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The Impact of Corporate Social Responsibility on Cost Stickiness

An Empirical Study of European Firms between 2002-2020

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Abstract

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Five key words: Cost Stickiness, Asymmetric Costs, ESG, CSR, Cost Behavior

Purpose: This paper studies the impact of corporate social responsibility on cost stickiness, as well as showing additional evidence of stickiness among European firms.

Methodology: OLS regression and fixed effects model.

Theoretical perspectives: The theoretical part of the study describe cost behavior, cost stickiness and corporate social responsibility from a stakeholder perspective.

Empirical foundation: The study is based on data from Thomson Reuters of the largest 600 European companies in the STOXX Europe 600 index between 2002 and 2020.

Conclusions: SG&A (Selling, General & Administrative) cost stickiness is present among European firms, but firms with higher ESG ratings are associated with lower cost stickiness.

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1. Introduction

1.1 Background

Corporate costs have traditionally been considered to behave in a mechanical way, either in the form of fixed costs or as variable costs in relation to sales volume (Noreen, 1991). This has been expected to be the case both when revenues increase and decrease, in other words, cost should behave symmetrically. However, factors such as manager's optimism or empire building could potentially lead managers to retain unneeded costs at times when revenues decrease, which would lead to a cost asymmetry (Anderson, Banker & Janakiraman, 2003). The authors label this phenomenon as cost stickiness. Their paper demonstrates that the costs related to selling, general and administrative (SG&A) increase by 0.55 % when revenues increase by 1 %, but only decrease by 0.35 % when revenues fall by 1 %. This study has been followed by a large number of studies that also have concluded the existence of cost stickiness and factors contributing to it (e.g. Golden, Kohlbeck & Rezaee, 2020). One of the most recent areas of interest has been corporate social responsibility.

Corporate social responsibility has gained in importance and has become an important issue for corporations (Carroll & Shabana, 2010) and the relationship between corporate social responsibility and financial performance has been studied in a large number of studies. In a meta study, Friede, Busch and Bassen (2015), conclude that a majority of over 2000 studies show a positive relation, while less than 10 % show a negative one. According to Carroll and Shabana (2010), corporate social responsibility can potentially lead to reducing risks and costs, creating competitive advantages and improving reputation and legitimacy. Many of these arguments are related to the stakeholder theory, as corporations may gain advantages by keeping their different stakeholders better satisfied.

Considering CSR related activities are attributed with additional costs and some of these costs also are likely difficult to reverse, CSR could potentially lead to increased cost stickiness (Hasan & Habib, 2016). However, research in this area of cost stickiness is limited so far.

1.2 Purpose of study

While cost stickiness has become a better studied phenomenon during the past two decades, there are still areas that need more attention. This study aims to create a better understanding of how corporate social responsibility affects cost stickiness as well as providing more evidence of stickiness among European firms. Cost stickiness has several important implications for both academics and professionals, such as for earnings estimates (Weiss, 2010) and earnings management (Dierynck, Landsman & Renders, 2012). Corporate social responsibility has during the past decades gained in importance for firms and is for many firms an important part of their strategy (Carroll & Shabana, 2010). Often, corporate social responsibility is associated with high costs (Hasan & Habib, 2016), and therefore it is likely useful to study how it affects cost stickiness.

The few studies on cost stickiness and corporate social responsibility that we are aware of are the ones by Hasan and Habib (2016) and Golden, Kohlbeck and Rezaee (2020), which both show a positive relation. In addition, there is a yet to be published study by Paek, Kim and Kim (2016) that indicates an opposite result, meaning better performance in corporate social responsibility was attributed with less stickiness. Hence, there is a need for more studies before any conclusions about this relation can be made. Golden, Kohlbeck and Rezaee (2020) suggested that this discrepancy could be a result of looking at the total ESG scores, as opposed to certain parts of the scores that are believed to cause stickiness.

Therefore, the objective of our study is to contribute to this scarcely researched topic and add to a better understanding on what effect ESG scores have on cost behavior. Furthermore, we want to display what components of the ESG score are the main drivers for cost stickiness, as it is expected that not all score constituents contribute to cost stickiness at the same magnitude. The approach to test for the impact of the combined ESG score, the individual pillar scores and the related individual categories is unique to our study and thus adding valuable results to the research subject, which can be the foundation of further research on the topic.

Considering all these studies about corporate social responsibility and cost stickiness have focused on the US market, there is also a need for studies of corporate social responsibility and stickiness in other markets, such as Europe. Overall, there is also a lack of studies of the concept of cost stickiness among European firms. One of few is the study by Calleja, Steliaros and Thomas (2006). This also allows our study to contribute with more evidence of cost stickiness in Europe.

1.3 Limitations of the study

This study will obtain a time frame of 2002 to 2020, which reflects the ESG data availability of Thomson Reuters, and research the companies that are part of the STOXX Europe 600 index, including the largest companies in Europe. Similarly, to other studies about corporate social responsibility and cost stickiness, such as the one by Golden, Kohlbeck and Rezaee (2020), this study will focus on the environmental and social parts of the ESG score.

2. Theory

Theoretical background and previous studies of the existence, sources and implications of cost stickiness will be presented in 2.1. In 2.2, corporate social responsibility as a potential factor affecting cost stickiness will be presented, followed by related studies. Finally, the hypotheses will be presented in 2.3 and the chapter will conclude with a short reflection on the choice of material in 2.4.

2.1 Concept of cost stickiness

The costs of a corporation are considered to consist of fixed and variable costs in the traditional cost behavior model, in relation to activity volumes (Noreen, 1991). Traditionally, the costs have been assumed to increase and decrease symmetrically along with the change in revenues in a mechanistic way, both as revenues decrease and increase. However, in a study of 108 US hospitals, Noreen and Soderstrom (1997) showed that costs did not behave symmetrically in relation to activity level. Instead, costs decreased less when activity level decreased then they increased as activity level increased.

Later on, this asymmetry has been further studied on a corporation level. Anderson, Banker and Janakiraman (2003) popularized the concept of cost stickiness. In their study, the authors focused on selling, general and administrative costs (SG&A) and discovered that these costs increased by 0.55 % per 1 % increase in sales, but only decreased by 0.35 % per 1 % decrease of sales. Additionally, they concluded that firms with higher asset intensity (asset to revenues) and employee intensity (employees to revenues) had a higher degree of stickiness. This is likely a result of more costs related to disposing of fixed assets and firing employees. A total of 7,629 firms over 20 years between 1979 to 1998 were studied. Following this article, there has been more research into this subject and most studies have used the same methodology.

Anderson, Banker and Janakiraman (2003) attributed managerial decisions over resource commitments as the primary source of cost stickiness. Instead of assuming that all costs were either a result of sales volume or fixed, they suggested that managers also had large control over

their costs. This means that the cost commitment would be affected by both managerial optimism and potential agency costs when managers make decisions that suit themselves best and not the owners. Optimism about future profitability could also lead to managers hesitate to dispose of assets or reduce the number of employees. Additionally, costs related to adjustments of the committed resources are another factor contributing to cost stickiness.

Several later studies have also shown the existence of cost stickiness as demonstrated in the study by Anderson, Banker and Janakiraman (2003), using similar methodology. The study by Subramanian and Weidenmier (2003) of 9,592 firms between 1979 to 2000 concluded that cost stickiness was present when major changes of more than 10 % in revenues occurred, but could not confirm cost stickiness for smaller changes. In addition to confirming the presence of stickiness of SG&A costs, they also concluded that cost of goods sold exhibits sticky behaviors. Another conclusion by the authors was that cost stickiness is more present in certain industries such as manufacturing, that require a higher degree of fixed assets. Anderson and Lanen (2007) were on the other hand only able to find stickiness for SG&A costs, while costs such as labor, research & development and plant, property & equipment did not appear sticky. The authors mention one possible explanation is that SG&A are the costs that are most influenced by decisions of managers. Chen, Lu and Sougiannis (2012) also mention that SG&A are the costs that are most subject of potentially empire building managers, as it captures many overhead costs, such as administration, travel and offices.

In a study of firms in the UK, US, France and Germany by Calleja, Steliaros and Thomas (2006) between 1988 and 2004, the authors were also able to conclude the presence of cost stickiness in total operating costs in all studied countries. However, it was shown that French and German based companies had a higher degree of stickiness than their US and UK counterparts, which the authors attributed to differences in corporate governance practices and managerial oversight. Additionally, to this study, Banker et al. (2016) find support for the hypothesis that the occurrence of cost stickiness is a global phenomenon, which can be observed in all developed industry countries. As mentioned before, it has to be said that the magnitude of cost stickiness varies between countries and industries.

Similarly, to the study by Anderson, Banker and Janakiraman (2003), Calleja, Steliaros and Thomas (2006) showed that cost stickiness was more present in firms with high asset intensity (asset to revenues) and high employee intensity (number of employees to sales). The authors were also able to conclude that cost stickiness was not affected by debt level, which they hypothesized could affect stickiness due to potential agency costs of debt.

Several studies have attributed agency problems to cost stickiness, as suggested by Anderson, Banker and Janakiraman (2003). Chen, Lu and Sougiannis (2012) were also able to confirm the stickiness of SG&A costs when they studied the S&P 1500 companies between 1996 to 2005, but also showed additional evidence that agency problems were a driving factor. They also concluded that stickiness was more pronounced in firms that also had weaker governance as measured by factors such as board composition. Being a part of that, they also suggest that the role of the CEO influences the level of cost stickiness considerably. To be mentioned here are the aspects of CEO horizon and tenure. Xue and Hong (2015) were moreover able to conclude that better governance was attributed with a lower degree of cost stickiness in a study of Chinese companies between 2003 and 2010. Habib and Costa (2020) showed that short-maturity debt reduces cost stickiness, as it limits the available free cash flow for managers.

Other variables that have been suggested affecting stickiness are technological constraints (Kama & Weiss, 2010), stock return, subsequent revenue decline and corporate social responsibility, in the form of ESG scores (Habib & Hasan, 2016; Golden, Kohlbeck & Rezaee, 2020). Technological constraints are results of past technology investments that lead to increased stickiness in later years (Kama & Weiss, 2010). Stock returns during the last year could potentially affect stickiness both positively and negatively (Chen, Lu & Sougiannis, 2012). Companies with good performance on the stock market may indicate a more cost aware management, while it also could reflect an optimistic outlook and therefore managers may decide to retain certain unnecessary costs. Subsequent decline of revenues could lead to less stickiness as managers see the negative demand shock as more of a long-term development (Chen, Lu & Sougiannis, 2012. Taking the influence of ESG scores on cost stickiness into consideration, we are familiar with the research of Habib and Hasan (2016), as well as Golden, Kohlbeck and Rezaee (2020), that will be presented in 2.2.

In addition to studying the existence of cost stickiness and variables affecting it, a number of papers have studied the effects of it. Weiss (2010) and Kim and Kinsey (2010) showed that cost stickiness leads to increased errors of earnings estimates from financial analysts and as a consequence, cost stickiness could also affect market reactions. Kim and Kinsay (2010) also concluded that errors of earnings estimates were especially apparent in firms with a higher degree of fixed assets as they believed financial analysts used too simplified models to forecast earnings. Anderson et al. (2007) also showed that increased SG&A cost ratios, which can be a result of stickiness when revenues decrease, could signal positive future earnings expectations from managers. Finally, Dierynck, Landsman and Renders (2012) provide a link between cost stickiness and earnings management as they show evidence that firms with less cost stickiness practiced more earnings management. The authors attribute this to the fact that companies with higher degree of stickiness will more often utilize earnings management to maintain profitability.

2.2 Corporate social responsibility and cost stickiness

In contrast to the shareholder theory, which has developed from the classical economic arguments of Milton Friedman's arguments that firms should only maximize their profits, the stakeholder theory takes all stakeholders of the company into consideration (Friedman, 1984). This means that any group or individual that is affected by the firm's actions should be taken into consideration and is an important aspect of corporate social responsibility (Carroll & Shabana, 2010).

The four-part model of corporate social responsibility by Carroll consists of four categories of responsibilities towards the society that firms have: economic, legal, ethical, and discretionary/philanthropic (Carroll & Shabana, 2010). The authors consider them to be derived from expectations of different stakeholders and society as a whole. Another important aspect of this is that different firms may have different preferences in terms of which stakeholder they put the most emphasis on (Crilly & Sloan, 2012). For example, while sustainability issues may be important for one company, they could be less important for another one which will therefore not hesitate to cut those costs if needed.

As corporate social responsibility has become a more important issue for investors, ESG scores have become an important metrics to measure corporate social responsibility. The acronyms stand for Environmental, Social and Governance and are meant to measure how well companies handle CSR related issues, as well as how well the firm is governed. ESG metrics are also a common proxy of CSR among academics and have been used in related articles such as the one by Golden, Kohlbeck and Rezaee (2020).

The overall perception of sustainability has become more important not only in business, but in the society as a whole. Therefore, companies who want to be successful in today's economic reality cannot ignore or act careless in regard to their sustainability efforts. This "new reality" is also influenced by the general public throughout various industries observed shift from a stakeholder centric business model towards a more wholesome stakeholder centric business model (Kiron et al., 2015). This is also mentioned by Carroll and Shabana (2010) who acknowledge that today there is a belief among most parts of the public that companies, in addition to pursuing profits, also should aim to satisfy stakeholders such as employees and communities.

Carroll and Shabana (2010) present several potential arguments for how corporate social responsibility can improve corporate financial performance, but also highlight that this is a highly disputed area of research. The first group of arguments is related to reduced risks and costs. Many of these arguments are attributed to the stakeholder theory. For example, by making sure that stakeholders are better satisfied, they can mitigate different potentially costly demands from different stakeholders. Another group of arguments is related to gaining competitive advantage by standing out in terms of CSR. This could help companies to stand out in the eyes of for example customers, investors and employees. Similarly, CSR can also help companies gain reputation and legitimacy, which in turn can improve financial performance. Finally, the authors suggest potential win-win situations, where companies can pursue several stakeholder interests at once. For example, by supporting education they could also improve the availability of potential employees for themselves.

At the time this thesis is being written, the topic of financial impact and influence of ESG and related scores has been widely researched and analyzed. Amongst others, El Ghoul et al. (2011) found that ESG related firm activities result in improved future financial performance and stability, since investors as well as customers increasingly value and reward activities that are related to positive ESG scores. Thus, it is interesting that not only the refinement of financial ESG performance measurements result in a more prosperous financial future, but also the betterment of non-financial ESG measures (Jain, Jain & Rezaee, 2016). The positive relation between ESG and financial performance is confirmed by the meta study by Friede, Busch and Bassen (2015), as the authors report a positive relation in more than half of the 2000 studies, while less than 10 % signal a negative relation.

2.2.1 Previous studies about the impact of CSR on cost stickiness

The influence of corporate social responsibility on cost stickiness has been a subject of recent studies. Habib and Hasan (2016) concluded that certain ESG activities that were deemed "strategic", lead to increased stickiness of total operating expenses. Opposed to "tactical" ESG, "strategic" ESG implied activities that were considered to be more long term and less reversible. This included issues related to the environment, employees, products, and diversity. The "tactical" ESG was based on issues related to communities. Similarly, Golden, Kohlbeck and Rezaee (2020) divided ESG activities into sticky and non-sticky ones, depending on which ones were expected to incur higher adjustment costs, and concluded that stickiness of SG&A and operating costs increased in firms with stickier ESG activities. In their study, they reported a cost stickiness level of 0.346, which is the difference between the increase of SG&A when revenues increase and the decrease when revenues decrease.

On the other hand, a yet to be published paper by Paek, Kim and Kim (2016) have shown indications that when overall ESG scores are used, firms with higher scores reported a lower degree of cost stickiness. All these studies were based on MSCI data of US companies and focused only on the environmental and social parts of the ESG scores as they excluded governance (Golden, Kohlbeck & Rezaee, 2020).

2.3 Hypothesis development

According to the traditional cost behavior model, cost should move asymmetrically up and down as revenues change (Noreen, 1991). Cost stickiness is an exception to this and evidence of it has been shown in a number of studies (Anderson, Banker & Janakiraman, 2003; Chen, Lu & Sougiannis, 2012). While most have covered US firms, the study by Calleja, Steliaros and Thomas (2006) have also shown its presence in European firms, but there is still a limited number of larger studies of European firms. Therefore, our study aims to study the cost stickiness of European companies as part of the first hypothesis *(H1)*:

H1: SG&A costs are sticky.

While many studies have shown factors such as assets intensity (assets to revenues), employee intensity (number of employees to revenues), agency problems (Anderson, Banker & Janakiraman, 2003) and sector belonging (Subramanian & Weidenmier, 2003) as factors that affects cost stickiness, corporate social responsibility has only recently started to become a factor of interest (Hasan & Habib, 2016). The authors argue that activities related to corporate social responsibility often are associated with high costs and in many cases these costs are difficult and slow to reverse. Intuitively, this would likely lead to more cost stickiness. On the other hand, firms that are better performing in terms of corporate social responsibility tend to perform better financially (Friede, Busch & Bassen, 2015). One factor contributing to this would be that these companies benefit from keeping their stakeholders better satisfied (Carroll and Shabana, 2010).

Studies on the impact of corporate social responsibility on cost stickiness are few. The first study of this subject by Habib and Hasan (2016) showed that firms performing better in terms of ESG related activities that were of more strategic character exhibited a higher degree of cost stickiness. In a similar study by Golden, Kohlbeck and Rezaee (2020), the authors were once again able to show evidence that certain ESG related activities were associated with more stickiness. However, a yet to be published study by Paek, Kim and Kim (2016) gives indications that firms with better ESG performance had less stickiness, as opposed to the results of the studies by Habib and Hasan (2016) and Golden, Kohlbeck and Rezaee (2020). One suggestion

from Golden, Kohlbeck and Rezaee (2020) is that this discrepancy is the result of one study which studied the impact of total scores of ESG performance, while the two other studies segmented the ESG score. Therefore, as part of the second hypothesis, we will study both the impact of total ESG scores and the subcategories of it.

H2: Corporate social responsibility affects cost stickiness.

2.4 Theory reflection

For the theoretical background and the literature review we aimed to use well cited articles. The foundation of the review on knowledge around cost stickiness is the article by Anderson, Banker and Janakiraman (2003), which have developed the methodology that most articles use to study cost stickiness. An exception to only using well cited articles is the inclusion of a yet to be published paper by Paek, Kim and Kim (2016), which studied the impact of ESG scores on cost stickiness. It was included as it is one of few studies on this topic available, and the only one to our knowledge that indicates a negative relationship between ESG and cost stickiness. Furthermore, considering it was mentioned and discussed in the article by Golden, Kohlbeck and Rezaee (2020), we decided it was important to also consider it.

3. Method and Data

This chapter will start with a description of the framework of ESG scores provided by Thomson Reuters, that will be used for this study. In 3.2, the methodology of measuring cost stickiness and assessing its influence from ESG scores will be presented. The sample for the study will be described in 3.3 and descriptive statistics will be provided in 3.4. The chapter will conclude with a reflection on the choice of methodology in 3.5.

The variable names for all our models are in line with Golden, Kohlbeck and Rezaee (2020) and are chosen for reasons of shortness and simplicity, although we are aware that they seem rather technical and hard to decipher. Therefore, a complete table with all the variable explanations and definitions is added in Appendix 3.

3.1 ESG data

The ESG scores used for this study are based on Thomson Reuters ESG scores obtained through the Refinitiv Datastream platform and are reported as a score from 0 to 100, with 0 being the worst possible score and 100 the best. Since 2002, Thomson Reuters have measured ESG performance by collecting over 500 company level data points from company reports, news and other media, which are then grouped into ten categories (Refinitiv, 2021). These ten categories form three pillars, environmental, social and governance. Combined, these pillars form an overall ESG score. In addition, Thomson Reuters provides a ESG controversy score, which reflects controversies that potentially affects the overall assessment of ESG performance. Today, Thomson Reuters ESG scores covers over 70 % of global market cap and is one of the most used data providers of ESG scores (Refinitiv, 2021).

As the governance dimension of ESG is out of the scope of this study, only the environmental and social pillars, and their respective categories, will be considered here.

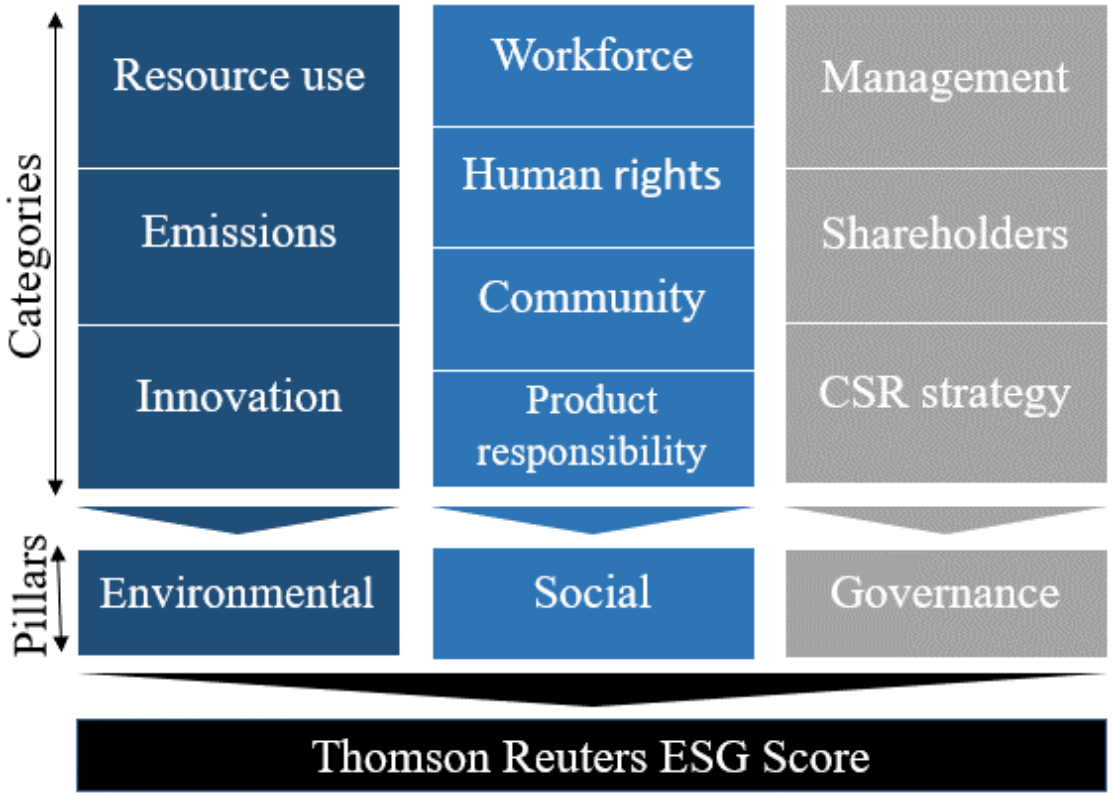

Figure 1: Composition of Thomson Reuters' ESG scores

3.2 Cost stickiness models

Our models for cost stickiness are mostly based on Anderson, Banker and Janakiraman (2003) and Golden, Kohlbeck and Rezaee (2020). As our data sample covers a time frame of 19 years with companies distributed over several industries, we use fixed effect controls for the *Year* and *Industry* variables in all our models in order to mitigate possible bias occurring based on the specification of our model. This is in line with Golden, Kohlbeck and Rezaee (2020).

Concluding, our first model is the following (a description of the variables can be found in Appendix 3):

$$\boldsymbol{LNSGA = \beta_0 + \beta_1\, LNREV + \beta_2\, REVDEC \times LNREV + Year\ FE + Industry\ FE + \varepsilon} \quad (\mathbf{1}).$$

By applying Model (1), we attempt to confirm the existence of cost stickiness and therefore test for our first hypothesis. Therefore, we chose $LNSGA$ as our dependent variable, which is the natural logarithm of SG&A costs in the current year divided by the SG&A costs in the preceding year. To further test for the existence of cost stickiness, our regression results should show that β_1 equals a significant positive coefficient, whereas β_2 should have a significantly negative coefficient. Hereby, $LNREV$ is the natural logarithm of the company's revenue in the current year divided by the revenue in the preceding year. To then test for the percentual decline in SG&A costs, we multiply the $LNREV$ variable with a decrease dummy, $REVDEC$, which equals 1 when the revenue in the current observation year declined compared to the preceding year. If this does not apply, $REVDEC$ equals 0. Therefore, the variable only tests for declining revenue observations, as a multiplication with factor 0 does not provide any result.

The sum of $(\beta_1 + \beta_2)$ defines the gratitude of cost stickiness in the sample at a revenue decrease of 1 %, due to the logarithmical consideration of SG&A costs (Banker et al., 2016). We expect our data set to confirm this theoretical approach and therefore the overall existence of cost stickiness.

Moreover, we want to test the impact of ESG scores on cost stickiness. Therefore, in order to test for *H2*, we expanded our first model by the ESG related variables, in accordance with Golden, Kohlbeck and Rezaee (2020), who created a similar model to test their research on ESG related cost stickiness. We follow the previous research and replicate Equation (2) of Golden, Kohlbeck and Rezaee (2020), who added their ESG variable as effect and multiplied it with the interaction term. The difference to our model is that we substitute their measurement of sticky ESG activities with the ESG and related pillar scores. This leads to the following Model (2):

$$\boldsymbol{LNSGA = \beta_0 + \beta_1\, LNREV + \beta_2\, REVDEC \times LNREV + \beta_3\, ESG + \beta_4\, ESG \times REVDEC + \beta_5\, ESG \times LNREV + \beta_6\, ESG \times REVDEC \times LNREV + Year\ FE + Industry\ FE + \varepsilon} \quad (\mathbf{2}).$$

In order to employ a robust approach, we will apply Model (2) by substituting the ESG variable by either one of the two pillar scores $ENVIRON$ and $SOCIAL$. Similar to the logic behind Model (1), it is expected that $LNSGA$ increases with revenues but does not decrease accordingly, hence

cost stickiness is given and will be represented, as before, by a negative and significant coefficient for the interaction term $REVDEC \times LNREV$. We test for our second hypothesis with the term $ESG \times REVDEC \times LNREV$. We expect an either positive or negative statistical significant coefficient β_6, in which case cost stickiness would increase or decrease with higher ESG scores. Consistent with Golden, Kohlbeck and Rezaee (2020), we make no further assumptions for the coefficients of the other terms, including the standalone ESG variable. Accordingly, we expect the same outcome by substituting ESG with $ENVIRON$ or $SOCIAL$.

The approach to regress for not only a total combined score but the underlying pillar scores is unique to our thesis, as far as we know and to our best belief.

In order to gain more reliable and thorough results and to explain the impact CSR in the form of ESG related scores has on cost stickiness, we want to test for not only the sole impact of ESG on SG&A increases and decreases, but to include the repercussions of certain economic variables as well. Therefore, we add four additional controlling variables to our second model, which are asset intensity (AI), employee intensity (EI), subsequent revenue decline (SD) and annual stock returns ($RETURN$), as introduced by Chen, Lu and Sougiannis (2012) and also considered by Golden, Kohlbeck and Rezaee (2020). In line with the above-mentioned research, asset intensity and employee intensity are expected to influence cost stickiness positively. Subsequent revenue decline *(SD)* is expected to reduce stickiness, while stock return could lead to either a positive or negative effect on stickiness (Chen, Lu & Sougiannis, 2012).

We have similar expectations regarding the ESG variables than to Model (2), with a significant coefficient $\beta_6$indicating additional evidence for the impact of ESG on cost stickiness.

As in the preceding models, we multiply the newly added variables with the interaction term $REVDEC \times LNREV$, due to the aim of controlling for differential cost stickiness. In accord with Golden, Kohlbeck and Rezaee (2020), we created Model (3) as follows, with our ESG variables added:

$$\boldsymbol{LNSGA} = \boldsymbol{\beta_0} + \boldsymbol{\beta_1}\,\boldsymbol{LNREV} + \boldsymbol{\beta_2}\,\boldsymbol{REVDEC} \times \boldsymbol{LNREV} + \boldsymbol{\beta_3}\,\boldsymbol{ESG} + \boldsymbol{\beta_4}\,\boldsymbol{ESG} \times \boldsymbol{LNREV} + \boldsymbol{\beta_5}\,\boldsymbol{ESG} \times \boldsymbol{REVDEC} \times \boldsymbol{LNREV} + \boldsymbol{\beta_6}\,\boldsymbol{AI} + \boldsymbol{\beta_7}\,\boldsymbol{EI} + \boldsymbol{\beta_8}\,\boldsymbol{SD} + \boldsymbol{\beta_9}\,\boldsymbol{RETURN} + \boldsymbol{\beta_{10}}\,\boldsymbol{AI} \times \boldsymbol{REVDEC} \times \boldsymbol{LNREV} + \boldsymbol{\beta_{11}}\,\boldsymbol{EI} \times \boldsymbol{REVDEC} \times \boldsymbol{LNREV} + \boldsymbol{\beta_{12}}\,\boldsymbol{SD} \times \boldsymbol{REVDEC} \times \boldsymbol{LNREV} + \boldsymbol{\beta_{13}}\,\boldsymbol{RETURN} \times \boldsymbol{REVDEC} \times \boldsymbol{LNREV} + \boldsymbol{Year\ FE} + \boldsymbol{Industry\ FE} + \boldsymbol{\varepsilon} \quad (\mathbf{3}).$$

As in Model (2), the ESG variable is interchangeable with the two pillar variables used in this study, $ENVIRON$ and $SOCIAL$.

3.3 Sample selection

We started by extracting a data set of 11,400 firm-year observations from the Refinitiv Eikon Datastream platform, including 600 companies from the STOXX Europe 600 index for the years from 2002 - 2020. We chose this time frame in order to cover the data availability for ESG, as Refinitiv and Thomson Reuters started their awarding of ESG scores in this year. The STOXX Europe 600 index contains the 600 largest European companies from out of 17 countries such as France, Germany, the UK and the Netherlands, based on market capitalization and is one of the reference indices for the European stock market (Qontigo, 2021).

We chose the STOXX Europe 600 index because prior research almost exclusively chose the S&P 500 or another index representing the U.S. American market as their database. Therefore, the impact of ESG scores and related behavior of cost stickiness in European companies has not been comprehensively researched enough, to our knowledge. Furthermore, European companies tend to score better in ESG related activities and provide an overall more comprehensive voluntary disclosure concerning their ESG activities (Reuters, 2021).

From our initial dataset, we subtracted 2,773 observations describing companies operating in regulated industries, namely financial and utility companies, due to the reason that companies in these sectors could distort our dataset due to regulations, in line with the customary literature on cost stickiness research (e.g. Golden, Kohlbeck & Rezaee, 2020). Furthermore, they rarely or irregularly report SG&A data overall. Following, we eliminated observations lacking data on SG&A, revenue or sales and annual returns. In addition to that, we excluded all observations in

which SG&A costs exceed revenues in order to mitigate potential manipulation of results, which were 22 firm-year observations.

This leaves us with a dataset of 5,275 firm-year observations. We additionally exclude 1,175 firm-year observations from our dataset which lack data on either the Refinitiv combined ESG score or data concerning the environmental or social pillar score. Concluding, the final sample consists of 4,100 firm-year observations (Table 1).

As seen in the Table 2, we depict the distribution of our dataset samples based on the FTSE codes for economic sectors and industry groups. FTSE divides the market in nine economic groups, from which seven of them can be seen in the table, as they are part of our data set. As mentioned before, FTSE also recognizes financials and utilities as separate sectors, which we excluded.

Representing our data set, general industrials such as engineering, machinery and electrical equipment are the largest industry group with a relative proportion of 24.10 %, followed by cyclical consumer goods, which unite industries like automobiles, clothing and leisure, at 16.85 % of the total sample observations. 10.07 % of the firm-year observations in our data set are considered other industries or do not report a specific affiliation to a certain economic sector or industry.

Table 1: Data sample selection

		Firm-year observations
Initial sample containing EURO STOXX 600 companies from 2002-2020		11,400
Less observations:		
Financial institutions (FTSE code 80-89) observations	-	484
Utility institution (FTSE code 70-79) observations	-	2,289
Missing sales revenue data and SG&A cost data in Datastream	-	2,757
Missing return data in Datastream	-	573
Observations where SG&A costs exceed Revenues	-	22
Missing Thomson Reuters / Refinitiv Eikon ESG data	-	1,175
Final sample for H1 and H2		***4,100***

Table 2: Sample industry distribution

Industry	N	Percentage
Resources	172	4.20 %
Basic industries	488	11.90 %
General industrials	988	24.10 %
Cyclical consumer goods	691	16.85 %
Non-cyclical consumer goods	578	14.10 %
Cyclical services	564	13.76 %
Non-cyclical services	206	5.02 %
Other	413	10.07 %
Total	**4,100**	**100 %**

3.4 Descriptive statistics

3.4.1 Correlation matrix

Table 3 presents the correlation matrix for the main dependent, ESG related and economic explanatory variables used in our study. First, we see that all three major ESG variables $ESG, ENVIRON$ and $SOCIAL$ are negatively correlated with the dependent variable $LNSGA$ (Panel 1). Furthermore, we see none of the economic explanatory variables having a significant high correlation with any of the ESG variables. Hereby, we observe the highest correlation between $SOCIAL$ and EI with a negative value of -0.182. This indicates that companies with a higher score on the Social pillar of the ESG score have a lower level of employee intensity.

Additionally, we tested for correlations between the overall ESG score, the pillar scores and their categories (Panel 2). As expected, the overall ESG score ESG has a high correlation with $ENVIRON$ and $SOCIAL$, with a correlation level of 77.38 % for the first and 80.74 % for the latter. We moreover observe that the pillar scores in general correlate highly with their related categories compared to the categories of the other pillar. All of them are positively correlated, underlining the fact that the categories thrive their respective overall pillar.

Table 3: Variable correlation tables

Panel 1

Variable	LNSGA	LNREV	REVDEC	ESG	ENVIRON	SOCIAL	AI	EI	SD	RETURN
	1	2	3	4	5	6	7	8	9	10
LNSGA	1.0000									
LNREV	0.5587	1.0000								
REVDEC	-0.3370	-0.6248	1.0000							
ESG	-0.1110	-0.1630	0.0986	1.0000						
ENVIRON	-0.1278	-0.1982	0.1422	0.7686	1.0000					
SOCIAL	-0.1086	-0.1601	0.0871	0.8051	0.7445	1.0000				
AI	0.0126	0.0335	0.0540	0.0309	0.0393	0.0548	1.0000			
EI	0.0462	0.0742	-0.0294	-0.1350	-0.1593	-0.1763	0.0161	1.0000		
SD	0.0160	0.0075	0.0000	-0.0283	-0.0332	-0.0145	-0.0088	0.0020	1.0000	
RETURN	0.0256	0.0494	-0.0273	-0.0689	-0.0880	-0.0786	-0.0210	-0.0495	0.0178	1.0000

Panel 2

Variable	ESG	ENVIRON	SOCIAL	CONTRO	COMMUN	EMISSION	ENVINNO	HUMAN	PRODUCT	RESOURCE	WORKFORCE
	1	2	3	4	5	6	7	8	9	10	11
ESG	1.0000										
ENVIRON	0.7738	1.0000									
SOCIAL	0.8074	0.7557	1.0000								
CONTRO	0.0486	-0.1644	-0.1981	1.0000							
COMMUN	0.3644	0.3102	0.4256	-0.2431	1.0000						
EMISSION	0.4474	0.5332	0.4095	-0.2633	0.4647	1.0000					
ENVINNO	0.3770	0.4636	0.3464	-0.2025	0.3173	0.4232	1.0000				
HUMAN	0.4891	0.4493	0.5912	-0.2549	0.4915	0.5414	0.4170	1.0000			
PRODUCT	0.4364	0.4136	0.5242	-0.2210	0.4138	0.4680	0.3850	0.4998	1.0000		
RESOURCE	0.4926	0.5561	0.4766	-0.2319	0.5170	0.7622	0.4550	0.6158	0.5359	1.0000	
WORKFORCE	0.3846	0.3432	0.4270	-0.2162	0.4886	0.6598	0.3197	0.5328	0.4716	0.6704	1.0000

3.4.2 Variable values

The descriptive statistics of the values used in this thesis are represented in Tables 4 and 5. As common statistical procedure recommends, we winsorized our variables at the 1st and 99th percentiles in order to exclude bias generated by extremely large or low values and to estimate more reliable standard errors (Bailey, 2019). As can be observed in Table 4 the dependent variable $LNSGA$ has a wide range from negative -0.619 to positive 0.955. Compared with the US firm sample of Golden, Kohlbeck and Rezaee (2020), we observe that $LNSGA$ values are considerably lower in our data set, as their sample shows a median of 0.076 for $LNSGA$, compared with our median of 0.060. Comparing the median of $LNREV$ shows the same picture, as Golden, Kohlbeck and Rezaee's (2020) sample has a median of 0.097, whereas our sample displays a median of 0.054. Moreover, we observe a median value for asset intensity of 1.232, which is higher than the median of 1.087 reported by Golden, Kohlbeck and Rezaee (2020). Concluding, the European companies in our sample have a generally higher level of assets compared to their revenues than the US American companies in the formerly mentioned study.

Furthermore, we have a substantial variety in firm size as portrayed by MV. Here, the largest firm is approximately 57 times higher valued than the smallest firm. Although our data sample consists of the 600 largest European firms, a substantial difference in market value is not unusual, with high-tech firms traditionally being higher valued than resource producing firms, for example. We furthermore see a median of 0.068 for return on assets in our data sample. This is considerably lower than the median ROA found by Golden, Kohlbeck and Rezaee (2020), who report a value of 0.089. This leads to the conclusion that American firms are generally more profitable than their European counterparts.

In Table 5 we can see our ESG variables and therefore the variables we lay focus on in this thesis. It can be observed that the ESG value of the companies in our sample varies drastically from 10.41 to 88.37, with the median being somewhat in the middle of the scoring board with 53.73 points.

Table 4: Descriptive statistics of economic explanatory variables

Variable	Mean	Median	Std. Dev.	25% Q.	75% Q.	Min	Max
LNSGA	.0599	.0484	.1895	-.009	.1146	-.619	.9553
LNOC	.0245	.0519	.7000	-.011	.1219	-3.64	2.990
LNREV	.0594	.0544	.1422	-.001	.1167	-.444	.6068
REVDEC	.2535	0.00	.4351	0.00	1.00	0.00	1.00
AI	1.446	1.232	.8127	.8788	1.760	.4774	3.707
EI	.0079	.0026	.0214	.0006	.0055	3.38e-06	.1593
SD	.5056	1.00	.5000	0.00	1.00	0.00	1.00
RETURN	.1440	.1210	.3397	-.065	.3170	-.607	1.363
MV	18597.77	8155.14	21196.45	2928.36	27597.26	1138.27	65351.27
ROA	.0805	.0679	.0577	.0414	.1083	-.0047	.2222

The pillar scores $ENVIRON$ and $SOCIAL$ have an even more considerable variance than ESG, ranging from 0.00 to 96.08, respectively from 7.14 to 96.16. Although the range is more volatile, we see the pillar's median being slightly higher than the overall ESG score median.

Table 5: Descriptive statistics of ESG score and related variables

Variable	Mean	Median	Std. Dev.	25% Q.	75% Q.	Min	Max
ESG	52.95	53.73	18.71	39.92	67.715	10.41	88.37
ENVIRON	54.33	58.99	27.22	33.9	77.185	0.00	96.08
SOCIAL	58.94	62.66	24.13	39.66	79.3	7.14	96.16
CONTRO	84.49	100	28.42	83.33	100	2.68	100
COMMUN	58.47	61.5	29.38	33.44	85.43	1.37	99.52
EMISSION	61.31	69.54	30.80	40.18	87.65	0.00	99.12
ENVINNO	35.81	30.56	34.32	0.00	67.11	0.00	98.64
HUMAN	50.03	58.33	36.48	7.04	84.82	0.00	98.21
PRODUCT	51.52	56.05	34.17	20	83.06	0.00	99.04
RESOURCE	62.28	70.75	31.62	40.91	90.19	0.00	99.55
WORKFORCE	74.09	80.64	22.61	62.18	92.5	6.25	99.53

Furthermore, we observe that the category scores are not necessarily in line with their related pillar scores, as the median of $HUMAN$ is considerably higher than the $SOCIAL$ median, whereas $PRODUCT$, which also is a category of $SOCIAL$, scores lower than the latter.

3.5 Methodology discussion

The study aims to have a high grade of reliability and validity, although there are limitations that will be discussed here. Reliability, which refers to how reliable and replicable the study is (Bryman & Bell, 2017), is achieved to a large degree as the methodology is based on several well cited articles and is presented with a large degree of transparency. The data used is available in Datastream, a source that can be considered as reliable. This allows this study to be replicated with similar results.

One concern we are aware of which can affect the reliability of this study is the usage of ESG scores as a proxy for CSR. While ESG scores are commonly used by both academics and professionals, there are limitations. According to Doyle (2018), ESG scores can be inconsistent between different rating agencies, as there are no standardized regulations. By using another provider for ESG scores we might find different results, and the best solution is likely to combine several sources. There are also several anomalies affecting ESG scores, one being that larger firms tend to have higher scores (Doyle, 2018). This could be a concern since we have looked at the STOXX Europe 600 companies, which could be viewed as limited as the index solely covers the 600 largest European companies based on their market capitalization. Therefore, our results could be biased as a study with a data sample consisting of smaller companies possibly shows a different impact of ESG scores on cost stickiness. Therefore, generalization of the results of this study should be made with caution.

Validity refers to how well the study is able to measure what is being studied, as well as how well the results can be generalized outside of the sample (Bryman & Bell, 2017). A large sample size of 4,100 observations during a time period of 19 years and a reputable and commonly adopted methodology helps this study to achieve a higher degree of validity. In addition to previously mentioned concerns about the usage of ESG scores, it should also be taken into consideration that this study has conflicting results to several articles about ESG and cost stickiness. Future studies are needed to better understand this relation and generalization of the results.

4. Empirical results and analysis

We test for our hypotheses by using three different models. Model (1) solely tests for the occurrence of cost stickiness in our data sample. We base this model on the work of Anderson, Banker and Janakiraman (2003), who pioneered in the research on cost stickiness by testing for the logarithmical change of SG&A cost when revenues change. Model (2) is the base model for testing our second hypotheses on whether ESG scores influence cost stickiness. Model (3) is an extension of our second model, in which we further test our second hypothesis by including certain economic explanatory variables to get a more thorough understanding on what factors drive cost stickiness.

4.1 Model (1)

We implemented the first model in order to test for overall cost stickiness in our dataset. For that, we first assess for SG&A costs by using $LNSGA$ as the dependent variable in our regression. We see in Table 6 that the coefficient for $LNREV$ equals a positive 0.798 and is highly significant at the 1 % level. Additionally, the estimated coefficient for $REVDEC \times LNREV$ equals a negative -0.150, also at the 1 % significance level. This indicates that for every one percent in revenue increase, SG&A costs increase by 0.798 % and for every one percent decrease in revenues, SG&A costs decrease by only 0.150 %.

As the coefficient for $LNREV$ is positive, whereas the coefficient for $REVDEC \times LNREV$ is negative, we can confirm that cost stickiness is present in our dataset (Anderson, Banker & Janakirman, 2003). Therefore, we can accept *H1* insofar SG&A costs are considered sticky in our data sample. By summing up $\beta_1$and β_2, we observe the magnitude of cost stickiness in our sample being 0.648. This is a substantially higher magnitude of cost stickiness as observed in the original cost stickiness paper by Anderson, Banker and Janakiraman (2003), in which cost stickiness was accounted for at a level of 0.200. Accordingly, the study by Golden, Kohlbeck and Rezaee (2020) report a sum of $\beta_1 + \beta_2 = 0.346$, providing evidence of cost stickiness in SG&A costs being exhibited in their data samples.

Overall, the comparison shows that there is a certain variation and volatility in different studies testing for cost stickiness, which in conclusion leaves us with a result at a realistic level for SG&A cost stickiness.

Table 6: Model (1) regression results

VARIABLES	LNSGA
LNREV	0.798***
	(0.025)
REVDEC*LNREV	-0.150***
	(0.051)
Constant	0.009**
	(0.003)
Year and Industry fixed effects	YES
Observations	3,946
R-squared	0.311

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4.2 Model (2)

We establish Model (2) as an extended version of the first model. The reason behind this extension is to test for the effect of ESG scores on cost stickiness, which we hypothesize to have an influence. Therefore, we added the overall ESG score variable ESG and computed additional regressions in which we substituted ESG with the pillar scores $ENVIRON$ and $SOCIAL$.

For the ESG regression, as seen in Panel 1 of Table 7 the adjusted R^2 is 30.54 %. R^2 is an indicator for how well the independent variables describe the dependent variable in a regression model (Bailey, 2019). Golden, Kohlbeck and Rezaee (2020) computed an adjusted R^2 of 42.80 % in their similar model approach. Concluding, we see that our value R^2 does not substantially differ and is in line with previous research.

Table 7: Model (2) regression results

	(1)	(2)	(3)
	ESG	ENVIRON	SOCIAL
VARIABLES	LNSGA	LNSGA	LNSGA
LNREV	0.905***	0.862***	0.931***
	(0.053)	(0.041)	(0.047)
REVDEC*LNREV	-0.457***	-0.362***	-0.356***
	(0.095)	(0.080)	(0.086)
ESG	-0.000		
	(0.000)		
ESG*LNREV	-0.002**		
	(0.001)		
ESG*REVDEC	0.000		
	(0.000)		
ESG*REVDEC*LNREV	0.005***		
	(0.001)		
ENVIRON		-0.000	
		(0.000)	
ENVIRON*LNREV		-0.002*	
		(0.001)	
ENVIRON*REVDEC		0.000	
		(0.000)	
ENVIRON*REVDEC*LNREV		0.004***	
		(0.001)	
SOCIAL			0.000
			(0.000)
SOCIAL*LNREV			-0.003***
			(0.001)
SOCIAL*REVDEC			-0.000
			(0.000)
SOCIAL*REVDEC*LNREV			0.003***
			(0.001)
Constant	0.010	0.009	0.008
	(0.010)	(0.008)	(0.009)
Year and Industry fixed effects	YES	YES	YES
Observations	3,940	3,940	3,940
R-squared	0.305	0.305	0.305

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The estimated coefficients for $LNREV$ and $REVDEC \times LNREV$ are both highly significant at the 1 % level and positive, respectively negative, consistent with the cost stickiness model. Therefore, cost stickiness is evident in Model (2).

In our study we focus on the ESG variable in combination with the interaction term, $ESG \times REVDEC \times LNREV$, where we expect a significant coefficient in line with our second hypothesis, implying that CSR in the form of ESG scores affect cost stickiness.

As a matter of fact, we observe the coefficient for the interaction term being positive with a value of 0.005 and highly statistically significant at the 1 % level. This finding is contrary with Golden, Kohlbeck and Rezaee (2020), who report negative coefficient results for their ESG variable combined with the interaction term $REVDEC \times LNREV$ whilst applying the same model. This result indicates the confirmation of our second hypothesis, that ESG scores have an impact on cost stickiness. In this case, firms with higher ESG scores generally have less cost stickiness.

In order to get a further understanding of how ESG scores influence cost stickiness, we substitute the variable ESG with the more granular pillar variables $ENVIRON$ and $SOCIAL$, to test for any indications whether the sole pillar scores have a varying effect on cost stickiness compared to the broader combined ESG score. The findings of these regression can be found in Panel 2 and 3 of Table 7. Accordingly, we see that the estimated coefficients for the interaction term in both pillar regressions show the same results as in the first regression, with a highly significant positive coefficient at the 1 % level, although slightly smaller with 0.004 for $ENVIRON \times REVDEC \times LNREV$ and 0.003 for $SOCIAL \times REVDEC \times LNREV$. These findings are in line with the first regression, that companies with higher ESG scores report less cost stickiness and that the individual pillar scores of Environmental and Social emphasize this result.

Finally, we want to test for the relationship of cost stickiness and the categories on which the ESG score is built upon. Therefore, we regress Model (2) using the categories that compose the ESG pillars, as described in 3.1. As these regressions are not part of our initial models, the results of the respective regressions can be found in Appendix 2. Nevertheless, we show the most important findings in Table 8, where focus lays on the interaction term.

Table 8: Interaction term results for the category scores in Model (2)

Variable	Coefficient
Environmental pillar	
$EMISSION \times REVDEC \times LNREV$	0.002**
$ENVINNO \times REVDEC \times LNREV$	-0.000
$RESOURCE \times REVDEC \times LNREV$	0.002***
Social pillar	
$COMMUN \times REVDEC \times LNREV$	0.001
$HUMAN \times REVDEC \times LNREV$	0.001*
$PRODUCT \times REVDEC \times LNREV$	0.003***
$WORKFORCE \times REVDEC \times LNREV$	0.001

*** p<0.01, ** p<0.05, * p<0.1

Our results imply that $EMISSION$ and $RESOURCE$ show similar results to the beforehand conducted regressions, a highly statistically significant positive coefficient in connection with the interaction term. The same results can be observed for the categories $HUMAN$ and $PRODUCT$. On the other hand, we find $ENVINNO$ to have a positive impact on cost stickiness, although the estimated coefficient is not statistically significant and therefore not explicitly reliable.

4.3 Model (3)

Model (3) is a further developed version of Model (2), in which a variety of economic control variables are added. These variables are considered to be causing factors regarding cost stickiness. As in the two previous models, we find evidence of highly significant cost stickiness for the ESG regression. The results of Model (3), including the ESG variable, can be observed in Panel 1 of Table 9.

Similar to the regression result in Model (2), we find decreasing cost stickiness for companies with higher ESG scores, represented by the highly significant (p-value < 0.01) coefficient of the interaction term $ESG \times REVDEC \times LNREV$ of 0.003. This finding is, again, opposing the results of Golden, Kohlbeck and Rezaee (2020), who report increased cost stickiness for ESG firms with their ESG determinant variable (-0.097, p-value < 0.01) in a similar model approach.

Observing the economic determinants of cost stickiness, we find $AI \times REVDEC \times LNREV$ being statistically significant with a negative coefficient of -0.003, implying that companies with a higher level of assets compared to others report a higher level of cost stickiness. This is consistent with the findings of Anderson, Banker and Janakiraman (2003) and Golden, Kohlbeck and Rezaee (2020). Additionally, we find a negative estimated coefficient of -0.130 for the interaction term $RETURN \times REVDEC \times LNREV$. This is in line with Golden, Kohlbeck and Rezaee (2020), who find a statistical significance in $RETURN$. Their study suggests that companies with higher annual stock returns have a higher level of cost stickiness, which our findings also imply.

Other than that, we find no statistical significance for the other economic variables, employee intensity and subsequent revenue decline. Contrastingly, Anderson, Kohlbeck and Janakiraman (2003) find a negative and highly significant coefficient for employee intensity, providing the theory that cost stickiness increases at companies that need more employees to generate revenue.

Table 9: Model (3) regression results

VARIABLES	(1) ESG LNSGA	(2) ENVIRON LNSGA	(3) SOCIAL LNSGA
LNREV	0.869***	0.816***	0.906***
	(0.060)	(0.045)	(0.053)
REVDEC*LNREV	-0.304***	-0.290***	-0.212**
	(0.108)	(0.089)	(0.097)
ESG	-0.000		
	(0.000)		
ESG*LNREV	-0.002		
	(0.001)		
ESG*REVDEC*LNREV	0.003**		
	(0.002)		
ENVIRON		-0.000	
		(0.000)	
ENVIRON*LNREV		-0.001	
		(0.001)	
ENVIRON*REVDEC*LNREV		0.003**	
		(0.001)	
SOCIAL			0.000
			(0.000)
SOCIAL*LNREV			-0.002***
			(0.001)
SOCIAL*REVDEC*LNREV			0.002*
			(0.001)
AI	0.002	0.002*	0.002
	(0.001)	(0.001)	(0.001)
EI	-0.014	-0.012	-0.019
	(0.049)	(0.049)	(0.049)
SD	0.007	0.007	0.007
	(0.005)	(0.005)	(0.005)
RETURN	-0.009	-0.010	-0.010
	(0.008)	(0.008)	(0.008)
AI*REVDEC*LNREV	-0.003*	-0.001	-0.003
	(0.004)	(0.003)	(0.004)
EI*REVDEC*LNREV	0.089	0.164	0.062
	(0.418)	(0.418)	(0.416)
SD*REVDEC*LNREV	0.048	0.049	0.070
	(0.058)	(0.055)	(0.056)
RETURN*REVDEC*LNREV	-0.130*	-0.140*	-0.147*
	(0.075)	(0.074)	(0.075)
Constant	0.004	0.005	0.001
	(0.011)	(0.009)	(0.010)
Year and Industry fixed effects	YES	YES	YES
Observations	3,504	3,504	3,504
R-squared	0.308	0.309	0.309

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Similar to our approach in Model (2), we substitute ESG with the individual pillar variables $ENVIRON$ and $SOCIAL$ and apply Model (3) again. The findings of these regressions can be found in Panel 2 and 3 of Table 9 Analog to the results before, we observe $ENVIRON$ and $SOCIAL$ to have a negative impact on cost stickiness, meaning that companies who score higher in the $ENVIRON$ and $SOCIAL$ pillar scores tend to have less cost stickiness (estimated coefficient of 0.003 for $ENVIRON \times REVDEC \times LNREV$, 0.002 for $SOCIAL \times REVDEC \times LNREV$). In contrast to the results of the ESG regression, we find asset intensity not to have an impact on cost stickiness for the pillar score variables.

Furthermore, we apply Model (3) again, but substitute the ESG variable for the pillar score's category variables, similar to the approach we conducted in the previous Model (2). The regression results can be seen in Appendix 2, whereas we present the values of the interaction term coefficients in Table 10. We observe that not all of the categories for $ENVIRON$ and $SOCIAL$ have an impact on cost stickiness. Especially $EMISSION$ and $RESOURCE$ for the environmental pillar as well as $HUMAN$ and $PRODUCT$ from the social pillar show highly significant estimated coefficients. All of these coefficients in relation to the interaction term $REVDEC \times LNREV$ are positive, which imply a negative effect on cost stickiness.

Therefore, our results indicate that companies who score high on the Emissions score, Resource Use score, Human Rights score and Product Responsibility score have less cost stickiness compared to companies scoring lower in these categories. As in Model (2), we see that $ENVINNO$ has a positive impact on cost stickiness, although statistically insignificant. Overall, the results regarding the category variables are in line with Model (2), with the magnitude of the coefficients varying slightly, but the overall impact being consistent.

Table 10: Interaction term results for the category scores in Model (3)

Variable	Coefficient
Environmental pillar	
$EMISSION \times REVDEC \times LNREV$	0.004***
$ENVINNO \times REVDEC \times LNREV$	-0.002
$RESOURCE \times REVDEC \times LNREV$	0.003***
Social pillar	
$COMMUN \times REVDEC \times LNREV$	0.001
$HUMAN \times REVDEC \times LNREV$	0.003***
$PRODUCT \times REVDEC \times LNREV$	0.002***
$WORKFORCE \times REVDEC \times LNREV$	0.002

*** p<0.01, ** p<0.05, * p<0.1

4.4 Regression diagnosis

In order to affirm overall reliability and resilience of our model approaches and results, we conducted several statistical tests, including the testing for multicollinearity and homoscedasticity. Conducting these tests, we reacted to the findings and made sure to mitigate any bias that could influence our statistical models. The results of these assessments can be found in Appendix 1.

Previous studies suggest that firm size is a viable influence factor for voluntary disclosure of information (Lang & Lundholm, 1996). We expect higher information disclosure to be positively related to higher ESG scores and therefore influencing cost stickiness. Moreover, Doyle (2018) suggests that larger firms generally have higher ESG scores, which is an incentive to further investigate the impact of firm size in our sample.

We also test for return on assets as a proxy for a company's level of performance. According to Lang and Lundholm (1996), better performing companies tend to reveal more information about their "good news" compared to poorly performing companies.

Therefore, we conducted a subsample distribution to make sure our findings are not manipulated in any way by these two variables. To do that, we created three subsamples each, based on the 25 % and 75 % quartiles of MV and ROA. Hereby we classified the new data sets as small/low (all observations smaller than 25 % quartile), mid (all observations between 25 % and 75 % quartiles) and large/high (all observations greater than 75 % quartile).

The results of these subsample regressions for Model (3) can be seen in Table 11 (MV) and Table 12 (ROA). For reasons of clarity, we only present the results for the regression including the ESG variable, as the regression with the pillar score variables $ENVIRON$ and $SOCIAL$ provided similar results.

Furthermore, the interaction term $ESG \times REVDEC \times LNREV$ is positive with an estimated coefficient of 0.007, highly significant at the 1 % level. As the interaction terms of the subsamples with mid and small market value show no significance, we can attest that the decreasing cost stickiness with increasing ESG scores we find in our initial sample is primarily driven by large companies.

Table 11: Model (3) with subsample divided by MV

VARIABLES	(1) Large MV LNSGA	(2) Mid MV LNSGA	(3) Small MV LNSGA
LNREV	0.486***	0.911***	1.053***
	(0.104)	(0.110)	(0.105)
REVDEC*LNREV	-0.711***	-0.096	-0.647***
	(0.224)	(0.164)	(0.201)
§ESG	-0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)
ESG*LNREV	0.003	-0.002	-0.003
	(0.002)	(0.002)	(0.002)
ESG*REVDEC*LNREV	0.007**	0.000	-0.003
	(0.003)	(0.003)	(0.004)
AI	0.003	0.000	0.007***
	(0.002)	(0.002)	(0.002)
EI	0.043	0.034	-0.129
	(0.059)	(0.159)	(0.131)
SD	0.019*	0.001	-0.010
	(0.010)	(0.008)	(0.010)
RETURN	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
AI*REVDEC*LNREV	-0.004	0.046**	0.035
	(0.004)	(0.020)	(0.035)
EI*REVDEC*LNREV	2.535***	-0.307	0.671
	(0.970)	(0.880)	(4.001)
SD*REVDEC*LNREV	0.173*	-0.139*	0.297**
	(0.100)	(0.083)	(0.118)
RETURN*REVDEC*LNREV	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
Constant	0.006	0.026	-0.009
	(0.022)	(0.018)	(0.020)
Year and Industry fixed effects	YES	YES	YES
Observations	1,195	1,665	833
R-squared	0.228	0.323	0.437

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 12: Model (3) with subsample divided by ROA

VARIABLES	(1) High ROA LNSGA	(2) Mid ROA LNSGA	(3) Low ROA LNSGA
LNREV	0.236**	0.965***	1.418***
	(0.114)	(0.098)	(0.111)
REVDEC*LNREV	0.392	-0.890***	-0.651***
	(0.278)	(0.247)	(0.162)
ESG	-0.001***	0.000	0.000
	(0.000)	(0.000)	(0.000)
ESG*LNREV	0.008***	-0.004*	-0.010***
	(0.002)	(0.002)	(0.002)
ESG*REVDEC*LNREV	-0.008*	0.013***	0.007***
	(0.005)	(0.004)	(0.002)
AI	-0.001	0.003*	0.000
	(0.003)	(0.001)	(0.003)
EI	-0.006	0.242	0.006
	(0.060)	(0.156)	(0.138)
SD	-0.001	0.010	-0.002
	(0.011)	(0.007)	(0.012)
RETURN	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)
AI*REVDEC*LNREV	0.143**	-0.129***	-0.010**
	(0.056)	(0.026)	(0.004)
EI*REVDEC*LNREV	1.451	3.578***	-0.212
	(2.248)	(1.012)	(0.786)
SD*REVDEC*LNREV	-0.286	0.158	-0.005
	(0.209)	(0.101)	(0.084)
RETURN*REVDEC*LNREV	0.000	0.000**	-0.000
	(0.000)	(0.000)	(0.000)
Constant	0.104***	-0.021	-0.032
	(0.022)	(0.016)	(0.025)
Year and Industry fixed effects	YES	YES	YES
Observations	931	1,857	903
R-squared	0.267	0.274	0.417

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 12 shows the regressions of ESG in a subsample of companies distributed by their level of ROA. We observe statistical significance for the interaction term $ESG \times REVDEC \times LNREV$ in all levels of profitability. Interestingly, the estimated coefficient for the subsample with high return on assets shows a negative value of -0.009, whereas the coefficients for mid and low level of ROA display statistically significant positive values. Concluding, we can say that the cost stickiness of highly profitable firms is increasing with higher ESG scores but cost stickiness is decreasing when firms have high ESG scores but generate lower return on assets.

5. Discussion

In addition to studying the impact of overall ESG scores and the pillar scores of $ENVIRON$ and $SOCIAL$, we have also attempted to determine which specific factors included in these scores lead to cost stickiness. We find that none of the categories that are the foundation of the ESG score and its pillars have a significant positive impact on cost stickiness. On the contrary, we observe that several categories have a negative impact on cost stickiness, meaning that a higher score in these specific categories lead to less cost stickiness. The categories with a negative impact on cost stickiness are $EMISSION, RESOURCE, HUMAN$ and $PRODUCT$. Moreover, we observe insignificant positive coefficients for $COMMUN$ and $WORKFORCE$. On the contrary, we find $ENVINNO$ to have a negative estimated coefficient, concluding that the variable's impact on cost stickiness is positive. Although, as mentioned before, this finding is not statistically significant. These outcomes are consistent throughout Model (2) and Model (3).

Our results, which show that firms performing better in terms of ESG scores have less stickiness, are conflicting with the research of Golden, Kohlbeck and Rezaee (2020), but similar to the ones by Paek, Kim and Kim (2016). According to Golden, Kohlbeck and Rezaee (2020), this difference could be a result of the decision to look at total ESG scores or just certain parts of the scores that are expected to be associated with stickier costs. In their method they classified the different ESG categories as sticky or non-sticky and were able to show that only the sticky ones were attributed with higher cost stickiness. Similarly, based on their methodology, we would expect the categories $PRODUCT$ and $RESOURCE$ in this study to have a significant positive impact on cost stickiness, whereas the other categories are expected to have no significant influence. Our research, on the other hand, show that both $PRODUCT$ and $RESOURCE$ have a significant negative impact on cost stickiness. This means that in our study, both when looking at the total ESG scores and when looking at certain categories, we observe decreased stickiness for firms with better ESG performance.

The fact that better ESG scores appear to be associated with less stickiness could be a result of several drivers. As reported in the previous chapter, one part of the attempt to identify drivers of cost stickiness in our sample was the division into subsamples based on market value and return

on assets. We find that the largest companies in our sample have decreasing cost stickiness with higher ESG scores, whereas mid-sized and smaller companies also show a positive impact of ESG scores on cost stickiness, although statistically insignificant (Table 11). One reason for that could be that larger firms tend to be more efficient, concluding that they are able to cut unnecessary costs faster than smaller companies, leading to less cost stickiness (Celli, 2013).

Moreover, our results, as seen in Table 12, indicate that cost stickiness in the most profitable firms of our sample increases with higher ESG scores, but decreases when return on assets is comparably moderate or low. A possible explanation for this result is that firms with high profitability have more resources to afford costs that occur due to ESG related commitments. Previous research suggests that high ESG scores are positively related to profitability (Brogi & Lagasio, 2019). Therefore, a yet unresearched explanation for our findings could be that ESG related cost stickiness is an expense companies have to be able to afford, whereas less profitable firms lay their focus primarily on saving and cutting costs instead of keeping them in the event of revenue decline.

Another possible, but yet to be researched, explanation could be related to the stakeholder theory. Many stakeholders value corporate social responsibility highly and many studies show that firms with better performance in terms of CSR also tend to perform better financially. The impact on cost stickiness is unknown, but a possibility could be that firms that better satisfy their stakeholders are better able to control their costs. As indicated by Crilly and Sloan (2012) there are also differences between firms in terms of stakeholder orientation, in other words on which stakeholders they focus to satisfy primarily. This could also be one factor affecting cost stickiness as some firms prioritize CSR more than others.

The difference in terms of which region is studied could also be one part of the explanation. Older studies on ESG and cost stickiness have studied the US market (Golden, Kohlbeck and Rezaee, 2020), while this study has considered the European market. According to Calleja, Steliaros and Thomas (2006), there are certain differences between the regions in terms of managerial oversight and corporate governance practices which they believe affect the degree of cost stickiness, but these differences should be relatively small.

6. Conclusion

6.1 Conclusion

In line with most other studies of cost stickiness, we are able to confirm stickiness among European firms between 2002 and 2020 as SG&A costs increase by 0.798 % per 1 % revenue increase, while only declining by 0.150 % for every 1 % revenue decrease. This is one anomaly of the traditional cost behavior model, which assumes that costs should increase and decrease at the same rate when revenues increase or decrease (Noreen, 1991). Large studies on European firms have been few as most have focused on the US market, therefore this study contributes with important confirmation that cost stickiness is a phenomenon in Europe as well. Therefore, the first hypothesis, *H1*, about the existence of stickiness among European firms, is accepted.

More interestingly are the results about the relation between ESG and cost stickiness. Previous studies about this have shown mixed results (Golden, Kohlbeck & Rezaee, 2020), but a majority of the studies have indicated a positive relationship. In other words, firms with better performance in terms of ESG have a higher level of cost stickiness. In contrast, we observe in this study that firms with higher ESG scores have a lower degree of cost stickiness. This is both the case when considering the overall ESG score, as well as when looking at the individual Environmental and Social pillars. As for the different categories that make up the pillar scores, all are either indicating a positive relation with cost stickiness or an insignificant one. The second hypothesis, *H2*, that cost stickiness is affected by corporate social responsibility, is therefore accepted. We are also able to conclude that this relationship holds for both when considering overall ESG scores and segments of it, which Golden, Kohlbeck and Rezaee (2020) argued could be the factor leading to the conflicting results in previous studies.

However, caution should be taken when making any conclusion of how and in what direction corporate social responsibility affects cost stickiness given the different results in the different studies. As far as we know, there is limited research on how activities related to corporate social responsibility generate costs in general, which would aid conclusions for its impact on cost stickiness as well. An interesting finding in this study is that firm characteristics appear to have

an impact on the relationship. An example of this is the return on assets, as more profitable firms with high ESG scores have more stickiness than firms with lower ESG scores, while the opposite is the case for firms with lower profitability.

Nonetheless, cost stickiness has important implications for both professionals and academics. Considering the increasing focus on corporate social responsibility during the past decades, it is important to continue researching this area in order to better understand cost stickiness and how it is affected by CSR.

6.2 Future research

This study shows that European firms have sticky cost behavior, but also that better performance in terms of corporate social responsibility appears to be associated with less stickiness. As several studies have shown indication of the opposite relationship, more research is needed to better understand it. There is also a general need for more research that considers different time frames, regions and providers of ESG scores.

As mentioned before, there are several research areas that need to be more studied in order to better understand how corporate social responsibility affects cost stickiness. One research direction that we think could be of interest is the stakeholder theory. This theory is an important aspect of corporate social responsibility and there also appears to be differences in stakeholder orientation between firms, which could have implications on how firms act when revenues fall.

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Appendix

1. Statistical testing

Multicollinearity

When testing for our hypotheses with regressions, it could be the case that the independent variable is highly correlated with one of the dependent variables. This leads to a high variance of the dependent variables, in which the standard errors would be greater, meaning higher uncertainty for our results (Bailey, 2019).

To test for the existence of multicollinearity in our regressions, we computed various VIF-tables based on our regression variables. For all our regressions, we found only one variable with a VIF value higher than 10, which is $LNREV$ in Model (3) testing for ESG. This indicates that the effect of the independent variable $LNREV$ in this regression may not provide reliable evidence on its impact on the dependent variable $LNSGA$.

Table 13: VIF calculation of Model (3)

Variable	VIF	1/VIF
LNREV	10.12	0.098838
ESG*LNREV	9.75	0.102522
ESG*REVDEC*LNREV	9.53	0.104924
REVDEC*LNREV	7.46	0.134054
SD*REVDEC*LNREV	2.60	0.383948
RETURN*REVDEC*LNREV	1.56	0.642229
EI*REVDEC*LNREV	1.50	0.667095
ESG	1.50	0.667887
EI	1.45	0.691800
AI*REVDEC*LNREV	1.43	0.697237
RETURN	1.14	0.879492
AI	1.12	0.894440
SD	1.07	0.931017
Mean VIF	3.86	

Homoscedasticity

We test for homoscedasticity in our regressions, in order to verify that our computed standard errors are valid and reliable. Homoscedasticity is accounted for if the regression's standard errors all have the same variance (Bailey, 2019), If there are certain errors contravene this condition, the data sample is considered heteroscedastic, meaning that the error term has a certain variation for some observations.

We test for heteroscedasticity in our regressions with the White test (White, 1980). The results of the test for the ESG variable in Model (2) and (3) can be observed in Table 14.

Table 14: White's test

White's test for H0: homoskedasticity against H1: unrestricted heteroskedasticity			
Model (2)		Model (3)	
chi2(19)	= 241.93	chi2(19)	= 562.65
Prob > chi2	= 0.000	Prob > chi2	= 0.000

Both models show high statistical significance at the 1 % level, resulting in the rejection of the null hypothesis. Therefore, heteroskedasticity is present in both our regressions from Model (2) and Model (3), involving the ESG variable.

In order to eliminate any bias which possibly influences our regression results, we generate regressions with heteroskedastic-consistent standard errors by using a fixed effects model in which we control for year and industry fixed effects. We see that the results for most of the statistically significant coefficients vary between the model regressions, therefore we implemented fixed effects in all our model regressions.

2. Regression results

Table 15: Model (2) regression results ENVIRON pillar categories

VARIABLES	(1) EMISSION LNSGA	(2) ENVINNO LNSGA	(3) RESOURCE LNSGA
LNREV	0.944***	0.916***	0.772***
	(0.046)	(0.046)	(0.034)
REVDEC*LNREV	-0.231**	-0.162*	-0.036
	(0.091)	(0.087)	(0.073)
EMISSION	-0.000		
	(0.000)		
EMISSION*LNREV	-0.002***		
	(0.001)		
EMISSION*REVDEC	0.000		
	(0.000)		
EMISSION*REVDEC*LNREV	0.002**		
	(0.001)		
ENVINNO		-0.000	
		(0.000)	
ENVINNO*LNREV		0.001	
		(0.001)	
ENVINNO*REVDEC		0.000	
		(0.000)	
ENVINNO*REVDEC*LNREV		-0.000	
		(0.001)	
RESOURCE			0.000
			(0.000)
RESOURCE*LNREV			-0.002***
			(0.001)
RESOURCE*REVDEC			0.000
			(0.000)
RESOURCE*REVDEC*LNREV			0.003***
			(0.001)
Constant	-0.001	0.012	0.013**
	(0.008)	(0.008)	(0.005)
Year and Industry fixed effects	YES	YES	YES
Observations	3,336	3,336	3,336
R-squared	0.327	0.327	0.323

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 16: Model (2) regression results SOCIAL pillar categories

VARIABLES	(1) COMMUN LNSGA	(2) HUMAN LNSGA	(3) PRODUCT LNSGA	(4) WORKFORCE LNSGA
LNREV	0.753***	0.860***	0.832***	1.111***
	(0.048)	(0.037)	(0.042)	(0.071)
REVDEC*LNREV	-0.079	-0.124*	-0.242***	-0.148
	(0.096)	(0.073)	(0.084)	(0.095)
COMMUN	-0.000			
	(0.000)			
COMMUN*LNREV	0.001			
	(0.001)			
COMMUN*REVDEC	0.000*			
	(0.000)			
COMMUN*REVDEC*LNREV	0.001			
	(0.001)			
HUMAN		0.000		
		(0.000)		
HUMAN*LNREV		-0.001**		
		(0.001)		
HUMAN*REVDEC		0.000		
		(0.000)		
HUMAN*REVDEC*LNREV		0.001*		
		(0.001)		
PRODUCT			-0.000	
			(0.000)	
PRODUCT*LNREV			-0.000	
			(0.001)	
PRODUCT*REVDEC			0.000	
			(0.000)	
PRODUCT*REVDEC*LNREV			0.003***	
			(0.001)	
WORKFORCE				0.000
				(0.000)
WORKFORCE*LNREV				-0.004***
				(0.001)
WORKFORCE*REVDEC				0.000
				(0.000)
WORKFORCE*REVDEC*LNREV				0.001
				(0.001)
Constant	0.015**	0.006	0.009	-0.007
	(0.008)	(0.006)	(0.007)	(0.011)
Year and Industry fixed effects	YES	YES	YES	YES
Observations	3,336	3,336	3,336	3,336
R-squared	0.324	0.324	0.325	0.328

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 17: Model (3) regression results ENVIRON pillar categories

VARIABLES	(1) EMISSION LNSGA	(2) ENVINNO LNSGA	(3) RESOURCE LNSGA
LNREV	0.933***	0.749***	0.946***
	(0.049)	(0.035)	(0.049)
REVDEC*LNREV	-0.315***	-0.075	-0.266***
	(0.099)	(0.081)	(0.094)
EMISSION	0.000		
	(0.000)		
EMISSION*LNREV	-0.003***		
	(0.001)		
EMISSION*REVDEC*LNREV	0.004***		
	(0.001)		
ENVINNO		-0.000	
		(0.000)	
ENVINNO*LNREV		0.001*	
		(0.001)	
ENVINNO*REVDEC*LNREV		-0.002	
		(0.001)	
RESOURCE			0.000
			(0.000)
RESOURCE*LNREV			-0.003***
			(0.001)
RESOURCE*REVDEC*LNREV			0.003***
			(0.001)
AI	0.002**	0.002*	0.002*
	(0.001)	(0.001)	(0.001)
EI	0.006	-0.003	0.008
	(0.049)	(0.048)	(0.048)
SD	0.006	0.009	0.007
	(0.006)	(0.006)	(0.006)
RETURN	-0.010	-0.008	-0.010
	(0.009)	(0.009)	(0.009)
AI*REVDEC*LNREV	-0.014***	-0.003	-0.008**
	(0.005)	(0.003)	(0.004)
EI*REVDEC*LNREV	-0.097	0.061	0.064
	(0.414)	(0.408)	(0.407)
SD*REVDEC*LNREV	0.079	0.177***	0.076
	(0.055)	(0.053)	(0.057)
RETURN*REVDEC*LNREV	-0.036	-0.017	-0.066
	(0.079)	(0.079)	(0.078)
Constant	0.003	0.007	-0.007
	(0.009)	(0.006)	(0.009)
Year and Industry fixed effects	YES	YES	YES
Observations	3,264	3,264	3,264
R-squared	0.333	0.328	0.331

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 18: Model (3) regression results SOCIAL pillar categories

VARIABLES	(1) COMMUN LNSGA	(2) HUMAN LNSGA	(3) PRODUCT LNSGA	(4) WORKFORCE LNSGA
LNREV	0.737***	0.864***	0.814***	1.127***
	(0.052)	(0.039)	(0.043)	(0.073)
REVDEC*LNREV	-0.163	-0.207**	-0.251***	-0.217**
	(0.102)	(0.084)	(0.092)	(0.102)
COMMUN	-0.000			
	(0.000)			
COMMUN*LNREV	0.001			
	(0.001)			
COMMUN*REVDEC*LNREV	0.001			
	(0.001)			
HUMAN		0.000		
		(0.000)		
HUMAN*LNREV		-.002***		
		(0.001)		
HUMAN*REVDEC*LNREV		0.003**		
		(0.001)		
PRODUCT			-0.000	
			(0.000)	
PRODUCT*LNREV			-0.000	
			(0.001)	
PRODUCT*REVDEC*LNREV			0.002**	
			(0.001)	
WORKFORCE				0.000
				(0.000)
WORKFORCE*LNREV				-0.005***
				(0.001)
WORKFORCE*REVDEC*LNREV				0.002
				(0.001)
AI	0.002*	0.002	0.002*	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)
EI	-0.010	-0.008	-0.018	0.002
	(0.048)	(0.048)	(0.048)	(0.048)
SD	0.008	0.008	0.008	0.007
	(0.006)	(0.006)	(0.006)	(0.006)
RETURN	-0.009	-0.009	-0.008	-0.009
	(0.009)	(0.009)	(0.009)	(0.009)
AI*REVDEC*LNREV	-0.004	-0.011**	-0.004	-0.006
	(0.004)	(0.005)	(0.003)	(0.004)
EI*REVDEC*LNREV	0.060	-0.110	-0.242	0.014
	(0.408)	(0.415)	(0.423)	(0.416)
SD*REVDEC*LNREV	0.150***	0.113**	0.121**	0.110*
	(0.057)	(0.054)	(0.054)	(0.058)
RETURN*REVDEC*LNREV	-0.038	-0.009	0.001	-0.082
	(0.080)	(0.082)	(0.080)	(0.078)
Constant	0.008	-0.003	0.004	-0.013
	(0.009)	(0.007)	(0.008)	(0.012)
Year and Industry fixed effects	YES	YES	YES	YES
Observations	3,264	3,264	3,264	3,264
R-squared	0.328	0.330	0.329	0.333

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

3. Variable definition

Cost stickiness related variables

Variable	Definition
LNSGA	Natural logarithm of SG&A costs in year t divided by SG&A costs in t-1
LNREV	Natural logarithm of revenue in year t divided by revenue in t-1
REVDEC	Dummy variable that equals 1 if revenue in year t is smaller than revenue in year t-1, and 0 otherwise
REVDEC*LNREV	Multiplication product of REVDEC and LNREV
AI	Asset intensity; defined as total assets divided by revenue
EI	Employee intensity; defined as number of employees divided by revenue
SD	Subsequent revenue decline; dummy variable that equals one of revenue in year t-1 is smaller than revenue in year t-2, and 0 otherwise
RETURN	Company's annual stock return at an unadjusted level
MV	Market value; based on the company's reported market value at the last trading day of the year
ROA	Return on assets as reported by the company on the last trading day of the year

ESG related variables

Variable	Definition
ESG	Overall company score based on the reported information in the environmental, social and corporate governance pillars
ENVIRON	Weighted average relative score based on the reported environmental information and the resulting three environmental category scores
SOCIAL	Weighted average relative score based on the reported social information and the resulting four social category scores.
COMMUN	Community Score; measures the company's commitment towards being a good citizen, protecting public health and respecting business ethics
EMISSION	Emissions Score; measures a company's commitment and effectiveness towards reducing environmental emission in the production and operational processes
ENVINNO	Environmental Innovation Score; reflects a company's capacity to reduce the environmental costs and burdens for its customers, and thereby creating new market opportunities through new environmental technologies and processes or eco-designed products
HUMAN	Human Rights Score; measures a company's effectiveness towards respecting the fundamental human rights conventions

PRODUCT	Product Responsibility Score; reflects a company's capacity to produce quality goods and services integrating the customer's health and safety, integrity and data privacy
RESOURCE	Resource Use Score; reflects a company's performance and capacity to reduce the use of materials, energy or water, and to find more eco-efficient solutions by improving supply chain management
WORKFORCE	Workforce Score; measures a company's effectiveness towards job satisfaction, healthy and safe workplace, maintaining diversity and equal opportunities, and development opportunities for its workforce