

# **Do social and environmental disclosures impact information asymmetry?**

## **Abstract**

We examine the impact of social and environmental disclosures (SEDs) on information asymmetry. Employing data from 145 banks from 2005 to 2021 across 19 European (EU) countries. Our findings reveal that both SEDs reduce information asymmetry by increasing market liquidity. We further find that the observed impact of such disclosures is more pronounced for banks operating in countries that pay high attention to human development.

**JEL classification:** G20, G21, G41

**Keywords:** Social disclosure, environmental disclosure, market liquidity, information asymmetry, European banks

## 1. Introduction

The association between corporate sustainability and financial markets has received massive attention recently (e.g., Del Gaudio et al., 2020; He et al., 2022; Jo et al., 2015). Corporations adopt responsible practices and disclose their commitment to sustainable development as awareness of the social and environmental impact on business growth (e.g., Scholtens, 2009; Islam et al., 2012). These disclosures provide useful non-financial information, impacting investment decisions and market dynamics. Meanwhile, market liquidity, the ease of buying or selling assets without significant price fluctuations, is critical to financial markets, affecting trading efficiency and investor confidence (Bertomeu et al., 2011; Cormier et al., 2011; Cui et al., 2023).

Although corporate disclosures' impact on financial markets has received considerable attention (e.g., Blankespoor et al., 2020; Christensen et al., 2021; Leuz & Wysocki, 2016; Loughran & McDonald, 2016), the impact of SEDs on market liquidity remains relatively underexplored. This paper fills this gap by investigating the association between SEDs and market liquidity in EU banks, given the sector's significance and influence on sustainable development (Elshandidy & Acheampong, 2021). We aim to shed light on how socially responsible practices improve market efficiency, addressing two key questions: How do SEDs in EU banks impact information asymmetry? Can improved market liquidity explain the reduction of information asymmetry through SEDs?

Our findings, based on 145 banks in 19 EU countries from 2005 to 2021, show that SEDs reduce information asymmetry by increasing market liquidity. Additionally, banks with a high Human Development Index (HDI) are incentivized to disclose more relevant SEDs reducing information asymmetry and increasing market liquidity. These findings withstand sensitivity tests. Our paper makes the following contributions. First, it focuses on EU banks, offering insights into the dynamics of SEDs and market liquidity within a specific industry that plays a pivotal role in financial intermediation. Second, we use text mining techniques to capture SEDs which improve the precision and objectivity of disclosure measurement. Third, we investigate the role of information asymmetry reduction in the association between SEDs and market liquidity. This offers a novel perspective on the underlying mechanisms driving liquidity improvements.

Investigating the association between SED and market liquidity provides a comprehensive view of the impact of disclosure beyond finance. Our findings are consistent with economic theory, emphasizing the influence of new information on economic agents' behavior. By implication, our findings provide guidance for banks' participation in SEDs and the potential benefits of improved market liquidity. Investors gain insights into the informational advantage of

investing in socially and environmentally responsible banks. Finally, disclosure requirements can be shaped by regulators and policymakers to promote transparency and sustainability, thereby contributing to more efficient and resilient financial markets. Subsequent sections of this paper will outline the literature review, methodology, and results.

## **2. Literature review**

Scholarly discourse presented by Diamond & Verrecchia (1991), emphasizes how increased disclosure reduces information asymmetry through two primary mechanisms. First, it broadens public access to comprehensive accounting data, making private information harder to access and more costly. This restricts the number of investors with access to privileged information, lowering the likelihood of trading with more informed counterparts. Second, greater transparency reduces investors' uncertainty including detailed reports on addressing environmental challenges, advocating social responsibility, and contributing to communities in SEDs. These disclosures provide information about a company's commitment to sustainability and stakeholder value.

Collectively, these mechanisms combined improve market liquidity by lowering the likelihood of uninformed investors inflating prices to mitigate potential losses when trading with better-informed parties (Leuz & Verrecchia, 2000). The bid-ask spread acts as a protective pricing mechanism in share transactions. Prior studies support these claims, demonstrating that voluntary disclosure improves market liquidity by reducing information asymmetry (e.g., Diamond & Verrecchia, 1991; Leuz & Verrecchia, 2000). Incorporating SEDs offers investors a more comprehensive and multidimensional information landscape, influencing their investment decisions and market dynamics.

Prior studies indicate that financial institutions, particularly EU banks, increasingly recognize the importance of SE responsibilities. This aligns with the findings of Cuadrado-Ballesteros et al. (2016), who show how improved corporate disclosures reduce information asymmetry and affect firms' cost of capital. Bertomeu et al. (2011) also emphasized the role of voluntary disclosures in reducing information asymmetry, emphasizing the importance of transparency in the financial sector, including SEDs. Financial institutions are increasingly aware that clients' failure to manage SE risks can impact their own operations. Cormier et al. (2011) report a link between non-financial disclosures and lower bid-ask spreads, implying less information asymmetry in financial markets. As reported by Islam et al. (2012), EU banks respond to stakeholder demands by incorporating environmental criteria into lending decisions to avoid

environmental risks. Scholtens (2009) also reports that some EU banks are offering specialized savings accounts to support social entrepreneurship and environmentally sustainable projects. These initiatives demonstrate banks' commitment to sustainability and their understanding of non-monetary values in savings and investments.

In summary, prior studies highlight the increasing awareness and actions of EU banks related to SE responsibilities, as they consider non-monetary values in their offerings, reflecting a broader societal shift toward sustainability and social impact (e.g., Bertomeu et al., 2011; Cormier et al., 2011; De la Cuesta-González et al., 2006; Islam et al., 2012; Scholtens, 2009).

### 3. Research Methodology

A systematic approach is employed using Datastream to gather an initial sample of 214 banks from Europe between 2005 and 2021. After data cleaning, we end up with a final sample of 145 banks leading to a total bank-year observation of 2,465. All variables are winsorized at 99% percentile. Following prior studies (e.g., Campbell et al., 2014; Elshandidy & Shrivies, 2016), we capture bank liquidity using three different measures. The first is the average relative spread percentage, computed as the division of the daily ask and bid price difference by the daily ask and bid price average, as per the following equation:

$$SPREAD = \frac{1}{Days} \sum_{d=1}^{Days} \frac{Ask-Bid}{\frac{Ask+Bid}{2}} \quad (1)$$

The second is *illiquidity ratio*, which is calculated as the mean of the daily ratio of the absolute value of stock return divided by dollar trading volume, as per the following equation:

$$ILLIQUIDITY = \frac{1}{Days} \sum_{d=1}^{Days} \frac{|stock\ return|}{Trading\ volume} \quad (2)$$

The third is the *share turnover ratio*, which is calculated by dividing the trading volume by the number of outstanding shares, as per the following equation:

$$TURNOVER = \frac{Trading\ volume}{Number\ of\ outstanding\ shares} \quad (3)$$

We developed a text-mining method to capture SED scores, as shown in Figure 1. We begin with a comprehensive list of SE wordlist compiled from various sources, including EU directives, the Global Reporting Initiative, and prior studies (e.g., Landrum & Ohsowski, 2018). We also manually read through 20 random annual reports based on their asset size. Next, following

Acheampong & Elshandidy (2021), we then refine the wordlist by using R to search 40 random annual reports and remove all unfound wordlists to get our final wordlist, which is then evaluated for validity and reliability.<sup>1</sup> Using our final wordlist, we create coding instruction using R packages (i.e., tm and quanteda) to search for statements reflecting wordlist in the annual reports. To deal with the large count of statements, we log-transform them and label them as SOC (social disclosure) or ENV (environmental disclosure) respectively.<sup>2</sup> Following prior studies (e.g., Campbel et al., 2014; Elshandidy & Acheampong, 2021), we employ the following controls: bank size (SIZE), leverage (LEV), profitability (ROE), earning volatility (VOL), corruption (CPI), OECD, regulatory quality (R-QLTY) and rule of law (R-LAW).

We employed the generalized method of moment (GMM), two-way fixed effects to investigate the impact of social and environmental disclosure on bank liquidity:

$$Liquidity_{it} = \beta_0 + \beta_1 Disc_{it} + \sum_{N=1}^{Nr} \beta_2 Ctrl_{it} + \varepsilon_{it} \quad (4)$$

where *Liquidity* refers to the three measures of liquidity (i.e., *SPREAD*, *ILLIQUIDITY*, and *TURNOVER*) for bank *i* in time *t*. *Disc* represents social (*SOC*) and environmental (*ENV*) disclosure score for bank *i* in time *t* captured using text-minning approach;  $\beta_2$  is the effect of both bank and country-level controls (*Ctrl<sub>it</sub>*) on liquidity.  $\varepsilon_{it}$  is the error term. All variables are described in Table 1.

#### 4. Results

Table 2 presents descriptive statistics. The mean (standard deviation) for SOC is 0.002(0.837), and for ENV is 0.010(1.021), indicating adequate SE disclosure by EU banks. The mean (standard deviation) for SPREAD, ILLIQUIDITY, and TURNOVER are 0.643 (0.713), 0.164 (0.351), and

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<sup>1</sup>Our final keywords for social disclosure (advocate, community, corruption, diversity, equality, ethic, employee, labour, media, policy, network, integrity, renumerate, safety, survey, team, opportunity, wellbeing, security, performance, monitor). Environmental disclosure (biodiversity, carbon, chemical, disposal, ecology, energy, emission, fuel, green, hazard, recycle, waste, water, plant, renewable, air, climate).

<sup>2</sup> We examine the degree to which our wordlist reflect the business around social and environmental sustainability by randomly selecting forty statements from R output for 20 banks. Our examination reveals that the sustainability measures are successful in identifying statements that portray both social and environmental sustainability (i.e., 79% on average). In addition, we used Cronbach alpha to statistically test the reliability of our text-based measures, the results revealed alpha to be 85.2%. These indicate that our SED scores capture the significant underlying construct of sustainability and therefore make them reliable measures.

0.323 (0.121), indicating significant variation. It is 5.726 (3.332) for bank size. The mean of leverage and ROE reflects more debt financing and profitability among EU banks.

Table 3 aligns with our expectation reporting significant and negative association between SED and all liquidity measures at  $p$ -values = 0.000. This suggests that EU banks disclose relevant information about their SE activities which likely increases market liquidity by reducing information asymmetry. Simply put, the market is rewarding for banks that disclose information about their sustainability activities. The economic impact of these findings indicates that a one percent increase in ENV results in 0.587, 0.059, and 0.010 fall in *SPREAD*, *ILLIQUIDITY*, and *TURNOVER* respectively.

The degree of SED within the annual reports signals market confidence and attracts investors consistent with prior studies (e.g., Bertomeu et al., 2011; Cormier et al., 2011; Cuadrado-Ballesteros et al., 2016). Turning to the controls, increased earnings volatility is positive and significantly associated with reduced market liquidity, reflecting rising information asymmetry. Profitability enhances market liquidity. In contrast with our expectation bank size shows no statistical significance with all liquidity measures for both SEDs. Turning to the country variables, banks operating in countries with improved regulatory quality experience improvement in their market liquidity.

Table 3 reveals, as expected, significant negative associations between SED and all liquidity measures among EU banks ( $p$ -value = 0.000). This suggests that disclosing information about SE activities improves market liquidity by reducing information asymmetry, rewarding banks for reporting on sustainability. A 1% increase in ENV reduces *SPREAD*, *ILLIQUIDITY*, and *TURNOVER* by 0.587, 0.059, and 0.010, respectively. A high SED creates market confidence and attracts investors. This is complemented by prior studies (e.g., Bertomeu et al., 2011; Cormier et al., 2011; Cuadrado-Ballesteros et al., 2016). Increased earnings volatility is positively and significantly associated with decreased market liquidity, reflecting rising information asymmetry. Profitability helps to increase market liquidity. In contrast with our expectations, bank size is not statistically significant with all liquidity measures for SED. Based on the country controls, banks existing in well-regulated countries experience improved market liquidity.

In a further analysis, we investigate the moderating role of HDI on the existing association between SED and market liquidity.<sup>3</sup> Table 4 shows that SEDs have a significant and negative

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<sup>3</sup> The HDI, introduced by the United Nations in 1990, assesses overall well-being in addition to economic indicators. It includes health, education, and living standards, and provides a normalized score ranging from 0 to 1. Greater

association with market liquidity. HDI has a negative association with these disclosures as well. Importantly, the interaction terms (SOC\*HDI and ENV\*HDI) maintain significant and negative associations with market liquidity, implying that banks with more SED existing in high-HDI countries improve liquidity by reducing information asymmetry. In terms of SPREAD, ILLIQUIDITY, and TURNOVER, HDI reduces information asymmetry by 0.3%, 0.01%, and 0.3% for social disclosure and 1.5%, 0.4%, and 0.2% for environmental disclosure. Although these impacts appear small, they can have a significant impact on individual banks, reinforcing the negative association between SED and market liquidity. Table 5 report results for multilevel analysis estimating the following model.<sup>4</sup>

$$Liquidity_{jit} = \beta_{0it} + \beta_t J_{jit} + \sum_{N=1}^{Nr} \beta_{nr} \chi^{bv}_{jit} + \sum_{N=1}^{Nc} \beta_{cr} \chi^{cv}_{jit} + \varepsilon_{jit} + a_{jit} \quad (5)$$

We find a strong negative association (p-value 0.000) between ENV and market liquidity measures, indicating the significant impact of environmental information in reducing information asymmetry and boosting stakeholder confidence (e.g., Bertomeu et al., 2011; Cormier et al., 2011). We observe 45% (i.e., 37% intercept and 8% in time) of the variation in SPREAD is between the banks over time and 55% at the country level (within banks). Similar trends are observed for SOC, reaffirming consistency with GMM results.

## 5. Conclusion

Our study explores how SED impact market liquidity. Our findings reveal that SED improves liquidity by reducing information asymmetry between insiders and stakeholders. Also, higher HDI countries experience a greater reduction in information asymmetry as SED increases. These findings have far-reaching implications for regulators. Recognizing SED's role in improving market liquidity and reducing information asymmetry is critical. To create a fairer, more efficient

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human development is represented by higher values, which guide international comparisons and policy decisions (Resce, 2021).

<sup>4</sup> Multilevel analysis offers a highly adaptable and potent toolkit for addressing hierarchical data, encompassing model design and hypothesis testing. Moreover, from a statistical perspective, it has been demonstrated to be more accurate (Robinson, 2003) and intellectually enriching. The ML captures the within and between effects for SEDs on market liquidity as data is nested across different layers where we have banks that are nested across countries (i.e., 19 countries) over 17-year period (i.e., 2005-2021).

marketplace and to foster trust and integrity in the financial sector, regulators should consider strengthening reporting standards for SED and offering incentives for transparent SED practices. The impact of SED on market liquidity varies by country, as reflected in the HDI, with countries prioritizing social and economic development experiencing a more pronounced positive impact from SEDs. This emphasizes the importance of aligning national development strategies with social and environmental concerns, as well as promoting an equitable and efficient financial landscape.

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**Table 1:** Variables description

| Variable    | Description                                                                                                                                                                                                                                                                                        | Source               |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| SPREAD      | $Bid-Ask\ Spread = \frac{1}{Days} \sum_{d=1}^{Days} \frac{Ask-Bid}{\frac{Ask+Bid}{2}}$                                                                                                                                                                                                             | Authors' computation |
| ILLIQUIDITY | $Illiquidity = \frac{1}{Days} \sum_{d=1}^{Days} \frac{ stock\ return }{Trading\ volume}$                                                                                                                                                                                                           | Authors' computation |
| TURNOVER    | $Share\ turnover = \frac{Trading\ volume}{Number\ of\ outstanding\ shares}$                                                                                                                                                                                                                        | Authors' computation |
| SOC         | Natural logarithm of the total number of social sustainability disclosure in the narrative sections of annual report for bank <i>i</i> in year <i>t</i> based on final social keywords identified through EU directives, GRI standard, sustainability reports, and prior literature.               | Authors' computation |
| ENV         | Natural logarithm of the total number of environmental sustainability disclosure in the narrative sections of annual report for bank <i>i</i> in year <i>t</i> based on final environmental keywords identified through EU directives, GRI standard, sustainability reports, and prior literature. | Authors' computation |
| SIZE        | Natural logarithm of total assets                                                                                                                                                                                                                                                                  | Authors' computation |

|        |                                                                                           |                                                     |
|--------|-------------------------------------------------------------------------------------------|-----------------------------------------------------|
| LEV    | Total debts scaled by total assets                                                        | DataStream Eikon                                    |
| ROE    | Return on equity                                                                          | DataStream Eikon                                    |
| VOL    | Standard deviation of bank <i>i</i> return on assets for the previous five years.         | Authors' computation                                |
| CPI    | Corruption perception index (10 – TI)                                                     | Transparency International and authors' computation |
| OECD   | Dummy variable: 1 if bank is OECD member, and 0 if otherwise                              | Authors' computation                                |
| R-QLTY | Regulatory quality                                                                        | World Bank                                          |
| R-LAW  | Measure of legal protection of minority shareholders from expropriation by firm insiders. | Authors' computation                                |

**Table 2:** Descriptive Statistics

|             | Obs.  | 1st Qu. | 3rd Qu. | Mean   | Median | Std. Dev. |
|-------------|-------|---------|---------|--------|--------|-----------|
| SPREAD      | 2,465 | 0.1664  | 1.1431  | 0.6432 | 0.6358 | 0.7131    |
| ILLIQUIDITY | 2,465 | -0.0693 | 0.4056  | 0.1645 | 0.1580 | 0.3506    |
| TURNOVER    | 2,465 | 0.2404  | 0.4063  | 0.3227 | 0.3244 | 0.1214    |
| SOC         | 2,465 | -0.4135 | 0.4745  | 0.0021 | 0.0019 | 0.8372    |
| ENV         | 2,465 | -0.6197 | 0.6348  | 0.0082 | 0.0231 | 1.0214    |
| SIZE        | 2,465 | 5.7830  | 7.8370  | 5.7260 | 7.0910 | 3.3318    |
| LEV         | 2,465 | 0.4025  | 0.8537  | 0.5385 | 0.7757 | 0.7109    |
| ROE         | 2,465 | 0.7833  | 11.500  | 6.7349 | 6.4400 | 7.6237    |
| VOL         | 2,465 | 0.0147  | 0.1100  | 0.1044 | 0.0365 | 0.4874    |
| CPI         | 2,465 | 1.0000  | 3.1000  | 2.2220 | 1.5000 | 1.8568    |
| OECD        | 2,465 | 1.0000  | 1.0000  | 0.8048 | 1.0000 | 0.5574    |
| R-QLTY      | 2,465 | 0.6460  | 1.6230  | 1.0020 | 1.2170 | 0.8120    |
| R-LAW       | 2,465 | 0.2751  | 1.8738  | 0.9535 | 1.4268 | 1.0207    |

**NB:** This table presents the descriptive statistics of all the variables employed in the analysis. All variables are winsorized at the 99<sup>th</sup> percentile. Table 1 describes all the variables.

**Table 3:** The impact of social and environmental disclosure on market liquidity

|               | <b>Panel A</b>          |                      |                      | <b>Panel B</b>          |                      |                      |
|---------------|-------------------------|----------------------|----------------------|-------------------------|----------------------|----------------------|
|               | <i>Market Liquidity</i> |                      |                      | <i>Market Liquidity</i> |                      |                      |
|               | SPREAD                  | ILLIQUIDITY          | TURNOVER             | SPREAD                  | ILLIQUIDITY          | TURNOVER             |
| SOC           |                         |                      |                      | -0.773***<br>(0.000)    | -0.227***<br>(0.000) | -0.136***<br>(0.000) |
| ENV           | -0.824***<br>(0.000)    | -0.169***<br>(0.000) | -0.051***<br>(0.000) |                         |                      |                      |
| SIZE          | -0.023<br>(0.280)       | 0.030<br>(0.184)     | -0.018<br>(0.818)    | -0.004<br>(0.937)       | 0.031<br>(0.215)     | 0.007<br>(0.325)     |
| LEV           | 0.256***<br>(0.000)     | 0.086**<br>(0.040)   | 0.003<br>(0.831)     | -0.386**<br>(0.020)     | -0.074**<br>(0.023)  | -0.084***<br>(0.000) |
| ROE           | -0.019***<br>(0.000)    | -0.010***<br>(0.000) | -0.020**<br>(0.013)  | -0.063***<br>(0.000)    | -0.011***<br>(0.000) | -0.010***<br>(0.000) |
| VOL           | 0.972***<br>(0.000)     | 0.235***<br>(0.000)  | 0.064***<br>(0.000)  | 0.601***<br>(0.000)     | 0.221***<br>(0.000)  | 0.121***<br>(0.000)  |
| LOSS          | -0.002<br>(0.955)       | 0.051<br>(0.215)     | -0.001<br>(0.793)    | 0.229**<br>(0.018)      | 0.158***<br>(0.000)  | 0.052**<br>(0.024)   |
| CPI           | 0.023<br>(0.397)        | -0.001<br>(0.971)    | -0.011<br>(0.170)    | 0.107*<br>(0.094)       | 0.025<br>(0.343)     | 0.033***<br>(0.003)  |
| OECD          | 0.162**<br>(0.016)      | 0.060<br>(1.792)     | 0.019<br>(0.333)     | -0.021<br>(0.871)       | 0.033<br>(0.423)     | 0.005<br>(0.781)     |
| R-QLTY        | 0.025<br>(0.331)        | 0.002*<br>(0.071)    | -0.003<br>(0.667)    | 0.232***<br>(0.001)     | 0.071***<br>(0.006)  | 0.039***<br>(0.001)  |
| R-LAW         | -0.107<br>(0.137)       | 0.056<br>(0.447)     | 0.020<br>(0.400)     | -0.041<br>(0.777)       | 0.068<br>(0.363)     | 0.041*<br>(0.094)    |
| Sargan Chisq. | 124.86*                 | 124.86*              | 122.13**             | 121.46                  | 118.52*              | 118.71*              |
| Wald Chisq.   | 265.42***               | 265.42***            | 228.22***            | 72.97*                  | 48.76**              | 78.38**              |
| Year FE       | YES                     | YES                  | YES                  | YES                     | YES                  | YES                  |
| Observations  | 2,465                   | 2,465                | 2,465                | 2,465                   | 2,465                | 2,465                |

**NB:** This table presents the results for the impact of social and environmental disclosure on market liquidity using GMM two-way fixed effects. Panel A and B are results for social and environmental disclosure respectively. \*, \*\*, \*\*\* denote statistical significance at 10%, 5% and 1% respectively. All variables are described in Table 1.

**Table 4:** The impact of social and environmental disclosure on market liquidity: the moderating role of Human Development Index

|               | Panel A                 |                      |                      | Panel B                 |                      |                       |
|---------------|-------------------------|----------------------|----------------------|-------------------------|----------------------|-----------------------|
|               | <i>Market Liquidity</i> |                      |                      | <i>Market Liquidity</i> |                      |                       |
|               | SPREAD                  | ILLIQUIDITY          | TURNOVER             | SPREAD                  | ILLIQUIDITY          | TURNOVER              |
| SOC           |                         |                      |                      | -1.107***<br>(0.000)    | -0.473***<br>(0.000) | -0.1566***<br>(0.000) |
| SOC*HDI       |                         |                      |                      | 0.005<br>(0.604)        | 0.015<br>(0.108)     | -0.030**<br>(0.048)   |
| ENV           | -0.436***<br>(0.000)    | -0.371***<br>(0.000) | -0.057***<br>(0.000) |                         |                      |                       |
| ENV*HDI       | -0.021*<br>(0.090)      | -0.011***<br>(0.004) | 0.014<br>(0.478)     |                         |                      |                       |
| SIZE          | 0.003<br>(0.824)        | -0.010*<br>(0.074)   | 0.024<br>(0.271)     | 0.007<br>(0.592)        | 0.001<br>(0.890)     | 0.004*<br>(0.071)     |
| LEV           | -0.201***<br>(0.000)    | 0.039**<br>(0.043)   | -0.033***<br>(0.008) | -0.470***<br>(0.000)    | -0.188***<br>(0.000) | -0.073***<br>(0.000)  |
| ROE           | -0.020***<br>(0.000)    | 0.009***<br>(0.000)  | -0.003***<br>(0.000) | -0.057***<br>(0.000)    | -0.020***<br>(0.000) | -0.007***<br>(0.000)  |
| VOL           | -0.463*<br>(0.063)      | -0.644***<br>(0.000) | -0.059***<br>(0.000) | 0.589***<br>(0.000)     | 0.273***<br>(0.000)  | 0.082***<br>(0.000)   |
| LOSS          | -0.007<br>(0.790)       | -0.072***<br>(0.000) | -0.005<br>(0.914)    | 0.336***<br>(0.000)     | 0.146***<br>(0.000)  | 0.046***<br>(0.000)   |
| CPI           | -0.034*<br>(0.084)      | 0.068***<br>(0.000)  | -0.011***<br>(0.002) | -0.222***<br>(0.000)    | -0.103***<br>(0.000) | -0.035***<br>(0.000)  |
| OECD          | -0.115***<br>(0.000)    | -0.051***<br>(0.000) | -0.001<br>(0.990)    | -0.059<br>(0.118)       | -0.007<br>(0.693)    | 0.009<br>(0.220)      |
| R-QLTY        | 0.021<br>(0.608)        | -0.131***<br>(0.000) | 0.014**<br>(0.048)   | 0.364***<br>(0.000)     | 0.185***<br>(0.000)  | 0.059***<br>(0.000)   |
| R-LAW         | 0.135***<br>(0.001)     | -0.102***<br>(0.000) | 0.048<br>(0.529)     | 0.464***<br>(0.000)     | 0.177***<br>(0.000)  | 0.045***<br>(0.000)   |
| HDI           | -0.105**<br>(0.016)     | 0.204***<br>(0.000)  | -0.019**<br>(0.012)  | -0.361***<br>(0.000)    | -0.175***<br>(0.000) | -0.046***<br>(0.000)  |
| Sargan Chisq. | 124.86*                 | 124.86*              | 122.13**             | 121.46                  | 118.52*              | 118.71*               |
| Wald Chisq.   | 265.42***               | 265.42***            | 228.22***            | 72.97*                  | 48.76**              | 78.38**               |
| Year FE       | YES                     | YES                  | YES                  | YES                     | YES                  | YES                   |
| Observations  | 2,465                   | 2,465                | 2,465                | 2,465                   | 2,465                | 2,465                 |

**NB:** This table presents the results for the moderating role of the Human Development Index on the association between social and environmental disclosure on market liquidity using GMM two-way fixed effects. Panel A and B are results for social and environmental disclosure respectively. \*, \*\*, \*\*\* denote statistical significance at 10%, 5% and 1% respectively. All variables are described in Table 1.

**Table 5:** The impact of social and environmental disclosure on market liquidity: a multilevel analysis

|                         | <b>Panel A</b>          |                      |                      | <b>Panel B</b>          |                      |                      |
|-------------------------|-------------------------|----------------------|----------------------|-------------------------|----------------------|----------------------|
|                         | <i>Market Liquidity</i> |                      |                      | <i>Market Liquidity</i> |                      |                      |
|                         | SPREAD                  | ILLIQUIDITY          | TURNOVER             | SPREAD                  | ILLIQUIDITY          | TURNOVER             |
| SOC                     |                         |                      |                      | -1.156***<br>(0.000)    | -0.527***<br>(0.000) | -0.173***<br>(0.000) |
| SOC*HDI                 |                         |                      |                      | 0.011<br>(0.558)        | -0.018*<br>(0.081)   | -0.035**<br>(0.041)  |
| ENV                     | -0.437***<br>(0.000)    | -0.372***<br>(0.000) | -0.057***<br>(0.000) |                         |                      |                      |
| ENV*HDI                 | -0.021*<br>(0.019)      | -0.010***<br>(0.004) | -0.001<br>(0.078)    |                         |                      |                      |
| SIZE                    | 0.030<br>(0.806)        | -0.010**<br>(0.032)  | 0.003<br>(0.256)     | 0.010<br>(0.502)        | 0.010<br>(0.883)     | 0.005*<br>(0.066)    |
| LEV                     | -0.201***<br>(0.000)    | 0.044***<br>(0.006)  | -0.035***<br>(0.000) | -0.488***<br>(0.000)    | -0.206***<br>(0.006) | -0.080***<br>(0.000) |
| ROE                     | -0.020***<br>(0.000)    | 0.010***<br>(0.000)  | -0.009***<br>(0.004) | -0.059***<br>(0.000)    | -0.022***<br>(0.000) | -0.008***<br>(0.000) |
| VOL                     | -0.465***<br>(0.000)    | -0.651***<br>(0.000) | -0.057***<br>(0.000) | 0.613**<br>(0.040)      | 0.301**<br>(0.035)   | 0.091**<br>(0.043)   |
| LOSS                    | -0.010<br>(0.821)       | -0.075***<br>(0.000) | 0.003<br>(0.992)     | 0.354**<br>(0.034)      | 0.163***<br>(0.000)  | 0.051***<br>(0.000)  |
| CPI                     | -0.035*<br>(0.087)      | 0.072***<br>(0.000)  | -0.019**<br>(0.016)  | -0.234***<br>(0.000)    | -0.116*<br>(0.072)   | -0.038***<br>(0.000) |
| OECD                    | -0.115**<br>(0.010)     | -0.053***<br>(0.000) | 0.001<br>(0.990)     | -0.061<br>(0.118)       | -0.008<br>(0.676)    | 0.010<br>(0.223)     |
| R-QLTY                  | 0.022<br>(0.597)        | -0.137***<br>(0.000) | 0.016**<br>(0.027)   | 0.380***<br>(0.000)     | 0.201***<br>(0.000)  | 0.066***<br>(0.000)  |
| R-LAW                   | 0.134**<br>(0.020)      | -0.101***<br>(0.000) | 0.015<br>(0.459)     | 0.477***<br>(0.000)     | 0.199***<br>(0.000)  | 0.051***<br>(0.000)  |
| HDI                     | -0.106**<br>(0.017)     | 0.211***<br>(0.000)  | -0.022***<br>(0.005) | -0.379***<br>(0.000)    | -0.199***<br>(0.000) | -0.052***<br>(0.000) |
| Intercept               | 2.356<br>(0.653)        | 4.044**<br>(0.013)   | -0.420*<br>(0.065)   | -7.700<br>(0.186)       | -8.372***<br>(0.004) | -1.634*<br>(0.098)   |
| Time                    | 0.009***<br>(0.000)     | 0.011***<br>(0.003)  | 0.081**<br>(0.001)   | 0.042**<br>(0.019)      | 0.088***<br>(0.003)  | 0.010***<br>(0.005)  |
| Year fixed effect       | YES                     | YES                  | YES                  | YES                     | YES                  | YES                  |
| <b>Random Effects</b>   |                         |                      |                      |                         |                      |                      |
| $\sigma^2$ (Repeated)   | 0.55                    | 0.55                 | 0.56                 | 0.60                    | 0.53                 | 0.54                 |
| $\tau_{00}$ (intercept) | 0.37                    | 0.34                 | 0.32                 | 0.30                    | 0.34                 | 0.34                 |
| $\tau_{11}$ (time)      | 0.08                    | 0.11                 | 0.12                 | 0.10                    | 0.13                 | 0.12                 |
| ICC                     | 30%                     | 28%                  | 27%                  | 31%                     | 29%                  | 28%                  |
| <b>Model-fit stats.</b> |                         |                      |                      |                         |                      |                      |
| Adjusted R <sup>2</sup> | 18%                     | 19%                  | 19%                  | 19%                     | 21%                  | 21%                  |
| AIC                     | 4777                    | -874                 | -3626                | 5345                    | 1888                 | 3325                 |
| BIC                     | 4881                    | -768                 | -3521                | 5450                    | 1993                 | 3220                 |
| Observations            | 2,465                   | 2,465                | 2,465                | 2,465                   | 2,465                | 2,465                |

**NB:** This table presents the results for the moderating role of the Human Development Index on the association between social and environmental disclosure on market liquidity using multi-level analysis. Panel A and B are results for social and environmental disclosure respectively. \*, \*\*, \*\*\* denote statistical significance at 10%, 5% and 1% respectively. All variables are described in Table 1.

**Figure 1.** Text-mining steps of measuring social and environmental disclosures for European banks.

