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THE EFFECTS OF MANDATORY ESG DISCLOSURE REGULATION ON COMPANY AND INVESTOR BEHAVIOUR: AN EXPERIMENTAL APPROACH

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Introduction

Traditionally, shareholders have evaluated companies based on their financial performance. As such, company reporting was focused on this audience and included primarily economic key performance indicators. In the last two decades, however, a broader audience of stakeholders became interested in companies' information disclosure with a focus towards non-financial topics, i.e., environmental, social and governance (ESG) aspects (Deegan 2017; Garcia-Sanchez et al. 2014; Verbeeten et al. 2016). Companies thus started to disclose ESG information of interest to stakeholders voluntarily as part of their annual reports or in separate sustainability reports to satisfy stakeholders' demands (Helfaya et al. 2019; Ioannou & Serafeim 2012; Kolk 2003). These developments have also motivated governmental institutions to introduce mandatory ESG disclosure regulations and set specific standards (Costa & Agostini 2016). For instance, in the European Union, the Non-Financial Reporting Directive (NFRD) was introduced in 2014 and tailored to large companies of public interest requiring such companies to disclose information on environmental and social aspects such as greenhouse gas emissions or compliance with human rights (European Parliament & European Council 2014). The directive aims at making companies' disclosed information more consistent, comparable, and relevant. Based on this initial directive, the European Union is currently preparing a new regulation, namely the Corporate Sustainability Reporting Directive (CSRD), which applies to an even broader set of companies and includes more requirements, such as an obligation to have an external audit of reported information (European Parliament & European Council 2021). The new directive extends the scope from around 11,700 companies under the NFRD to more than 50,000 companies under the CSRD within the European Union (European Commission 2023). Whether or not those recently introduced and planned regulatory measures to disclose non-financial information are value-enhancing for stakeholders or just an additional bureaucratic effort for companies has, however, yet to be agreed upon in the literature (Bernardi & Stark 2018; Stubbs & Higgins 2014).

As said previously, companies are already disclosing ESG information voluntarily today. Such voluntary disclosure has been of interest to researchers for many decades who have found voluntary disclosure as means to reduce uncertainty among investors and thus reduce agency costs (Eccles et al. 2014; Jensen & Meckling 1976), signal good performance to outsiders (Akerlof 1970; Ramchander et al. 2012), achieve broad legitimacy in society (Suchman 1995) or manage relationships with various stakeholders properly to maintain good financial performance (Darnall et al. 2010; Freeman 1984). Besides the theoretical point of view, researchers found voluntary disclosure to result in higher company valuations (Dowell et al. 2000), reduced cost of equity (Plumlee et al. 2015), better predictability of future cash flows and profit (Clarkson et al. 2013), higher financial performance (Abdi et al. 2022), and an increased likelihood of receiving capital from investors (Dhaliwal et al. 2011). While voluntary disclosure can result in the mentioned benefits, not all companies use this mechanism, resulting in regulators setting specific rules which entail certain advantages and disadvantages. On the one hand, researchers find mandatory reporting directives to be helpful as they assure standardisation of disclosed information, make reports more understandable for multiple stakeholders and increase transparency overall, which eventually can result in better ESG performance and thus also increase shareholder value (Darnall et al. 2010; Dowell et al. 2000). On the other hand, mandatory reporting regulations' critics describe mandatory regulations as partly ineffective (Aragón-Correa et al. 2020) and even argue that companies forced to disclose information face significant cost increases as well as changes in corporate processes to provide such reporting (Cheng et al. 2014; Ioannou & Serafeim 2017).

Our paper analyses how companies and investors react to the introduction of regulatory minimum disclosure levels and whether such an introduction is value-enhancing or puts a cost burden on companies while not adding valuable information for potential investors or other stakeholders. Thus, we aim to understand better how mandatory reporting regulations affect companies and investors. Based on a thorough literature review, we expect mandatory reporting regulations to impact both amount of disclosed information by companies as well as capital invested positively (e.g., Ioannou & Serafeim 2017; Reverte 2016; Verrecchia 2001), while also believing that investors only value information up to a certain point (De Villiers et al. 2021) resulting in a convergence of company disclosure towards the minimum set by the regulator (Cordazzo et al. 2020). We approach this with an experimental approach allowing us to isolate the mere effects of regulation as voluntary disclosure has increased in the past. As such, increasing information does not automatically provide evidence of an impactful regulation

(Ioannou & Serafeim 2012). Moreover, the CSRD has not become effective to date, allowing us to predict the potential effects of the CSRD through experimenting with university students who represent future investor behaviour. Our work inspiration stems from the research completed by Falk and Kosfeld (2006), who identified adverse effects of control in a principal-agent relationship when the principal controls the agent instead of trusting the agent. In our experiment, two agents each disclose a specific amount of ESG information to achieve an investment from one principal. In the no-regulation group, subjects choose the disclosure level freely, while certain minimum disclosure levels are exogenously provided in the treatment groups. We thus extend the inspirational paper in three main aspects, i.e., (1) by applying a quadratic instead of a linear cost function due to increasing proprietary costs (Wagenhofer 1990), (2) by using a one-to-two principal-agent relationship instead of a one-to-one relationship and thus creating a competitive environment among agents, and (3) by basing the principal's payout on a risk-return relationship, thus factoring in the principals' risk propensities.

Based on our experimental study among more than 200 students from Munich's universities, we derive three key results: First, we find that regulation increases disclosed information among companies and capital invested among investors, i.e., the higher the regulatory requirements for minimum information disclosure, the higher both disclosed amount and capital invested. Second, companies are already voluntarily disclosing comparably high amounts of information in the no-regulation case. In contrast, investors invest statistically significantly more capital in the low-regulation treatment than in the no-regulation case, raising whether even more regulation is necessary. Third, we analysed the profits of both companies and investors, supporting the point of low-regulation vis-à-vis higher regulation, as combined profits are highest in the low-regulation treatment. With these three findings in mind, regulators should carefully consider how to design minimal regulatory frameworks. Key to success from our point of view is a balance between assuring enough standardisation and thus allowing all stakeholders to comprehend disclosed information easily while not overcomplicating disclosure such that companies bear bureaucratic costs of little incremental value to investors or other stakeholders.

We contribute to the existing literature by deploying an experimental approach in which past researchers primarily have deployed statistical analyses based on existing databases. As such, we isolate the mere effects of ESG information disclosure on company and investor behaviour and simultaneously provide a potential scenario for future impacts of the CSRD. From our point of view, we are the first to analyse this area of tension using this particular method. Our findings are important for companies, investors, and regulators. For companies, we provide guidance on how other companies react when information disclosure of competing companies is uncertain. Furthermore, we shed light on investors' risk propensities and, thus, the right level of disclosure from a company perspective. For investors, we provide insights into the risk propensities of other investors and determine the maximum level of risk investors are generally willing to take related to ESG disclosure. For regulators, we stress the significant contribution of their work to higher ESG-related information disclosure and, eventually, higher ESG performance. Furthermore, we provide guidance on the right level of ESG disclosure from a regulator perspective to achieve optimal results regarding disclosed information and capital invested.

The remainder of our paper is structured as follows: Section 2 reviews the literature regarding voluntary and mandatory information disclosure, including theoretical background, impact, advantages, and disadvantages to derive our hypotheses. Section 3 describes our experimental methodology, inspirational work, and procedural details. Section 4 presents our results to conclude our work in section 5.

Literature review and hypotheses development

This paper analyses the effects of moving from voluntary to mandatory ESG reporting on company and investor behaviour. We will therefore begin by outlining companies' motivations to disclose ESG-related information voluntarily from a theoretical standpoint and provide insights into previous research on its impact on company performance and value. We then continue with the (dis-)advantages of mandatory reporting regimes and provide empirical evidence on its impact found by previous researchers to develop our hypotheses.

While some companies are already regulated to disclose ESG-related information under the NFRD, many companies are still not obliged to report such information. Nevertheless, many companies are already motivated to report information voluntarily. In every market situation, information asymmetries between shareholders and managers exist as managers are assumed to have superior knowledge about the company's future performance (Healy & Palepu 2001). This information gap can be overcome by voluntarily disclosing information to shareholders, thus reducing uncertainty about the company's future performance (Jensen & Meckling 1976). As such, information is valuable to outside shareholders as it allows them to assess a company's future better and thus better determine the fair price to pay for the company. Stated differently, the voluntarily provided information

creates trust, reducing agency costs and efficiency (Eccles et al. 2014). Graham et al. (2005) surveyed more than 400 company leaders regarding the reasoning behind information disclosure. They identified the reduction of information risks and a desire to be perceived as a transparent company as the main motivators. A second crucial theoretical lens is the theory described by Akerlof (1970), i.e., the so-called signalling theory. Companies performing exceptionally well in a particular field want to signal their performance to outsiders. As such, companies aim to make investors aware of their environmental, social or governance-related actions (Cordazzo et al. 2020; Lourenço et al. 2014). By voluntarily disclosing such information, a company's reputation increases and uncertainty among investors decreases, resulting in a higher willingness to invest more and pay higher prices (Ramchander et al. 2012). Both agency and signalling theories focus on reducing information asymmetries between shareholders and company managers.

Nevertheless, disclosing information voluntarily can also be focused on a broader audience of stakeholders, thus increasing the company's legitimacy. Suchman defines legitimacy as "*a generalised perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions*" (Suchman 1995). Especially in today's world, a broad legitimacy in society is relevant for a company's success as various stakeholder groups increasingly observe companies' ESG-related performance. Lastly, we consider stakeholder theory as a theoretical perspective on company information disclosure. Stakeholder theory refers to a company's relationship management with its various stakeholders, not just shareholders, e.g., suppliers, customers, or employees. Initially introduced by Freeman (1984), it refers to a correlation between a company's ability to perform well financially and the degree of stakeholder relationship management. Especially in light of increasing ESG pressure, managing the various relationships acceptably can create a competitive advantage for a company and increase overall performance (Darnall et al. 2010; Donaldson & Preston 1995). Delmas and Toffel (2008) differentiate further between the pressure exerted via different stakeholder groups and differentiate mainly direct business stakeholders, e.g., competitors, suppliers or customers, and indirect, non-market stakeholders, e.g., non-governmental organisations, regulatory organisations or press. According to the authors, marketing organisations mainly manage relationships with members of the first group to enhance revenue opportunistically and grow market share. Conversely, legal departments primarily deal with the second group to avoid sanctions or punishment. When instead taking a country perspective, Kolk and Perego (2010) find that companies situated in countries known for a more extensive stakeholder orientation are instead assuring their sustainability report via an external provider than companies located in shareholder-oriented countries, e.g., the United States or the United Kingdom, which is furthermore emphasised when the respective country faces especially litigious structures, i.e., United States (Kolk & Perego 2010).

From a theoretical standpoint, various motivations for companies exist to disclose additional information, in our case, ESG-related information, voluntarily. In line with the theoretical considerations, many authors have shown empirically that voluntary information disclosure can enhance company value. Dowell et al. (2000) find that companies adhering to an agreed-upon global standard, e.g., the Greenhouse Gas Protocol for environmental information disclosure (WBCSD & WRI 2015), results in higher market valuations measured by Tobin's Q, i.e., company's market value divided by reproduction costs of tangible assets, than companies not applying such a standard. Companies with lower market valuations also adhere less to globally accepted standards. Voluntary non-financial information disclosure and performance are generally more substantial among larger companies than smaller companies, while smaller companies are instead pushed by internal stakeholders and regulatory authorities (Darnall et al. 2010).

Dhaliwal et al. (2011) find a positive correlation between ESG disclosure and company value driven by lowered cost of equity through provided ESG information. Additionally, they indicate that companies are filing ESG reports intending to achieve a lower cost of equity. According to the authors, companies issuing ESG reports receive special attention from market analysts and show an increased likelihood of receiving investments. This finding is backed by Veltri et al. (2020), who found a positive correlation between non-financial risk information disclosure and the market value of the related company. Clarkson et al. (2013) investigate five industries in the United States characterised as high-polluting. The authors analyse the effects of voluntary environmental disclosure on company valuation, future cash flows, profitability, and company risks and find that voluntarily disclosing environmental information is incrementally informative for investors. They announce that such information results in better predictability of future cash flows and profitability. These findings align with Reverte (2016), who finds a link between reporting ESG-related information and financial performance in the future. Nevertheless, disclosing voluntarily does not support investors in evaluating the company's risk. Voluntary environmental disclosure impacts the cost of equity, concluding that voluntarily disclosing impacts the numerator more than the denominator in company valuation (Clarkson et al. 2013).

Plumlee et al. (2015) extend this work by looking at the amount of environmental disclosure and its quality and finding that voluntarily disclosing environmental information positively correlates with the cost of equity. Verbeeten et al. (2016) analyse the value of voluntary ESG reporting among DAX, MDAX and SDAX companies and find that issuing an ESG report positively relates to company value, yet this correlation is relatively marginal. Moreover, they show that disclosure of social aspects adds company value. In contrast, environmental disclosure does not create company value, explaining this with the high public scrutiny and even litigation risks when disclosing ecological information in Germany.

Marshall et al. (2009) find that companies operating in industries known for higher environmental sensitivity issue more voluntary environmental reports of, on average, higher quality. In addition, they find a positive correlation between issuing voluntary ecological information as part of an ESG report and company value. In contrast, De Villiers et al. (2021) find that investors are willing to pay for environmental disclosure, not social disclosure. Looking at the flip side of higher ESG-related performance, i.e., acting irresponsibly regarding ESG matters, Jackson et al. (2020) do not observe a reduction in irresponsible acting when disclosing ESG-related information.

Summarising the above, we see various theories that deal with the reasoning behind voluntary information disclosure, and many researchers have found positive relationships between market value and voluntary information disclosure. We, however, see that, for instance, in the European Union, mandatory ESG-related information disclosure is receiving more attention with the NFRD and the upcoming CSRD. We will thus shed light on the reasoning behind mandatory reporting regulation and its anticipated advantages and disadvantages in the following. From a regulator's perspective, the first question is whether information disclosure regulation makes sense, as voluntary information disclosure can already make sense, at least for some companies, in case of a positive cost-benefit relationship. Moreover, regulation is especially justified in case private contracts for disclosure between companies and stakeholders are inefficient (Leuz 2010). Throughout the literature, four primary reasons exist regularly justifying the regulation of information disclosure, i.e., positive externalities, cost savings throughout the market, unsatisfactory sanctions in the private market, and costs savings through preventing fraud and reducing agency costs (Leuz & Wysocki 2008). Positive externalities may arise when the disclosure of a company benefits companies or other institutions which do not compete with the company facing the mandatory disclosure. For instance, in the example of environmental information disclosure, companies providing software for greenhouse gas emission accounting can benefit from the environmental information disclosed as the information can contribute to improving their software. At the same time, this is not to the disadvantage of the disclosing company. In this regard, Porter and van der Linde (1995) even find that regulatory measures can foster innovation exceeding the cost required to comply with the set standards. Moreover, they find that regulation can be valuable as it points towards resource inefficiencies, puts pressure on companies to innovate and makes companies feel more secure about investing in certain technologies allowing them to comply with the regulation (Porter & van der Linde 1995). Based on and in line with Porter's work, a more recent study conducted in an experimental approach by Chakraborty and Chatterjee (2017) reveals increasing expenditures on research and development of 11% to 61% caused by foreign regulations. In contrast to these findings, however, regulations can also result in an opposite effect where companies are discouraged by uncertain regulations. As such, regulatory actions can impede investments targeted for a longer period (Kemna 2015). Cost savings throughout the market are the second main reason in favour of regulatory measures driven by standardisation of reporting formats, i.e., information processing is a lot easier and less time-consuming for stakeholders when all companies apply the same standard. Moreover, disclosing companies are no longer required to negotiate disclosure agreements with various stakeholders, saving company costs. As such, regulation can benefit companies and their stakeholders by providing a standard at lower costs if it is adequately designed (Berthelot et al. 2012; Christensen et al. 2021; Mahoney 1995). These regulatory benefits, however, are not entirely backed by the literature as some authors argue that mandatory reporting regulation impacts the quantity of disclosed information, yet not necessarily the quality (Bebbington et al. 2012; Veltri et al. 2020). The third main reason in the literature is unsatisfactory sanctions in the private market. Leuz and Wysocki (2008) bring up the example of a family-owned company with a non-family member as a manager. Monetary punishments for the manager can be insufficient in achieving the disclosure amount requested by the owner of the family company. The sanctions are limited to monetary punishments in private contracts, whereas a governmental regulator can further impose criminal penalties beyond financial punishment. In the example of ESG-related regulation, it can be furthermore challenging for a purchasing company to sanction a supplier unless the exact scope of information disclosure is defined diligently, which, however, can be challenging given the wide spectrum of possible information provision. Lastly, it can be the case that company insiders generate private advantages at the disadvantage of outside investors, and thus regulation

can serve as fraud-preventing measures. To hide such activities, company insiders might be hesitant to disclose information that would make their private actions obvious but reduce the overall cost of capital and thus also generate shareholder value. It can even be the case that managers decide not to make specific investments with positive returns for their gain. If another company performs such an investment, no loss for society occurs, yet if no other company exploits such an opportunity, this results in a loss for society altogether (Shleifer & Wolfenzon 2002). Mandatory information disclosure thus has the potential to avoid such holding back of information helping to avoid social losses.

While the previously mentioned advantages point out the potential of mandatory disclosure regulation, we cannot forget that introducing such regulatory measures also comes with drawbacks. We summarise these into costs occurring for regulators and society on the one hand and into costs and risks for companies on the other hand. First, developing and designing a mandatory reporting structure is costly for the regulator and society as it requires both resources to develop the regulatory framework and enforce compliance with this set of rules or punishment otherwise (Leuz & Wysocki 2008). In 1995, costs for complying with environmental regulations in the United States already exceeded USD 125 billion, a number expected today beyond USD 200 billion and roughly one per cent of gross domestic product (Jaffe et al. 1995). Additionally, regulators are often not as familiar with the information required for disclosure as companies that produce or consume such data. Moreover, political developments are sometimes subject to inefficient decision-making (Peltzman et al. 1989). Overall, the regulator should create a regulation which is either less costly or of better performance than a solution created within the market (Leuz & Wysocki 2008).

From a company perspective, regulatory measures will increase efforts among companies with previously high and low disclosure efforts. For companies performing superiorly before the regulation, it becomes harder to differentiate themselves from other companies as all companies at least meet a certain minimum standard of disclosure. For companies performing inferiorly before the regulation, additional effort is required to meet at least the minimum standard required. Ioannou and Serafeim (2017) assume that the value of ESG-related information disclosure could thus vanish and destroy shareholder value. Additionally, companies might end up disclosing information they would usually not want to become public. The fact that various stakeholders such as competitors, suppliers or customers now know about such confidential information imposes a risk on the disclosing company, potentially resulting in proprietary costs (Graham et al. 2005; Wagenhofer 1990). Lastly, disclosing more information also results in a higher degree of public scrutiny, time-consuming requests from society members and even the risk of facing litigations from private people or organisations (Arora & Cason 1995; Christensen et al. 2021; Graham et al. 2005). In summary, regulating companies to disclose specific ESG-related information can be justifiable and, in an ideal case, creates a positive upward spiral where more information increases transparency in the market, thus increasing internal governance structures, which then affect internal systems and eventually increase not only ESG information disclosure but also ESG performance (Cheng et al. 2014). Mandatory reporting requirements have been introduced in many countries for various industry parts. Nevertheless, it comes down to the proper design of regulatory aspects and the right way of enforcing the defined rules to achieve optimal regulation (Leuz 2010).

We see various advantages and disadvantages when introducing mandatory reporting regimes from a theoretical standpoint. Therefore, we want to emphasise the actual impact of introducing mandatory reporting regulations. Effects discovered by previous authors, however, yield mixed results. On the one hand, Ioannou and Serafeim (2017) identify an explicit increase in reported ESG information based on an introduced ESG regulation, both on companies disclosing much information and little information before the regulation. They thus identify mandatory ESG reporting regulations as cause for a so-called "race to the top" (Ioannou & Serafeim 2017) and determine the positive effect of introducing ESG disclosure regulation regimes. This finding aligns with Verrecchia (2001), who finds a motivation among companies to increase the disclosed amount of information once a regulator introduces a regulation. Henriques and Sadorsky (1999) find that proactive and accommodative companies are triggered the most by regulatory pressure, while reactive companies respond the least to pressure exerted by regulatory authorities (Carroll 1979; Wartick & Cochran 1985). Furthermore, Doshi et al. (2013) find that larger companies respond more slowly to regulatory pressure in rural areas than smaller companies, while both act at similar speed in areas of higher density. They explain this with the higher power larger companies have in sparser regions.

Additionally, a regulation does not only have an impact on the amount of information but also the ESG-related performance (Aragòn-Correa et al. 2020; Christmann 2004) as well as the quality of disclosed information (Criado-Jiménez et al. 2008). Companies disclosing information particularly well prior to the regulation might

even be motivated to disclose more information than required to put pressure on regulatory authorities and thus increase the minimum regulatory disclosure level through their over-compliance and restrict their competitors (Arora & Cason 1995). We, therefore, expect a positive effect of regulation on company disclosure and thus state our first hypothesis as follows:

H1: The amount of information companies disclose increases after introducing a regulatory minimum for disclosing ESG-related information.

On the other hand, Cordazzo et al. (2020) do not find companies to disclose more ESG-related information once an ESG regulation has come to power and instead identify companies to shift towards a pragmatic legitimacy mentioned earlier (Suchman 1995). Cormier et al. (2005) back this finding as they find company disclosure to converge over time due to imitation of other companies' behaviour and routine. We, therefore, believe that companies will use the minimum level set by the regulator as the point of orientation, leading us to our second hypothesis:

H2: The amount of information companies disclose will converge towards the regulator's minimum level.

Looking at the effects of introducing a mandatory ESG disclosure regulation from an investor perspective, it is interesting to understand how they react to introducing a regulatory minimum level of ESG disclosure. We previously identified that investors generally find ESG information value-enhancing as it increases transparency and thus reduces risks (e.g., Clarkson et al. 2013; Reverte 2016). Furthermore, These findings are backed by other authors who perceive additional non-financial information as beneficial and positively affect their investment decisions (e.g., Rikhardsson & Holm 2008). In line with H1 and an assumed increase in disclosed information, we, therefore, assume an increase in total invested capital, bringing us to our third hypothesis:

H3: The amount of capital the investors invest increases after introducing a regulatory minimum for disclosing ESG-related information.

However, the incremental added value of higher ESG information disclosure does not seem constant. De Villiers et al. (2021) find that investors value information beyond the minimum level, yet only until the average level of disclosed information and not beyond this point, underlining our H2 as companies are assumed to be aware of this investor behaviour. Moreover, the authors find that investors accept lower returns when companies disclose more information as their investment failure risk decreases (De Villiers et al. 2021). Nevertheless, we do not assume the acceptance of lower returns for reduced risk as an absolute term. Rather, we believe that investors will, at some point, have no further interest in accepting the lower-risk-lower return investment. Investors, from our point of view, thus invest in the company of higher return at higher risk if both companies provide an above-average level of ESG information safeguarding the investor sufficiently. Our fourth hypothesis thus follows:

H4: Investors will invest in companies with higher disclosure pre-regulation and companies with lower disclosure post regulation

Experimental design

Experimental setting & selected treatments

For the planned experiment, we adapt the experiment conducted by Falk and Kosfeld (2006). Their experiment analysed a simple principal-agent relationship in which an agent could decide to conduct an activity x at the cost of (I).

$$c(x) = x \text{ where } x \in \{0, 1, \dots, 120\} \quad (\text{I})$$

$$p(x) = 2x \text{ where } p(x) \in \{0, 1, \dots, 240\} \quad (\text{II})$$

The principal then receives a payout according to formula (II). The authors introduced three main treatments in which the principal could choose not to set any minimum activity level \underline{x} or a minimum activity level of 5, 10 or 20. They introduced multiple control treatments where one was used to implementing an exogenous minimum activity level of 10. Agents received the explicit information that this level was set exogenously rather than by the principal itself. The results revealed agents implementing a higher activity level when the principal did not set a minimum activity level. As such, they concluded that hidden costs of control arise as the agent's activity decreases when being controlled for a certain level. When they controlled for the minimum level being set exogenously, agents showed ~50% higher activity levels compared to the treatment where the

principal set the same minimum activity level. However, the differences between an exogenous minimum activity level and the treatment in which the agent can choose an activity level freely were insignificant, constituting our analysis's starting point.

In our experiment, subjects will either participate representing a company or an investor where a company equals an agent, and an investor equals a principal in the classical principal-agent relationship. In our case, we pair one investor with two companies. Both companies have an initial endowment of 100 and decide how much ESG information x they want to disclose where $x \in \{0, 1, \dots, 10\}$. Other than Falk and Kosfeld (2006), associated costs are not linear but increase quadratically, resulting in companies' costs function as stated in (III).

$$c(x) = x^2 \text{ where } x \in \{0, 1, 4, \dots, 100\} \quad (\text{III})$$

Thus, each additional information disclosure unit (IDU) becomes more costly for the disclosing company. We assume a quadratic cost development mainly due to two factors. First, additional information disclosure results in proprietary costs resulting from legal authorities and competitors knowing more about internal company data & processes (Wagenhofer 1990). Second, our previous research shows that providing more detailed information becomes increasingly difficult. For instance, reporting greenhouse gas emission information is typically clustered into three scopes according to the Greenhouse Gas Protocol: Scope 1, 2 and 3 (WBCSD & WRI 2015). While providing data for Scope 1 & 2 emissions is reasonably straightforward, providing detailed information on Scope 3 emissions is highly complex and a task many companies are still avoiding due to the high complexity of calculating emission data along the entire value chain. The second player group in this experiment are investors, whom we endow with an initial endowment of 110. Investors decide whether to invest an amount y where $y \in \{0, 1, \dots, 110\}$ either in the first or the second company creating a competitive environment between both companies as only one can receive an investment. Each company's payout thus follows the formula stated in (IV).

$$p_c = 100 - x^2 + y \quad (\text{IV})$$

$$p_i = 110 - y + \frac{2*y}{p_x} * s \quad (\text{V})$$

The investor's payout follows a risk-return pattern depending on the amount of information disclosed by the company they invested in. We, therefore, associate a success probability p_x with each amount of disclosed information x where p_x increases linearly by 2.5 percentage points with each disclosure level such that $p_x \in \{0.65, 0.675, \dots, 0.90\}$. This assumption relates to the reduced investor uncertainty coming with higher knowledge about ESG information (Ramchander et al. 2012). The invested amount y is doubled and then divided by the success probability p_x . As such, investors achieve higher returns when investing in companies with little ESG information disclosure. However, there is also a higher probability that the investor's investment will fail, resulting in a total loss of the amount invested. We model this using a dummy variable s representing the investment success where $s \in \{0, 1\}$. A random number r is generated for each investment where $r \in \{0, \dots, 1\}$. The dummy variable $s = 1$, if $p_x \geq r$ and $s = 0$ otherwise. The investor's return thus results as stated in (V). In summary, companies cannot be sure whether an investor will invest in them or the competing company.

As stated earlier, the idea is to study the effects on company and investor behaviour when introducing a regulatory minimum ESG disclosure level \underline{x} . Therefore, we divide participants into four groups, each including subjects representing companies and investors. For the first group, i.e., the control or no-regulation group (C0), no regulatory minimum ESG disclosure level \underline{x} is required. As such, $\underline{x} = x \in \{0, 1, \dots, 10\}$ for each company in the no-regulation group, i.e., companies choose the disclosure level freely. Additionally, we introduce three treatments in which the regulatory minimum ESG disclosure level \underline{x} is different for each treatment. In the first treatment group, we set $\underline{x} \geq 3$ (T3). For the second treatment group, we set $\underline{x} \geq 5$ (T5), and the third and last treatment group requires $\underline{x} \geq 7$ (T7). The disclosure amount thus follows as $x \in \{\underline{x}, \underline{x} + 1, \dots, 10\}$ for each treatment group.

On the one hand, we believe this design adapts relevant measures from the established experiment by Falk and Kosfeld (2006) while differentiating itself sufficiently from the chosen design. In summary, we apply three main differences in our experiment. First, we choose a quadratic cost function for the company, whereas Falk and Kosfeld (2006) chose a linear cost function. Second, we choose a 2:1 relationship between companies and investors, creating a competitive situation between both companies. This competitiveness additionally intensifies as the company's payout depends on the investment received from the investor. Third, we base the

investor's payout on a risk-return relationship in which investors are incentivised to invest their endowment while factoring in the investor's risk appetite.

Experimental procedure

Across all treatments, subjects play the company-investor game as a one-shot-game similar to the approach chosen by Falk and Kosfeld (2006). As such, we avoid unwanted effects due to learning from previous periods and increase external validity while being aware that we might miss real-world patterns (Charness et al. 2012). We randomly assign investor and company roles to subjects at the beginning of the experiment. The subjects are students from Technical University Munich and Ludwig Maximilian University. All experiments are conducted at experimenTUM, a computer lab at Technical University Munich, which allows us to create an environment of minimal distraction where subjects can focus on the required task. We formulate all experiment instructions neutrally. For the experimental design, we use the 'z-tree' software (Fischbacher 2007). In the no-regulation group, 54 subjects participated, and for each treatment group (T3, T5, T7), 51 subjects participated, resulting in 18 (C0) and 17 (T3, T5, T7) observations, respectively, for the four groups. In total, 207 subjects participated, 69 representing investors and 138 representing companies, for 69 observations across all treatments. The experiments lasted, on average, 42 minutes, and subjects earned, on average, EUR 12.42. We ran 15 sessions in April and May 2023, where each subject participated only once. 41% of subjects identified as female while 56% identified as male¹ and 54% of subjects were below 25 while 38% were between 25 and 30, and 8% were above 30 years. The experiment was conducted in German, and the full pre-experiment text provided to subjects can be found in Appendix 2.

Predictions of subject behaviour

The subject behaviour predictions depend on each subject's risk attitude. In the following, we present two scenarios of subject' risk propensity, i.e., (1) we anticipate subjects as being risk-neutral and (2) present a scenario in which subjects are expected to reflect risk aversion in their utility function.

Starting with the more trivial yet less realistic scenario of risk neutrality among subjects, we apply a backward approach as we start with investors' reactions to a company disclosure. Implementing the parameters into the utility function (VI) results in a formula in which the first term represents the investment failure and the second represents the investment success case.

$$U(I) = (0.35 - 0.025 * x) * (110 - y) + (0.65 + 0.025 * x) * (110 - y + \frac{2y}{0.65+0.025*x}) \quad (VI)$$

$$U(I) = 110 + y \quad (VII)$$

The investor's utility function, in case the investor is risk-neutral, at first appears to be dependent on the disclosed amount x . Nevertheless, the formula can be simplified as stated under (VII), yielding that a risk-neutral investor's utility does not depend on the disclosed amount. Moreover, the investor maximises personal utility according to the presented utility function when investing the entire capital available into any company, regardless of the disclosure amount provided by any company. In other terms, the investor chooses one company randomly. With this in mind, we turn to the companies' choices. When subjects representing a company anticipate the investor's risk-neutral behaviour in which one company is chosen randomly, the optimum choice of information to be disclosed is the minimum as the company's utility function follows the formula under (VIII). The company should expect to receive an investment of the total possible amount at an expected probability of 50% (see IX).

$$U(C) = 100 - x^2 + y \quad (VIII)$$

$$U(C) = 100 - 0 + 110 * 0.5 \quad (IX)$$

As briefly mentioned earlier, however, the case of risk-neutral investors and companies within the market appears to not be the case in most scenarios (e.g., Arrow 1966; Kahneman & Tversky 1979; Pratt 1964). We, therefore, also consider a predictive scenario in which subjects are risk averse. Starting again with anticipated

¹ 3% of subjects did not identify as female nor male (2%) or decided not to disclose their gender (1%)

investor behaviour, we now shift from a linear utility function used in the risk-neutral scenario to a generally accepted risk-averse utility function, i.e., \sqrt{x} , resulting in an investor's utility function dependent on x and y , i.e., the investors' choice of capital invested depends on the amount of information disclosed by both companies (see formula X). Notable here are two things: (1) the investor's utility increases in x , i.e., the higher the amount disclosed by one company, the higher the investor's utility, and (2) the higher the amount disclosed, the higher the optimum investment amount which is strictly below the maximum of 110. We present a complete overview of optimum investment amounts by information disclosure amount in Appendix 1. For instance, should both companies disclose an amount of zero IDUs, the optimum strategy for the investor would be to invest ~90 experimental currency units (ECUs) into one of the two companies. In contrast, if one company discloses the maximum amount of 10, the investor would maximise personal utility by investing ~108 ECUs into the respective company. Stated differently, the risk-averse investor will always choose the maximum possible disclosure amount to invest in and then chooses the respective amount presented in Appendix 1, dependent on the disclosure level to maximise personal utility.

$$U(I) = (0.35 - 0.025 * x) * \sqrt{(110 - y)} + (0.65 + 0.025 * x) * \sqrt{(110 - y + \frac{2y}{0.65+0.025*x})} \quad (X)$$

Assuming that companies anticipate this specific investor behaviour, we now identify the optimum strategy for each company. We already discussed that if both companies disclose the same amount, the investor will choose one company randomly to invest the respective amount of capital. Should one company disclose more than the other, the investor will choose the higher-disclosing company. From a company perspective, being the higher disclosing company is thus attractive as it secures investment from the investor in theory. At the same time, equal disclosure amounts will lead to an investment at a 50% probability and disclosing less than the other company yields no investment. In the no-, low- and medium-regulation scenarios, we cannot identify a single optimum strategy for a company but only local optima in which a company always discloses exactly one incremental unit of information vis-à-vis the other company to maximise personal utility. However, when the other company discloses the maximum amount, the optimum strategy for the other company manifests in disclosing no information resulting in a loop when trying to identify the optimum strategy. In the high-regulation treatment, the optimum strategy is for both companies to disclose the maximum driven by the high costs when choosing the minimum disclosure level possible, i.e., seven IDUs. Based on this infinite loop where no global optimum can be found, a company thus could consider that the other company chooses one amount randomly, where each amount has the same probability of being chosen. In this case, the optimum strategy for a company depends on the treatment. In the scenario of no regulation, a company maximises personal utility by disclosing the mean, i.e., five IDUs. For the subsequent treatments, the optimum strategy increases linearly beyond the mean with optimum strategies of seven (T3), nine (T5), and ten (T7) IDUs to be disclosed across treatments.

Reverting to the previously stated hypotheses, we expect support for H1 and H3, i.e., disclosed amount and invested capital increase post-regulation. In contrast, we do not expect to find evidence for H2 and H4. A convergence towards the minimum disclosure level post-regulation does not resonate with the predictions, as investors should always choose the higher disclosing company as an investment target.

Subject questionnaire

Besides our experimental study, we conducted a short post-experiment survey among experiment participants to elaborate further on each subject's main characteristics and perception of ESG importance. To test the importance of ESG to subjects during the experiment, we asked subjects how relevant the fact was that they were dealing with ESG rather than financial information. We applied a 5-point Likert scale with levels of not relevant, somewhat irrelevant, neutral, somewhat relevant, and very relevant. We chose the 5-point Likert scale to assure sufficient reliability and validity while at the same time avoiding overcomplicating the questionnaire with a more detailed scale (Dawes 2008; Malhotra & Peterson 2006). While we only conducted a one-shot experiment, we aimed to understand better how learning would affect subjects' behaviour in a subsequent round. We, therefore, asked subjects representing investors whether they would invest more, less or the same amount of capital in a subsequent round and subjects representing companies whether they would disclose more, less or the same amount of information in a subsequent round. We deliberately decided to use a 3-point Likert scale for these questions to avoid differentiation between, e.g., the terms "much more capital / information" and "slightly more capital / information" as such qualitative assessment did not seem appropriate for precisely quantifiable amounts.

Lastly, we sought further information regarding the investor's risk propensity and thus asked only subjects representing investors whether they would always invest in the company disclosing the same or higher amount of ESG information. Subjects could only choose between yes and no. We deliberately deviated from the Likert scale here to force subjects into making a decision while not necessarily reducing validity or reliability (Dolnicar et al. 2011). The complete set of questions can be found in Appendix 3.

Results

In this chapter, we present the results of our experimental study. We first present results related to the subjects who represent companies. We then shift to the investor perspective and their behaviour across treatments. We add results from our post-experiment questionnaire for both sections to further enhance our findings. Lastly, we turn to the combined results to discuss our findings and interpret these in the broader context of ESG-related information disclosure.

Company behaviour

Starting with company behaviour and their reactions to the introduction of minimum regulatory disclosure levels, we stated as our first hypothesis that the amount of information companies disclose increases after introducing a regulatory minimum for disclosing ESG-related information.

Table 1 – Company disclosure behaviour by regulatory treatment

		C0	T3	T5	T7
Disclosed amount [IDUs]	Average	4.64	5.50	6.44	7.56
	Median	5.00	5.50	6.00	7.00
Wilcoxon rank-sum test results	C0	-	0.1583	0.0000***	0.0000***
	T3	-	-	0.0099**	0.0000***
	T5	-	-	-	0.0000***

Note - number of subjects representing companies: 36 (C0), 34 (T3, T5, T7)

General support for our first hypothesis comes from the results stated in Table 1. Table 1 presents the chosen disclosure amounts across the no-regulation case and three other treatment groups. First, we see a close to linear increase of one additional IDU per treatment, e.g., increasing the disclosure level from T3 to T5 increases the average disclosure from 5.5 to 6.4 IDUs. To further test this, we deploy the Wilcoxon rank-sum test for unmatched data sets (Mann & Whitney 1947; Wilcoxon 1945). According to the test, T3 does not differ significantly from the no-regulation group, so we cannot reject the null hypothesis that T3 differs significantly from C0. Average disclosure values for C0 and T3 differ by a disclosure level of 0.85 IDUs, and median disclosure levels differ slightly less at 0.50 IDUs. T5 differs significantly from the no-regulation group (p-value <0.0001), yet it differs significantly but only at the 1% level from treatment T3. Moreover, we identify T7 to significantly differ from the no-regulation and other treatment groups (Wilcoxon rank-sum test, p-value <0.0001).

We, therefore, confirm hypothesis H1 only partly for the T5 and T7 treatments, yet not for the T3 treatment confirming that more regulation also leads to more disclosure. Nevertheless, already in the no-regulation case, almost half the possible disclosure amount is disclosed in the no-regulation case. While this result might be influenced by the subject's central tendency bias under uncertainty (Douven 2018; Stevens 1971), we also identified more than 55% of subjects to state that dealing with ESG information, in this case, was (very) relevant to them while less than 15% identified dealing with ESG information as somewhat irrelevant and less than 10% defined it as not relevant (n = 138). We can thus interpret this finding as a willingness to disclose information beyond an economically reasonable level for this information being ESG-related. In our case, a different approach to explaining this economically irrational behaviour is a general will to receive an investment instead of not receiving an investment, similar to preferring winning over losing. In our second company-focused question, we asked how the subject would disclose in a subsequent round. When companies received an investment, 48% of subjects would disclose an equal amount, while 28% would disclose less and 25% would disclose more. When, however, not receiving an investment, 48% of subjects would disclose more to ensure an investment in a subsequent round thus. In comparison, 29% would disclose even less and 23% would disclose a similar amount. When setting a regulatory minimum for ESG disclosure, the regulator should thus bear in mind that companies potentially exceed the set minimum level to thus appear more attractive on the market. We will circle back to these findings towards the end of the results chapter putting these results into a broader perspective on ESG regulation and disclosure combined with the investor view.

In our second hypothesis, we stated that the amount of information companies disclose will converge towards the minimum level set by the regulator. We present the analysis of this effect in Table 2.

Table 2 – Convergence of company disclosure against the regulatory minimum

		C0	T3	T5	T7
Delta disclosed amount vs required minimum [IDUs]	Average	4.64	2.50	1.44	0.56
	Median	5.00	2.50	1.00	0.00
Share of subjects choosing reg. minimum		11%	15%	24%	59%
Shapiro-Wilk test result p-values		0.1566	0.3881	0.1089	0.0003***

Note - number of subjects representing companies: 36 (C0), 34 (T3, T5, T7)

First, we examine the delta between average (median) disclosure values and the possible regulatory minimum. For our no-regulation case, we discover the most considerable difference between the average (median) disclosure level chosen and the absolute minimum of zero IDUs, i.e., the average (median) lies 4.64 (5.00) IDUs above the absolute minimum. For our first treatment with a regulatory minimum of three IDUs, we see a delta of almost half of the no-regulation case to 2.50 (2.50) IDUs on average (median). This trend continues again for treatment T5 and T7, where the delta lies at 1.44 (1.00) IDUs on average (median) for T5 and 0.56 (0.00) IDUs for T7 above the regulatory minimum. We also analysed what share of subjects chose the very regulatory minimum. While in the no-regulation case, only 11% chose the regulatory minimum of zero IDUs, 15% already chose the regulatory minimum of three IDUs in treatment T3. For T5, we identified one-quarter of the subjects to choose the minimum of five IDUs; for treatment T7, 59% chose the regulatory minimum of seven IDUs. While we see a general tendency for disclosure levels to converge against the regulatory minimum, the significance of this observation is yet to be tested. We, therefore, deploy the Shapiro-Wilk test (Royston 1982; Shapiro & Wilk 1965) to test each sample for normality. Based on the performed analysis, we see that only for treatment T7 we can reject the null hypothesis that the disclosure amounts are normally distributed at the 0.1% significance level. For all other treatments, including the no-regulation case, we cannot reject the null hypothesis that these treatments are normally distributed. As disclosure costs rise significantly between disclosure levels seven, eight and nine, the added value of disclosure vis-à-vis the incremental cost seems to motivate subjects to stick with the regulatory minimum instead. For all other cases, added value of an incremental IDU vis-à-vis the incremental cost seems appropriate, thus resulting in a broader distribution of disclosure levels. Considering once again the previously made predictions, subject behaviour appears to move in the opposite direction, i.e., information disclosure converges rather towards the minimum than towards the maximum. Multiple effects could be the reason for this: (1) subjects could anticipate that investors will not value higher disclosure indefinitely, i.e., at a certain point, the investor's appetite for a secure investment could be satisfied, or (2) subjects are too risk-averse to invest high amounts and rather keep the initial endowment as much as possible.

Interestingly, treatment T3 is closest to a normal distribution with a test statistic value of 1.15, where a value of 1.00 would indicate a normal distribution. For comparison, the test statistic for T7 is 5.19. These findings can be interpreted as the first indicator that a moderate regulation could make sense to achieve a good balance between a certain minimum disclosure level for all companies and a willingness to exceed this level for more ambitious companies.

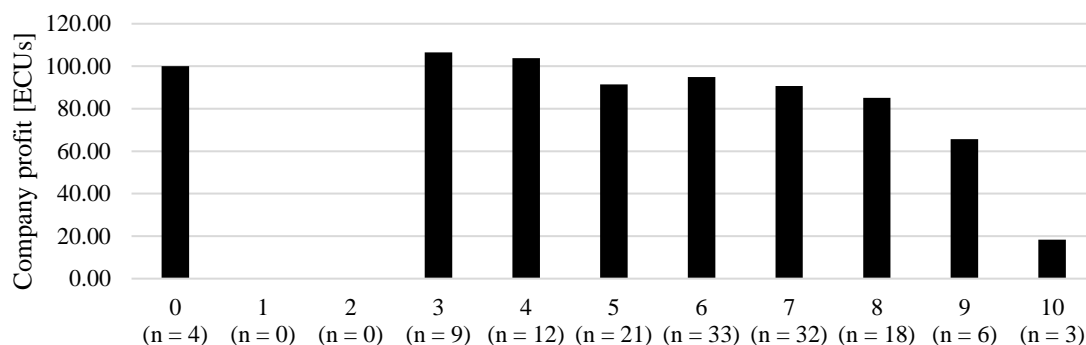
In addition to our results related to the company hypotheses stated earlier, we also analyse the average (median) profits achieved by companies to generate a better understanding of how profitable companies can be in each treatment. Our results for company profits are supported by Table 3, which presents company profits and Wilcoxon rank-sum test results, where we compare average company profits by treatment. Looking at average company profits, companies in the low-regulation treatment (T3) show the highest profits with 100.44 ECUs earned, followed by the no-regulation case (C0) with 93.08 average ECUs. The medium-regulation treatment (T5) shows similar results to the no-regulation case, with 91.56 ECUs earned on average. We see that C0 and treatments T3 and T5 are similar in profits.

Table 3 – Company profits by regulatory treatment

		C0	T3	T5	T7
Company profits [ECUs]	Average	93.08	100.44	91.56	78.29
	Median	91.00	90.00	75.00	53.50
Wilcoxon rank-sum test results	C0	-	0.3064	0.8257	0.0142*
	T3	-	-	0.1730	0.0001***
	T5	-	-	-	0.0052**

Note - number of subjects representing companies: 36 (C0), 34 (T3, T5, T7)

Only the high-regulation treatment ranks below, with 78.29 ECUs earned. Turning to medians, we see a similar yet slightly different picture. The case without regulatory influence (C0) ranks highest for median company profits, closely followed by the low-regulation treatment (T3), with 91.00 and 90.00 ECUs earned. The medium-regulation treatment is further away from the first two treatments with 75.00 ECUs earned, and T7 ranks again lowest with 53.50 ECUs earned. As case C0 and treatments T3 and T5 are all close to each other, we performed a Wilcoxon rank-sum test to determine differences in profit distributions. As presented in Table 3, the differences between C0, T3 and T5 are insignificant, yet all three treatments differ significantly at either the 5%, 1% or 0.1% level from the high-regulation treatment. Based on these results, high regulation appears unattractive from a company perspective as profits are the lowest. Looking at the highest average profits, companies are between the no-regulation case and the low-regulation treatment with a tendency towards the low-regulation treatment based on a combination of average and median profits as well as Wilcoxon test results which are insignificant yet provide a direction as T3 and T5 differ at the 17% level. At the same time, C0 and T5 appear very similar according to the test results. To further elaborate on this topic, we not only analyse the average profits by treatment but also average profits by disclosed amount irrespective of treatment (see Figure 1). In our case, only four companies disclosed zero IDUs, and no company chose a level of one or two IDUs.

**Figure 1** – Company profits [ECUs] by disclosure amount choice [IDUs]

Moreover, profits are highest for a disclosure level of three IDUs (106.44 ECUs) and second highest for four IDUs (103.83 ECUs). These two levels are the only two exceeding the zero disclosure decision where company profit equals 100.00 ECUs. Companies disclosing amounts between five and seven IDUs reached similar profits between 90.69 and 94.94 ECUs. Companies disclosing beyond this level then saw an explicit decrease in profits from 85.17 ECUs at a disclosure level of eight IDUs to 65.67 ECUs at a disclosure level of nine IDUs and 18.33 ECUs at a disclosure level of ten IDUs. While the number of companies disclosing an amount of ten (n=3) is comparably small, it is still interesting to see that not even the highest possible disclosure amount made investors either invest in them (only one of the three companies received an investment) or invest high amounts, i.e., the one company receiving an investment received an investment amount of 55 ECUs. This finding is interestingly contradictory to our previously assumed utility function for investors, where we assumed that investors always prefer a higher disclosure over a lower disclosure. Instead, it appears that investors require a certain level of investment security, yet this need is at one point fulfilled, resulting in an investment shift towards the riskier investment. These findings support our earlier statement that regulation of company disclosure makes sense, yet only at a moderate level, i.e., in our case of three or four IDUs. We will now shift to the investor analysis to better understand how the initial decisions made by companies affect investor behaviour to conclude in a broader economic context then.

Investor behaviour

As we previously took the company perspective, we now shift towards the investor perspective in our experiment to further understand how introducing regulatory minimum values influences investor behaviour. In our third hypothesis, we stated that we expect the amount of capital invested by investors to increase after introducing a regulatory minimum for disclosing ESG-related information. Support for this hypothesis comes from Table 4. We present average and median investment amounts and the differences between investment distributions by treatment according to the previously described Wilcoxon rank-sum test. Looking first at the average (median) invested amounts, we observe an investment amount of 38.56 (30.00) ECUs in the no-regulation case. For all three other treatments, invested amounts are almost twice as high (or more than twice as high when considering medians), with 67.29 (60.00), 68.82 (65.00) and 72.06 (70.00) ECUs for the treatments T3, T5 and T7. Two aspects are important to highlight here: (1) the steep increase in invested amounts between the case of no regulation vis-à-vis any treatment of regulation and the subtle differences between any regulatory treatment scenario.

Table 4 – Investor behaviour by regulatory treatment

		C0	T3	T5	T7
Investment amount [ECUs]	Average	38.56	67.29	68.82	72.06
	Median	30.00	60.00	65.00	70.00
Wilcoxon rank-sum test results	C0	-	0.0057**	0.0048**	0.0023**
	T3	-	-	0.8578	0.3948
	T5	-	-	-	0.6506

Note - number of subjects representing investors: 18 (C0), 17 (T3, T5, T7)

We applied the Wilcoxon rank-sum test to further elaborate on these findings and find further support. The investment distribution of the no-regulation case differs significantly from all the regulatory treatments (p-value < 0.01 for all three treatments). However, no significant differences can be observed when comparing treatments T3, T5 and T7 regarding invested amounts. These findings confirm H3 partly as we observe a significant increase in invested amounts. However, the difference appears to result from the regulation's existence, irrespective of its magnitude. Whether the regulatory minimum is at a higher or a lower level appears not to impact investor behaviour any further. Again, a low to moderate regulatory level seems reasonable as invested amounts are already reasonably high in the T3 treatment. Considering our survey results, interestingly, investors reported that dealing with ESG information is especially relevant to them. More than 75% of respondents reported that ESG information is either relevant or very relevant to them (55% among companies), while only 11% reported ESG information as rather or not relevant. Nevertheless, investors were mostly not willing to invest their full capital. We discover that investment amounts are generally lower than previously predicted. One explanation for this could be a higher level of risk aversion than previously anticipated. Another explanation could stem from investors' negative reciprocity, i.e., investors generally invest less to punish companies for disclosing too little. We, therefore, performed another analysis on investment amounts by IDU and treatment. We, however, find mixed results and thus only limited support for the phenomena of negative reciprocity. While in treatments T3 and T5, investors invest (significant) more capital when a company slightly exceeds the minimum disclosure level, we do not observe this trend in T7. Moreover, comparing investment amounts across treatments, investors, for instance, invest more capital into a company providing a disclosure level of five IDUs in T3, i.e., more than the company should, as in T5, i.e., minimum the company has to disclose. Conversely, we find the opposite effect when comparing T3 and T7. Here, investors invest more in the T7 treatment, although this is what companies at least have to disclose, and companies in T3 exceed the minimum level strongly. It appears instead that investors are generally not willing to invest their full capital. At the same time, some regulation already safeguards them to disclose a substantial amount which does not further increase much with higher disclosure levels.

From the investors' decision regarding the amount of invested capital, we now shift to the investors' decisions dependent on the amounts disclosed by both companies. In our fourth hypothesis, we hypothesised that investors would invest in companies with higher disclosure pre-regulation and companies with lower disclosure post-regulation. Support for this hypothesis comes partly from Table 5.

Table 5 – Investor's investment decision by regulatory treatment and disclosure amount

		C0	T3	T5	T7
Relative share of investment decisions based on company disclosure	Higher disclosure	61.1%	70.6%	64.7%	41.2%
	Lower disclosure	5.6%	17.6%	35.3%	23.5%
	Equal disclosure	33.3%	11.8%	0.0%	35.3%

Note - number of subjects representing investors: 18 (C0), 17 (T3, T5, T7)

Starting with the no-regulation case, 61.1% of investors invested in the company with the higher disclosure amount, while 5.6% invested in the company with lower disclosure than the other disclosing company. This finding confirms at least the first part of our hypothesis, i.e., pre-regulation investors invest in companies with higher disclosure. This finding is also statistically significant (binomial test, $p < 0.01$)². Turning to the regulatory treatments, we still find that most investors invest in the company with higher disclosure in the low-regulation treatment. 70.6% of investors invest in the company with higher disclosure, while 17.6% invest in the company with lower disclosure. These results indicate statistically significant that investors still invest in company disclosing at a higher level (binomial test, $p < 0.05$). For the medium-regulation treatment (T5), 64.7% of companies invest in the higher-disclosing company, while 35.3% invest in the lower-disclosing company. In the high-regulation treatment (T7), 41.2% invest in the high-disclosure company, while 23.5% invest in the low-disclosure company. For both treatments, findings are insignificant, i.e., we cannot reject the null hypothesis that the actual probability is above 50% or vice versa. We thus reject our fourth hypothesis as most investors in all treatments invest in the higher disclosing company, which is significant in both the no-regulation case and the low-regulation treatment. We find support for this in the general risk aversion of investors beyond expected levels. This generally aligns with our assumption that investors prefer a higher information disclosure. Nevertheless, the desire for higher disclosure appears to vanish once information disclosure is higher among both companies the investor can invest in.

When asked about their risk propensity, 59% of investors replied to invest in the company with higher disclosure at any given disclosure level. In comparison, only 41% of investors would not choose this at any level. We see a tendency towards fewer investors investing in the higher disclosure option, e.g., investors are four times more likely to invest in the higher disclosure company in the low-regulation treatment (T3). This likelihood decreases to less than two times in the high-regulation treatment (T7), and the overall risk aversion overweighs. This finding is backed by the third questionnaire question in which investors were asked about their investment strategy for a potential next round. While 39% answered that they would be willing to invest more in a subsequent round, more than 50% of investors would stick to their investment strategy and reinvest the same amount. Nevertheless, only 6% of investors would even invest less, i.e., would not become even more risk averse. Another exciting fact was found in the investors' decisions when confronted with two companies disclosing the same amount of information. Overall, this occurred in 20% of the time. In 93% of these cases, the investor decided to invest in the first company, while only in one case the investor decided to invest in the second company. While the overall relevance for regulators might not be too relevant, it is still interesting to see how people are biased to choose the first option in case of a decision with an equal outcome, e.g., being positioned first in a list can help secure investments.

Similar to the analysis we performed in the previous chapter, we also analyse the profits achieved by investors during the experiment. Our results are presented in Table 6.

² One-sided binomial test at 50% probability, observations where companies had same disclosure were omitted for the binomial test

Table 6 – Investor profits by regulatory treatment

		C0	T3	T5	T7
Investor profits [ECUs]	Average	153.61	183.09	187.34	201.01
	Median	150.09	195.45	204.84	204.71
Wilcoxon rank-sum test results	C0	-	0.0492*	0.0457*	0.0077**
	T3	-	-	0.8851	0.4688
	T5	-	-	-	0.7402

Note - number of subjects representing investors: 18 (C0), 17 (T3, T5, T7)

Considering average (median) profits first, we identify a continuous increase in investor profits from 153.61 (150.09) ECUs in the no-regulation case to 183.09 (195.45) ECUs in the low-regulation treatment across the medium-regulation treatment with an average (median) investor profit of 187.34 (204.84) ECUs to a profit of 201.01 (204.71) ECUs in the high-regulation treatment. These results align with the higher invested amounts presented in Table 4. We test these results again with the Wilcoxon rank-sum test and find significant differences between the no-regulation case and all other three treatments ($p < 0.05$ (C0, T3) and $p < 0.01$ (T7)). Nevertheless, we find only insignificant differences when comparing each treatment (T3, T5, T7) against each other. Based on these results, we interpret the introduction of a regulatory minimum as value-enhancing.

In contrast, the magnitude of the regulatory minimum seems somewhat irrelevant to the investor's decision and the achieved profits. This finding can have important implications for regulators in developing and setting a certain minimum for companies, as we have seen previously that excessive regulation increases companies' costs substantially. In the next chapter, we will elaborate on the connection to company profits and the overall meaning of setting a regulatory minimum.

Lastly, we want to understand which disclosure amount generated the most investments overall. We plotted the number of investments and split them by treatment and disclosure amount chosen for the investment by the investor. First, we see that no investments were taken below the low-regulation level of a disclosure amount of three. For both the no-regulation and

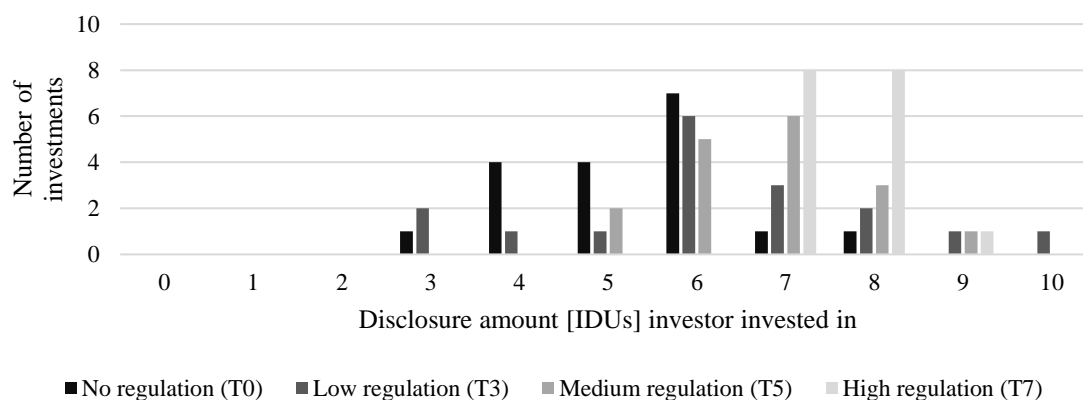


Figure 2 – Number of investments by disclosure amount invested in

the low-regulation treatments, a disclosure level of six IDUs was chosen most often. A disclosure level of seven IDUs was primarily chosen for investment for the medium-regulation treatment. Seven and eight IDUs were chosen equally often for the high-regulation treatment. We thus assume that investors generally acknowledge the extra effort of going beyond the minimum level required by the regulator while also investing lower than initially predicted to signal their expectation of higher disclosure amounts. On the other side, investors tend not to value this effort indefinitely but rather have an interest in investing slightly above the required level. This tendency decreases with higher minimum regulatory levels. An insightful conclusion for companies thus could be that it pays to gently exceed the required regulatory minimum to secure an investment, at least for the low- and medium-regulation treatments.

Combined behaviour

Lastly, we examine the combined results of companies' behaviours and investors' responses. We, therefore, combine the profits of both companies and the investor per regulatory treatment. The results are presented in Table 7.

Table 7 – Combined profits across companies and investors by regulatory treatment

		C0	T3	T5	T7
Combined company and investor profits [ECUs]	Average	339.77	383.98	370.46	357.60
	Median	317.48	390.45	398.24	361.71
Wilcoxon rank-sum test results	C0	-	0.1458	0.3304	0.3305
	T3	-	-	0.7789	0.2415
	T5	-	-	-	0.4691

Note - number of combined observations considered: 18 (C0), 17 (T3, T5, T7)

Overall, profits are lowest for the no-regulation case, with an average combined profit of 339.77 ECUs and highest in the low-regulation treatment (T3), with 383.98 ECUs. The second highest profits are achieved in the medium-regulation treatment (T5), and the third highest in the high-regulation treatment (T7) with 357.60 ECUs. Looking at medians, we see a shift between the low- and medium-regulation treatments, as the median for T5 is slightly higher. Performing the Wilcoxon rank-sum test, we see insignificant differences between all profit distributions. In contrast, the differences between the no-regulation case and the low-regulation treatments are closest to statistical significance, with a p-value < 0.15. Although insignificant, a moderate regulation makes sense vis-à-vis a no-regulation scenario. This aligns with what we have seen in our analyses in the previous chapters.

On the one hand, companies are already disclosing relatively high amounts of information in the no-regulation and low-regulation treatments, which do not differ significantly (see Table 1). On the other hand, investors invest significantly more capital in the low-regulation treatment vis-à-vis the no-regulation case (see Table 4) and achieve significantly higher profits (see Table 6). For companies, no statistically significant differences occur regarding profits besides a significant decrease in profits in the high-regulation treatment. In line with the previously discussed literature, we thus argue that moderate regulation helps to safeguard investors at a reasonable cost for companies. Regulating companies too strictly results in an excessive cost burden for companies. At the same time, no regulation yields investors investing too little due to insecurity resulting in losses for the overall economy.

Conclusion

We conducted an experimental study among more than 200 students from Technical University Munich and Ludwig Maximilian University in which subjects had to decide how much ESG information to disclose when representing a company or how much capital to invest in one of two companies when representing an investor. We were motivated by already introduced European ESG-related regulatory guidelines (e.g., NFRD) and further planned regulatory guidelines (e.g., CSRD). We aimed to identify how introducing such guidelines affects investors and companies to derive recommendations for regulatory authorities, companies, and investors. We find statistically significant evidence that higher regulation leads to more information disclosure by companies and more capital invested by investors. Nevertheless, this trend continues less steeply once a minimum regulation has been introduced. While we do not find significant evidence for a convergence of disclosed information amounts against the regulatory minimum disclosure level when the minimum level is increased, we find investors to generally invest in the company with a higher level of disclosed information over the other company. We attribute these findings to the high-risk aversion among experiment subjects. Furthermore, investors value a certain minimum level of information disclosure, motivating them to invest most of their capital. Nevertheless, the investment amount increases not strongly when disclosed amounts increase due to stronger regulation. Investors, in turn, do not appear to be motivated by the effects of reciprocity, i.e., either punish companies for not exceeding the minimum disclosure level or reward companies for going far beyond the required minimum disclosure level.

Nevertheless, we see the high importance of ESG to subjects as more than 60% of subjects indicate ESG as a high priority influencing their decisions during the experiment. In comparison, less than 20% of subjects indicate ESG as somewhat irrelevant to their decisions. This is also reflected in the comparably high level of information disclosure in the no-regulation case, where companies disclose high levels of information voluntarily.

Conversely, investors appear to be safeguarded by the introduced regulation as we see a significant increase in investments from the no-regulation case to the low-regulation treatment. In contrast, no further significant increase is observed towards the medium- and high-regulation treatments. Considering disclosed amounts, invested capital, and profits, companies benefit from a low-regulation treatment, while higher regulation leads to an excessive cost burden. Combining company and investor profits, we still see the highest profits in the low-regulation treatment. Assuming that the regulator's highest interest is to assume the highest amount of welfare among all market participants, we see the case of low to moderate regulation as the best way to reconcile all stakeholders' interests in the best possible way. Regulators must ensure a proper standardisation of disclosed information while avoiding requesting information from companies of limited interest and value to investors. Our analyses have shown that some information is valuable to investors while further incremental information is only of limited added value in safeguarding investors in their decision-making process.

Experimental limitations

While we have conducted our experimental research diligently and thoroughly, we still face various limitations based on our chosen experimental setup. First, we look back at the participating subjects during our experimental sessions. All subjects were either Technical University Munich or Ludwig Maximilian University students, with slightly more than half being younger than 25 years and roughly 38% between 25 and 30, while only about ten percent of subjects were older than 30. On the one side, these subjects thus have the potential to represent future investor behaviour. On the other side, most subjects are still quite far away in their personal development from becoming a decision maker either in a disclosing company or an investment company. Thus, the generalizability of the results is considered limited, whereas an experiment among actual decision-makers could have a higher degree of generalizability. Nevertheless, the practicability of such an endeavour is much more challenging.

Second, we have focused our experiment on the amount of ESG disclosure. Nevertheless, not only the amount of information disclosed to investors matters when making investment decisions but also the quality. However, we deliberately excluded the qualitative aspects in our experimental study to avoid over-complication. Nevertheless, we cannot say with certainty that subjects might have associated a higher level of disclosure with a higher quality of information. Moreover, we did not distinguish between environmental, social and governance aspects and instead just grouped everything under the term ESG. While it is a term used broadly, the individual aspects have little in common besides non-financial characteristics. We found that ESG mattered to subjects, yet we cannot say which specific aspects mattered most to subjects, thus driving disclosure or investment decisions.

Third, we made specific experimental choices for our experiment, e.g., quadratic disclosure cost. Of course, our experimental parameters could have been chosen differently, which could affect the overall outcome. At this point, it is impossible to say how this would shape our experimental results. In addition, we paid a high degree of attention to assuring a proper and randomised experiment to achieve high internal and external validity. While experimental studies generally allow for high control over potential confounding factors (Eden 2017), it might still be the case that unobserved confounders have influenced subject behaviour.

Fourth and last, we must consider that investment decision processes are complex and usually involve various legal, technological, financial, and non-financial aspects. While we focus specifically on non-financial aspects, we omit all other aspects in our experiment, drawing a black-and-white picture in a world which is most likely much greyer than we think. In addition, we only looked at investors making decisions. Thus companies' only aim was to achieve an investment from the investor. In the real world, company behaviour is influenced by various stakeholders besides investors, such as customers, employees, or non-governmental organisations, especially in today's world (cf. stakeholder theory mentioned earlier). Leaving these factors and other stakeholders apart allows for controlling the company-investor relationship and enormously facilitates a real-world scenario, potentially reducing real-world generalizability.

Areas for future research

Based on the described limitations, three future research areas would be worth investigating in subsequent work. First, we believe that factoring in disclosure quality as a second differentiating parameter besides disclosure amount could influence investors' decisions. It would be interesting to understand how investors would substitute quality for quantity and which aspects are more relevant to investors. With future regulations, certain minimum levels of quantity and quality must be met. Understanding how investors value companies' efforts to exceed these thresholds could provide valuable insights into company behaviour.

Second, we have previously mentioned the undifferentiated combination of environmental, social and governance aspects. Dividing these aspects in a subsequent experiment could provide further insights into which aspects matter most to investors and which are less relevant. It could even be imaginable to break down E, S, and G further into the most relevant aspects in each cluster to understand better where investors' interests lie.

Lastly, we suggest extending the scope of focusing on the narrow company-investor relationship to a broader audience of stakeholders. It can be interesting to see how companies react to comply with various stakeholder interests and better understand where companies want to keep good, neutral, or bad relationships. On top, generating a better understanding of how various stakeholder groups react to ESG-related information disclosure amounts and the quality of disclosed information can be beneficial to designing optimal disclosure reports and, as such, tailoring regulatory guidelines to the requirements of the broad set of stakeholders has and deems value enhancing.

References

- Abdi, Y., Li, X., & Càmara-Turull, X. (2022). Exploring the impact of sustainability (ESG) disclosure on firm value and financial performance (FP) in airline industry: the moderating role of size and age. *Environment, Development and Sustainability*, 24(4), 5052–5079.
- Akerlof, G. A. (1970). The market for 'lemons': Quality uncertainty and the market mechanism. *Quarterly Journal of Economics*, 84(3), 488–500.
- Aragòn-Correa, J. A., Marcus, A. A., & Vogel, D. (2020). The Effects of Mandatory and Voluntary Regulatory Pressures on Firms' Environmental Strategies: A Review and Recommendations for Future Research. *Academy of Management Annals*, 14(1), 339–365.
- Arora, S., & Cason, T. N. (1995). An Experiment in Voluntary Environmental Regulation: Participation in EPA's 33/50 Program. *Journal of Environmental Economics and Management*, 28(3), 271–286.
- Arrow, K. J. (1966). Aspects of the Theory of Risk-Bearing. *Economica*, 33(130), 251.
- Bebbington, J., Kirk, E. A., & Larrinaga, C. (2012). The production of normativity: A comparison of reporting regimes in Spain and the UK. *Accounting, Organisations and Society*, 37(2), 78–94.
- Bernardi, C., & Stark, A. W. (2018). Environmental, social and governance disclosure, integrated reporting, and the accuracy of analyst forecasts. *The British Accounting Review*, 50(1), 16–31.
- Berthelot, S., Coulmont, M., & Serret, V. (2012). Do Investors Value Sustainability Reports? A Canadian Study. *Corporate Social Responsibility and Environmental Management*, 19(6), 355–363.
- Carroll, A. B. (1979). A Three-Dimensional Conceptual Model of Corporate Performance. *Academy of Management Review*, 4(4), 497–505.
- Chakraborty, P., & Chatterjee, C. (2017). Does environmental regulation indirectly induce upstream innovation? New evidence from India. *Research Policy*, 46(5), 939–955.
- Cheng, B., Ioannou, I., & Serafeim, G. (2014). Corporate social responsibility and access to finance. *Strategic Management Journal*, 35(1), 1–23.
- Christensen, H. B., Hail, L., & Leuz, C. (2021). Mandatory CSR and sustainability reporting: economic analysis and literature review. *Review of Accounting Studies*, 26(3), 1176–1248.
- Christmann, P. (2004). Multinational Companies and the Natural Environment: Determinants of Global Environmental Policy. *Academy of Management Journal*, 47(5), 747–760.
- Clarkson, P. M., Fang, X., Li, Y., & Richardson, G. (2013). The relevance of environmental disclosures: Are such disclosures incrementally informative? *Journal of Accounting and Public Policy*, 32(5), 410–431.
- Cordazzo, M., Bini, L., & Marzo, G. (2020). Does the EU Directive on non-financial information influence the value relevance of ESG disclosure? Italian evidence. *Business Strategy and the Environment*, 29(8), 3470–3483.
- Cormier, D., Magnan, M., & van Velthoven, B. (2005). Environmental disclosure quality in large German companies: Economic incentives, public pressures or institutional conditions? *European Accounting Review*, 14(1), 3–39.
- Costa, E., & Agostini, M. (2016). Mandatory Disclosure about Environmental and Employee Matters in the Reports of Italian-Listed Corporate Groups. *Social and Environmental Accountability Journal*, 36(1), 10–33.
- Criado-Jiménez, I., Fernández-Chulián, M., Larrinaga-González, C., & Husillos-Carqués, F. J. (2008). Compliance with Mandatory Environmental Reporting in Financial Statements: The Case of Spain (2001–2003). *Journal of Business Ethics*, 79(3), 245–262.
- Darnall, N., Henriques, I., & Sadosky, P. (2010). Adopting Proactive Environmental Strategy: The Influence of Stakeholders and Firm Size. *Journal of Management Studies*, 47(6), 1072–1094.
- Dawes, J. (2008). Do Data Characteristics Change According to the Number of Scale Points Used? An Experiment Using 5-Point, 7-Point and 10-Point Scales. *International Journal of Market Research*, 50(1), 61–104.
- De Villiers, C., Cho, C. H., Turner, M. J., & Scarpa, R. (2021). Are Shareholders Willing to Pay for Financial, Social and Environmental Disclosure? A Choice-based Experiment. *European Accounting Review*, 1–28.
- Deegan, C. (2017). Twenty five years of social and environmental accounting research within Critical Perspectives of Accounting: Hits, misses and ways forward. *Critical Perspectives on Accounting*, 43, 65–87.
- Delmas, M. A., & Toffel, M. W. (2008). Organisational responses to environmental demands: opening the black box. *Strategic Management Journal*, 29(10), 1027–1055.
- Dhaliwal, D. S., Li, O. Z., Tsang, A., & Yang, Y. G. (2011). Voluntary Non-financial Disclosure and the Cost of Equity Capital: The Initiation of Corporate Social Responsibility Reporting. *The Accounting Review*, 86(1), 59–100.
- Dobler, M., Lajili, K., & Zéghal, D. (2014). Environmental Performance, Environmental Risk and Risk Management. *Business Strategy and the Environment*, 23(1), 1–17.

- Dolnicar, S., Grün, B., & Leisch, F. (2011). Quick, Simple and Reliable: Forced Binary Survey Questions. *International Journal of Market Research*, 53(2), 231–252. <https://doi.org/10.2501/ijmr-53-2-231-252>
- Donaldson, T., & Preston, L. E. (1995). The Stakeholder Theory of the Corporation: Concepts, Evidence, and Implications. *Academy of Management Review*, 20(1), 65–91.
- Doshi, A. R., Dowell, G. W. S., & Toffel, M. W. (2013). How firms respond to mandatory information disclosure. *Strategic Management Journal*, 34(10), 1209–1231.
- Douven, I. (2018). A Bayesian perspective on Likert scales and central tendency. *Psychonomic Bulletin & Review*, 25(3), 1203–1211.
- Dowell, G., Hart, S., & Yeung, B. (2000). Do Corporate Global Environmental Standards Create or Destroy Market Value? *Management Science*, 46(8), 1059–1074.
- Eccles, R. G., Ioannou, I., & Serafeim, G. (2014). The Impact of Corporate Sustainability on Organizational Processes and Performance. *Management Science*, 60(11), 2835–2857.
- Eden, D. (2017). Field Experiments in Organisations. *Annual Review of Organizational Psychology and Organizational Behavior*, 4(1), 91–122.
- European Commission. (2023). Corporate sustainability reporting. https://finance.ec.europa.eu/capital-markets-union-and-financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en (Accessed 13.02.2023).
- European Parliament, & European Council (2014). Directive 2014/95/EU of the European Parliament and of the Council. *Official Journal of the European Union*. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0095&from=EN>.
- European Parliament, & European Council (2021). Proposal for a Directive of the European Parliament and of the Council amending Directive 2013/34/EU, Directive 2004/109/EC, Directive 2006/43/EC and Regulation (EU) No 537/2014, as regards corporate sustainability reporting. *Official Journal of the European Union*. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021PC0189&from=EN>.
- Falk, A., & Kosfeld, M. (2006). The Hidden Costs of Control. *American Economic Review*, 96(5), 1611–1630.
- Freeman, R. E. (1984). *Strategic Management: A Stakeholder Perspective*. Boston, MA. Pitman.
- Garcia-Sanchez, I.-M., Cuadrado-Ballesteros, B., & Sepulveda, C. (2014). Does media pressure moderate CSR disclosures by external directors? *Management Decision*, 52(6), 1014–1045.
- Graham, J. R., Harvey, C. R., & Rajgopal, S. (2005). The economic implications of corporate financial reporting. *Journal of Accounting and Economics*, 40(1-3), 3–73.
- Healy, P. M., & Palepu, K. G. (2001). Information asymmetry, corporate disclosure, and the capital markets: A review of the empirical disclosure literature. *Journal of Accounting and Economics*, 31(1-3), 405–440.
- Helfaya, A., Whittington, M., & Alawattage, C. (2019). Exploring the quality of corporate environmental reporting. *Accounting, Auditing & Accountability Journal*, 32(1), 163–193.
- Henriques, I., & Sadosky, P. (1999). The Relationship Between Environmental Commitment and Managerial Perceptions of Stakeholder Importance. *Academy of Management Journal*, 42(1), 87–99.
- Ioannou, I., & Serafeim, G. (2012). What drives corporate social performance? The role of nation-level institutions. *Journal of International Business Studies*, 43(9), 834–864.
- Ioannou, I., & Serafeim, G. (2017). The Consequences of Mandatory Corporate Sustainability Reporting. *Harvard Business School Research Working Paper*, 1, 11–100.
- Jackson, G., Bartosch, J., Avetisyan, E., Kinderman, D., & Knudsen, J. S. (2020). Mandatory Non-financial Disclosure and Its Influence on CSR: An International Comparison. *Journal of Business Ethics*, 162(2), 323–342.
- Jaffe, A. B., Peterson, S. R., Portney, P. R., & Stavins, R. N. (1995). Environmental regulation and the competitiveness of US manufacturing: what does the evidence tell us? *Journal of Economic Literature*, 33(1), 132–163.
- Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3(4), 305–360.
- Kahneman, D., & Tversky, A. (1979). Prospect Theory: An Analysis of Decision under Risk. *Econometrica*, 47(2), 263.
- Kemna, A. (2015). The impact of regulation. *McKinsey & Company*. <https://www.mckinsey.com/capabilities/strategy-and-corporate-finance/our-insights/the-impact-of-regulation#/> (Accessed 25 January 2023).
- Kolk, A. (2003). Trends in sustainability reporting by the Fortune Global 250. *Business Strategy and the Environment*, 12(5), 279–291.
- Kolk, A., & Perego, P. (2010). Determinants of the adoption of sustainability assurance statements: an international investigation. *Business Strategy and the Environment*, 19(3), 182–198.

- Leuz, C. (2010). Different approaches to corporate reporting regulation: How jurisdictions differ and why. *Accounting and Business Research*, 40(3), 229–256.
- Leuz, C., & Wysocki, P. D. (2008). Economic Consequences of Financial Reporting and Disclosure Regulation: A Review and Suggestions for Future Research. *University of Chicago & Massachusetts Institute of Technology Research Working Paper*.
- Lourenço, I. C., Callen, J. L., Branco, M. C., & Curto, J. D. (2014). The Value Relevance of Reputation for Sustainability Leadership. *Journal of Business Ethics*, 119(1), 17–28.
- Mahoney, P. G. (1995). Mandatory Disclosure as a Solution to Agency Problems. *The University of Chicago Law Review*, 62(3), 1047.
- Malhotra, N. K., & Peterson, M. (2006). *Basic marketing research: A decision-making approach*. Pearson/Prentice Hall.
- Mann, H. B., & Whitney, D. R. (1947). On a Test of Whether one of Two Random Variables is Stochastically Larger than the Other. *The Annals of Mathematical Statistics*, 18(1), 50–60.
- Marshall, S., Brown, D., & Plumlee, M. (2009). The impact of voluntary environmental disclosure quality on firm value. *Academy of Management Proceedings*, 2009(1), 1–6.
- Peltzman, S., Levine, M. E., & Noll, R. G. (1989). The Economic Theory of Regulation after a Decade of Deregulation. *Brookings Papers on Economic Activity*. *Microeconomics*, 1–59.
- Plumlee, M., Brown, D., Hayes, R. M., & Marshall, R. S. (2015). Voluntary environmental disclosure quality and firm value: Further evidence. *Journal of Accounting and Public Policy*, 34(4), 336–361.
- Porter, M. E., & van der Linde, C. (1995). Toward a New Conception of the Environment-Competitiveness Relationship. *Journal of Economic Perspectives*, 9(4), 97–118.
- Pratt, J. W. (1964). Risk Aversion in the Small and in the Large. *Econometrica*, 32(1/2), 122.
- Ramchander, S., Schwebach, R. G., & Staking, K. I. (2012). The informational relevance of corporate social responsibility: evidence from DS400 index reconstitutions. *Strategic Management Journal*, 33(3), 303–314.
- Reverte, C. (2016). Corporate social responsibility disclosure and market valuation: evidence from Spanish listed firms. *Review of Managerial Science*, 10(2), 411–435.
- Rikhardsson, P., & Holm, C. (2008). The effect of environmental information on investment allocation decisions - an experimental study. *Business Strategy and the Environment*, 17(6), 382–397.
- Royston, J. P. (1982). An Extension of Shapiro and Wilk's W Test for Normality to Large Samples. *Applied Statistics*, 31(2), 115.
- Shapiro, S. S., & Wilk, M. B. (1965). An Analysis of Variance Test for Normality (Complete Samples). *Biometrika*, 52(3/4), 591.
- Shleifer, A., & Wolfenzon, D. (2002). Investor protection and equity markets. *Journal of Financial Economics*, 66(1), 3–27.
- Stevens, S. S. (1971). Issues in psychophysical measurement. *Psychological Review*, 78(5), 426–450.
- Stubbs, W., & Higgins, C. (2014). Integrated Reporting and internal mechanisms of change. *Accounting, Auditing & Accountability Journal*, 27(7), 1068–1089.
- Suchman, M. C. (1995). Managing Legitimacy: Strategic and Institutional Approaches. *Academy of Management Review*, 20(3), 571–610.
- Veltri, S., Luca, F. de, & Phan, H.-T.-P. (2020). Do investors value companies' mandatory non-financial risk disclosure? An empirical analysis of the Italian context after the EU Directive. *Business Strategy and the Environment*, 29(6), 2226–2237.
- Verbeeten, F. H., Gamerschlag, R., & Möller, K. (2016). Are CSR disclosures relevant for investors? Empirical evidence from Germany. *Management Decision*, 54(6), 1359–1382.
- Verrecchia, R. E. (2001). Essays on disclosure. *Journal of Accounting and Economics*, 32(1-3), 97–180.
- Wagenhofer, A. (1990). Voluntary disclosure with a strategic opponent. *Journal of Accounting and Economics*, 12(4), 341–363.
- Wartick, S. L., & Cochran, P. L. (1985). The Evolution of the Corporate Social Performance Model. *Academy of Management Review*, 10(4), 758–769.
- WBCSD, & WRI (2015). *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard - Revised Edition*.
- Wilcoxon, F. (1945). Individual comparisons by ranking methods. *Biometrics*(1), 80–83.

Appendix

Appendix 1 – Optimum investment amount for risk-averse investors per amount disclosed by the company

Amount disclosed by company [IDUs]	Optimum investment amount for risk-averse investors [ECUs]
0	90.04
1	92.46
2	94.77
3	96.95
4	99.00
5	100.91
6	102.67
7	104.27
8	105.70
9	106.94
10	108.00

Appendix 2 – Full pre-experimental text provided to subjects

In diesem Experiment gibt es zwei Arten von Spielern. Jeder Spieler ist entweder ein Unternehmen oder ein Investierender. Es werden jeweils zwei Unternehmen mit einem Investierenden in einer Gruppe gepaart. Zunächst entscheiden beide Unternehmen, welches Level an ESG (Environment, Social, Governance) Informationen sie preisgeben wollen. Im Anschluss kann sich der Investierende dann basierend auf der bereitgestellten ESG Information entscheiden, in welches der beiden Unternehmen und in welcher Höhe investiert wird. Es kann nicht in beide Unternehmen investiert werden, sondern lediglich in eines der beiden Unternehmen.

Sie repräsentieren in diesem Fall ein Unternehmen / einen Investierenden.

Für Unternehmen: Unternehmen können grundsätzlich ESG Informationen auf einer Skala von 0 bis 10 bereitstellen. Die Kosten für die Bereitstellung der ESG Informationen entsprechen dabei dem Quadrat der zur Verfügung gestellten ESG Informationen. Ein ESG Informationslevel von 2 kostet das Unternehmen also 4 Economic Currency Units (ECUs), ein ESG Informationslevel von 4 kostet das Unternehmen 16 ECUs, usw. Das Startkapital des Unternehmens beträgt 100 ECUs. Der Profit des Unternehmens berechnet sich somit als Summe des Startkapitals abzüglich der Kosten für die Bereitstellung der ESG Informationen und zuzüglich des möglicherweise erhaltenen Investments des Investierenden. Die genaue Übersicht der Kosten pro ESG Informationslevel findet sich in der ersten Tabelle unten.

Für Investierende: Basierend auf den bereitgestellten ESG Informationen der beiden Unternehmen, entscheidet sich der Investierende dann, in nur eines der beiden Unternehmen ein Kapital in Höhe von maximal 110 ECUs zu investieren. Der Profit des Investierenden hängt dabei von dem bereitgestellten Level an ESG Informationen und dem damit verbundenen Risiko ab. Je höher das bereitgestellte Level an ESG Informationen in das der Investierende investiert hat, desto geringer das Ausfallrisiko, aber auch desto geringer der Profit. Eine Übersicht des Risikos in Abhängigkeit des bereitgestellten ESG Informationslevel findet sich in der zweiten Tabelle. Der Profit des Investierenden errechnet sich damit wie folgt: Startkapital abzüglich dem investierten Kapital und zuzüglich dem Gewinn, welcher sich errechnet als verdoppeltes investiertes Kapital multipliziert mit dem Kehrwert des Risikos. Die Wahrscheinlichkeit, dass der Gewinn eintritt, entspricht dem Risiko. Folgendes Beispiel dient zur Illustration: Investiert der Investierende 50 ECUs in ein Unternehmen, welches ein ESG Informationslevel von 4 gewählt hat, so ergibt sich der Profit des Investierenden wie folgt: $110 - 50 + (2 * 50 / 0.75) = 193$. Dieser Profit tritt aber nur mit einer Wahrscheinlichkeit von 75% ein. In 25% der Fälle macht der Investierende nur einen Profit von 60.

Appendix 3 – Full post-experimental questionnaire text provided to subjects

Question 1: What gender do you identify with?

- Female
- Male
- Neither
- I prefer not to answer

Question 2: How old are you?

- <25
- 25-30
- >30
- I prefer not to answer

Question 3: For investors only (otherwise, please state n/a): How relevant was it for you that this was ESG information?

- Very relevant
- Somewhat relevant
- Neutral
- Somewhat irrelevant
- Not relevant
- n/a

Question 4: For investors only (otherwise, please state n/a): How would you invest in a next round with ESG information levels remaining the same?

- Invest more
- Invest the same
- Invest less
- n/a

Question 5: For investors only (otherwise, please state n/a): Would you always invest in a company that provides higher ESG information?

- Yes
- No
- n/a

Question 6: Only for companies (otherwise, please state n/a): How relevant was it for you that this was ESG information?

- Very relevant
- Somewhat relevant
- Neutral
- Somewhat irrelevant
- Not relevant
- n/a

Question 7: Only for companies (otherwise, please state n/a): Which ESG information level would you choose in the next round?

- Higher level
- Same level
- Lower level
- n/a