30 days after release of annual report.
Mid Price60	Average daily share price 60 days after release of annual report.
GHG Coverage	Percentage of how much GHG related words. are covered in each firm's annual report in a broad view.
GHG References	Number of times GHG related words are mentioned in each firm's annual report.
GRI	A dummy variable where the firms that follow the GRI framework receive a 1 and those who do not receive a 0.
Earnings per share (EPS)	Net profit divided by common shares
P/B	Previous year price to book ratio
Size (MC)	Total value of a firm's common shares
Return on Assets (ROA)	Earnings/Assets

Table 2, Variable definitions.

3.4 Empirical model

3.4.1 GHG emission disclosure

To test the first hypothesis, I will regress the two variables related to the GHG disclosures together with the control variables, both through an ordinary OLS-regression model and use a stepwise regression method. The Mid Price serves as a dependent variable. The following OLS model is applied:

$$MidPrice_{it,n} = \beta_0 + \beta_1 GHGvariable_{it} + \beta_2 EPS_{it} + \beta_3 ROA_{it} + \beta_4 P/B_{it} + \beta_5 MarketCap_{it} + \varepsilon_{it} \quad (1)$$

where subscripts i and t refer to firm and time respectively.

The share price is calculated as the average of a firm's daily stock price, e.g. mid price. Two different filing dates of each annual report are being used; 30 days (n=30) after the filing date of the annual report, respectively 60 days (n=60) after. The regression is being performed using the statistical programme Stata.

Apart from the OLS-regression, a stepwise regression has also been conducted to strengthen the analysis of hypothesis 1. The stepwise regression has been conducted through *vselect* in Stata. This regression indicates which independent variables better explain the dependent variable. The dependent variable is the mid price, where the model is regressed two times to test both Mid Price30 and Mid Price60. The independent variables are GHGcoverage, GHGreferences, EPS, P/B, MarketCap, and ROA. In order to identify which independent variable that explains the dependent variable the most, forward selection is being used with the regression in equation 1. The process of *forward selection* starts with one variable and then another variable is added until no variable is affected by the inclusion of the critical significance level of model entrance. All variables that do not reach the critical significance level are correspondingly excluded. When choosing the size of the subset the criteria of AICc is used. AICc is an extension of Akaike Information Criterion and introduces a penalty for extra parameters and decides how many variables that should be included in the final model.

3.4.2 The GRI framework

To test the second hypothesis, a dummy variable, that states if the firm uses the GRI framework or not, is analyzed in a regression analysis. The regression is similar to the one that is being used to test the first hypothesis, with Mid Price as the dependent variable. The regression equation is as follows:

$$MidPrice_{it,n} = \beta_0 + \beta_1 GRI_{it} + \beta_2 GHGvariable_{it} + \beta_3 EPS_{it} + \beta_4 ROA_{it} + \beta_5 P/B_{it} \quad (2) \\ + \beta_6 MarketCap_{it} + \varepsilon_{it}$$

3.5 Summary statistics

Table 2 shows summary statistics for all regression variables. The mean of the GHG Coverage is 0.3 percent with a median of 0, indicating that the GHG disclosures of Swedish firms are small, and to a large extent non-existent. The same applies to the number of GHG References, where the mean is equal to 4.473 words per annual report. The firm with the largest coverage of 3.4 percent, also has 107 GHG references. A majority of the firms do not include GHG disclosures in their annual report. Approximately 890 out of 1,650 observations does include GHG references in the annual report. The GRI dummy variable indicates that 36 percent of the observed annual reports follow the GRI framework for their sustainability report.

A pairwise (pearson) correlation matrix can be found in table 3. There exists a positive and a significant ($p\text{-value} < 0.01$) correlation among the GHG variables and the Mid Price30 and Mid Price60. Besides the Mid Prices, the GHG variables are positively significantly correlated with the remaining control variables except for EPS and to some extent P/B. The dummy variable GRI is positively and significantly correlated with all other variables except for P/B.

	N	Mean	Median	Min	Max	SD
Mid Price30	2,024	102.563	70.70	0	5055	151.470
Mid Price60	2,016	103.168	70.41	0	5097.5	152.052
<i>Disclosure Variables</i>						
GHG Coverage	1,651	0.003	0	0	0.034	0.004
GHG References	1,651	4.473	1	0	107	9.176
GRI	1,651	0.360	0	0	1	0.480
<i>Control Variables</i>						
EPS	1,936	-11.178	2.22	-19886.15	304	461.250
P/B	1,994	4.002	2.65	0	205.701	7.857
MarketCap	2,040	23348,9	5126.78	0	620071.1	55456.65
ROA	2,171	2.608	4.24	-241.559	67.531	14.654

Table 3, Descriptive statistics.

		1	2	3	4	5	6	7	8	9
1	Mid P30	1								
2	Mid P60	0.996***	1							
3	GHG C	0.111***	0.115***	1						
4	GHG R	0.112***	0.115***	0.779***	1					
5	GRI	0.192***	0.196***	0.415***	0.449***	1				
6	EPS	-0.093***	-0.099***	0.044	0.041	0.059**	1			
7	P/B	0.043	0.044	-0.034	-0.054**	-0.029	0.010	1		
8	MC	0.195***	0.191***	0.251***	0.316***	0.312***	0.017	0.033	1	
9	ROA	0.120***	0.120***	0.119***	0.079***	0.118***	0.017	0.002	0.119***	1

Table 4, Pairwise correlations, (***) $p < 0.01$, (**) $p < 0.05$, (*) $p < 0.1$.

4. Results

4.1 The effect of GHG disclosures on share price

The first hypothesis concerns the relationship between share price and GHG disclosures. The analysis has been conducted with several control variables that potentially affect the share price. The GHG variables along with the control variables have been regressed two times with different points in time, at 30 days after annual report's filing date, respectively 60 days after. The regression was initially performed with both GHG variables. However, different results were shown when the variables were regressed alone due to multicollinearity, which is why the latter result is analyzed. Table 4 presents the regression with the GHG Coverage variable, while table 5 presents the regression with the GHG References variable.

Neither of the GHG variables are significant in any of the different time aspects. The GHG Coverage presents a large coefficient of 836 respectively 959. This could indicate as the GHG Coverage in the annual reports increases, the share price of the firm is being boosted. A small increase in share price could also be expected if the amount of GHG related words increases. However, none of these assumptions could be said with certainty, as the coefficients of the GHG variables are not significant. This indicates that I can not reject the first null hypothesis. Hence, this study concludes that there is no significant correlation between firms GHG emissions and share prices. The study does only analyze annual reports. Firms can choose to report the sustainability report separately, which this thesis has not taken into consideration. Thus, the result may differ if separate sustainability reports were taken into account.

As expected MarketCap and ROA who serve as control variables present positive significant results with a p-value equal 0.01. This means that larger firms and firms with high return on assets can gain a better share price. Among the control variables, P/B does not show significant result and EPS shows significant result, however with a negative coefficient. The EPS coefficient indicates that as earnings per share increases, the mid price of it slightly decreases.

	Mid Price (n = 30)		Mid Price (n = 60)	
	Coefficient	<i>t</i>	Coefficient	<i>t</i>
GHG Coverage	836.337	1.27	959.004	1.46
EPS	-0.140***	-4.87	-0.135***	-4.69
P/B	0.480	1.53	0.484	1.54
MarketCap	0.001***	9.15	0.001***	8.84
ROA	1.526***	6.80	1.530***	6.84
Adj. R^2	0.126		0.123	
<i>N</i>	1,252		1245	

Table 5, Regression result from test of hypothesis 1 with the GHG Coverage variable,

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	Mid Price (n = 30)		Mid Price (n = 60)	
	Coefficient	<i>t</i>	Coefficient	<i>t</i>
GHG References	0.352	1.13	0.390	1.25
EPS	-0.140***	-4.85	-0.135***	-4.68
P/B	0.487	1.54	0.490	1.56
MarketCap	0.001***	8.86	0.001***	8.56
ROA	1.541***	6.89	1.547***	6.93
Adj. R^2	0.125		0.122	
<i>N</i>	1,252		1,245	

Table 6, Regression result from test of hypothesis 1 with the GHG References variable,

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The stepwise regression model excluded several of the independent variables of the equation model 1, only remaining four in the final model. These four variables, market capitalization, ROA, EPS, and P/B are of incremental explanatory power of the mid price in both of the two time aspects. The GHG disclosures variables does not seem to have the same explanatory power of the share prices as the four variables in the final model of the stepwise regression. Both the OLS regression and the stepwise regression indicates that investors' investing behavior is driven by variables not related to GHG emissions. As further could be interpreted in table 7, the adjusted R square does not differ from the regressions presented in table 5 and 6, meaning that the two GHG variables do not bring any further explanation to the variable Mid Price.

	Mid Price (n = 30)		Mid Price (n = 60)	
	Coefficient	<i>t</i>	Coefficient	<i>t</i>
MarketCap	0.001	9.68	0.001	8.84
ROA	1.551	6.94	1.530	6.84
EPS	-0.140	-4.83	-0.135	-4.69
P/B	0.461	1.46	0.484	1.54
Adj. R^2	0.125		0.123	
<i>N</i>	1,252		1,245	

Table 7, Stepwise regression results from the test of equation 1. Both MidPrice30 and MidPrice60 have been tested as the dependent variable. The result represents the best fitted model of the variables being tested in this study that best explains the dependent variable.

4.2 The effect of the GRI framework

Table 7 and 8 presents the regression results for hypothesis 2. The dependent variable is Mid Price30 and Mid Price60, where GHG Coverage is included in table 7, and GHG References is included in table 8. In all regressions, the GRI dummy variable is included as an independent variable.

The regressions indicate that the GRI dummy variable is significant and positive towards the mid price with a p-value of either 0.05 or 0.01 in all of the four regressions below. The value of the GRI dummy variable is similar irrespective of which GHG variable it is regressed with. The coefficient of GRI reflects that firms who follow the GRI framework, would experience an increase in their share price. This indicates that I can reject the second null hypothesis and that compliance towards the GRI framework has an impact on a firm's share price.

Henceforth, the result is similar to the regression from hypothesis 1, except that P/B shows a significant coefficient. The adjusted R square does also appear slightly higher than in the regression of hypothesis 1, indicating that the GRI dummy variable adds as a further explanation towards the mid price.

	Mid Price (n = 30)		Mid Price (n = 60)	
	Coefficient	<i>t</i>	Coefficient	<i>t</i>
GHG Coverage	80.39	0.12	184.273	0.26
GRI	20.146**	3.23	20.571***	3.30
EPS	-0.144***	-5.01	-0.139***	-4.83
P/B	0.504***	1.61	0.508***	1.62
MarketCap	0.001***	8.21	0.001***	7.89
ROA	1.479***	6.61	1.483***	6.64
Adj. R^2	0.132		0.129	
<i>N</i>	1,252		1,245	

Table 8, Regression result from test of hypothesis 2, with the GHG Coverage variable.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	Mid Price (n = 30)		Mid Price (n = 60)	
	Coefficient	<i>t</i>	Coefficient	<i>t</i>
GHG References	-0.061	-0.18	-0.036	-0.11
GRI	20.821**	3.29	21.384***	3.37
EPS	-0.144***	-5.00	-0.138***	-4.83
P/B	0.499***	1.59	0.502***	1.60
MarketCap	0.001***	8.14	0.001***	7.83
ROA	1.482***	6.63	1.487***	6.67
Adj. R^2	0.132		0.130	
<i>N</i>	1,252		1,245	

Table 9, Regression result from test of hypothesis 2, with the GHG References variable.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

To further analyze the effects of GRI, figure 1, 2 and 3 has been produced. Out of 1,651 firm year observations, 596 annual reports state that they follow the GRI framework in their sustainability report. As could be interpreted from figure 2, the average GHG Coverage variable has increased through the examined years, as has the amount of firm year observations who follow the GRI framework as could be perceived in figure 1. Figure 3 demonstrates that firms who follow the GRI framework at a higher level disclose GHG information, while those who do not follow the GRI framework disclose less GHG information.

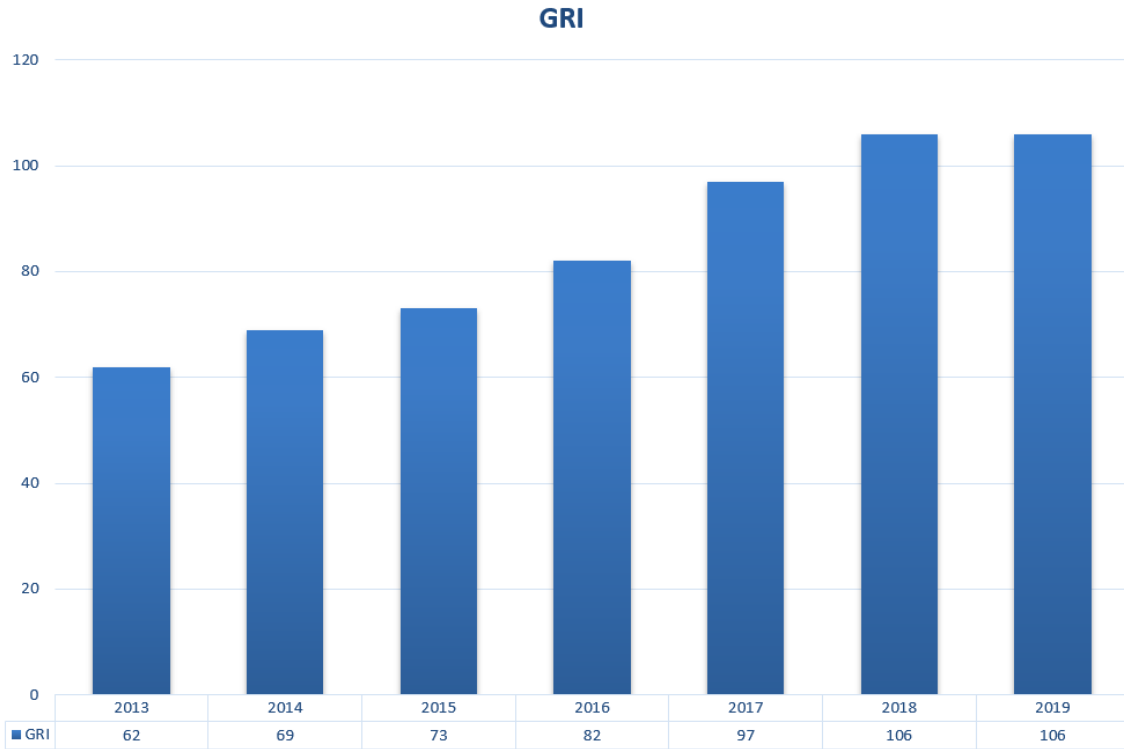


Figure 1, The development of how many of the firm-year observations who follow the GRI framework through the years 2013-2019.

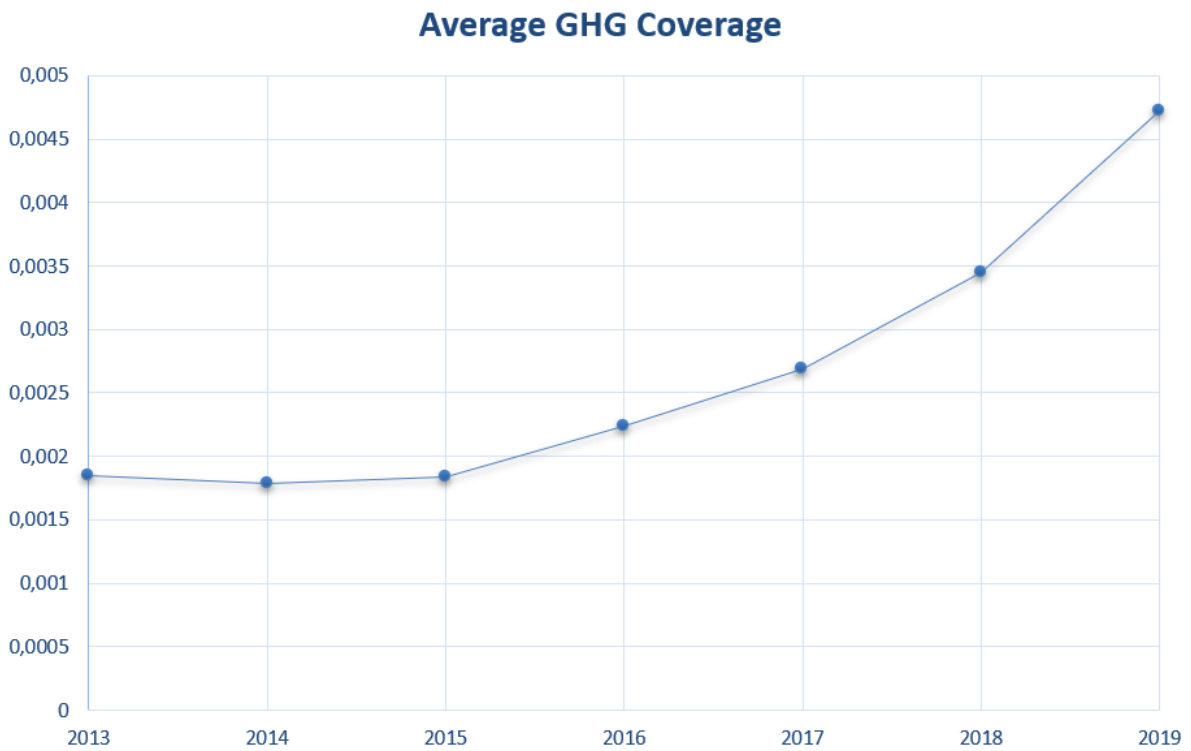


Figure 2, The development of average GHG coverage over the examined years. The x-axis shows the examined years and the y-axis shows the GHG coverage.

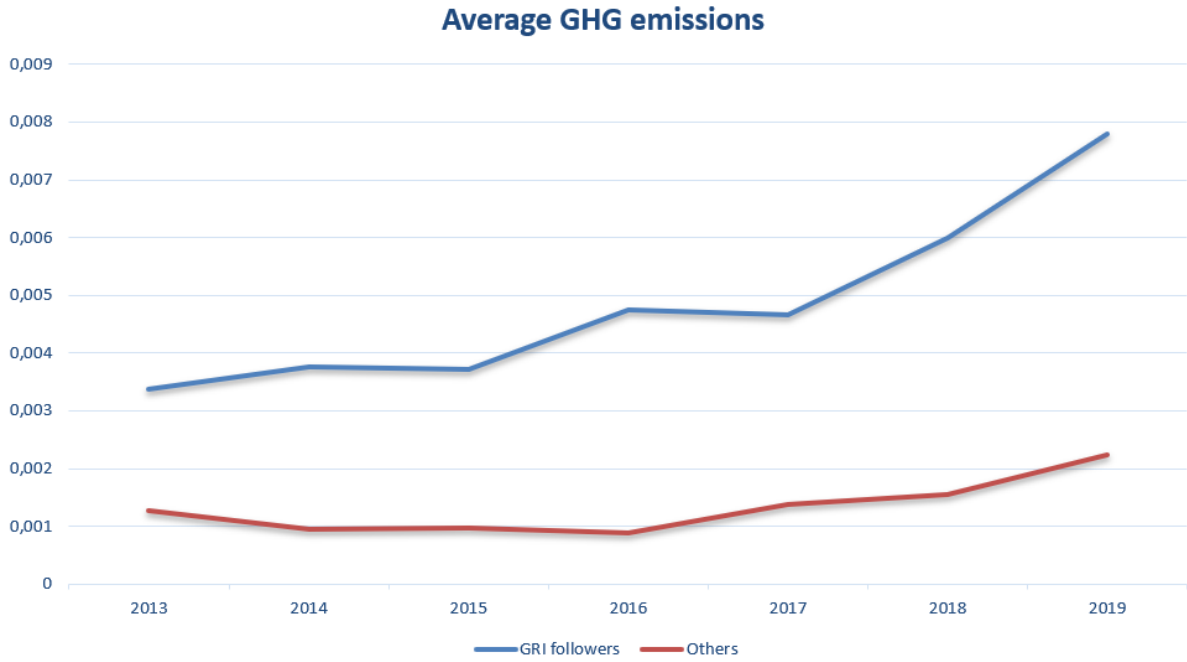


Figure 3, The development of average GHG coverage over the examined years, where the blue line represents the observations who follow the GRI framework, and the red line represents the observations who do not follow the GRI framework. The x-axis shows the examined years and the y-axis shows the GHG coverage.

5. Discussion of findings

This study presents a somewhat twofold result. In the last few years, the amount of disclosed GHG emissions in annual reports have steadily increased in Swedish firms. The desire to reach a sustainable development of our society and the environment has increased the attention to carbon emissions. The result of hypothesis 1 is however unexpected in comparison with prior studies. This study does not provide significant results of the GHG variables. Prior studies have inconclusive results, both negative (Chapple, Clarkson, & Gold, 2013; Matsumura, Prakash, & Vera-Muñoz, 2014; Clarkson et al., 2015) and positive (Fazzini & Dal Maso, 2016). But in alignment with Kolk et al. (2008), the result of this thesis does not show that the GHG variables have a significant impact on the share price. Interesting results are thus provided when testing hypothesis two, where GRI does seem to have a positive impact on both share price and the amount of reported GHG related disclosures.

Even though a relation between GHG disclosures and share prices can not be concluded, a large proportion of the firms that are subject of this study, disclose their GHG emissions. One possible explanation of this can be found within legitimacy theory. Deephouse & Carter (2005) concludes that firms are affected by society's expectations. Given this and the fact that today's societies rank sustainability high on the agenda, it is likely that this will make an imprint on the firms operating in the society. Patten (1992) highlights the importance for organizations of having the support of the society members, meaning that it is a necessity in order to thrive - especially in dynamic societies like Sweden. This means that for a firm to legitimize itself, it must not only address sustainability, but they must also address it in a way that successfully rallies the support of the society's members. Mitchell et al. (2006) describes so-called *legitimacy gaps* that can occur if a firm does not successfully legitimize its operations in the eyes of the society. This could jeopardize the entire operation of a firm. All together, these studies show that in order to be able to operate on a dynamic market, sustainability must be addressed in the right way in order to gain legitimacy. This could be a possible explanation to why GHG disclosures are so common even though they can not be proven to be profitable in this thesis. GHG disclosures have become a necessity - not by legislation, but by public opinion.

Approximately 36 percent of the observed annual reports are following the GRI framework in sustainability reporting. As could be interpreted in figure 1, 2 and 3, the amount of GHG disclosures has increased during the last years, and there is a great difference between the firms who follow and do not follow the GRI framework. Since the new GRI guidelines were produced in 2016 containing a framework of GHG reporting, the amount of GHG disclosures has drastically increased (figure 3). This is in line with prior studies (Freedman & Jaggi, 2010; Freedman & Park, 2014; Kolk et al., 2008) stating that sustainability regulations and a framework to follow increases the amount of GHG disclosures. The Swedish firms' does not have a regulation to follow, but have the opportunity to follow the GRI framework. The result from this thesis clearly states that it would be beneficial to set up a regulatory framework for firms to follow regarding sustainability reporting.

6. Conclusion

In the last few years, the amount of disclosed GHG emissions in annual reports have steadily increased among Swedish firms. The desire to reach a sustainable development of our society and the environment has increased the attention towards GHG emissions. This study examined if reported GHG emissions affected a firm's share price and did a further analysis whether compliance towards the GRI framework had a further impact. The findings of this thesis has implications both for firms and legislators.

The thesis provides extensive implications to Kolk et al. (2008) that express doubt about the relevance of disclosures of GHG emissions for investors. The study does not land with any significant result towards the relationship between share price and how much GHG emissions Swedish firms report. Instead, consistent with the legitimacy theory, firms could be assumed to disclose their GHG emissions to gain legitimacy in order to avoid potential penalization from the public.

In alignment with prior studies within the field, regulation regarding sustainability reporting has an impact on the market valuation where the Swedish firms who follow the GRI framework experience an increase in their share price. The result indicates that it would be beneficial, both for the society and the firms themselves, to impose a mandatory regulation regarding sustainability reporting. The result can be useful for public and capital markets that intend or have already introduced a sustainability framework for firms to follow regarding their sustainability reporting.

There are some limitations to this study regarding the GHG variables. Annual reports are the alone reports that have been taken into consideration in this thesis. There is an option for firms in Sweden to disclose their sustainability report separately from the annual report. Hence, there might be a higher GHG coverage and GHG references if these reports were analyzed. Further, the words that were being used in the word search in Nvivo might be limiting, since more words could be used to investigate how much attention GHG emission were brought in the annual reports.

As to potential for future research, the study could be further investigated through examining different industries. The GHG emissions can differ largely between different industries, and thus have an impact on the result. The disclosure of GHG emissions might have an impact on stock prices in industries that generally have higher emissions, such as the mining industry, transport industry or manufacturing industry. Such a study could focus on finding trends over the years and potentially unveil areas of the market where legally enforced GHG-disclosures in accordance with the GRI framework could be the most beneficial in terms of sustainability.

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