



**Single vs. Double Materiality in Nonfinancial
Disclosure: A Methodological Framework for
Measuring Equity Market Reactions**

by

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Abstract

This thesis proposes a methodological framework to assess how the scope of materiality in mandated nonfinancial disclosures influences equity market reactions, using stock liquidity as a behavioral proxy. How the difference in information set due to different materiality frameworks - single materiality or double materiality- affects investor behavior has become increasingly important as global sustainability reporting standards evolve. Grounded in Targeted Transparency Action Cycle and supported by information asymmetry theory, reputation theory, and stakeholder theory, the thesis presents two research propositions: that double materiality disclosures improve stock liquidity more than single materiality, and that this effect is stronger for firms with high pre-existing ESG performance. The study proposes panel fixed effects and difference-in-differences empirical models incorporating ESG interaction terms and multiple stock liquidity proxies to test the propositions. By offering a conceptual framework and an empirical research design toolkit, this study provides regulators, investors, and researchers with a new foundation to empirically evaluate the effectiveness of nonfinancial disclosures as comprehensive data becomes available.

Acknowledgments

This thesis represents not only a year-long research project, but the broader learning journey I've experienced throughout my time at the University of Michigan. What began as a plan to conduct an empirical study on market reactions to nonfinancial disclosures eventually evolved into a methodology paper - an adjustment made necessary by recent shifts in regulatory timelines following political changes in the United States. While this pivot was unanticipated, it opened the door for a deeper exploration of theoretical frameworks and research design, which ultimately supported my academic journey.

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1. Introduction

This thesis provides research insights into corporate nonfinancial disclosures, focusing on two different types of materiality frameworks: single-materiality and double-materiality disclosures. The paper discusses conceptual and empirical frameworks to investigate how the scope of materiality in nonfinancial disclosures affects equity market stock liquidity. For the purpose of review, we define corporate disclosure regulation as the set of rules that govern a firm's provision of information in capital markets (Hombach *et al.*, 2018).

1.1 Background on Nonfinancial Disclosures

Nonfinancial disclosure can be defined as the dissemination of information that extends beyond traditional financial metrics, encompassing environmental, social, and governance (ESG) factors, as well as other aspects of a company's operations that impact long-term value creation. The disclosure provides stakeholders with insights into a company's sustainability practices and overall impact on society and the environment (Romito *et al.*, 2021). The importance of nonfinancial disclosure has grown significantly in recent years, driven by increasing awareness of sustainability issues and the recognition that a company's long-term success depends on factors beyond financial performance alone (La Torre *et al.*, 2022). Therefore, nonfinancial disclosure serves as a framework for organizations to communicate their performance, risks, and opportunities in areas that are not captured by traditional financial statements (Romito *et al.*, 2021)

This paper specifically focuses on sustainability reporting within the realm of nonfinancial disclosures. The International Financial Reporting Standards (IFRS) highlighted the recent trend of sustainability reporting, noting the overlapping effects of nonfinancial regulation,

stakeholder pressures, investor behaviors, and sustainability risks in value-creation processes (IFRS, 2020). This thesis examines mandated sustainability reporting standards as instruments of nonfinancial disclosure, aiming to develop a conceptual and empirical framework for understanding how such regulations influence equity market behavior by investigating stock liquidity.

1.2 The Debate: Single vs. Double Materiality

In recent years, policymakers and companies have been showing increased attention to the debate of whether the disclosure requirements should specify a materiality assessment framework as single-materiality or double-materiality. Moving from single materiality to double materiality requires the identification of companies' positive and negative externalities in terms of sustainable development (Adams *et al.*, 2021). The double materiality principle, grounded in a sociological understanding of environmental crises within capitalist systems (Pichler *et al.*, 2020), calls for companies to move beyond short-term strategic thinking. As the application of double materiality requires wider and more direct stakeholder engagement to gain a comprehensive understanding of materiality (Brown, 2009; Brown *et al.*, 2013; Brown *et al.*, 2017; Puroila *et al.*, 2019), it promotes more holistic frameworks that acknowledge the pivotal role of corporations in advancing global sustainability objectives.

Academic discourse remains fragmented due to the relative novelty of the concept of single and double materiality (Grewal *et al.*, 2021). The divergence in the scope of materiality assessment has significant implications - not just for firms and regulators but also for investors and capital markets, who increasingly rely on nonfinancial information to inform decision-making. This is most notably reflected in the EU's Corporate Sustainability Reporting Directive (CSRD) and the UK's TCFD-aligned climate disclosure rule. These regimes represent

two materially distinct disclosure frameworks—one grounded in impact materiality, the other in financial materiality—and set the stage for comparative analysis of how materiality scope influences market behavior. This thesis contributes to the ongoing conversation by developing a conceptual and empirical framework to examine whether differences in materiality scope between the two disclosure regimes influence equity market reactions, with a specific focus on their impact on stock liquidity.

1.3 Stock Liquidity and Equity Market Reaction

Stock liquidity is an important dimension of a company's capital market performance. Research shows that stock liquidity has positive effects on the overall firm's performance (Fang *et al.*, 2009), price of stocks (Kelly and Ljungqvist, 2012), investment efficiency (Sun *et al.*, 2019), financing costs (Amihud *et al.*, 2015), innovation level (Du *et al.*, 2020), institutional and foreign ownership (Ferreira and Matos, 2008; Gompers and Metrick, 2021), and even ESG disclosure quality (Cao *et al.*, 2024). There is a growing focus in the literature on how stock liquidity is affected by various factors, including a firm's equity structure, (Brockman *et al.*, 2009), the degree of digital transformation (Wu *et al.*, 2021), and through a larger scale, monetary policy (Fang *et al.*, 2011) and policy uncertainty (Wang *et al.*, 2022). However, how a difference in the scope of materiality in nonfinancial disclosures affects stock liquidity remains an empirical issue. This study centers on stock liquidity as the primary outcome variable, proposing it as a real-time, behaviorally grounded indicator of how markets interpret and react to varying ESG disclosure mandates—a topic explored in greater depth in subsequent sections. By measuring the change in stock liquidity after the selected nonfinancial disclosures, we can reveal how the equity market reacts to this new information and quantify the disclosures' impact on equity market investors and the firm's overall performance.

1.4 Overview of Research Objectives and Contribution

As corporate sustainability reporting practices and relevant nonfinancial disclosure regulations evolve, there is an increased need to assess how specific features of the disclosure framework, such as materiality scope, shape capital market outcomes. However, as the implementation of major mandates like the UK's TCFD-aligned rule and the EU's CSRD was adopted very recently, comprehensive, standardized firm-level disclosure data is not yet fully available. Due to this data constraint, this thesis adopts a methodological approach, offering a conceptual and empirical framework that can be used to study the effects of materiality scope on equity markets once full datasets become available. By focusing on stock liquidity, this study provides a foundation for future empirical research to evaluate whether expanding the scope of materiality from single to double in nonfinancial disclosures enhances market functioning. The following section outlines the specific research problem and justification for this approach.

2. Literature Review

2.1 The Evolution of Sustainability Reporting in Capital Markets

Sustainability reporting in capital markets has undergone a major transformation over the past few decades. In 1995, fewer than 50 companies globally issued sustainability of corporate social responsibility (CSR) reports. By 2015, the number increased to over 6000 (Ioannou and Serafeim, 2018). This increase in nonfinancial reporting reflects increasing demand from a range of stakeholders - including investors, regulators, consumers, and social organizations- for information that extends beyond traditional financial metrics.

Several factors influenced this evolution, according to prior literature. First, companies faced pressure from stakeholder groups to disclose information on the environmental and social impact of their operations (Delmas and Toffel, 2008; Reid and Toffel, 2009). This pressure drives firms to develop internal governance procedures to manage and disclose such information more systematically. Second, there has been an increase in investor interest in nonfinancial data, such as ESG risks and opportunities that may influence long-term firm performance (Eccles *et al.*, 2011). These changes reflect a shift in the investor community's understanding of value creation and risk assessment, which explains an increased demand for standardized sustainability reporting through nonfinancial disclosures.

While most of the preceding research focused on firms' voluntary nonfinancial disclosures, there has been an emerging trend of mandating nonfinancial disclosures worldwide. Ioannou and Serafeim's study shows that firms in China, Denmark, Malaysia, and South Africa not only increased disclosure but also adopted assurance practices and reporting guidelines that improve the credibility and comparability of the reported data (Ioannou and Serafeim, 2018).

The financial implications of this shift have been studied in prior research. Existing literature has shown that disclosure improves a firm's information environment and resolves uncertainties about the firm for equity and debt market participants. In equity markets, Lang and Lundholm's research shows that a firm's disclosure practice reduces estimation risk and information asymmetry (Lang and Lundholm, 1996). Hope found that transparency in a firm's accounting policies can reduce uncertainty about its forecasted earnings and therefore reduce forecast dispersion and forecast error (Hope, 2003).

As sustainability reporting is becoming more and more institutionalized through regulations like the EU's Corporate Sustainability Reporting Directive or the SEC's Climate Disclosure Rule, a new empirical question is raised about how different mandated nonfinancial disclosures affect capital market behavior. In particular, how does the scope of materiality - whether single or double- shape the ability of sustainability reporting to improve market functioning?

2.2 Targeted Transparency Action Cycle

Given the regulatory weight placed on materiality framing, understanding its real-world effects is critical. The following section introduces a conceptual framework that is often applied to transparency policies like nonfinancial disclosures—the Targeted Transparency Action Cycle.

The Targeted Transparency Action Cycle (TTAC) is a conceptual framework developed by Archon Fung, Mary Graham, and David Weil to explain how mandated disclosure policies are designed to influence stakeholder behavior and market outcomes, which is outlined in their book *Full Disclosure: The Perils and Promise of Transparency* (Fung *et al.*, 2007)

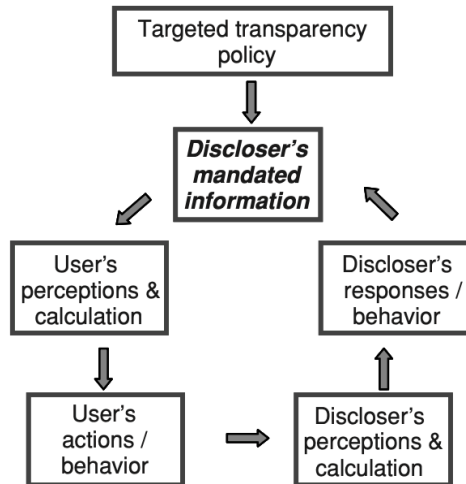


Figure A. Targeted Transparency Action Cycle

- (1) **Discloser's Mandated Information:** A new transparency policy requires organizations such as corporations, government agencies, or other regulated entities to disclose specific types of standardized, disaggregated, and comparable information.
- (2) **User's Perceptions & Calculation:** Stakeholders, including consumers, investors, and regulators, access the disclosed information, interpret it, and incorporate it into their decision-making processes.
- (3) **Users' Actions / Behavior:** Based on their interpretation of the newly available data, users adjust their behavior. This can include choosing alternative products, filing complaints, amplifying issues through advocacy, or reallocating capital. These individual or collective decisions apply pressure to the disclosure.
- (4) **Discloser's Perceptions & Calculations:** Organizations observe users' behavioral changes and reassess the risks, costs, and benefits of their current practices. They monitor feedback signals to evaluate how the transparency is influencing them.

(5) Discloser's Responses / Behavior: As a response to user actions, disclosers can change their behavior that complete the feedback loop. If effective, this will lead to reduced risk, improved service, or better alignment with public interest.

While the TTAC has been applied in domains such as executive compensation, food labeling, and social transparency, its use in capital market contexts - especially in ESG disclosures and their financial consequences- remains limited. Prior literature has focused on how transparency affects public awareness or policy compliance and has not yet extended the TTAC framework to analyze how differences in the materiality scope of the information can influence market-based outcomes driven by user and discloser's behavior change. This represents a critical research gap, as ESG disclosures are increasingly used as regulatory tools to resolve information asymmetries and guide market behavior.

This study applies TTAC to this underexplored domain to demonstrate how the TTAC framework can be adapted to evaluate the behavioral and financial effects of mandated non-financial disclosures responding to different materiality scope regulations.

2.3 Materiality Assessment

The concept of materiality originates from financial accounting. The omission or misstatement of an item is material in a financial report if “the magnitude of the item is such that it is probable that the judgment of a reasonable person relying upon the report would have been changed or influenced by the inclusion or correction of an item (Messier *et al.*, 2005, p. 155).” Recently, materiality has been utilized in the realm of sustainable business and reporting (Gibassier, 2019; Morney Trotman, 2016) as well as assurance (Edgley *et al.*, 2015), to distinguish between material and non-material sustainable issues. Material sustainable issues

refer to sustainability issues that are “likely to influence the decision-making of stakeholders” such as investors, consumers, and regulators (Jørgensen *et al.*, 2021, p. 344).

Traditionally, materiality focused on the factors that might financially affect the company, addressing risks and opportunities that ESG factors may generate for the company. This concept of materiality refers to “financial materiality”, which targets information to investors. The “impact materiality” focuses on firm-level sustainability performance to provide information about their external impacts to all stakeholders, including governments, employees, customers, NGOs, and communities (Delgado-Ceballos *et al.*, 2022). In this paper, we define single-materiality as the framework of materiality that only considers financial materiality, and double-materiality as the framework of materiality that includes both financial materiality and impact materiality.

2.3.1 Single Materiality

Single materiality, which focuses solely on the financial materiality of a company’s initiative, emerged with ESG when the term was first introduced to business investors. In December 2004, the UN Global Compact published the report “Who Cares Wins: Connecting Financial Markets to a Changing World,” suggesting guidelines for incorporating ESG-related risks and opportunities into financial-market analyses, investments, and research. The concept was quickly accepted and spread through the support of banks, asset managers, asset owners, securities brokerage agencies, and rating agencies, further integrating ESG issues into institutional investment and thereby establishing the notion of financial materiality of ESG factors (Eccles *et al.*, 2019). Now, ESG is understood as “the financialization of sustainability (Delgado-Ceballos *et al.*, 2022), since its main goal is to understand the risks and opportunities related to social and environmental factors that affect the financial returns. This is incorporated

in the way current ESG ratings (e.g., MSCI) are performed, where they measure firms' exposure to ESG risks and how well they manage those risks compared to the industry competitors. This means that a business might not be penalized in ESG factor analyses based on single materiality if the regulations of the sector in which that business operates do not have regulations in place to address the negative impact on the environment and society (Delgado-Ceballos *et al.*, 2022).

2.3.2 Double Materiality

Double materiality, a new concept of materiality that not only includes financial materiality but also impact materiality, was introduced by the European Commission for the first time through its publication, "Guidelines on non-financial reporting: Supplement on Reporting Climate-Related Information" (2019/C 209/011) in 2019. Impact materiality, a new factor introduced to assess materiality, refers to the "impact of [the company's] activities", addressing the consequences of business activities for society and the natural environment (European Commission, 2019). Therefore, the concept of double materiality employs two perspectives:

(1) "The reference to the company's development, performance [and] position indicates financial materiality in the broad sense of affecting the value of the company", suggesting financial materiality. European Commission notes that "a sustainability matter is material from a financial perspective if it generates risks or opportunities that affect (or could reasonably be expected to affect) the undertaking's financial position, financial performance, cash flows, access to finance or cost of capital over the short, medium or long term (European Commission, 2023)".

(2) "The reference to the impact of [the company's] activities indicates environmental and social materiality", indicating impact materiality, or environmental and social materiality. European Commission states that "a sustainability matter is material from an impact perspective if it pertains to the undertaking's material actual or potential, positive or negative impacts on

people or the environment over the short-, medium- and long-term (European Commission, 2023)”.

The impacts must be analyzed from three perspectives: sustainability impacts caused directly by the enterprise, impacts to which the enterprise contributes, and the impacts that are otherwise related to the value chain of the company (European Commission, 2023).

Corporate Sustainability Reporting Directive 2022/2464 has been the main regulatory framework to promote this new paradigm (Jørgensen *et al.*, 2021), which entered into force in January 2023, expecting the first reports under this methodology to be published in 2025.

2.3.3 Research Gap in Materiality Assessment of Nonfinancial Disclosures

Despite growing attention to nonfinancial disclosures and sustainability reporting, and recent debate between single and double materiality frameworks, there exists a research gap in empirical studies comparing the capital market consequences of these two different approaches. Existing literature has examined single-materiality nonfinancial disclosures, which have shaped much of the ESG investing landscape and underpinned the design of frameworks such as the United Kingdom (UK)’s Task Force on Climate-related Financial Disclosures (TCFD) or Sustainability Accounting Standards Board (SASB), which focused on informing stakeholders about financially material sustainability risks.

On the other hand, as double materiality has recently been introduced to the public, empirical studies exploring its market-based implications remain scarce. Very few studies have tested whether expanding the materiality scope from single to double meaningfully alters investor behavior or improves market functioning. As the difference between single and double materiality disclosures largely comes from the additionally provided impact materiality information, comparing the market consequences of two different types of materiality scope in

nonfinancial disclosures proposes a meaningful empirical question. The academic literature has yet to provide systematic evidence on whether double materiality disclosures offer a comparative advantage in resolving information asymmetries, reducing uncertainty, or increasing trading activity relative to single materiality disclosures.

Given the regulatory momentum behind sustainability disclosure mandates and the debate between different materiality logics, there exists a research gap in comparative empirical evidence. Without understanding whether and how differences in materiality scope influence investor behavior and market functioning, the evaluation of the effectiveness of emerging disclosure regimes will be limited. This research addresses this gap as a definable research problem and outlines the rationale for pursuing a forward-looking methodological study.

3. Problem Statement & Justification

3.1 Research Gap and Problem Definition

The difference between single and double materiality frameworks represents more than a semantic distinction; it reflects fundamentally different assumptions about the purpose of corporate reporting and who it is intended to serve. Single materiality, the foundation of frameworks like TCFD and SASB, focuses exclusively on financially material ESG risks to inform investors. In contrast, double materiality, institutionalized by the EU's Corporate Sustainability Reporting Directive (CSRD), incorporates both financial and impact materiality, requiring firms to disclose how sustainability issues affect their financial performance and how their operations affect society and the environment.

While prior literature has been paying attention to the adoption of both frameworks, how this distinction in materiality scope shapes capital market outcomes has not been studied extensively. Most studies center on voluntary disclosures and rarely distinguish between different underlying materiality logics. More importantly, few studies examine mandated disclosure regimes like the UK's TCFD or the EU's CSRD, let alone compare their effects. This lack of empirical clarity limits the ability of regulators, firms, and investors to assess the informational effectiveness of sustainability mandates and to understand how these regulations influence real investor behavior in capital markets. This thesis addresses that problem by posing a targeted research question: *“How can a study be designed to assess the impact of materiality scope in Nonfinancial Disclosures on equity market reactions as standardized sustainability reporting data becomes available?”* Specifically, the study proposes stock liquidity as a key outcome

variable for assessing how investors respond to disclosures based on different materiality frameworks.

3.2 Justification for a Methodology-Focused Study

The recent implementation of disclosure mandates like CSRD (January 2025) means that comprehensive firm-level ESG datasets under these new regulatory frameworks are not yet fully available. As a result, it is premature to conduct a robust, large-scale empirical study using finalized data. However, there exists an opportunity to lay the foundation for future empirical research by developing a clear methodological framework during this transitional period.

This thesis positions itself as a methodology paper, not to test final outcomes, but to define how such outcomes can be tested. By outlining a structured research design—including proposed theoretical framing, data sources, sample composition, dependent/independent/control variables, and empirical model—it supports future researchers and policymakers when evaluating the impact of single versus double materiality mandates once standardized datasets become available. In doing so, this paper bridges the gap between regulatory development and empirical validation.

3.3 Contribution

This thesis offers a forward-looking methodology to test whether broader disclosure scope - shifting from single to double materiality- leads to better-informed markets, as reflected in changes in stock liquidity. By proposing comparative designs of the empirical model, the paper supports the growing body of research on nonfinancial disclosures as targeted transparency regulation and its potential to improve market functioning through more stakeholder-inclusive sustainability disclosure practices.

4. Theoretical Framework

4.1 Modified Targeted Transparency Action Cycle

This study leverages Targeted Transparency Action Cycle (TTAC) as the central theoretical framework to explain how mandated sustainability nonfinancial disclosures, grounded in differing materiality scope- trigger behavioral responses among market participants. As discussed in the literature review, TTAC, developed by Fung, Graham, and Weil, presents a process-oriented model that outlines how information disclosure can be strategically designed to influence stakeholder decisions and institutional behavior. To analyze how mandated single materiality (e.g., the UK's TCFD-aligned rule) and double materiality disclosures (the EU's CSRD) impact equity market behavior, the study adopts TTAC to understand how the targeted transparency efforts through these disclosures influence investors, stakeholders, and firms to disclose standardized materiality information. The cycle consists of five stages, each of which plays an important role in shaping market outcomes:

- (1) Discloser's mandated information: Under regulatory reforms such as the UK's TCFD or the EU's CSRD, corporations, government agencies, or other organizations are mandated to disclose new information under a newly established targeted transparency policy. The scope of information provided would differ by their materiality scope - single materiality versus double materiality. These mandates represent targeted transparency efforts to influence investor behavior through increased availability of financial and impact materiality information.

- (2) User's Perceptions & Calculations: Stakeholders (investors, consumers, regulators, etc.) access the newly provided information and assess the relevance of newly disclosed risks, opportunities, and impact.
- (3) Users' actions/behavior: With new insights driven by new information, users adjust their trading behavior. These behavioral shifts manifest in observable market indicators like changes in stock liquidity. Thus, stock liquidity becomes a measurable proxy for how effectively the information has been assimilated and acted upon.
- (4) Discloser's perceptions & calculation: Firms monitor investor reactions to their disclosures to receive feedback on how the market values the disclosed information. Importantly, firms begin to recognize that comprehensive disclosures can generate reputational capital and financial benefits through improved investor and stakeholder relationships.
- (5) Discloser's responses/behavior: As a response, firms invest in incorporating feedback from the market and provide better disclosures to meet evolving stakeholder expectations. Over time, this can create a reinforcing loop where improved information quality can foster more informed markets and more sustainable corporate behavior.

While TTAC represents the full feedback cycle between disclosers and users, this study focuses primarily on the first three steps, from mandated information disclosure to users' actions/behavior. This scope aligns with the study's emphasis on market-based reactions, specifically the extent to which mandated sustainability disclosure influences investor trading activity, informational efficiency, price impact, and uncertainty. By capturing this dynamic through stock liquidity proxies such as Turnover Ratio, Zero Return, High-Low Spread of

Corwin and Schultz, and Amihud Illiquidity Ratio, the study evaluates the effectiveness of disclosure mandates in equity market functioning. This modified TTAC presents a theoretically grounded and empirically actionable framework that provides a rationale for using stock liquidity as a behavioral signal.

4.2 Information Asymmetry Theory

Information Asymmetry Theory suggests that firms with better disclosure and transparency in information will have a higher level of stock market liquidity (Utami *et al.*, 2020; Kurlat, 2018; Diamond and Verrecchia, 1991) and traders with more information impose adverse selection costs on those with less information (Glosten and Milgrom, 1985; Kyle, 1985). This study hypothesizes that the increased scope of materiality in double materiality nonfinancial disclosures better reduces the information asymmetry between internal and market investors, assisting investors in understanding the firm's performance in sustainability.

In the context of sustainability reporting, this theory suggests that broader and higher-quality disclosures can narrow the information asymmetry between corporate insiders and the public market investors. By providing more comprehensive data, firms help market participants to assess firm value and risk profiles more accurately. Especially, double materiality can go even further in reducing information asymmetry by providing impact materiality information that has been neglected in single materiality disclosures. This additional information set can present latent risks and externalities that are often overlooked in traditional financial reporting or single materiality nonfinancial disclosures, providing a more holistic view of firm value, allowing investors to make more confident and timely trading decisions.

The proposition of this study suggests that double materiality-based nonfinancial disclosures can lead to greater improvements in stock liquidity compared to single

materiality-based nonfinancial disclosures, as measured through liquidity proxies that capture the market's response to enhanced information environments.

4.3 Reputation Theory

Reputation and social capital are considered valuable assets that affect the long-term operations of a company (Cao *et al.*, 2024). Existing literature has shown that corporate reputation is essential in market liquidity provision (Battalio, 2007), and mandatory CSR regulation leads to improved social and reputational capital, thus improving the stock market liquidity of CSR firms and obtaining higher market valuations in the long term (Roy *et al.*, 2022). By disclosing financial materiality and stakeholder materiality information through double materiality disclosure, companies can build reputation capital that can enhance the trust of investors and stakeholders of the company, which can ultimately affect the level of stock liquidity due to increased stock attention.

In the context of sustainability reporting, mandatorily providing additional impact materiality information through double materiality disclosures, highlighting social and environmental consequences of a firm's activities, firms can signal their alignment with broader societal values and stakeholder expectations, providing a stronger foundation for reputation-building. This approach can enhance transparency not only for investors but also for customers, employees, regulators, and NGOs, building trust and improving firm reputation across multiple stakeholder groups beyond the shareholder base. Activating multiple trust-building channels and broadening the scope of reputational benefits through providing additional impact materiality information in double materiality disclosures can influence generating more significant improvements in stock liquidity. This thesis incorporates these

insights into its theoretical framework to explain why markets may react more favorably to double materiality disclosures.

4.4 Stakeholder Theory

Stakeholder theory explains that companies “spend time and resources” to engage with stakeholders (Freeman, 1984), which includes investors, employees, customers, communities, and NGOs (Krasodomska and Zarzycka, 2021). These stakeholders influence and are influenced by firms’ activities, and therefore, firms are expected to engage with and address their financial needs as part of long-term value creation.

By adopting a double materiality assessment, additional information on impact materiality in non-financial disclosures addresses the material interests of financial capital providers and all relevant stakeholders. The theory suggests that mutual understanding of stakeholder needs and expectations promotes transparency and accountability, thereby building trust by openly sharing information about the organization’s sustainability efforts (Dewi et al., 2023), and this can be realized by integrating impact materiality to expand the scope of reporting to capture broader societal and environmental implications of corporate behavior. Employing the stakeholder theory, this study’s framework suggests that double materiality nonfinancial disclosures can more directly address the informational needs of a broader set of stakeholders, including investors. Through increased visibility and perceived accountability, double materiality can foster internal stakeholder trust and external stakeholder recognition by addressing impact of the firm on stakeholders, thereby driving liquidity improvements from more meaningful stakeholder engagement.

4.5 From Disclosure Framework to Stock Liquidity

Together, the Targeted Transparency Action Cycle (TTAC) and the supporting theoretical frameworks provide a comprehensive explanation for how mandated sustainability disclosure can address persistent market failures in pricing long-term ESG-related risks. The Modified TTAC offers a process-oriented model in which targeted transparency policy compels firms to disclose information, users interpret that information and respond following a 4-step progression: (1) Targeted Transparency Policy, (2) Discloser's Mandated Information, (3) User's Perception & Calculation, (4) User's Actions & Behavior.

- (1) Targeted Transparency Policy: Mandated nonfinancial disclosure regulations represent targeted transparency efforts that aim to improve market functioning by increasing the availability of decision-relevant information. These regulations differ fundamentally according to their materiality frameworks - single or double.
- (2) Discloser's Mandated Information: The nature and scope of information disclosed differ by materiality framework in this step. Under single materiality, disclosures are limited to financial materiality, and under double materiality, disclosures encompass both financial materiality and impact materiality.
- (3) User's Perception and Calculation: Once disclosed, this information is processed and interpreted by market participants—including institutional investors, analysts, ESG data providers, and more, who integrate it into their decision-making. The following theories help explain this interpretive step:
 - (a) Information Asymmetry Theory: Broader disclosures —especially under double materiality—reduce uncertainty by revealing risk-relevant

information that might otherwise remain hidden, thereby enabling more informed trading activity

(b) Reputation Theory: Transparent, comprehensive reporting builds trust and credibility, attracting investor attention and signaling long-term firm value.

(c) Stakeholder Theory: Double materiality disclosures better meet the informational needs of a wide array of stakeholders, further enhancing transparency and engagement, increasing perceived accountability and market legitimacy.

(4) User's Actions / Behavior: In response to users adjust their trading behavior. This is where market response becomes observable:

(a) Increased Trading Activity, reflecting heightened investor engagement

(b) Reduced Uncertainty, as broader disclosure narrows the information gap

(c) Increased Information Efficiency, where prices more accurately incorporate firm values according to its financial and impact materiality information

(d) Reduced price impact, indicating smoother trade execution and better liquidity.

These mechanisms converge to improve market functioning, with stock liquidity serving as a measurable signal of how effectively the market is processing and reacting to mandated sustainability information. How these market response relates to the calculation of stock liquidity is further elaborated in the review of stock liquidity proxies in the variable construction section.

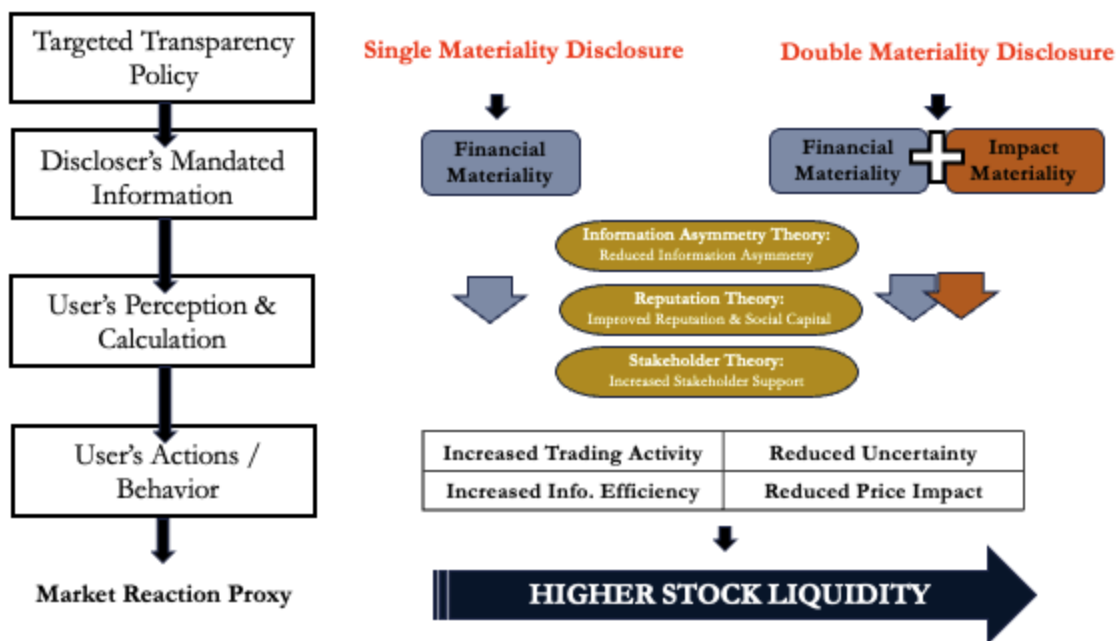


Figure B. Theoretical Framework

In doing so, disclosure becomes not merely a compliance exercise, but a tool to correct information-based inefficiencies in capital markets, bringing long-term ESG risks more accurately into asset pricing. This study leverages this theoretical framework to assess how differences in materiality scope translate into tangible differences in equity market behavior.

4.6 Research Propositions and Theoretical Expectations

Drawing on theoretical foundations outlined above, this thesis proposes two propositions regarding how equity markets will respond to mandated single and double materiality nonfinancial disclosure frameworks.

Proposition 1: *Mandated double materiality nonfinancial disclosures will lead to greater improvements in stock liquidity than disclosures based on single materiality.*

This proposition builds on the assumption that double materiality-based nonfinancial disclosures offer a broader and more stakeholder-inclusive information set, which will reduce information asymmetry and increase investor confidence through reputation and stakeholder support.

According to the TTAC, double materiality can provide a stronger information trigger that is more likely to result in investor behavior changes, such as increased trading activity and smoother price discovery, which can be measured through stock liquidity.

Proposition 2: *Firms with strong pre-existing ESG performance will experience larger liquidity improvements following both disclosure announcements, with the effect being more pronounced for mandated double materiality-based disclosures.*

Firms with strong existing ESG profiles are likely to be perceived more favorably when a broader and more stakeholder-inclusive information set is provided through mandated double materiality disclosures. Its enhanced transparency can amplify reputational capital and align with stakeholder expectations, which can result in greater investor trust and engagement.

These propositions inform the empirical methodology outlined in the following section, which specifies the design used to evaluate differences in market reaction.

5. Proposed Methodology

5.1 Research Design Overview

This thesis proposes a forward-looking research design to investigate how the scope of materiality in nonfinancial disclosures affects equity market reactions, particularly stock liquidity. Rather than presenting completed empirical results, the study develops a methodological design that can be implemented once comprehensive, standardized firm-level data becomes available, based on the theoretical framework reviewed in previous sections.

The research design is motivated by the difference in the scope of materiality information, single materiality, and double materiality disclosures. While both aim to enhance transparency by mandatorily requiring firms to disclose material sustainability information, single materiality disclosures present financial material risks where whereas double materiality presents both financial and impact materiality, addressing a broader set of stakeholders.

Guided by the Modified Targeted Transparency Action Cycle and supported by information asymmetry theory, reputation theory, and stakeholder theory, the design centers on how the scope of materiality in nonfinancial disclosures affects investor perception and behavior. Specifically, the study proposes to use stock liquidity as a market-based proxy for equity market reaction, which reflects changes in trading activity, informational efficiency, uncertainty, and price informativeness.

The methodological framework in this study incorporates within-firm comparisons (firms subject to both single and double materiality disclosures at different points in time) and between-group comparisons (firms disclosing under single materiality disclosure only and both single and double materiality disclosures) using panel regression and difference in differences

analysis. These proposed designs are intended to serve as a toolkit for future empirical research on nonfinancial disclosures' regulation.

5.2 Sample Composition and Data Collection

5.2.1 Nonfinancial Disclosure Selection Criteria

To examine the impact of disclosure scope on equity market reactions, this study proposes selecting mandated nonfinancial instead of voluntary nonfinancial disclosures. This ensures compatibility with the Targeted Transparency Action Cycle, which begins with the imposition of a disclosure mandate. All selected disclosures must also be publicly available, and the data should be standardized and comparable across firms and time. The study proposes the following criteria for selecting appropriate disclosure mandates in an empirical analysis:

- (1) The disclosure must be legally mandated by a regulatory body and is not a voluntary disclosure for firms
- (2) The disclosed information through the regulation must be public and standardized to facilitate consistent data collection and cross-firm comparison.
- (3) The disclosure regime must clearly reflect its materiality scope:
 - (a) Single materiality disclosure: Financial materiality only
 - (b) Double materiality disclosure: Financial materiality and Impact materiality
- (4) The single materiality disclosure must precede the double materiality disclosure, enabling temporal separation and staggered analysis

An example that satisfies these criteria would be the UK's Task Force on Climate-related Financial Disclosures (TCFD) for single materiality disclosure, which was mandated in April

2022, and the EU's Corporate Sustainability Reporting Directive (CSRD) for double materiality disclosure, with its first reports due in 2025.

5.2.2 Sample Firm Selection Criteria and Sample Composition

To operationalize the proposed methodology, the following sample firm selection criteria are recommended to allow both between-group comparisons and moderation analysis based on a firm's pre-existing ESG performance:

- (1) Firms must be publicly listed to ensure the availability of stock trading and financial data
- (2) Firms must have disclosed under the selected single materiality and double materiality disclosures, ideally at different points in time, with the single materiality disclosure adopted first and double materiality disclosure later for within-firm comparisons.
- (3) Firms must operate in jurisdictions where the following data are consistently available for the relevant time periods
 - (a) Daily or monthly stock trading and price data
 - (b) ESG performance score
 - (c) Firm-specific financial control variables are listed in the variable construction section

To enable empirical testing of Proposition 1, firms are classified into two groups based on the materiality scope adopted in a given fiscal year. The Treatment Group will consist of firms disclosing under double materiality disclosure, and the Control Group will be the firms disclosing under single materiality disclosure.

To test Proposition 2, the sample will incorporate a continuous measure of ESG performance, obtained prior to the disclosure event. This enables the estimation of interaction effects between the scope of materiality in nonfinancial disclosures and pre-existing ESG performance, allowing researchers to assess whether firms with stronger sustainability performance can have more pronounced stock liquidity improvements following disclosure, particularly under double materiality disclosure.

5.2.3 Data Collection

The thesis identifies the following data collection method to execute the proposed empirical model.

First, stock price and trading data are advised to be collected from Refinitiv Workspace and Datastream to construct multiple stock liquidity proxies, capturing different dimensions of liquidity. ESG Performance Data can be collected from Morgan Stanley Capital International (MSCI) ESG ratings, as it serves as a moderating variable in Proposition 2 analysis. The ESG Rating can be used to segment firms into high and low ESG Performers, as its component scores (Environmental, Social, and Governance) are each scaled 0-10 and allow for nuanced subgroup analysis. Firm-specific Financial data is recommended to be collected from S&P Capital IQ (CIQ) to collect data for control variables needed for both the panel-fixed effects model and the DiD framework. More details about stock liquidity proxies and independent/control variables will be provided in the following sections.

5.3 Variable Construction and Justification

5.3.1 Dependent Variable: Stock Liquidity

The dependent variable in this thesis is stock liquidity. Based on the established theoretical framework, enhanced information set through the adoption of double materiality

disclosure increases trading activity and informational efficiency while reducing uncertainty and price impact, which enables broader stakeholder engagement and prompts investor reassessment. Firm stock liquidity was selected as the dependent variable, as it offers the most immediate and quantifiable reflection of these market reactions through various stock liquidity proxies from prior literature.

There are three main reasons why stock liquidity was evaluated as an ideal market response variable in this paper's research framework.

First, liquidity is a direct manifestation of information assimilation. Based on the information asymmetry theory, providing materiality information in disclosures reduces adverse selection and facilitates trade. The increased scope of materiality information in double materiality disclosure is expected to provide broader and more stakeholder-relevant information, which will lead to reduced uncertainty for a wider investor base. This reduced uncertainty will enable the market to better understand a firm's true value or risk exposure, and we expect the firm's stock to trade more smoothly and frequently. Stock liquidity is a direct manifestation of this relationship as it captures the ease with which shares can be bought or sold without significantly affecting the stock price, reflecting both investor confidence and the availability of information to support investment decisions.

Second, stock liquidity is a real economic outcome with market and firm-level implications. Prior literature suggests that a firm's improved stock liquidity is associated with a lower cost of capital (Amihud *et al.*, 1986; Diamond *et al.*, 1991) and firm value (Fang *et al.*, 2009; Holmstrom *et al.*, 1993). These associations imply that stock liquidity has consequences for a firm's financial health and strategic flexibility. This will influence investor participation,

especially from institutional investors who are liquidity-sensitive, affecting price efficiency and overall market capital allocation.

Comparative analyses of market outcome variables further underscore why stock liquidity is a more suitable choice, as it offers a timely, quantifiable, and behaviorally grounded measure of market response, unlike other variables, which may be influenced by broader market noise or speculative sentiment. For instance, abnormal returns can measure the change in stock price post-disclosure, but they capture the perceived value, not the actual investor behavior as stock liquidity does by reflecting ongoing usability of the information in trading decisions. Abnormal returns can also be easily confounded by external events, which are not appropriate for this proposed methodology. Another potential dependent variable, the cost of capital, captures the long-term risk premium embedded in a firm's valuation; however, it relies on model-based assumptions and is sensitive to macroeconomic fluctuations, making it slower and less precise in capturing immediate market responses to improvement in the information environment through disclosure changes. ESG Scores and Ratings can be an evaluator for the perception of ESG performance, but are subjective and vary across providers, but most importantly not an investor behavior metric, which is not appropriate for the proposed study design. As such, stock liquidity serves as an appropriate dependent variable for the proposed methodology to measure real effects and an early signal of the effectiveness of nonfinancial disclosure regulation in market outcomes.

Since liquidity is not observed directly and multiple aspects of liquidity need to be captured through various measures to quantify liquidity, there has been a lot of effort in establishing liquidity or illiquidity measures in prior literature. These measures can be broadly classified into three categories: Volume-Based Measures, Transaction Cost-Based Measures, and

Price Impact-Based Measures. In this paper, stock liquidity as a dependent variable is proposed to be measured by four measures as described below. To ensure comparability and reduce the influence of outliers, all liquidity proxies are suggested to be winsorized at the 1st and 99th percentiles. Where appropriate, variables such as the Amihud illiquidity ratio and turnover can be log-transformed to address right-skewness. Because the proxies vary in scale and directionality, each should be analyzed separately, allowing the study to assess consistency in findings across different dimensions of stock liquidity (price impact, trading volume, and transaction frequency). No composite index is advised constructed to avoid masking proxy-specific effects.

5.3.1.1 Turnover Ratio (Volume-Based Measure)

The first liquidity measure used in this study's methodological framework is the Turnover Ratio, a volume-based measure defined as the number of traded shares divided by the number of shares outstanding (Le *et al.*, 2020). As shown in the formula, this metric directly captures the frequency and intensity of trading activity, which reflects how actively investors are engaging with a firm's equity.

$$Turnover_{it} = \frac{1}{D_{it}} \sum_{d=1}^{D_{it}} \frac{Vol_{idt}}{Shrout_{idt}}$$

The turnover ratio is widely used in empirical finance as a measure to capture breadth and depth characteristics of a market or an asset (Sarr and Lybek, 2002). In the context of this study, the turnover ratio provides an observable and intuitive signal of market reaction to the release of nonfinancial disclosure regulations. A higher turnover ratio indicates greater stock liquidity, and the difference between the scope of materiality information provided by two different disclosure requirements will be captured if valuable new information (specifically, impact materiality information in double materiality disclosures) prompts active trading.

While common measures in this category are trading volume and turnover ratio, this study uses the turnover ratio as one of the proxies to measure our dependent variable, stock liquidity. It is because the turnover ratio is considered to be more suitable to measure liquidity compared to trading volume in prior literature, since it accounts for a market capitalization of stocks (Gabrielsen *et al.*, 2011).

5.3.1.2 Zero Returns (Transaction-Cost Based Measure)

The second measure is a spread proxy suggested by Lesmond *et al.* (1999), which measures the stock's zero return days proportionate to the total trading days. Prior literature argues that zero return days occur when the transaction costs of trading outweigh the value of new information not yet contained in prices and choose not to trade, and therefore commonly serves as a proxy for stock liquidity in U.S. and other international settings (Goyenko *et al.*, 2006; Lesmond, 2005; Bekaert *et al.*, 2007). Specifically, Lesmond *et al.* argue that the higher the illiquidity of the stock, the higher will be the zero volume days (days with no stocks traded) and therefore higher zero return days. Additionally, when trading costs are high and it is not fully compensated by the gains from trading, investors who have private information are less likely to trade, which will lead to days with zero returns (Lesmond *et al.*, 1999). Since security with low transaction costs will have more frequent price movement and fewer zero returns than a security with high transaction costs, the proportion of zero return days in a period is used as a proxy for transaction cost-based liquidity measures (Le *et al.*, 2020).

In the context of comparing single versus double materiality disclosures, the Zero Returns proxy is particularly relevant because it captures the effect of the market's decision to trade based on perceived informational value. Since double materiality disclosure expands the scope of disclosed information to include impact materiality information, it is expected to reduce

uncertainty for a broader set of stakeholders. This will stimulate more frequent trading activity due to information asymmetry theory explained in previous sections, especially among investors who were previously sidelined due to the lack of stakeholder-focused data. As a result, firms affected by double materiality disclosures are expected to experience fewer zero-return days (higher stock liquidity) than under single materiality disclosures, making this measure a useful indicator of how comprehensive disclosure drives market engagement.

The Zero Returns measure is computed as the following equation.

$$Zeros_{i,t} = \frac{(ZRD)_{i,t}}{N_t}$$

In this formula, $(ZRD)_{i,t}$ is the total number of zero return days for firm i 's stock in year t , and N_t is the total number of trading days in year t , following the prior literature's adoption of the Zero Returns measure (Roy *et al.*, 2022; Bekaert *et al.*, 2007).

One limitation of this proxy is that days with zero returns may suggest other information related to the equity market in general instead of stock liquidity. For example, a market with larger stocks tends to have a lower level of zero return days observed. Additionally, no trading days can occur due to a lack of information flow (Bekaert *et al.*, 2007). To mitigate the risk of this measure, we combine it with other liquidity measures suggested below.

5.3.1.3 High-Low Spread of Corwin and Schultz (Transaction-Cost Based Measure)

Corwin and Schultz (2012) proposed a bid-ask spread proxy called the High-Low spread, which uses daily high and low prices. This measure is based on an assumption that a stock's daily high and low price is initiated by buyers and sellers, and therefore the daily high-low prices reflect both the stock's intraday volatilities and their bid-ask spreads (Corwin *et al.*, 2012).

Their argument states that "the sum of the price ranges over 2 consecutive single days reflects 2 days' volatility and one twice the spread, while the price ranges over one 2-day period

reflects 2 days' volatility and one spread." A big advantage of this measure is that it has a relatively low standard deviation in low-frequency data (Bleaney *et al.*, 2015).

The High-Low Spread is useful for distinguishing the effects of single versus double materiality disclosure because it can be estimated with a relatively short period of time, which is useful for event studies that incorporate changes in spreads and measure levels of information asymmetry over short intervals (Corwin *et al.*, 2012). (Corwin *et al.*, 2012). By comparing changes in this measure around the two disclosure events, we can assess whether single or double materiality disclosure more effectively improves informational efficiency in pricing.

The High-Low Spread is computed as the following equation.

$$Spread_{i,d} = \frac{2(e^{a_{i,d}} - 1)}{1 + e^{a_{i,d}}}$$

$$\text{where } a_{i,d} = \frac{\sqrt{2\beta_{i,d}} - \sqrt{\beta_{i,d}}}{3 - 2\sqrt{2}} - \sqrt{\frac{\gamma_{i,d}}{3 - 2\sqrt{2}}}$$

$$\beta_t = (h_{t+1} - l_{t+1})^2 + (h_t - l_t)^2$$

$$\gamma_i = (\max\{h_{t+1}, h_t\} - \min\{l_{t+1}, l_t\})^2$$

In this equation, $Spread_{i,d}$ is the High-Low spread of stock in day t , h_t and l_t are observed high and low stock prices in day t , respectively. We can calculate the High-Low spread for the sample of D days by averaging the above two-day estimator.

The limitation of this measure is that it requires adjustment for nontrading periods such as holidays and weekends, because it is based on the assumption that stock trades continuously while the market is open, and stock values do not change while the market is closed. However, since this study uses the measure to compute stock liquidity for a short period of time, the

measure was chosen as a proxy to measure the dependent variable of the proposed empirical methodology.

5.3.1.4 Amihud illiquidity ratio (Price-Impact Based Measure)

The Amihud illiquidity index (Amihud, 2022) has been studied to be the best measure for capturing low-frequency liquidity (Fong *et al.*, 2017; Zhang *et al.*, 2014; Marshall *et al.*, 2012; Goyenko *et al.*, 2009). The Amihud illiquidity index follows Albert S. Kyle's concept of illiquidity, the response of price to order flow (Kyle, 1985). Therefore, in this paper, stock illiquidity is the “average ratio of the daily absolute return to the (dollar) trading volume on that day,” representing the daily price response associated with one dollar of the trading volume. The Amihud illiquidity is measured through the following formula.

$$Amihud_{i,t} = Average(\frac{|r_{i,d}|}{Volume_{i,d}})$$

In this formula, $|r_{i,d}|$ is the absolute value of the return for firm i 's stock on day d , and $Volume_{i,d}$ is the volume of trade (number of stocks traded times price) for firm i on day d . The daily ratio is averaged throughout year t to obtain the annual Amihud illiquidity ratio (Roy *et al.*, 2022). Obtaining a larger Amihud ratio over the 3-day event window implies lower stock liquidity since illiquid stock prices tend to be more sensitive to trades.

One limitation of this measure is that it does not incorporate days without trading, which can contain important information about illiquidity (Le *et al.*, 2020). Using multiple liquidity proxies can mitigate this factor by capturing different aspects of market activity.

5.3.2 Independent Variables

This study includes two key independent variables in alignment with the theoretical framework and its research propositions.

First, a binary indicator variable is constructed to capture whether a firm discloses under double materiality disclosure or not in a given fiscal year. The variable will equal 1 if the firm's nonfinancial disclosure in year t reflects is double materiality disclosure and 0 if the firm disclosed only under single materiality disclosure. This independent variable will be used to test Proposition 1, which hypothesizes that double materiality nonfinancial disclosures will lead to greater improvements in stock liquidity than single materiality disclosures. It is used as the main treatment variable in both panel regression and the difference-in-differences model.

Second, to test Proposition 2, the study includes a measure of a firm's pre-existing ESG performance, collected from MSCI ESG ratings. The MSCI ESG score is composed of three components - Environmental, Social, and Governance - each rated on a 0 to 10 scale, with higher values indicating stronger performance. The variable can be included as a continuous variable or a categorical split (high v. low ESG performer groups). This variable will allow researchers to examine whether firms with stronger sustainability performance experience greater liquidity benefits after disclosures. It also supports interaction terms in regression models to identify moderating effects.

5.3.3 Control Variables

To ensure that the proposed empirical models can accurately isolate the effect of nonfinancial disclosure materiality scope on stock liquidity, this study advises including a set of control variables that capture firm-level, industry-level, and macroeconomic characteristics known to influence market liquidity. For example, existing literature has shown that large firms have higher stock liquidity due to "higher investor interest, higher trading frequency, and lower adverse selection (Gompers and Metrick, 2001; Harris, 1994), so we consider *Firm Size* as a control variable. Drawing on prior literature, we consider *Firm Duration* in this study since stock

characteristics display significant age interactions that account for considerable return differences (Bank *et al.*, 2021). Prior studies also suggest that firms with higher levels of information asymmetry rely more on debt capital, and therefore, its capital structure can influence stock market liquidity (Andres *et al.*, 2014; Myers and Majluf, 1984). This motivated the study to select *Leverage* and *Cash* as control variables. Prior literature also suggests that higher ownership concentration is associated with significantly lower stock liquidity since large shareholders are assumed to possess private information, contributing to information asymmetry (Prommin *et al.*, 2016). Therefore, we consider the *Degree of Equity Concentration* as a control variable. This paper also considers *CapEx* as a control variable, since studies suggest that a firm's tangibility is correlated with stock market liquidity since tangible assets' payoffs are more observable to investors (Pham *et al.* 2020; Chung *et al.*, 2010). *Stock volatility* was chosen as the control variable since prior literature shows that a higher level of institutional ownership should be associated with higher stock market liquidity (Gompers and Metrick, 2001), and stock return volatility positively correlates with stock market liquidity (Bail *et al.*, 2005). *Analyst* was also considered since studies have shown that firms with more analysts following the stock tend to have higher stock market liquidity due to higher trading activity, since they provide greater information efficiency in the market (Charitou *et al.*, 2019; Roulstone, 2003). These control variables will be sourced from databases S&P Capital IQ (CIQ) and Refinitiv, and incorporated in the suggested empirical models to strengthen the reliability and interpretability of future empirical findings.

Type	Variables	Characterization Methods
Dependent Variable	Stock Liquidity	Stock Liquidity over the 3-day event window

Explanatory Variable	ESG Performance Data pre-announcement	MSCI variable that scores from 0 to 10
Control Variables	Firm Size	Natural logarithm of the operating revenue scale (in billion) plus 1
	Firm Duration	Natural logarithm of the duration of existence in years plus 1
	Leverage	Total Book Value of Debt / Total Shareholders' Equity
	Cash	Sum of year-end cash and short term securities scaled by total sales
	Degree of Equity Concentration	Sum of the ownership percentage of the top ten shareholders (%)
	CapEx	Capital Expenditure scaled by total assets
	IO	Total percentage of share ownership by institutional investors
	Stock Volatility	Annual standard deviation of the daily stock returns
	Analyst	Number of analysts following the stock

5.4 Empirical Methodology Designs

5.4.1 Panel Fixed Effects Model

$$Liquidity = \beta_0 + \beta_1 DoubleMateriality + \beta_2 PriorYearESG + \beta_3 DoubleMateriality \times PriorYearESG + \sum \beta_j Controls_j + \epsilon$$

The first empirical strategy involves a firm-level panel fixed effects regression, which controls for unobserved, time-invariant heterogeneity across firms. This model allows researchers to estimate within-firm changes in stock liquidity as firms transition between single materiality and double materiality frameworks. The core specification includes a binary variable

indicating whether the firm disclosed under double materiality disclosure in a given year, the interaction term between this indicator and the firm's prior-year ESG performance score.

In the model, DoubleMateriality is stock liquidity for a firm at a given time, and DoubleMateriality refers to the binary indicator for double materiality disclosure. PriorYearESG refers to the ESG score in the year prior to disclosure.

This model allows for testing Proposition 1 by evaluating the average effect of double materiality disclosures on stock liquidity, and Proposition 2 by testing whether this effect is amplified for firms with stronger pre-existing ESG performance.

5.4.2 Difference in Differences (DiD) Model

$$Liquidity = \alpha + \beta_1 PostDisclosure + \beta_2 DoubleMaterialityGroup + \beta_3 PostDisclosure \times DoubleMaterialityGroup + \sum \beta_j Controls_j + \epsilon$$

In order to strengthen the causal inference, a difference-in-differences (DiD) model is also proposed in this study. This empirical model can compare changes in stock liquidity between a treatment group of firms adopting double materiality disclosures and a control group of firms disclosing under single materiality only, before and after the implementation of the disclosure. The interaction term between the treatment group and post-disclosure time indicator binary variable captures the causal effect of double materiality disclosure on stock liquidity.

In the model, PostDisclosure is a binary variable used as a time indicator, whether the observation occurs after the double materiality is implemented. DoubleMaterialityGroup is a binary variable utilized as a group indicator, showing whether a firm is in the treatment group or in the control group. α refers to the mean liquidity level for the control group in the pre-period.

5.4.3 Moderated DiD Model

$$\text{Liquidity} = \alpha + \beta_1 \text{PostDisclosure} + \beta_2 \text{DoubleMaterialityGroup} + \beta_3 \text{PostDisclosure} \times \text{DoubleMaterialityGroup} + \\ + \beta_4 \text{ESG} + \beta_5 \text{PostDisclosure} \times \text{DoubleMaterialityGroup} \times \text{ESG} + \sum \beta_j \text{Controls}_j + \epsilon$$

To incorporate ESG Performance as a moderator, the DiD model can be extended with a tripartite interaction term. This model can allow the estimation of heterogeneous treatment effects, capturing whether the impact of double materiality disclosure can be amplified for firms with stronger ESG performance.

6. Conclusion

This study has developed a forward-looking methodological framework to assess how the scope of materiality in mandated nonfinancial disclosures influences stock liquidity as a market-based indicator of equity market reaction by comparing single materiality and double materiality disclosures.

With the European Union's Corporate Sustainability Reporting Directive entering into force and other jurisdictions moving toward enhanced ESG disclosure requirements, we are entering a new phase of standardized mandatory sustainability reporting with a double materiality framework. These changes mark a critical shift in regulatory expectations and the information environment that investors rely on to make decisions.

Drawing on Targeted Transparency Action Cycle and supported by information asymmetry theory, reputation theory, and stakeholder theory, the study proposes a series of empirically testable propositions and designs that future researchers can utilize when standardized firm-level data becomes available in the future.

The primary contribution of the work lies in its dual offering of a conceptual framework and a set of practical empirical research designs. The thesis integrates multiple theories from prior literature with diverse liquidity proxies and panel-based estimation strategies, thereby providing a structured roadmap to evaluate the evolving relationship between sustainability reporting and market functioning.

While this thesis does not offer immediate empirical results, it lays the foundation for a new generation of research into the effectiveness of ESG disclosure regulation depending on the materiality framework it adopts. As global reporting evolves and data availability improves,

empirical validation of the hypotheses and models proposed here will be critical, as it can test the validity of current regulatory assumptions but also help shape more informed, transparent, and sustainable financial markets.

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