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Abstract

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ABSTRACT

We compile a novel dataset on mandatory environmental, social, and governance (ESG) disclosure around the world to analyze the stock liquidity effects of such disclosure mandates. We document a significant positive effect of ESG disclosure mandates on firm-level stock liquidity. The effects are strongest if the disclosure requirements are implemented by government institutions—not on a comply-or-explain basis—and coupled with strong enforcement by informal institutions. Firms with weaker information environments benefit the most from ESG disclosure mandates. The findings are robust to different estimation methods and concerns related to the staggered introduction of the disclosure mandates. Our results support the view that ESG disclosure regulation improves the information environment and has beneficial capital market effects.

Keywords: Sustainability reporting; ESG reporting; Nonfinancial information; stock liquidity

JEL Classification: G14; G15; G18; G32; G38

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1. Introduction

Environmental, social, and governance (ESG) considerations have become increasingly important for investment decisions. Yet investors frequently complain that the availability and quality of firm-level ESG disclosures are insufficient to make informed investment decisions (Ilhan et al. [2022]). In response to the gap between the demand for ESG information by investors and the supply of such information by firms, several countries have initiated *mandatory* ESG disclosure regulations to force firms to disclose high-quality information on ESG issues either jointly with traditional financial disclosures or in specialized standalone reports. In addition to these country-level initiatives, there are significant efforts at the global level to design, harmonize, and eventually mandate international ESG disclosure standards.[1]

In this paper, we compile a novel and comprehensive dataset on mandatory ESG disclosure regulations around the world and analyze how such disclosure rules affect firm-level stock liquidity. ESG disclosure rules may affect many firm-level outcomes, but our focus on stock liquidity is motivated by several considerations. First, liquidity is a first-order stock characteristic that is of importance for investors, firms, and regulators because it affects real and financial outcomes (e.g., Amihud and Levi [2022] for recent evidence).[2] Second, measures of stock liquidity are easily available and comparable across countries. Our measures include the bid-ask spread, Amihud's [2002] price impact measure, the fraction of trading days with zero returns, and a

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[1] Most recently, the International Sustainability Standards Board (ISSB), established in 2021 by the International Financial Reporting Standards (IFRS) Foundation, launched a first set of proposals on ESG reporting standards with a focus on broad sustainability issues and climate disclosures. Emanuel Faber, chair of the ISSB, motivated the proposals by stating that "[the] problem in today's market is that companies can make claims that nobody can verify." He concludes that this "makes it extremely difficult for people making capital allocation decisions" (Pavoni [2022]).
[2] Following the seminal work of Amihud and Mendelson [1986], many studies have analyzed the determinants and consequences of stock liquidity. For example, Amihud et al. [2015] provide evidence for a significant pricing effect of liquidity in an international sample.

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summary measure derived from the common factor of the individual proxies. Third, stock liquidity is a prime outcome variable in the literature on *financial* disclosure mandates (e.g., Daske et al. [2008]), which allows us to compare the relative magnitudes of the effects of financial and nonfinancial disclosure rules. Fourth, by focusing on one specific consequence, we can examine rich cross-country heterogeneities in depth in our global sample. Finally, as stressed by Christensen, Hail, and Leuz [2021] in their review of the ESG disclosure literature, "[the] relatively low number of studies on liquidity effects is surprising considering that market liquidity has been shown to be very responsive to corporate disclosures and it is probably one of the capital-market outcomes that we understand the best (see Leuz and Wysocki [2016])."

After matching the different data sources, our analysis uses a panel of 136,269 firm-year observations covering 17,680 unique firms across 65 countries. We identify 35 countries that introduced ESG disclosure mandates during our sample period between 2002 and 2020, including Australia (2003), China (2008), South Africa (2010), and the United Kingdom (2013). Twenty-two countries implemented comprehensive mandatory ESG disclosure all at once, while the remaining 13 countries introduced E, S, and G disclosure one by one.[3]

The effect of mandatory ESG disclosure on stock liquidity is unclear *ex ante*. One view holds that the introduction of such regulation improves liquidity by reducing information asymmetry about firm fundamentals, which should in turn mitigate adverse selection problems and improve secondary market liquidity. However, it can also be argued that disclosure mandates covering ESG topics do not have such effects, either because nonfinancial information is too complex, broad, unstructured, and qualitative, or because it is not financially material. In addition, there may be a

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[3] We assume that mandatory ESG disclosure has been introduced once disclosure encompassing all three topics is required. This assumption implies that there is some complementarity in E, S, and G disclosure to fully obtain the effects of the ESG disclosure mandate (see, e.g., Dyck et al. [2022] for supporting evidence).

lack of standardized reporting structures and little guidance on the ESG metrics that firms need to disclose. Firms may take advantage of this vacuum by adopting minimum disclosure criteria to only superficially meet regulatory requirements.[4]

Our empirical estimations deliver consistent and robust evidence that the introduction of ESG disclosure mandates *does* have beneficial liquidity effects, with estimated magnitudes that are economically sizeable. For example, bid-ask spreads decrease by 8.4% once a country requires ESG disclosure. This figure compares to an improvement in bid-ask spreads by around 17% after IFRS is adopted in European Union (EU) countries (Christensen, Hail, and Leuz [2013]). The relatively stronger effects for financial disclosure mandates are plausible and reassuring. Amihud's [2002] illiquidity measure improves by 16%, and the fraction of zero-return days declines by around three trading days per year (13% of the standard deviation) after ESG disclosure mandates are introduced. These individual effects also translate into significant effects for the summary liquidity measure.

Among many other robustness tests, we document that results are unaffected if we exclude countries that never passed ESG disclosure rules, if we collapse firm-years into pre- and post-mandate periods, or if we exclude countries that passed E, S, and G regulations at different points in time. Results are also robust if we apply the Callaway and Sant'Anna [2021] estimator or a stacked regression approach (e.g., Gormley and Matsa [2011], Cengiz et al. [2019]) to address concerns related to heterogeneous treatment effects or variation in treatment timing.

Importantly, we reveal substantial heterogeneity across countries beyond the average treatment effect. First, we explore treatment-effect heterogeneity by examining variation in how

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[4] Moreover, some firms may have voluntarily reported high-quality ESG information prior to the introduction of the disclosure mandates; additional disclosure rules may then not have large effects for these firms.

countries implemented the disclosure mandates, namely: i) whether the mandates are issued by a government institution or a stock exchange, and ii) whether they are implemented on a full-compliance or a comply-or-explain basis. We expect larger liquidity benefits if the mandates are issued by government institutions rather than stock exchanges, because governments tend to have more credible implementation mandates, are less affected by regulatory capture, and have more resources to implement and enforce the rules effectively. Likewise, we expect stronger effects in countries requiring full compliance without the option to deviate from a default case, because disclosure rules are stricter if firms cannot opt out of compliance by providing explanations for why they choose not to disclose.

In line with these predictions, ESG disclosure mandates improve liquidity almost three times more when implemented by governments rather than stock exchanges. Moreover, the liquidity improvements are around 40% stronger in countries where firms cannot evade full compliance through a comply-or-explain option. That said, our estimates still suggest that it is better to have some form of ESG disclosure mandates—even if issued by stock exchanges or implemented on a comply-or-explain basis—rather than not requiring such disclosures at all.

Second, we examine cross-country heterogeneity related to disclosure enforcement. Mandatory ESG disclosure is unlikely to have a meaningful effect on liquidity if the disclosure requirements are not enforced properly. We consider enforcement effects stemming from formal and informal institutions in a country. A large body of research in accounting and finance demonstrates that enforcement by *formal* institutions is critical to reap any real or capital market benefits of *financial* disclosure mandates (Leuz and Wysocki [2016]). Applied to our ESG setting, this implies that countries with better formal institutions—as reflected by better legal environments,

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stricter rules of law, or more effective governments—should experience stronger liquidity improvements after mandatory ESG disclosure is introduced.

Next to formal institutions, *informal* institutions—as captured by societal norms or values—may also be important for the enforcement of ESG disclosure mandates.[5] Given that the disclosure mandates in part cover topics related to societal externalities (e.g., carbon emissions), social and environmental norms in particular may affect how strictly firms apply ESG disclosure rules. Relatedly, Christensen, Hail, and Leuz [2021] argue that nonfinancial preferences of investors are important determinants of the capital market effects of ESG disclosures. These arguments imply that the liquidity benefits of ESG disclosure rules may be strengthened if enforcement pressure related to a country's informal institutions is stricter.

We document interesting enforcement heterogeneity depending on whether we consider proxies for formal or informal institutions. Specifically, stricter *informal* enforcement increases the liquidity benefits of ESG disclosure mandates, while there is no such evidence for *formal* enforcement mechanisms. These results complement prior evidence documenting the important role of formal enforcement mechanisms for the liquidity benefits of mandatory IFRS reporting (Christensen, Hail, and Leuz [2013]). Taken together, it appears that *informal* mechanisms are critical for enforcing *nonfinancial* disclosure mandates, while *formal* enforcement channels drive the benefits of *financial* reporting mandates.

Finally, we explore variation across firms to test Diamond and Verrecchia's [1991] theoretical prediction that the benefits of reducing information asymmetry are larger if the initial level of

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[5] Wysocki [2011] provides a review of the role of informal institutions for accounting research. Several papers show that informal institutions can act as substitute mechanisms for formal institutions (see, e.g., Guiso, Sapienza, and Zingales [2006], Aghion et al. [2010], Guan et al. [2020]).

asymmetric information is higher. This prediction implies that any liquidity effects stemming from ESG disclosure mandates should depend on the initial conditions of a firm's information environment. To test this idea, we exploit firm-level heterogeneity in information levels based on voluntary disclosures that some firms provide to investors in the form of managerial earnings guidance. We expect stronger liquidity effects among firms that do not provide earnings guidance.[6] Consistent with this prediction, liquidity improves more strongly after the introduction of mandatory ESG disclosure among firms not issuing earnings guidance.

A concern with our analysis is that ESG mandates were implemented either as a result of intense public debates surrounding ESG topics or as a result of major ESG incidents. The documented liquidity improvements may then be confounded by these economic or societal developments, with the ESG disclosure rules being merely a symptom or corollary outcome of these underlying forces. To address this concern, we run country-level tests in the spirit of Altonji, Todd, and Taber [2005] and Bonetti, Leuz, and Michelon [2022], in which we explain the introduction of the disclosure mandates with measures reflecting either abnormal public discussion of ESG topics or major ESG incidents. Across various measures, we cannot detect that the disclosure mandates were implemented as a result of an increase in ESG-related public debates or the occurrence of ESG incidents.

Overall, our findings show that mandatory ESG disclosure has beneficial capital market effects by improving stock liquidity, but also that such mandates need to be implemented and enforced well. These findings add to other studies that examine the effects of ESG disclosure rules on the information environment or other firm outcomes, either in cross-country or single-country

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[6] Earnings guidance not only includes estimates of key accounting numbers, but also often includes qualitative discussions about a firm's risks and opportunities, potentially incorporating information on material ESG issues.

settings. Contemporaneous work by Gibbons [2022] is most related in terms of our cross-country focus. Using a global sample, he shows that improved E and S disclosure requirements affect investment and financing outcomes. Also related is Fiechter, Hitz, and Lehmann [2022], who find that mandatory corporate social responsibility (CSR) disclosure in the EU increases CSR reporting and CSR activities, with firms starting to react *before* the entry-into-force of the directive. Several researcher teams started to use the data we compiled. Lu et al. [2022] document that mandatory ESG disclosure changes firms' global outsourcing practices, while Zhang et al. [2022] find that it improves firm-level price discovery efficiency (because firm-specific information is incorporated more quickly into stock prices), and Mbanyele et al. [2022] show that it increases green innovation. The primary sources underlying our disclosure data are also used by Schiller [2020] and Wang [2022] to study how disclosure mandates transmit through global supply chains and lending relationships, respectively.[7]

Two papers are related to our work by also linking nonfinancial disclosures to liquidity, but with a focus on a single country. Early evidence by Barth et al. [2017] in South Africa, where ESG disclosure (specifically, "integrated reporting") became mandatory in 2010, indicates that more ESG-related information improves liquidity. Roy, Rao, and Zhu [2022] find that liquidity improves when firms in India are forced to increase CSR spending, and they argue that these effects arise as mandatory CSR expenditures reduce information asymmetry. We complement these two papers by using a global sample, which allows us to study cross-country heterogeneity in terms of the implementation and enforcement of the disclosure mandates.

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[7] Our data primarily originate from the Carrots & Sticks (C&S) project. We complement these data with information from the Global Reporting Initiative (GRI) and the Sustainable Stock Exchanges (SSE).

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Beyond these directly related papers, other research on the effects of nonfinancial disclosure regulation predominantly focus on i) financial and valuation effects in selected countries (Ioannou and Serafeim [2019]); ii) how mandatory disclosure requirements affect ESG rating disagreement (Christensen, Serafeim, and Sikochi [2022]); iii) the real effects of the disclosure of specific ESG items, such as carbon emissions (Krueger [2015], Jouvenot and Krueger [2021], Tomar [2023]), mine-safety records in financial reports (Christensen et al. [2017]), or environmental information (Bonetti, Leuz, and Michelon [2022]); and iv) the effects of one single nonfinancial reporting regulation (Chen, Hung, and Wang [2018], Grewal, Riedl, and Serafeim [2019], She [2022]). Also related is Dhaliwal et al. [2011], who show that the issuance of CSR/ESG reports is associated with less information asymmetry, as reflected by lower analyst forecast errors. Our comprehensive global evidence contributes to this literature.

2. Hypothesis Development

2.1 MANDATORY ESG DISCLOSURE AND LIQUIDITY

The effects of mandatory ESG disclosure on stock liquidity are *a priori* unclear. Mandatory ESG disclosure regulation may improve liquidity through an information channel. Market microstructure models by Kyle [1985] and Glosten and Milgrom [1985] show that asymmetric information about a stock's fundamentals leads to adverse selection, which lowers secondary market liquidity. Diamond and Verrecchia [1991] demonstrate that revealing public information can reduce information asymmetry and improve liquidity because more investors will demand a stock when the playing field is leveled.[8]

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[8] On the empirical side, several papers document that disclosure and the information environment are important determinants of stock liquidity (e.g., Leuz and Verrecchia [2000], Kelly and Ljungqvist [2012]).

ESG disclosure regulation may increase the amount and quality of firm-specific nonfinancial information that is available in the market and—as a consequence—reduce information asymmetry among investors. Specifically, mandatory ESG disclosure has the potential to lower search and information processing costs, which may result in better access to new or more accurate information for investors.[9] This should reduce adverse selection problems and level the playing field among investors. Therefore, mandatory ESG disclosure may increase stock liquidity in secondary markets.

Conversely, one may argue that ESG disclosure mandates do *not* improve liquidity. In contrast to financial information, ESG information is more complex, is often industry-specific, covers a wider range of topics, and is often unstructured and only partly quantifiable (Christensen, Hail, and Leuz [2021]). These factors make it difficult to create standardized one-size-fits-all reporting structures. As a result, countries may not provide clear guidance on the ESG metrics and information that firms have to disclose. One issue is that firms may exploit the lack of guidance and adopt minimum disclosure criteria to cosmetically meet regulatory requirements without disclosing much quality information (Leuz, Nanda, and Wysocki [2003], Burgstahler, Hail, and Leuz [2006], Christensen, Hail, and Leuz [2021]). Further, some firms may already report high-quality ESG information voluntarily prior to the introduction of mandatory ESG disclosure; thus, additional disclosure requirements may not have significant effects. Therefore, ESG disclosure regulation may not improve stock liquidity.[10]

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[9] As long as ESG information is complementary to firms' fundamental information relevant to market participants, ESG information is useful for traders and helps reduce adverse selection *even if* ESG information does not have direct financial implications.

[10] Broader disclosure literature argues that more public disclosures may not have beneficial information effects overall. For example, Morris and Shin [2002] argue that the effect of increased public disclosures can be ambiguous depending on market participants' information source and strategic complementarity among them. In fact, Balakrishnan, Ertan, and Lee [2022] argue that if public disclosure incentivizes only sophisticated investors to produce private information,

The above arguments lead to the following hypothesis, which we test against the null hypothesis that ESG disclosure mandates do not affect stock liquidity:

Hypothesis 1: Stock liquidity improves after mandatory ESG disclosure is introduced.

2.2 DISCLOSURE IMPLEMENTATION MECHANISMS AND LIQUIDITY

Hypothesis 1 reflects the average liquidity effect of mandatory ESG disclosures, but this effect likely varies across countries as a result of differences in the implementation or enforcement of the mandates. As argued in the context of IAS/IFRS adoptions by Daske et al. [2013] and Christensen, Hail, and Leuz [2013], it is important to demonstrate such heterogeneity to understand the economic and legal channels underlying any disclosure effects. Our next two hypotheses address such heterogeneity by building on two forms of cross-country variation related to the implementation of ESG disclosure mandates.

The first heterogeneity exploits the fact that ESG disclosure mandates are implemented by different institutions around the world. Government institutions such as ministries and securities regulators implement the rules in some countries, while local stock exchanges take the lead in other countries. Based on prior evidence, this variation can lead to heterogeneity in the liquidity effects of ESG disclosure rules; thus, we expect the liquidity benefits to be larger if the mandates are issued by government institutions rather than local stock exchanges.[11] This is because governments should have more credible implementation mandates, be less affected by regulatory

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this could exacerbate the information asymmetry among investors and lower stock liquidity. Hence, it is theoretically possible for mandatory ESG disclosure to hurt liquidity.

[11] For example, in the context of securities regulation, Christensen, Hail, and Leuz [2016] find that the liquidity benefits of regulations aiming to reduce market abuse and increase transparency depend on how strictly the rules are implemented.

capture, and have more resources to implement (and eventually enforce) the rules effectively. These arguments lead to the following hypothesis:

Hypothesis 2a: Stock liquidity improves more strongly if mandatory ESG disclosure is introduced by government institutions rather than when it is introduced by stock exchanges.

The second implementation heterogeneity exploits the practice of some countries to adopt "comply-or-explain" disclosures under which firms can either opt to provide the ESG disclosures or explain why they do not. The underlying rationale for such regulation is that a one-size-fits-all approach may not be suitable for all firms in a country, possibly because of high information production or proprietary disclosure costs. In contrast, other countries require full compliance without the option to deviate from a default case; thus, the disclosure rules are more rigid because firms cannot opt out of compliance by providing an explanation for the lack of disclosure. These arguments lead to the following hypothesis:

Hypothesis 2b: Stock liquidity improves more strongly if mandatory ESG disclosure is introduced on a binding basis rather than when it is introduced on a comply-or-explain basis.

2.3 ENFORCEMENT AS A RESULT OF FORMAL AND INFORMAL INSTITUTIONS AND LIQUIDITY

Mandatory ESG disclosure is unlikely to have a meaningful effect if the disclosure requirements are not properly enforced. Specifically, if a country's institutions only weakly enforce newly introduced disclosure mandates, this may hamper the improvement of the information environment, which in turn would imply that liquidity is not improving. We consider enforcement channels originating from both formal and informal institutions in a country.

Turning to the first channel, in countries with stronger enforcement by formal institutions— as captured by a better legal environment, stricter rule of law, or more effective governments—

newly introduced disclosure rules will likely lead to stronger improvements in the information environment. Such effects are plausible because prior literature has established the importance of formal enforcement mechanisms for various disclosure rules (see Leuz and Wysocki [2016] for a review). For example, in the context of IFRS reporting, Christensen, Hail, and Leuz [2013] document that strict reporting enforcement by a country's formal institutions is critical to achieve any liquidity benefits from IFRS mandates. These arguments may also translate to the enforcement of nonfinancial disclosure rules, suggesting that the liquidity effects of mandatory ESG disclosures are larger if enforcement from a country's formal institutions is stricter:

Hypothesis 3a: Stock liquidity improves more strongly if mandatory ESG disclosure is introduced in countries with stronger formal institutions.

In terms of the second channel, the economics literature demonstrates that societal norms—so-called "informal institutions"—can also play an important role in the enforcement of rules. In Williamson's [2000] framework on how business activity is affected by institutional influences, the most fundamental are social norms and cultural influences. North [1994] argues that informal institutions can fill the void when formal institutions are ineffective or nonexistent, and empirical evidence demonstrates that informal institutions are central for rule enforcement in various societal contexts (e.g., Fisman and Miguel [2007]).[12] Given our focus on ESG disclosure, social and environmental norms may affect how strictly firms abide by ESG disclosure rules. Christensen, Hail, and Leuz [2021] argue that nonfinancial investor preferences can be another channel through which norms affect how capital markets react to ESG disclosures. There is also evidence that

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[12] Wysocki [2011] provides a review of the role of informal institutions for accounting research. When legal enforcement is weak, informal institutions can emerge as important mechanisms (e.g., Guiso, Sapienza, and Zingales [2006]). Aghion et al. [2010] and Guan et al. [2020] find results suggesting that societal trust—a type of social norm and an informal institution—can act as a substitute mechanism for a formal institution.

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public pressure affects corporate disclosure behavior, as demonstrated, for example, by Dyreng, Hoopes, and Wilde [2016] in relation to the disclosure of corporate subsidiary locations. In our context, She [2022] finds that the effects of mandatory ESG disclosures for supply chain transparency are stronger when firms face greater pressure from nongovernmental organizations. Taken together, these arguments imply that the effect of ESG disclosure rules is strengthened if enforcement pressure related to a country's informal institution is stronger:

Hypothesis 3b*: Stock liquidity improves more strongly if mandatory ESG disclosure is introduced in countries with stronger informal institutions.*

2.4 VOLUNTARY FIRM DISCLOSURES AND LIQUIDITY

Diamond and Verrecchia [1991] show theoretically that the benefits of reducing information asymmetry are larger if the initial level of information asymmetry about a stock is higher. This implies that any liquidity effects that stem from the introduction of ESG disclosure mandates should depend on the initial conditions of a firm's information environment. In our context, we are able to exploit firm-level heterogeneity in the level of information because some firms choose to voluntarily provide information to investors beyond what is required by financial disclosure mandates. Hence, for firms that do *not* provide information voluntarily to markets, we expect the effects of ESG disclosure rules to be stronger:

Hypothesis 4*: Stock liquidity improves more strongly after mandatory ESG disclosure is introduced when firms do not provide voluntary disclosures to financial markets.*

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3. Data

3.1 SAMPLE

To create our sample, we start with all publicly listed firms in Datastream's constituent list between 2002 and 2020 and apply the screening procedure by Ince and Porter [2006] and Griffin, Kelly, and Nardari [2010]. Details on the screening procedure are reported in Online Appendix (OA) A. We extract stock price and trading data from Eikon, firm fundamental data from Worldscope, and analyst and earnings guidance data from I/B/E/S. We compile data on ESG disclosure mandates using the Carrots & Sticks (C&S) project as the primary source, which we complement with data from the Global Reporting Initiative (GRI) and the Sustainable Stock Exchanges (SSE). After matching our data sources and applying the screening protocol, we obtain a panel of 136,269 firm-year observations covering 17,680 firms from 65 countries for our main tests.

3.2 DATA ON MANDATORY ESG DISCLOSURE REGULATION

3.2.1. Data Collection. We build a dataset of ESG disclosure mandates by collecting information on countries' ESG regulations. Our primary source, the C&S project, collects data on countries' policies relating to the voluntary or mandatory reporting of ESG-related information.[13] We complement these data with information from the SSE initiative and the GRI.[14] Additionally, we use information from governments, stock exchanges, and the media to cross-check the accuracy

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[13] The C&S project tracks information on nonfinancial reporting provisions, including policy, regulation, guidance, frameworks and standards, and is supported by the GRI and University of Stellenbosch Business School.

[14] The SSE initiative is a project of the United Nations and is co-organized by the United Nations (UN) Conference on Trade and Development, the UN Global Compact, the UN Environment Programme Finance Initiative, and the Principles for Responsible Investment. Its goal is to enhance corporate transparency on ESG issues and encourage sustainable investment at the stock exchange level. The SSE initiative collects ESG reporting policies and regulations around the world.

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of the information. Based on these sources, we compile a dataset of country-level regulations related to mandatory ESG reporting. OA table B1 provides an overview of the regulations.

3.2.2. Main Measure. Table 1, panel A, lists the countries that introduced mandatory ESG disclosure ("treatment countries") together with the year of each regulation's introduction. By 2022, 35 of the 65 sample countries required some form of mandatory disclosure of ESG information.[15] The table also shows that 22 of the 35 treatment countries implemented mandatory ESG disclosure all at once, while the remaining 13 countries introduced E, S, and G disclosure one by one. For our main regressions, we create the dummy variable *Mandatory ESG Disclosure*, which equals one starting from the first year in which a country introduced mandatory ESG disclosure, and zero otherwise. The variable equals zero for all years in countries that never introduced ESG disclosure mandates during the sample period.

[Insert table 1 about here]

Figure 1 displays in greater detail the years in which the specific E, S, and G disclosure requirements were introduced. Countries that required disclosure along all three ESG dimensions at the same moment in time ("all at once") are shaded grey.[16] There are no obvious patterns in the figure in terms of which ESG topic was introduced first or last. Our subsequent tests assume that mandatory ESG disclosure was introduced once disclosure encompassing *all three* topics was required. Hence, for countries introducing ESG disclosure gradually, *Mandatory ESG Disclosure*

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[15] In some ambiguous cases, we make judgement calls on how to code the data. Slovakia and Estonia introduced mandatory ESG disclosure in 2015 and 2017 respectively, but firms from these countries are not included in the sample as a result of missing data on the liquidity and control variables (especially on analyst coverage).

[16] Country names in brackets indicate countries that did not implement mandatory ESG disclosure for all three topics during the sample period, and country names with an asterisk indicate when regulation for the last of the three disclosure topics was introduced. In the case of India, the Securities and Exchange Board of India introduced ESG disclosure for the top 100 listed firms in 2012. This was extended in 2015 to the top 500 listed firms. Because our data contain a broad sample of firms, we use the year 2015 as the year in which ESG disclosure mandates were introduced.

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equals one starting in the year in which disclosure on the third and last topic was required. This coding assumes that there is some complementarity in E, S, and G disclosure to fully obtain the effects of the disclosure mandates. Dyck et al. [2022] provide evidence for such a complementarity outside the disclosure environment by demonstrating that high environmental performance usually requires the existence of good governance. Below, we show that the results are robust to excluding countries that introduced ESG disclosure mandates one by one.

[Insert figure 1 about here]

3.2.3. Implementation Mechanisms. Table 1, panel A, shows that ESG disclosure rules vary significantly across countries. As explained, we exploit such heterogeneity to understand the relative importance of different regulatory implementations. The first dimension hinges on whether disclosure regulation is issued by a government institution or a stock exchange.[17] To test for the role of the body issuing the regulation, we partition *Mandatory ESG Disclosure* into two nonoverlapping subsets using binary indicators: i) *Mandatory ESG Disclosure$^{Gov. Inst.}_{c,t}$* equals one starting from the first year in which a government institution in a country introduces mandatory ESG disclosure, and zero otherwise; and ii) *Mandatory ESG Disclosure$^{Stock Exch.}_{c,t}$* equals one starting from the first year in which a stock exchange in a country introduces mandatory ESG disclosure, and zero otherwise. ESG disclosure rules are issued in 27 countries by government institutions and in eight countries by stock exchanges.

The second dimension exploits that 16 treatment countries have comply-or-explain regulations, while the remaining 19 countries require full compliance without the option to deviate

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[17] For example, in Australia, Listing Rule 4.10.3, issued by the Australian Stock Exchange (ASX), requires firms to disclose how they followed the recommendations set by the ASX Corporate Governance Council, which include how ESG issues are integrated into risk management processes. In South Africa, the Johannesburg Stock Exchange collaborated with the Institute of Directors in Southern Africa to issue guidance notes on reporting ESG information.

from a default case.[18] To compare the effects of full-compliance mandates with a comply-or-explain approach, we again partition *Mandatory ESG Disclosure* into two nonoverlapping subsets: i) *Mandatory ESG Disclosure*^{Comply} equals one starting from the first year in which a country introduces mandatory full-compliance ESG disclosure, and zero otherwise; and ii) *Mandatory ESG Disclosure*$^{Comply-or-Explain}$ equals one starting from the first year in which a country introduces mandatory comply-or-explain ESG disclosure, and zero otherwise.[19]

3.2.4. Firm-Year Distribution across Countries. Because our main analysis is at the firm-year level, table 1, panel A, lists the number of firm-years across treatment countries. Most observations from treatment countries originate from the United Kingdom (12.7%), India (9.6%), and Taiwan (8.8%). Table 1, panel B, lists the sampled nontreatment countries. Within this set of control countries, most observations come from the United States (54.1%), Japan (17.4%), and Korea (14.5%). Results are robust to excluding the largest countries.

3.3 DATA ON LIQUIDITY MEASURES

We use three proxies for stock liquidity that vary at the firm-year level. *Bid-Ask Spread* is the yearly median value of the daily bid-ask spreads of a firm. The bid-ask spread is the difference between the daily closing bid and ask prices divided by the midpoint. *Price Impact* is the yearly median value of the daily Amihud [2002] illiquidity measure, calculated as the daily absolute stock return (in %) divided by the daily trading volume (in USD). *Zero Return* is the number of trading days with zero daily stock returns out of the total number of potential trading days in a year. We

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[18] For example, the reporting guidelines of the Hong Kong Stock Exchange's ESG Reporting Guide contains a comply-or-explain approach for the disclosure of E and S policies and the disclosure of environmental KPIs (key performance indicators) listed in the ESG Reporting Guide.

[19] Our baseline estimates of the average treatment effects treat comply-or-explain regulations as "mandatory ESG disclosure." This follows the approach in Ioannou and Serafeim [2019]. The reason is that, while offering firms the option to withhold ESG information, the requirement to explain why a firm does not disclose information still provides incentives to firms to provide some ESG information to the public.

measure liquidity over the [+1; +12]-month period after the end of the fiscal year (i.e., for the year *t*+1). Following Daske et al. [2008], we aggregate the three proxies into a single factor, *Illiquidity Factor*, by employing factor analysis with one oblique rotation. Higher (lower) values of the factor indicate less (more) liquidity.

Descriptive statistics for the liquidity measures are reported in table 2. The measures are available for firms in all 65 countries, albeit to varying degrees because of missing data. The mean (median) *Bid-Ask Spread* is 0.008 (0.003) and the mean (median) *Price Impact* is 0.37 (0.011). There is substantial variation in the measures across the sample, and the divergence between the mean and median values shows that both variables are skewed. With respect to *Zero Return*, 8% of daily stock returns in a year are zero as a result of nontrading.[20]

[Insert table 2 about here]

3.4 DATA ON FORMAL AND INFORMAL INSTITUTIONS

3.4.1. Formal Institutions. We create two measures to study heterogeneity in enforcement levels stemming from formal institutions in a country. Both measures vary at the country-year level. For example, Following, for example, Leuz, Nanda, and Wysocki [2003], the first proxy captures enforcement related to the rule of law in a country. Specifically, *Rule of Law* measures the quality of contract enforcement, property rights, or the legal system, and it reflects the strength of a country's legal institution with respect to the enforcement of regulations. The second proxy, *Govt. Effectiveness*, measures enforcement-related issues originating from the quality of policy implementations or the credibility of a government's commitment to its stated policies. Both

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[20] The mean and median values of *Bid-Ask Spread*, *Price Impact*, and *Zero Return* in our sample are smaller than the corresponding values in Daske et al. [2008]. One potential reason is that our sample focuses on firms followed by financial analysts, which improves information transparency and leads to better liquidity.

measures range between −2.5 and 2.5, and higher values indicate a stricter rule of law or higher government effectiveness. Our assumption is that the enforcement of mandatory ESG disclosure is stronger when the rule of law or government effectiveness is stricter. Table 1, panels A and B, report mean values by country for *Rule of Law* and *Govt. Effectiveness*.

3.4.2. Informal Institutions. As hypothesized, social and environmental norms may affect how strictly firms apply ESG disclosure rules. To capture these effects, as in Dyck et al. [2019], we employ three proxies that measure norms based on either observed societal outcomes or expressed societal values. To quantify norms based on observed outcomes in relation to a country's norms toward the environment, we use Yale University's Environmental Performance Index (EPI), which measures societal outcomes related to environmental health and ecosystem vitality (the usage of this measure follows Dyck et al. [2019] or Ilhan et al. [2022] in other ESG contexts). The index, *EPI E Norms*, ranges between 0 and 100 and takes larger values in country-years with stronger environmental performance. Larger index values capture a stronger common belief in the importance of environmental issues. The next two measures reflect expressed societal values or beliefs. *IVS E Norms* is a survey-based index of the environmental awareness in a country-year, while *IVS S Norms* is a proxy of social norms. Both indexes are obtained from the Integrated Values Survey (IVS) and are based on interviews with representative samples of individuals.[21] The indexes are constructed from different survey questions, and the responses to these questions are aggregated following the methodology of Welzel [2013].[22] The variable definitions in Data Appendix A explain in detail which questions are included in our construction of the indexes. Both

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[21] We use Waves 4 (years 1999–2004), 5 (2005–2009), 6 (2010–2014), and 7 (2017–2022) of the World Values Survey and Waves 4 (2008) and 5 (2017) of the European Values Study to construct the indexes. The two IVS-based indexes change values whenever new survey data become available (i.e., not every year).

[22] The surveys underlying the two indexes are used in economics, accounting, and finance to measure environmental or social norms (e.g., Hayes, Jiang, and Pan [2021], Guiso, Sapienza, and Zingales [2006], Dyck et al. [2022]).

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indexes take values between 0 and 1. Higher values for *IVS E Norms* indicate a better environmental awareness, and higher values for *IVS S Norms* imply stronger social norms.

3.4.3. Residual Values of Measures. As pointed out by Daske et al. [2008], a concern about using country-level proxies is that these measures may be outcomes of more fundamental qualities of countries' institutional environments. We therefore follow their approach and orthogonalize each of the three measures with respect to more fundamental country characteristics. We do this by regressing the raw values of each measure on a country's legal origin, gross domestic product (GDP) per capita, and an index reflecting the degree of a country's globalization. Our subsequent tests use the residuals from those regressions, which we label as *Rule of Law^{Res}*, *Govt. Effectiveness^{Res}*, *EPI E Norms^{Res}*, *IVS E Norms^{Res}*, and *IVS S Norms^{Res}*, respectively. The first three measures are available for 60 sample countries and the last two measures for 55 countries.[23]

3.5 Data on Voluntary Firm Disclosures

As a proxy for voluntarily disclosure practices, we create an indicator that reflects whether a firm provides earnings guidance to the market (e.g., Li and Yang [2016], Tsang, Xie, and Xin [2019]). Earnings guidance not only constitutes a release of a quantitative estimation of key accounting numbers, but it also often includes qualitative analyses about risks and opportunities, potentially incorporating information on (material) ESG issues. Data on managerial guidance are obtained from I/B/E/S. *No Guidance* equals one if a firm does not provide earnings guidance in a firm-year, and zero if a firm provides such guidance. The variable is available in all 65 countries.

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[23] *Rule of Law^{Res}* and *EPI E Norms^{Res}* are missing for Taiwan, Cyprus, Kazakhstan, Malta, and Mauritius as a result of missing data for the orthogonolizing variables. We additionally miss *IVS E Norms^{Res}* and *IVS S Norms^{Res}* for Bahrain, Kenya, Oman, Sri Lanka, and United Arab Emirates as a result of missing data on *IVS E Norms* and *IVS S Norms.*

Our regressions control for other variables that may also affect liquidity. In terms of firm fundamentals, we control for firm size (Log(*Assets*)), profitability (*ROA*), leverage (*Leverage*), and market-to-book ratios (*Market-to-Book Ratio*). Furthermore, we control for analyst coverage (*Analyst Coverage*) to ensure there is a reasonable equity market following by key market participants that may use ESG disclosures as information sources. Country-level controls related to liquidity include equity market performance (*Index Return*) and volatility (*Index Volatility*).

4. Effect of Mandatory ESG Disclosure on Liquidity

4.1 BASELINE REGRESSIONS: AVERAGE TREATMENT EFFECTS

The research design for our main tests employs a firm-year analysis to examine the average treatment effect of mandatory ESG disclosure on stock liquidity. Because the regulatory events occur in different countries and at different points in time, the estimation essentially corresponds to a staggered difference-in-differences (DiD) model. We estimate variants of the following baseline model for firm i in country c and year t:

$$Liquidity_{i,c,t+1} = \beta_1 \, Mandatory \, ESG \, Disclosure_{c,t} + X_{i,c,t-1} \, \theta + \delta_i + \delta_j \times \delta_t + \varepsilon_{i,c,t+1}, \qquad (1)$$

where *Liquidity*$_{i,c,t+1}$ denotes a measure of stock liquidity—that is, either an individual proxy (*Bid-Ask Spread*$_{i,c,t+1}$, *Price Impact*$_{i,c,t+1}$, or *Zero Return*$_{i,c,t+1}$) or the aggregate measure (*Illiquidity Factor*$_{i,c,t+1}$). We measure liquidity over the year $t+1$ because most disclosure mandates give firms a time buffer until they have to comply with the rules.[24] As in Daske et al. [2008], we estimate

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[24] Firms in some countries may not yet have provided additional ESG information to the market during year $t+1$. However, according to Fiechter, Hitz, and Lehmann [2022], firms often increase ESG disclosures before the formal entry-into-force dates of ESG disclosure mandates.

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regressions using *Bid-Ask Spread$_{i,c,t+1}$* and *Price Impact$_{i,c,t+1}$*, with log-linear specifications. Our independent variable of interest is *Mandatory ESG Disclosure$_{c,t}$*, which captures the introduction of mandatory ESG disclosure in country *c* during year *t*. The vector **X** includes control variables that vary at the firm or country level, δ_i denotes the inclusion of firm fixed effects, and $\delta_j \times \delta_t$ denotes industry-by-year fixed effects. The firm fixed effects imply that our identification is obtained from within-firm variation in liquidity—that is, year-by-year changes over time for a given firm. Industry-by-year fixed effects are included to account for the industry-specific nature of ESG issues. Standard errors are clustered at the firm level.[25] If mandatory ESG disclosure improves liquidity, as predicted by Hypothesis 1, we expect the coefficient β_1 in equation 1 to be negative and statistically significant.

To capture the causal effect of mandatory disclosure, some key assumptions are needed to estimate equation 1—in particular, the assumptions of i) parallel trends; ii) stable unit treatment value; iii) exogeneity of the regulatory disclosure events; and iv) no dynamic treatment effects. We discuss potential violations of these assumptions in detail in section 5.

Table 3 reports estimation results from different specifications of equation 1. Columns 1–3 provide estimates for *Bid-Ask Spread$_{i,c,t+1}$*, *Price Impact$_{i,c,t+1}$*, and *Zero Return$_{i,c,t+1}$*, and columns 4–11 report estimates for *Illiquidity Factor$_{i,c,t+1}$*. In columns 1–3, we find for all three individual liquidity proxies a consistent picture: the negative and significant β_1 estimates indicate that firms mandated to disclose ESG information experience an increase in liquidity. The magnitudes are economically meaningful. In column 1, the bid-ask spread decreases by 8.4% after a country

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[25] Our choice of fixed effects and the level at which we cluster standard errors follows Daske et al. [2008], whose setting is similar to ours because they examine how mandatory financial reporting due to IFRS affects stock liquidity. Nevertheless, we provide various robustness checks with respect to the fixed-effects structure of the estimation. We also demonstrate robustness with respect to the choice of clustering of standard errors.

introduces ESG disclosure mandates; in column 2, the Amihud [2002] measure improves by 16%; and in column 3, the fraction of zero-return days declines by 150 basis points (13% of the standard deviation) or approximately three trading days per year.

The effects of the individual liquidity measures in columns 1–3 translate into a negative and significant β_1 coefficient in column 4 for the *Illiquidity Factor$_{i,c,t+1}$*; we estimate a decrease in the summary measure by 0.085 or 9% of the standard deviation (0.902). The high explanatory power across all regressions, with adjusted *R*-squares of 0.8 and above, originates primarily from the inclusion of firm fixed effects, which is consistent with prior literature on the determinants of stock liquidity. The table also reports the percentage of never-treated firms. Across the four regressions, this percentage amounts to a substantial 44%. This is a benefit of our setting because a large percentage of never-treated firms reduces potential biases from heterogeneity in treatment effects (Baker, Larcker, and Wang [2022]).

[Insert table 3 about here]

The remaining columns in table 3 evaluate the robustness of the baseline estimates for the *Illiquidity Factor$_{i,c,t+1}$* to variations in the estimation design. In column 5, the estimate for β_1 is unaffected if we identify effects exclusively from within-firm variation (i.e., we omit industry-by-year fixed effects). In columns 6 and 7, we separate the sample into pre- and post-2010 periods to examine how effects changed in calendar time. Consistent with a strengthening influence of ESG principles in the investment process over time, β_1 in column 7 (post-2010 years) is about twice as large as the corresponding estimate in column 6 (pre-2010 years).[26]

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[26] That we also obtain a meaningful and significant effect prior to 2010 mitigates the concern that most of the effects in column 4 originate from a wave of ESG disclosure mandates in EU countries introduced in 2016 (see figure 1).

Columns 8–11 address concerns related to the countries from which we obtain identification. In column 8, we restrict the estimation to treatment countries only; that is, we exclude countries that never passed ESG disclosure rules. This refined sample primarily identifies the liquidity effects of firms treated by ESG disclosure mandates relative to firms that are not yet, or are already, subject to such mandates.[27] This comparison ensures that the treatment effects do not originate from liquidity changes in nontreatment countries (with firms in treatment countries being unaffected). Reassuringly, we continue to find negative and significant estimates for β_1. In column 9, we address the concern that statistical significance in DiD estimates is overstated when there is a large number of observations from the same firm (Bertrand, Duflo, and Mullainathan [2004]). To this end, for each firm, we collapse observations into a pre- and post-disclosure-mandate period by computing mean values. We continue to find a negative and significant β_1 coefficient when we re-estimate equation 1 on the collapsed panel.[28]

In column 10, we partition *Mandatory ESG Disclosure*$_{c,t}$ into two nonoverlapping indicators based on whether a country introduced ESG disclosure all at once (*Mandatory ESG Disclosure*$^{All-at-Once}_{c,t}$) or one by one (*Mandatory ESG Disclosure*$^{One-by-One}_{c,t}$). Both types of implementations are associated with a decline in the illiquidity factor. In fact, the coefficient estimates are statistically indistinguishable (-0.064 versus -0.070, *p*-value of 0.6067 for an *F*-test comparing the estimated coefficients). That is, the liquidity benefits from one-by-one disclosure requirements—assuming that all three ESG topics are eventually covered—are similar to those when disclosure for all three topics is mandated at once. Finally, in column 11, we exclude countries that passed E, S, and G

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[27] "Primarily" because two treatment countries—France and Australia—introduced mandatory ESG disclosure prior to the sample period, in 2001 and 2003, respectively. In the case of Australia, firm-year observations in the pre-period are dropped because we use lagged values of the controls.

[28] The number of treatment countries decreases from 35 to 33 because there is no pre-period French and Australian firms.

regulations at different points in time because it may be more difficult to quantify the liquidity benefits of the disclosure mandate for those countries (effects may build up over time). Consistent with column 10, we continue to find a significant increase in liquidity. Overall, table 3 provides robust and consistent evidence across various specifications in support of Hypothesis 1.

Estimates for the control variables align with reasonable priors. Large firms, more profitable firms, firms with lower leverage, firms with higher valuations, and firms with higher analyst coverage have more liquid stocks. Liquidity is higher when a country's stock market has performed well. There is no consistent evidence on how index volatility relates to liquidity.

OA table B2 address further concerns with the results in table 3. In column 1, we report estimates for an alternative fixed-effects structure whereby we replace the demanding within-firm estimation with industry-by-country fixed effects. This fixed-effects structure addresses the fact that disclosure mandates may affect industries differently within a country—for example, because concerns related to E and S issues are more relevant for some industries than others. Column 2 adds linear and quadratic time trends for each country to account for confounding trends in individual countries. In both columns, we continue to find significantly negative estimates for β_1, which are of similar magnitude when compared with the baseline estimates. In column 3, we verify that the results are not driven by the four countries that make up the largest fractions of the firm-year sample. Columns 4–6 show that the inference of our tests is unaffected if we cluster standard errors at different levels.[29] Finally, in column 7, we explore the role of anticipation effects by

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[29] In column 4 and 5, we cluster standard errors conservatively at the country-year or year level to allow observations within the same country-year or country to be affected similarly by ESG disclosure mandates. These alternative clustering procedures are also useful because the decision to adopt mandatory ESG disclosure is made at the country level. Furthermore, in column 6, we allow observations to be correlated within industry-by-year clusters to account for the possibility that firms in the same industry-year are similarly affected by ESG disclosure mandates (e.g., as a result of peer or competition effects).

excluding firm-years in the year immediately before the mandates are introduced (Daske et al. [2008]). Consistent with the presence of some anticipation effects, the size of the estimated β_1 coefficient increases relative to the comparable benchmark estimate in column 4 of table 3 (-0.095 relative to -0.085). Improved liquidity as a result of disclosure *prior to* the mandate introduction year aligns with the evidence by Fiechter, Hitz, and Lehmann [2022].

Figure 2 provides an event-time analysis of the treatment effect. We estimate a version of table 3, column 5, for the *Illiquidity Factor$_{i,c,t+1}$* in which we replace *Mandatory ESG Disclosure$_{c,t}$* with six indicators, each marking one year around the introduction of a disclosure mandate. We omit the year $t=-1$ so that the effects are relative to this benchmark year. Years that are three or more years before ($t\leq-3$) or after ($t\geq+3$) the introduction of a mandate are grouped together. The figure shows that the liquidity benefits emerge starting from the year in which the disclosure rules are introduced ($t=0$). The liquidity effects increase over the subsequent years, especially from $t=+2$ onwards. There is little evidence for noticeable pre-trends, although *Illiquidity Factor$_{i,c,t+1}$* is slightly elevated in $t=-2$ relative to the benchmark year immediately prior to the mandate introduction. The increase in liquidity from $t=-2$ to $t=-1$ is consistent with some anticipation effect (as discussed earlier). Importantly, in $t=-3$ and before, the liquidity measure is indistinguishable from zero.

[Insert figure 2 about here]

4.2 DISCLOSURE IMPLEMENTATION MECHANISMS: HETEROGENEOUS TREATMENT EFFECTS

Our evidence so far suggests that mandatory ESG disclosure, on average, has a beneficial effect on stock liquidity. We next consider how the estimate of this treatment effect changes once we vary the regulatory mechanisms through which the disclosure mandates are implemented. Still

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applying the firm-year design, we explore treatment-effect heterogeneity by estimating the following variant of equation 1 for firm i in country c and year t:

$$Liquidity_{i,c,t+1} = \beta_1 \text{ } Mandatory \text{ } ESG \text{ } Disclosure^{X}_{c,t} + \beta_2 \text{ } Mandatory \text{ } ESG \text{ } Disclosure^{-X}_{c,t} +$$

$$\boldsymbol{X}_{i,c,t-1} \theta + \delta_i + \delta_j \times \delta_t + \varepsilon_{i,c,t+1}, \tag{2}$$

where $Liquidity_{i,c,t}$ is the *Illiquidity Factor$_{i,c,t+1}$*, and *Mandatory ESG Disclosure$^{X}_{c,t}$* and *Mandatory ESG Disclosure$^{-X}_{c,t}$* stand for the two different partitions of *Mandatory ESG Disclosure$_{c,t}$*—that is, those into i) *Mandatory ESG Disclosure$^{Gov. Inst}_{c,t}$* versus *Mandatory ESG Disclosure$^{Stock Exch.}_{c,t}$*; and ii) *Mandatory ESG Disclosure$^{Comply}_{c,t}$* versus *Mandatory ESG Disclosure$^{Comply-or-Explain}_{c,t}$*. We use the same set of control variables and fixed effects as in equation 1. Hypotheses 2a and 2b predict that ESG disclosure rules issued by a government institution (or implemented on a full-compliance basis) improve liquidity more strongly than mandates issued by a stock exchange (or on a comply-or-explain basis). If this is the case, then β_1 in equation 2 is expected to be more negative than β_2.

[Insert table 4 about here]

Table 4 reports estimation results from different specifications of equation 2. On top of including *Mandatory ESG Disclosure$^{X}_{c,t}$* and *Mandatory ESG Disclosure$^{-X}_{c,t}$* jointly, we estimate regressions including the variables individually. For brevity, we report only coefficients and standard errors for the main variables of interest. Testing Hypothesis 2a, columns 1–3 show that ESG disclosure mandates have much more beneficial effects when implemented by government institutions rather than stock exchanges. In column 3, when we include both binary indicators jointly, the estimate for *Mandatory ESG Disclosure$^{Gov. Inst.}_{c,t}$* is almost three times larger than the corresponding estimate for *Mandatory ESG Disclosure$^{Stock Exch.}_{c,t}$*, and the difference in coefficients is highly statistically significant (*p*-value of 0.000). This confirms Hypothesis 2a.

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Columns 4–6 consider Hypothesis 2b—that is, how the average estimates change once we contrast the effects between countries with full-compliance rules and countries with comply-or-explain mandates. Both disclosure implementations are associated with improvements in liquidity. However, effects are stronger economically in countries where firms cannot evade full compliance through a comply-or-explain option. In column 6, the estimate for *Mandatory ESG Disclosure$^{Comply}_{c,t}$* is around 44% larger than that for *Mandatory ESG Disclosure$^{Comply-or-Explain}_{c,t}$*. The difference is again statistically significant (*p*-value of 0.030). This confirms Hypothesis 2b.

4.3 FORMAL AND INFORMAL INSTITUTIONS: HETEROGENEOUS TREATMENT EFFECTS

To further gauge the possible role of country-level heterogeneity for the effect of ESG disclosure mandates on liquidity, we modify equation 1 by introducing interaction terms between *Mandatory ESG Disclosure* and proxies reflecting the enforcement strength of a country's formal or informal institutions. For firm *i* in country *c* and year *t,* we estimate the model:

$$\textit{Liquidity}_{i,c,t+1} = \beta_1 \, \textit{Mandatory ESG Disclosure}_{c,t} \times \textit{Conditional Variable}_{c,t} + \beta_2 \, \textit{Mandatory ESG Disclosure}_{c,t} + \beta_3 \, \textit{Conditional Variable}_{c,t} + \, X_{i,c,t-1} \, \theta + \delta_i + \delta_j \times \delta_t + \varepsilon_{i,c,t+1}, \tag{3}$$

where *Liquidity$_{i,c,t+1}$* is again the *Illiquidity Factor$_{i,c,t+1}$*, *Mandatory ESG Disclosure$_{c,t}$* is the indicator for the introduction of ESG disclosure regulation, and *Conditional Variable$_{c,t}$* is one of our proxies for formal or informal enforcement—that is, *Rule of Law$^{Res}_{c,t}$*, *Govt. Effectiveness$^{Res}_{c,t}$*, *EPI Norms$^{Res}_{c,t}$*, *IVS E Norms$^{Res}_{c,t}$*, or *IVS S Norms$^{Res}_{c,t}$*, respectively (see section 3.4 for details on how we construct the measures). As before, we use control variables and fixed effects in line with equation 1. If the liquidity benefits increase with the stringency of a country's formal or informal enforcement, then Hypotheses 3a and 3b predict negative interaction coefficients β_1.

[Insert table 5 about here]

Table 5 provides estimations of equation 3. In panel A, we report results for the proxies of formal enforcement, and in panel B those for the proxies of informal enforcement. An interesting pattern emerges when we compare the results across panels. While *informal* enforcement appears to be significant for the liquidity improvements after the disclosure mandates are introduced, there is no such evidence for the more *formal* mechanisms. Specifically, in panel A (columns 1 and 2), the liquidity benefits of the disclosure mandates do not vary across country-years depending on *Rule of Law*$^{Res}_{c,t}$ or *Govt. Effectiveness*$^{Res}_{c,t}$. Hence, we cannot confirm Hypothesis 3a.

In contrast, in panel B (column 3–5), we find strong evidence that social and environmental norms, which, as argued, can affect how strictly firms apply ESG disclosure mandates, matter strongly for the estimated liquidity effects. Consistently across all three columns, we find a negative and significant coefficient β_1 for the interaction terms. In terms of magnitudes, column 4 implies that a one-standard-deviation shock to *IVS E Norms*$^{Res}_{c,t}$, leads to an incremental decline in *Illiquidity Factor* that equals -0.033, or 7% relative to the mean. Hence, we can confirm Hypothesis 3b.

The results in columns 3–5 of table 5 are interesting considering the literature that documents the effects of formal enforcement mechanisms for the liquidity benefits of mandatory IFRS reporting (e.g., Christensen, Hail, and Leuz [2013]). Specifically, while *formal* enforcement channels are important for *financial* reporting mandates, *informal* mechanisms appear to be most critical for *nonfinancial* disclosure mandates.

4.4 Voluntary Firm Disclosures: Heterogeneous Treatment Effects

In this section, we explore the role of cross-firm heterogeneity for the treatment effects of ESG disclosure mandates. We modify equation 1 by introducing an interaction term between *ESG Mandatory Disclosure* and the variable reflecting voluntary disclosure choices by firms:

$$Liquidity_{i,c,t+1} = \beta_1\ Mandatory\ ESG\ Disclosure_{c,t} \times No\ Guidance_{i,c,t} + \beta_2\ Mandatory\ ESG$$
$$Disclosure_{c,t} + \beta_3\ No\ Guidance_{i,c,t} + X_{i,c,t-1}\ \theta + \delta_i + \delta_j \times \delta_t + \varepsilon_{i,c,t+1}, \tag{4}$$

where *Liquidity_{i,c,t}* is *Illiquidity Factor_{i,c,t+1}*, *Mandatory ESG Disclosure_{c,t}* is defined as before, and *No Guidance_{i,c,t}* equals one if a firm does not provide earnings guidance to the market, and zero if a firm provides such guidance. The set of control variables and fixed effects is unchanged. Hypothesis 4 predicts that ESG disclosure mandates improve liquidity more strongly among firms that do not disclose voluntarily. If this is the case, then β_1 on the double interaction term should be negative. We provide variants of equation 4 in which we replace *Mandatory ESG Disclosure_{c,t}* with the two sets of partitioning variables that identify how the rules are implemented.

[Insert table 6 about here]

Table 6 reports the regression estimates. In column 1, the coefficient estimate for the interaction term is 0.037, which implies that the decline in illiquidity from before to after the introduction of mandatory ESG disclosure is around 4% of a standard deviation stronger if a treated firm provides no voluntary disclosures to the market through earnings guidance. The negative estimate supports Hypothesis 4. The presence of heterogeneous treatment effects at the firm level is not surprising given that there is abundant literature on how firm-specific attributes are related to firms' ESG disclosure decisions (e.g., Christensen, Hail, and Leuz [2021]).

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Columns 2 and 3 show interesting heterogeneity in the effects of column 1 depending on the specific implementation mechanisms. In column 2, the incremental benefit for firms that do not provide guidance arises only among treated firms from countries where the disclosure mandate is implemented by a government. In a similar spirit, in column 3, stock liquidity improves only for firms not providing voluntary disclosures if these firms are from countries that implement disclosure mandates on a full-compliance basis. These results corroborate that the firm-level information environment as well as the implementation mechanism are key determinants for how mandatory ESG disclosure affects liquidity in equity markets.

5. Threats to Identification and Robustness

5.1 OVERVIEW OF KEY RESEARCH DESIGN ASSUMPTIONS

Our research design implicitly makes some key assumptions to identify the causal effect of ESG disclosure mandates and to insulate other effects. First, we require that firms in treatment and control countries follow parallel trends (parallel trends assumption). This implies the assumption that absent ESG disclosure mandates, the change in liquidity from the pre- to the post-treatment period for firms from treatment countries is the same, on average, as the corresponding change for firms from nontreatment countries. A violation of this assumption is less likely in our staggered DiD design compared to a one-country setting, because the parallel trends assumption would need to be violated for the majority of countries that introduced disclosure mandates. Second, we require that there are no spillover effects from firms in treated countries to firms in nontreated countries (stable unit treatment value assumption). In our context, a violation may arise as a result of peer effects within global industries—for example, if firms from nontreatment countries choose to disclose on ESG topics because their peers from treatment countries are forced to do so. Such

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spillovers would lead to an underestimation of the treatment effect. We mitigate concerns about such spillover effects by obtaining identification primarily from within-firm changes and also within the set of treatment countries. Third, we need to assume that the regulatory events in the 35 treatment countries are not endogenous—that is, driven by unobserved variables that also affect liquidity outcomes (event exogeneity assumption). Finally, we assume that firms from early-treated countries, which act as control countries for firms from later-treated countries, do not exhibit treatment effects that change over time (no dynamic treatment effects assumption). We provide a detailed appraisal of the third and fourth assumption in the next subsections.

5.2 ENDOGENOUS NATURE OF MANDATORY ESG DISCLOSURE

A typical challenge with studies exploring a single-event regulation is the potentially endogenous nature of the regulation. Specific to our context, one may be concerned that ESG mandates were implemented by lawmakers or other institutions as a result of intense public debate surrounding ESG or CSR topics or in response to a wave of ESG incidents in a country. The decline in liquidity may in turn originate from these underlying economic or societal developments (or other related confounding regulations). To address this challenge, we follow the approach in Altonji, Todd, and Taber [2005] and Bonetti, Leuz, and Michelon [2022] and try to explain the introduction of the disclosure mandates with proxies for the public interest in ESG topics and ESG scandals, respectively. We create for each country-year three measures of the Google search volume for terms that plausibly reflect public debate surrounding ESG or CSR topics. As search terms, we use the acronyms and word combinations "CSR," "corporate social responsibility," and "ESG." Furthermore, we use news-based data on ESG incidents from RepRisk to create a measure

of the number of ESG incidents in a country-year.[30] A limitation is that the measures only go back to 2004 (Google-based measures) or 2007 (RepRisk), respectively; however, this restriction is not overly problematic because the majority of disclosure mandates were introduced after 2007.[31] Using these measures, we estimate the following regression for country c and year t:

$$\textit{Mandatory ESG Disclosure Year}_{c,t} = \beta_1 \textit{ Google Search}^X_{c,t-1} + \beta_2 \textit{ ESG Incidents}_{c,t-1} + \varepsilon_{c,t}, \quad (5)$$

where *Mandatory ESG Disclosure Year*$_{c,t}$ equals one in the year in which a country introduced mandatory ESG disclosure, and zero otherwise; *Google Search*$^X_{c,t-1}$ are measures of the search volume for the terms "CSR," "corporate social responsibility," and "ESG;" and *ESG Incidents*$_{c,t-1}$ is the number of ESG incidents in a country-year. The public debate and ESG incidents variables are lagged by one year to reflect that regulations do not instantaneously react to such events (because of the drafting and lawmaking processes). Standard errors are clustered by country.

[Insert table 7 about here]

Table 7 provides different estimation results of equation 5. The sample in columns 1–3 contains all countries that introduced mandatory ESG disclosure, and columns 4–6 contain those countries that introduced the mandates all at once. Across all six regressions, we observe that none of the regressors load up significantly, and that the overall explanatory power of the regressors is low. Overall, this mitigates concerns about the endogenous nature of the regulations.

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[30] A benefit of a RepRisk-based measure is that it provides almost global coverage. RepRisk is a data provider that each day screens more than 100,000 public sources for more than 200,000 firms globally in 23 languages. The sources used to identify environmental incidents include print, online, and social media; government bodies, regulators, think tanks, and newsletters; and other online sources.

[31] The term "ESG" started to be used popularly from 2004 onwards after the publication of a report by the International Finance Corporation and the UN Global Compact.

Recent papers in econometrics (Goodman-Bacon [2021]) and accounting and finance (Baker, Larcker, and Wang [2022]) show that when treatment is rolled out in a staggered way, estimates from staggered DiD regressions obtained through ordinary least squares (OLS) estimations can be biased as a result of heterogeneous treatment effects and variation in treatment timing.[32] The intuition behind the estimation problem is that whenever staggered DiD regressions are estimated using OLS, the estimator uses both "good" comparisons between treated and not-yet-treated units as well as "bad" comparisons between units that are both already-treated. Baker, Larcker, and Wang [2022] provide several recommendations on how to resolve this issue. For instance, they recommend using a stacked regression approach (Gormley and Matsa [2011], Cengiz et al. [2019]) or more flexible estimators developed in the econometrics literature (e.g., Callaway and Sant'Anna [2021]). Baker, Larcker, and Wang [2022] apply these approaches to revisit two finance studies with a staggered DiD design and evaluate whether the conclusions of the papers hold up to the abovementioned problems.

Following the recommendations and replications carried out in Baker, Larcker, and Wang [2022], we apply both the Callaway and Sant'Anna [2021] estimator and the stacked regression approach to our setting. Using these approaches, we estimate the static average treatment effect of the treated (ATT), estimating models with and without controls. In our estimations, we use all observations from before and after treatment. In these estimations, the control groups are "clean" or "good" in the sense that the set of control firms are either not treated at all or not-yet-treated.

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[32] Roth et al. [2022] provide a review of the problems surrounding staggered DiD designs and survey recent econometric developments addressing these issues.

[Insert table 8 about here]

We report the corresponding results in table 8. In columns 1 and 2, we report the ATT obtained using the estimator from Callaway and Sant'Anna [2021] without and with control variables. We include year and firm fixed effects, implying that the coefficient estimate is best compared with the estimate from table 3, column 5. In column 1, the coefficient estimate is smaller compared to the baseline effect from table 3, column 5, but remains significantly negative. When we add control variables, the magnitude of the effect increases and is closer to the base effect from table 3.

In columns 3 and 4, we rely on the stacked regressions approach. The idea behind this approach is to create, for each treatment event, an event-specific dataset in which a clean set of control firms is used (i.e., only not-yet and never-treated firms). These datasets are then "stacked" together and the DiD regression is estimated using the stacked dataset, including dataset-specific unit and time fixed effects. In our case, this amounts to adding firm-by-stack and year-by-stack fixed effects. The resulting ATTs are reported in column 3 (without controls) and column 4 (with controls). Again, the estimates are negative and significant and of a similar magnitude as for the effects in table 3. Overall, we conclude that potentially problematic issues arising from the staggered timing of the treatment effects and treatment-effect heterogeneity do not appear to affect our inferences.

6. Conclusion

We compile a novel and comprehensive dataset on mandatory ESG disclosure around the world to analyze the stock liquidity effects of such disclosure requirements. We document a significant positive and robust effect of mandatory ESG disclosure regulations on stock liquidity. The effects are stronger if the mandatory disclosure requirements are implemented by government

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institutions, not on a comply-or-explain basis, and coupled with strong enforcement by informal institutions. Different from findings on mandatory financial disclosures, such as those in the IFRS literature, we cannot detect that enforcement by formal institutions increases the liquidity benefits of the disclosure mandates. Firms with weaker information environments benefit the most from the disclosure mandates. Overall, our results support the view that mandatory ESG disclosure regulation improves the corporate information environment with beneficial capital market effects. Our findings encourage and support more regulatory changes for other countries that have not yet required mandatory ESG disclosure.

Data Appendix A: Variable Definitions

Variable Name	Definition	Sources
Panel A: Variables for Firm-Year Level Analysis		
Mandatory ESG Disclosure Variables		
Mandatory ESG Disclosure$_{c,t}$	Indicator that equals one starting from the first year in which a country introduced mandatory ESG disclosure, and zero otherwise. If ESG disclosure is not introduced all at once, we require that mandatory E, S, and G disclosure is present for the indicator to be one.	Hand-Collected, C&S, SSE, GRI
Mandatory ESG Disclosure$^{All-At-Once}_{c,t}$	Indicator that equals one starting from the first year in which a country with all-at-once implementation of ESG disclosure introduced mandatory ESG disclosure, and zero otherwise. The all-at-once implementation means that mandatory disclosure on E, S, and G was introduced at the same time.	Hand-Collected, C&S, SSE, GRI
Mandatory ESG Disclosure$^{One-by-One}_{c,t}$	Indicator that equals one starting from the first year in which a country with one-by-one implementation of ESG disclosure introduced mandatory disclosure on the last of the three E, S, and G topics, and zero otherwise. One-by-one implementation means that mandatory disclosure on E, S, and G was *not* introduced at the same time but gradually.	Hand-Collected, C&S, SSE, GRI
Mandatory ESG Disclosure$^{Gov. Inst.}_{c,t}$	Indicator that equals one starting from the first year in which a government institution in a country introduced mandatory ESG disclosure, and zero otherwise. A government institution can be a ministry, the parliament, a securities regulator, or a similar institution. If ESG disclosure is not introduced all at once, we require that mandatory E, S, and G disclosure is present for the indicator to be one.	Hand-Collected, C&S, SSE, GRI
Mandatory ESG Disclosure$^{Stock Exch.}_{c,t}$	Indicator that equals one starting from the first year in which a stock exchange in a country introduced mandatory ESG disclosure, and zero otherwise. If ESG disclosure is not introduced all at once, we require that mandatory E, S, and G disclosure is present for the indicator to be one.	Hand-Collected, C&S, SSE, GRI
Mandatory ESG Disclosure$^{Comply}_{c,t}$	Indicator that equals one starting from the first year in which a country introduced mandatory ESG disclosure if the disclosure is on a full-compliance basis (not on a comply-or-explain basis), and zero otherwise. If ESG disclosure is not introduced all at once, we require that mandatory E, S, and G disclosure is present for the indicator to be one.	Hand-Collected, C&S, SSE, GRI
Mandatory ESG Disclosure$^{Comply-or-Explain}_{c,t}$	Indicator that equals one starting from the first year in which a country introduced mandatory ESG disclosure if the disclosure is on a comply-or-explain basis (not on a full-compliance basis), and zero otherwise. If ESG disclosure is not introduced all at once, we require that mandatory E, S, and G disclosure is present for the indicator to be one.	Hand-Collected, C&S, SSE, GRI
Liquidity Variables		
Bid-Ask Spread$_{i,c,t+1}$	Yearly median value of the daily bid-ask spreads of a firm. The bid-ask spread is the difference between the daily closing bid and ask prices divided by the midpoint. We set the annual bid-ask spread as missing if the annual quoted bid-ask spread is greater than 100% or less than zero. The measure is calculated over the 12-month period starting from the end of a fiscal year (i.e., over the year *t*+1). Winsorized at 1% and 99%.	Eikon
Price Impact$_{i,c,t+1}$	Yearly median value of the daily Amihud [2002] illiquidity measure, calculated as the daily absolute stock return (in %) divided by the daily USD trading volume (measured in thousands). We set the price impact as missing if there are less than 120 daily observations or if there is no price variation within 12 months. The measure is calculated over the 12-month period starting from the end of a fiscal year (i.e., over the year *t*+1). The metric is multiplied by 1,000. Winsorized at 1% and 99%.	Eikon
Zero Return$_{i,c,t+1}$	Number of trading days with zero daily stock returns scaled by the number of potential trading days in the year. The measure is calculated over the 12-month period starting from the end of a fiscal year (i.e., over the year *t*+1).	Eikon
Illiquidity Factor$_{i,c,t+1}$	Aggregate illiquidity factor constructed as the score of a single factor extracted from Log(*Bid-Ask Spread$_{i,c,t+1}$*), Log(*Price Impact$_{i,c,t+1}$*), and *Zero Return$_{i,c,t+1}$* using factor analysis.	Self-Constructed
Formal and Informal Institutions Variables		

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Rule of Law$_{c,t}$	Index that captures perceptions of the extent to which agents in a country have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. The values of the index can range between −2.5 and 2.5. Higher values indicate stronger rule of law in a country-year.	World Bank (WGI)
Rule of Law$^{Res}_{c,t}$	Residual from a regression of *Rule of Law$_{c,t}$* on countries' legal origins, gross domestic product (GDP) per capita, and an index reflecting the globalization in a country.	World Bank (WGI), ETH KOF
Govt. Effectiveness$_{c,t}$	Index that captures the quality of public services, the quality of the civil service and its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to its stated policies in a country-year. The values of the index can range between −2.5 and 2.5. Higher values indicate higher government effectiveness in a country-year.	World Bank (WGI)
Govt. Effectiveness$^{Res}_{c,t}$	Residual from a regression of *Govt. Effectiveness$_{c,t}$* on countries' legal origins, GDP per capita, and an index reflecting the globalization in a country.	World Bank (WGI), ETH KOF
EPI E Norms$_{c,t}$	Yale University's Environmental Performance Index (EPI). The index measures societal outcomes related to environmental health and ecosystem vitality. The values of the index can range between 0 and 100. Higher values indicate a stronger environmental performance in a country-year and, in turn, a stronger common belief in the importance of environmental issues.	Yale Center for Environmental Law
EPI E Norms$^{Res}_{c,t}$	Residual from a regression of *EPI E Norms$_{c,t}$* on countries' legal origins, GDP per capita, and an index reflecting the globalization in a country.	Yale Center for Environmental Law, World Bank, ETH KOF
IVS E Norms$_{c,t}$	Survey-based index of the environmental awareness in a country. The index is obtained from the Integrated Values Survey (IVS) and is based on interviews with representative samples of individuals. The values of the index range between 0 and 1. Higher values indicate better environmental awareness in a country-year. The index is built on five survey questions that capture: (1) voluntary work for unpaid work environment, conservation, and animal rights; (2) active/inactive membership of an environmental organization; (3) whether it is important to a person to look after the environment; (4) whether a person would give part of their income for the environment; and (5) whether protecting the environment has priority in contrast to economic growth. The index uses data from Wave 4–7 of the World Values Survey (WVS) and from Waves 4 and 5 of the European Value Survey (EVS). Responses to these questions are aggregated following the methodology of Welzel [2013]. The index change values whenever new survey data become available for a country (i.e., not every year).	IVS
IVS E Norms$^{Res}_{c,t}$	Residual from a regression of *IVS E Norms$_{c,t}$* on countries' legal origins, GDP per capita, and an index reflecting the globalization in a country.	IVS, World Bank, ETH KOF
IVS S Norms$_{c,t}$	Survey-based index of the social norms in a country. The index is obtained from the IVS and is based on interviews with representative samples of individuals. The values of the index range between 0 and 1. Higher values indicate stronger social norms in a country-year. Following Welzel [2013], this index reflects four dimensions: (1) autonomy: whether independence and imagination are important in child qualities; (2) gender equality: a) men should have more right to jobs than women; b) men make better political leaders than women do; c) university is more important for a boy than for a girl; d) men make better business executives than women do; (3) voice: assign first, second, or no priority to the goals of (a) protecting freedom of speech; (b) giving people more say in important government decisions; (c) giving people more say about how things are done at their jobs and in their communities; (4) freedom: how acceptable respondents find (a) divorce; (b) abortion; and (c) homosexuality. The index uses data from Wave 4–7 of the WVS and from Waves 4 and 5 of the EVS. Responses	IVS

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	to these questions are aggregated following the methodology of Welzel [2013]. The index change values whenever new survey data become available for a country (i.e., not every year).	
IVS S Norms$^{Res}_{c,t}$	Residual from a regression of *IVS S Norms$_{c,t}$* on countries' legal origins, GDP per capita, and an index reflecting the globalization in a country.	IVS, World Bank, ETH KOF

	Voluntary Disclosure Variable	
No Guidance$_{i,c,t}$	Indicator that equals one if a firm does not provide earnings guidance in a firm-year according to I/B/E/S, and zero if a firm provides guidance.	I/B/E/S

	Control Variables	
Log(Assets)$_{i,c,t-1}$	Logarithm of total assets (in USD) in a firm-year (Eikon data item: TR.TotalAssetsReported). Winsorized at 1% and 99%.	Eikon
ROA $_{i,c,t-1}$	Net income before extraordinary items (TR.NetIncomeBeforeExtraItems) scaled by the total assets in a firm-year. Winsorized at 1% and 99%.	Eikon
Leverage $_{i,c,t-1}$	Total debt (TR.TotalDebtOutstanding) scaled by the total assets (TR.TotalAssetsReported) in a firm-year, calculated as the market price (TR.PriceClose) divided by the book value of equity per share (TR.BVPSTotalEquity). Winsorized at 1% and 99%.	Eikon
Market-to-Book Ratio $_{i,c,t-1}$	Market-to-book ratio in a firm-year. Winsorized at 1% and 99%.	Eikon
Analyst Coverage $_{i,c,t-1}$	Number of analysts following a firm in a firm-year. Winsorized at 1% and 99%.	I/B/E/S
Index Volatility$_{c,t-1}$	Volatility of the monthly return of the MSCI equity market index in a country-year. Winsorized at 1% and 99%.	Datastream
Index Return$_{c,t-1}$	Annual return of the MSCI market index in a country-year. Winsorized at 1% and 99%.	Datastream

	Panel B: Variables for Country-Year Level Analysis	
Mandatory ESG Disclosure Year$_{c,t}$	Indicator that equals one in the year in which a country introduced mandatory ESG disclosure, and zero otherwise.	Hand-Collected
Google Search$^{CSR}_{c,t-1}$	Google search volume for the term "CSR" in a country-year. The measure is calculated as the sum of the monthly values of the Google search index within the year. Available from 2004 to 2020. Winsorized at 1% and 99%.	Google Trends
Google Search$^{Corp. Soc. Resp}_{c,t-1}$	Google search volume for the topic "corporate social responsibility" in a country-year. The measure is calculated as the sum of the monthly values of the Google search index within the year. Available from 2004 to 2020. Winsorized at 1% and 99%.	Google Trends
Google Search$^{ESG}_{c,t-1}$	Google search volume for the term "ESG" in a country-year. The measure is calculated as the sum of the monthly values of the Google search index within the year. Available from 2004 to 2020. Winsorized at 1% and 99%.	Google Trends
ESG Incidents$_{c,t-1}$	Number of ESG incidents in a country-year documented by RepRisk. The variable includes the ESG incidents of both public and private firms. Available from 2007 to 2020. Winsorized at 1% and 99%.	RepRisk

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TABLE 1

Country-Level Descriptive Statistics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A: Treatment countries												
Country/Region	Mand. ESG disc. year	All-at-once disc.?	Issued by govern. inst?	No comply-or-explain disc?	# Firm-years	%	*Rule of Law$_{c,t}$*	*Govt. Effect.$_{c,t}$*	*EPI Norms$_{c,t}$*	*IVS E Norms$_{c,t}$*	*IVS S Norms$_{c,t}$*	*No Guidance$_{i,c,t}$*
Argentina	2008	1	1	1	195	0.3	-0.52	-0.08	49.1	0.47	0.49	1.00
Australia	2003	0	0	1	5003	6.6	1.75	1.66	70.1	0.54	0.57	0.99
Austria	2016	0	1	1	484	0.6	1.85	1.64	77.2	0.43	0.54	1.00
Belgium	2009	0	1	1	1187	1.6	1.38	1.54	71.2	0.28	0.52	0.98
Canada	2004	1	0	1	6472	8.6	1.77	1.77	68.7	0.54	0.56	0.96
Chile	2015	0	1	0	16	0.0	1.23	1.06	51.6	0.52	0.49	1.00
China	2008	1	0	1	2666	3.5	-0.25	0.46	35.9	0.55	0.36	1.00
Denmark	2016	1	1	0	948	1.3	1.93	2.05	77.9	0.55	0.66	0.98
Finland	2016	1	1	0	1577	2.1	1.99	2.08	76.0	0.51	0.55	0.99
France	2001	1	1	1	3673	4.9	1.43	1.49	75.4	0.45	0.53	0.99
Germany	2016	1	1	0	4735	6.3	1.67	1.55	76.6	0.44	0.57	0.98
Greece	2006	1	1	1	633	0.8	0.55	0.49	66.8	0.42	0.45	1.00
Hong Kong	2015	1	0	0	3085	4.1	1.61	1.77	32.1	0.48	0.42	1.00
Hungary	2016	1	1	0	167	0.2	0.70	0.66	61.4	0.46	0.46	1.00
India	2015	1	1	1	7246	9.6	-0.02	0.02	26.2	0.53	0.40	1.00
Indonesia	2012	0	1	1	672	0.9	-0.50	-0.16	34.1	0.57	0.35	1.00
Ireland	2016	1	1	0	364	0.5	1.62	1.47	71.5	0.26	0.52	0.83
Italy	2016	1	1	0	2299	3.1	0.39	0.44	70.2	0.51	0.47	0.99
Malaysia	2007	0	0	0	3349	4.4	0.43	1.03	45.0	0.55	0.38	1.00
Netherlands	2016	0	1	0	1158	1.5	1.80	1.83	74.4	0.44	0.57	0.97
Norway	2013	0	1	1	1580	2.1	1.95	1.89	72.3	0.54	0.69	1.00
Pakistan	2009	1	1	1	553	0.7	-0.79	-0.67	31.0	0.37	0.26	1.00
Peru	2015	1	1	1	93	0.1	-0.55	-0.29	42.7	0.50	0.41	1.00
Philippines	2011	1	1	1	584	0.8	-0.49	0.10	39.9	0.54	0.38	1.00
Poland	2016	1	1	1	994	1.3	0.62	0.59	60.2	0.38	0.41	1.00
Portugal	2010	0	1	1	83	0.1	1.09	1.05	63.7	0.48	0.43	1.00
Romania	2016	1	1	0	87	0.1	0.29	-0.08	64.0	0.39	0.41	1.00
Singapore	2016	0	0	0	1738	2.3	1.69	2.18	59.7	0.38	0.42	1.00
Slovenia	2017	1	1	0	91	0.1	1.01	1.04	69.5	0.49	0.55	1.00
South Africa	2010	1	0	0	1690	2.2	0.03	0.27	37.1	0.35	0.43	0.97
Spain	2012	0	1	0	1469	2.0	1.08	1.10	69.0	0.44	0.54	1.00
Sweden	2016	1	1	0	2801	3.7	1.89	1.82	76.0	0.54	0.69	1.00
Taiwan (China)	2019	1	0	1	6642	8.8	1.05	1.26	55.6	0.54	0.42	1.00
Turkey	2014	0	1	1	1397	1.9	-0.09	0.19	39.5	0.47	0.39	1.00
United Kingdom	2013	0	1	1	9534	12.7	1.69	1.60	76.4	0.47	0.54	0.98

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TABLE 1— *Continued*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel B: Non-treatment countries								
Country/Region	# Firm-Years	%	*Rule of Law$_{c,t}$*	*Govt. Effect.$_{c,t}$*	*EPI Norms$_{c,t}$*	*IVS E Norms$_{c,t}$*	*IVS S Norms$_{c,t}$*	*No Guidance$_{i,c,t}$*
Bahrain	34	0.1	0.41	0.43	36.2	.	.	1.00
Brazil	1084	1.8	-0.16	-0.23	47.1	0.55	0.43	1.00
Bulgaria	69	0.1	-0.10	0.04	57.3	0.43	0.43	1.00
Colombia	7	0.0	-0.29	-0.06	51.0	0.60	0.41	1.00
Cyprus	6	0.0	0.66	0.94	63.1	0.47	0.38	1.00
Egypt	473	0.8	-0.38	-0.47	39.3	0.39	0.25	1.00
Israel	458	0.8	0.97	1.27	61.1	0.35	0.45	0.92
Japan	10607	17.4	1.48	1.63	75.1	0.40	0.49	0.31
Jordan	69	0.1	0.31	0.17	47.3	0.49	0.25	1.00
Kazakhstan	4	0.0	-0.47	0.13	44.7	0.41	0.35	1.00
Kenya	156	0.3	-0.58	-0.44	31.1	.	.	1.00
Korea (South)	8857	14.5	1.03	1.09	64.9	0.43	0.42	1.00
Malta	2	0.0	0.93	0.94	68.5	0.29	0.38	1.00
Mauritius	4	0.0	0.83	0.89	44.6	.	.	1.00
Mexico	727	1.2	-0.54	0.05	47.5	0.51	0.45	1.00
Morocco	168	0.3	-0.23	-0.18	40.6	0.54	0.31	1.00
New Zealand	758	1.2	1.89	1.76	69.9	0.51	0.57	1.00
Nigeria	113	0.2	-1.01	-1.07	33.3	0.42	0.28	1.00
Oman	216	0.4	0.50	0.25	34.5	.	.	1.00
Qatar	8	0.0	0.82	0.83	37.7	0.57	0.27	1.00
Russian Federation	314	0.5	-0.81	-0.26	49.1	0.42	0.35	1.00
Saudi Arabia	442	0.7	0.18	0.25	43.2	0.40	0.35	1.00
Sri Lanka	207	0.3	-0.02	-0.09	39.8	.	.	1.00
Switzerland	281	0.5	1.83	1.95	73.9	0.58	0.57	0.99
Thailand	1799	2.9	-0.08	0.25	43.2	0.52	0.38	1.00
Tunisia	205	0.3	0.08	-0.03	45.5	0.34	0.33	1.00
Ukraine	26	0.0	-0.82	-0.70	49.8	0.42	0.36	1.00
United Arab Emirates	254	0.4	0.66	1.27	50.9	.	.	1.00
United States	33031	54.1	1.56	1.52	67.4	0.41	0.52	0.69
Vietnam	625	1.0	-0.22	-0.03	32.6	0.55	0.39	1.00

Panel A reports for treatment countries, that is, countries that introduced mandatory ESG disclosure, summary statistics at the country level for i) a series of mandatory ESG disclosure variables (columns 1 to 4); ii) the number of firm-year observations (column 5); iii) the number of firm-years relative to the total number of firm-years in the panel (column 6); iv) measures of formal and informal institutions (columns 7 to 11); and v) a measure of voluntary disclosure by firms (column 12). The statistics in columns 6 to 11 are calculated as country-level averages across country-year observations. The statistics in column 12 are calculated as country-level averages across firm-year observations within a country. The sample in the panel consists of 35 countries that introduced mandatory ESG disclosure during between 2002 and 2020. Panel B reports for non-treatment countries, that is, countries that did not introduce mandatory ESG disclosure, summary statistics at the country level for i) the number of firm-year observations (column 1); ii) the number of firm-years relative to the total number of firm-years in the panel (column 2); iii) measures of formal and informal institutions (columns 3 to 7); iv) and a measure of voluntary disclosure by firms (column 8). The statistics in columns 3 to 6 are calculated as country-level averages across country-year observations. The statistics in column 8 are calculated as country-level averages across firm-year observations within a country. The sample in the panel consists of 30 countries between 2002 and 2020. In both panels, the summary statistics are calculated for those countries and firm-years included in the regression sample in table 3, column 4. Data Appendix A defines all variables.

TABLE 2

Descriptive Statistics and Correlations

Panel A: Summary statistics (Firm-year level)						
	Mean	Std. Dev.	P5	Median	P95	# Obs.
Mandatory ESG disclosure variables						
Mandatory ESG Disclosure$_{c,t}$	0.306					136269
Mandatory ESG Disclosure$^{All-At-Once}_{c,t}$	0.186					136269
Mandatory ESG Disclosure$^{One-by-One}_{c,t}$	0.127					136269
Mandatory ESG Disclosure$^{Comply}_{c,t}$	0.075					136269
Mandatory ESG Disclosure$^{Comply-or-Explain}_{c,t}$	0.231					136269
Mandatory ESG Disclosure$^{Gov. Inst.}_{c,t}$	0.159					136269
Mandatory ESG Disclosure$^{Stock Exch.}_{c,t}$	0.147					136269
Liquidity variables						
Bid-Ask Spread$_{i,c,t+1}$	0.008	0.014	0.000	0.003	0.034	136269
Price Impact$_{i,c,t+1}$	0.370	2.153	0.000	0.011	1.399	136269
Zero Return$_{i,c,t+1}$	0.080	0.112	0.000	0.038	0.306	136269
Log(*Bid-Ask Spread*)$_{i,c,t+1}$	-5.698	1.350	-8.010	-5.737	-3.384	136269
Log(*Price Impact*)$_{i,c,t+1}$	-4.356	2.704	-8.623	-4.532	0.336	136269
Illiquidity Factor$_{i,c,t+1}$	-0.505	0.902	-1.787	-0.629	1.164	136269
Formal and informal institutions variables						
Rule of Law$_{c,t}$	1.20	0.69	-0.23	1.53	1.88	135292
Govt. Effectiveness$_{c,t}$	1.27	0.62	-0.02	1.51	1.89	135292
EPI Norms$_{c,t}$	62.5	15.1	27.6	68.2	78.6	136269
IVS E Norms$_{c,t}$	0.46	0.07	0.35	0.46	0.56	135398
IVS S Norms$_{c,t}$	0.49	0.08	0.37	0.51	0.60	135398
Voluntary disclosure variable						
No Guidance$_{i,c,t}$	0.86					136269
Control variables						
Log(Assets)$_{i,c,t-1}$	20.549	2.040	17.416	20.418	24.292	136269
ROA$_{i,c,t-1}$	0.022	0.166	-0.181	0.038	0.167	136269
Leverage$_{i,c,t-1}$	0.204	0.183	0.000	0.173	0.544	136269
Market-to-Book Ratio$_{i,c,t-1}$	2.741	3.669	0.475	1.708	7.989	136269
Analyst Coverage$_{i,c,t-1}$	6.394	6.375	1.000	4.000	20.500	136269
Index Volatility$_{c,t-1}$	0.200	0.148	0.069	0.158	0.579	136269
Index Return$_{c,t-1}$	0.076	0.193	-0.289	0.093	0.307	136269

Panel B: Correlations of illiquidity variables (Firm-year level)			
	Log(*Bid-Ask Spread*)$_{i,c,t}$	Log(*Price Impact*)$_{i,c,t}$	*Zero Return$_{i,c,t}$*
Log(*Price Impact*)$_{i,c,t}$	0.79	1.00	
Zero Return$_{i,c,t}$	0.63	0.53	1.00
Illiquidity Factor$_{i,c,t}$	0.94	0.89	0.80

Panel A reports summary statistics at the firm-year level of the variables used in the firm-level analysis. Panel B reports firm-year level correlations of the liquidity measures. The sample consists of firm-year observations from 65 countries between 2002 and 2020. In both panels, the summary statistics are calculated for those countries and firm-years included in the regression sample in table 3, column 4. Data Appendix A defines all variables.

TABLE 3

Mandatory ESG Disclosure and Stock Liquidity: Average Treatment Effects

	Log(Bid-Ask Spread)$_{i,c,t+1}$	Log(Price Impact)$_{i,c,t+1}$	Zero Return$_{i,c,t+1}$	Illiquidity Factor$_{i,c,t+1}$							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Mandatory ESG Disclosure$_{c,t}$	-0.084***	-0.161***	-0.015***	-0.085***	-0.085***	-0.045***	-0.089***	-0.121***	-0.139***		-0.095***
	(0.011)	(0.019)	(0.001)	(0.007)	(0.007)	(0.017)	(0.007)	(0.008)	(0.011)		(0.008)
Mandatory ESG Disclosure$^{All-At-Once}_{c,t}$										-0.064***	
										(0.008)	
Mandatory ESG Disclosure$^{One-by-One}_{c,t}$										-0.070***	
										(0.012)	
Log(Assets)$_{i,c,t-1}$	-0.134***	-0.538***	-0.009***	-0.131***	-0.132***	-0.103***	-0.084***	-0.144***	-0.141***	-0.130***	-0.121***
	(0.009)	(0.015)	(0.001)	(0.005)	(0.005)	(0.008)	(0.006)	(0.007)	(0.012)	(0.005)	(0.006)
ROA$_{i,c,t-1}$	-0.372***	-0.644***	-0.019***	-0.240***	-0.262***	-0.078***	-0.210***	-0.270***	-0.765***	-0.241***	-0.235***
	(0.024)	(0.051)	(0.003)	(0.017)	(0.018)	(0.025)	(0.017)	(0.026)	(0.086)	(0.017)	(0.019)
Leverage$_{i,c,t-1}$	0.350***	1.151***	0.018***	0.292***	0.305***	0.305***	0.230***	0.352***	0.383***	0.292***	0.259***
	(0.031)	(0.055)	(0.003)	(0.019)	(0.019)	(0.031)	(0.021)	(0.027)	(0.061)	(0.019)	(0.020)
Market-to-Book Ratio$_{i,c,t-1}$	-0.025***	-0.070***	-0.002***	-0.020***	-0.021***	-0.013***	-0.016***	-0.026***	-0.037***	-0.020***	-0.018***
	(0.001)	(0.002)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)
Analyst Coverage$_{i,c,t-1}$	-0.013***	-0.021***	0.000	-0.006***	-0.006***	-0.001*	-0.003***	-0.007***	-0.023***	-0.006***	-0.006***
	(0.001)	(0.002)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
Index Volatility$_{c,t-1}$	-0.269***	0.062	0.000	-0.071***	-0.089***	-0.077	-0.022*	-0.047**	0.020	-0.067***	-0.120***
	(0.022)	(0.041)	(0.002)	(0.013)	(0.013)	(0.054)	(0.012)	(0.022)	(0.037)	(0.013)	(0.013)
Index Return$_{c,t-1}$	-0.243***	-0.107***	-0.006***	-0.092***	-0.100***	-0.105***	-0.036***	-0.017**	-0.206***	-0.091***	-0.095***
	(0.011)	(0.019)	(0.001)	(0.006)	(0.006)	(0.011)	(0.007)	(0.007)	(0.067)	(0.006)	(0.007)
F-test for difference across coefficients (*p*-value) Mand. ESG Disc.$^{All-at-Once}$ = Mand. ESG Disc.$^{One-by-One.}$									0.6967		
Industry × year fixed effects	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes
Year fixed effects	No	No	No	No	Yes	No	No	No	No	No	No
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	All countries	All countries	All countries	All countries	All countries	All countries before 2010	All countries in/after 2010	Mand. ESG disc. countries	Mand. ESG disc. countries; collapsed pre and post obs.	All countries	Exclude mand. ESG disc. one by one countries
# Observations	136286	137673	137678	136269	136269	38579	95834	75252	8456	136269	105514
# Unique firms	17683	17750	17751	17680	17680	8325	15031	9861	4228	17680	13748
% Never-treated firms	44%	44%	44%	44%	44%	38%	46%	0%	0%	44%	57%
# Countries	65	65	65	65	65	50	65	35	33	65	51
Adj. R-squared	0.871	0.902	0.805	0.897	0.886	0.919	0.916	0.889	0.899	0.897	0.888

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TABLE 3— *Continued*

This table reports regressions at the firm-year level to investigate the impact of mandatory ESG disclosure on stock liquidity. We use four dependent variables: i) *Bid-Ask Spread$_{i,c,t+1}$* is the yearly median value of the daily bid-ask spread of a firm's stock; ii) *Price Impact$_{i,c,t+1}$* is the yearly median value of the daily Amihud [2002] illiquidity measure, calculated as the daily absolute stock return (in %) divided by the daily USD trading volume; iii) *Zero Return$_{i,c,t+1}$* is the number of trading days with zero daily stock returns scaled by the number of potential trading days in the year; and iv) *Illiquidity Factor$_{i,c,t+1}$* is an aggregate illiquidity factor constructed as the score of a single factor extracted from the three liquidity measures. We use the following key independent variables: i) *Mandatory ESG Disclosure$_{c,t}$* equals one starting from the first year in which a country introduced mandatory ESG disclosure, and zero otherwise (if ESG disclosure is not introduced all at once, we require that mandatory E, S, and G disclosure is present for the indicator to be one); ii) *Mandatory ESG Disclosure$^{All\text{-}At\text{-}Once}_{c,t}$* equals one starting from the first year in which a country with all-at-once implementation of ESG disclosure introduced mandatory ESG disclosure, and zero otherwise (all-at-once implementation means that mandatory disclosure on E, S, and G was introduced at the same time); iii) *Mandatory ESG Disclosure$^{One\text{-}by\text{-}One}_{c,t}$* equals one starting from the first year in which a country with one-by-one implementation of ESG disclosure introduced mandatory disclosure on the last of the three E, S, and G topics, and zero otherwise (one-by-one implementation means that mandatory disclosure on E, S, and G was not introduced at the same time but gradually). The sample consists of firm-year observations from 65 countries between 2002 and 2020 (unless indicated differently). Data Appendix A defines all variables. Standard errors, reported in parentheses, are clustered at the firm level. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively.

TABLE 4

Mandatory ESG Disclosure and Liquidity: Implementation Mechanisms

	Illiquidity Factor$_{i,c,t+1}$			Illiquidity Factor$_{i,c,t+1}$		
	(1)	(2)	(3)	(4)	(5)	(6)
Mandatory ESG Disclosure$^{Gov. Inst.}_{c,t}$	-0.100***		-0.102***			
	(0.009)		(0.009)			
Mandatory ESG Disclosure$^{Stock Exch.}_{c,t}$		-0.018	-0.037***			
		(0.012)	(0.012)			
Mandatory ESG Disclosure$^{Comply}_{c,t}$				-0.088***		-0.098***
				(0.010)		(0.010)
Mandatory ESG Disclosure$^{Comply-or-Explain}_{c,t}$					-0.051***	-0.068***
					(0.010)	(0.010)
F-test for difference across coefficients (*p*-value):						
Mand. ESG Disc.$^{Gov. Inst.}$ =						
Mand. ESG Disc.$^{Stock Exch.}$			0.000			
Mand. ESG Disc.^{Comply} =						
Mand. ESG Disc.$^{Comply-or-Explain}$						0.030
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry × year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Sample	All countries	All countries	All countries	All countries	All countries	All countries
# Observations	136269	136269	136269	136269	136269	136269
# Unique firms	17680	17680	17680	17680	17680	17680
% Never-treated firms	44%	44%	44%	44%	44%	44%
# Countries	65	65	65	65	65	65
Adj. R-squared	0.897	0.896	0.897	0.897	0.896	0.897

This table reports regressions at the firm-year level to investigate the role of different implementation mechanisms for the impact of mandatory ESG disclosure on stock liquidity. We use the following dependent variable: *Illiquidity Factor$_{i,c,t+1}$* is an aggregate illiquidity factor constructed as the score of a single factor extracted from the three liquidity measures *Bid-Ask Spread$_{i,c,t+1}$*, *Price Impact$_{i,c,t+1}$*, and *Zero Return$_{i,c,t+1}$*. We use the following key independent variables: i) *Mandatory ESG Disclosure$^{Gov. Inst.}_{c,t}$* equals one starting from the first year in which a government institution in a country implemented mandatory ESG disclosure, and zero otherwise; ii) *Mandatory ESG Disclosure$^{Stock Exch.}_{c,t}$* equals one starting from the first year in which a stock exchange in a country introduced mandatory ESG disclosure; iii) *Mandatory ESG Disclosure$^{Comply}_{c,t}$* equals one starting from the first year in which a country introduced mandatory ESG disclosure if the disclosure is on a full-compliance basis (not on a comply-or-explain basis), and zero otherwise; iv) *Mandatory ESG Disclosure $^{Comply-or-Explain}_{c,t}$* equals one starting from the first year in which a country introduced mandatory ESG disclosure if the disclosure is on a comply-or-explain basis (not on a full-compliance basis), and zero otherwise. The sample consists of firm-year observations from 65 countries between 2002 and 2020. Data Appendix A defines all variables. Standard errors, reported in parentheses, are clustered at the firm level. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively.

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TABLE 5

Mandatory ESG Disclosure and Liquidity: Enforcement by Formal and Informal Institutions

	Panel A: Formal Institutions		Panel B: Informal Institutions		
	Illiquidity Factor$_{i,c,t+1}$		*Illiquidity Factor$_{i,c,t+1}$*		
	(1)	(2)	(3)	(4)	(5)
Mandatory ESG Disclosure$_{c,t}$ × Rule of Law$^{Res}_{c,t}$	0.004				
	(0.015)				
Mandatory ESG Disclosure$_{c,t}$ × Govt. Effectiveness$^{Res}_{c,t}$		-0.022			
		(0.014)			
Mandatory ESG Disclosure$_{c,t}$ × EPI Norms$^{Res}_{c,t}$			-0.003***		
			(0.001)		
Mandatory ESG Disclosure$_{c,t}$ × IVS E Norms$^{Res}_{c,t}$				-0.467***	
				(0.085)	
Mandatory ESG Disclosure$_{c,t}$ × IVS S Norms$^{Res}_{c,t}$					-0.564***
					(0.116)
Mandatory ESG Disclosure$_{c,t}$	-0.077***	-0.076***	-0.089***	-0.072***	-0.064***
	(0.007)	(0.008)	(0.009)	(0.008)	(0.008)
Rule of Law$^{Res}_{c,t}$	0.004				
	(0.015)				
Govt. Effectiveness$^{Res}_{c,t}$		-0.072***			
		(0.012)			
EPI Norms$^{Res}_{c,t}$			-0.000		
			(0.001)		
IVS E Norms$^{Res}_{c,t}$				0.428***	
				(0.050)	
IVS S Norms$^{Res}_{c,t}$					-0.738***
					(0.105)
Controls	Yes	Yes	Yes	Yes	Yes
Industry × year fixed effects	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Sample	All countries	All countries	All countries	All countries	All countries
# Observations	121353	121353	121353	120555	120555
# Unique firms	15989	15989	16048	15924	15924
% Never-treated firms	47%	47%	47%	46%	46%
# Countries	60	60	60	55	55
Adj. R-squared	0.900	0.900	0.900	0.901	0.901

This table reports regressions at the firm-year level to investigate the role of country-level formal and informal institutions for the impact of mandatory ESG disclosure on stock liquidity. We use the following dependent variable: *Illiquidity Factor$_{i,c,t+1}$* is an aggregate illiquidity factor constructed as the score of a single factor extracted from the three liquidity measures *Bid-Ask Spread$_{i,c,t+1}$*, *Price Impact$_{i,c,t+1}$*, and *Zero Return$_{i,c,t+1}$*. We use the following key independent variables: i) *Mandatory ESG Disclosure$_{c,t}$* equals one starting from the first year in which a country introduced mandatory ESG disclosure, and zero otherwise; ii) *Rule of Law$^{Res}_{c,t}$* is the residual from a regression of *Rule of Law$_{c,t}$* on countries' legal origins, GDP per capita, and an index reflecting the globalization in a country (*Rule of Law$_{c,t}$* captures the quality of contract enforcement, property rights, the police, and the courts; higher values indicate stronger rule of law); iii) *Govt. Effectiveness$^{Res}_{c,t}$* is the residual from a regression of *Govt. Effectiveness$_{c,t}$* on country variables (*Govt. Effectiveness$_{c,t}$* captures the quality of public services, the quality of the civil service and its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to its stated policies.; higher values indicate higher government effectiveness); iv) *EPI E Norms$^{Res}_{c,t}$* is the residual from a regression of *EPI E Norms$_{c,t}$* on country variables (*EPI E Norms$_{c,t}$* is Yale University's EPI and measures societal outcomes related to environmental health and ecosystem vitality); v) *IVS E Norms$^{Res}_{c,t}$* is the residual from a regression of *IVS E Norms$_{c,t}$* on country variables (*IVS E Norms$_{c,t}$* is an index of the environmental awareness in a country; higher values indicate better environmental awareness); and vi) *IVS S Norms$^{Res}_{c,t}$* is the residual from a regression of *IVS S Norms$_{c,t}$* on country variables (*IVS S Norms$_{c,t}$* is an index of the social norms in a country; higher values indicate stronger social norms). The sample consists of firm-year observations from 65 countries between 2002 and 2020 (unless indicated differently). Data Appendix A defines all variables. Standard errors, reported in parentheses, are clustered at the firm level. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively.

TABLE 6

Mandatory ESG Disclosure and Stock Liquidity: Voluntary Firm Disclosures

	Illiquidity Factor$_{i,c,t+1}$		
	(1)	(2)	(3)
Mandatory ESG Disclosure$_{c,t}$ × No Guidance$_{i,c,t}$	-0.037**		
	(0.016)		
Mandatory ESG Disclosure$^{Gov. Inst.}_{c,t}$ × No Guidance$_{i,c,t}$		-0.070***	
		(0.022)	
Mandatory ESG Disclosure$^{Stock Exch.}_{c,t}$ × No Guidance$_{i,c,t}$		-0.007	
		(0.020)	
Mandatory ESG Disclosure$^{Comply}_{c,t}$ × No Guidance$_{i,c,t}$			-0.040**
			(0.017)
Mandatory ESG Disclosure$^{Comply-or-Explain}_{c,t}$ × No Guidance$_{i,c,t}$			-0.024
			(0.031)
Mandatory ESG Disclosure$_{c,t}$	-0.049***		
	(0.016)		
Mandatory ESG Disclosure$^{Gov. Inst.}_{c,t}$		-0.033	
		(0.022)	
Mandatory ESG Disclosure$^{Stock Exch.}_{c,t}$		-0.030	
		(0.022)	
Mandatory ESG Disclosure$^{Comply}_{c,t}$			-0.058***
			(0.019)
Mandatory ESG Disclosure$^{Comply-or-Explain}_{c,t}$			-0.044
			(0.031)
No Guidance$_{i,c,t}$	0.021***	0.021***	0.021***
	(0.007)	(0.007)	(0.007)
Controls	Yes	Yes	Yes
Industry × year fixed effects	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Sample	All countries	All countries	All countries
# Observations	136269	136269	136269
# Unique firms	17680	17680	17680
% Never-treated firms	44%	44%	44%
# Countries	65	65	65
Adj. R-squared	0.897	0.897	0.897

This table reports regressions at the firm-year level to investigate the role of voluntary firm-level disclosure for the impact of mandatory ESG disclosure on stock liquidity. We use the following dependent variable: *Illiquidity Factor$_{i,c,t+1}$* is an aggregate illiquidity factor constructed as the score of a single factor extracted from the three liquidity measures *Bid-Ask Spread$_{i,c,t+1}$*, *Price Impact$_{i,c,t+1}$*, and *Zero Return$_{i,c,t+1}$*. We use the following key independent variables: i) *No Guidance$_{i,c,t}$* equals one if a firm does not provide earnings guidance in a firm-year according to I/B/E/S, and zero if a firm provides guidance; ii) *Mandatory ESG Disclosure$_{c,t}$* equals one starting from the first year in which a country introduced mandatory ESG disclosure, and zero otherwise; iii) *Mandatory ESG Disclosure$^{Gov. Inst.}_{c,t}$* equals one starting from the first year in which a government institution in a country introduced mandatory ESG disclosure, and zero otherwise; iv) *Mandatory ESG Disclosure$^{Stock Exch.}_{c,t}$* equals one starting from the first year in which a stock exchange in a country introduced mandatory ESG disclosure, and zero otherwise; v) *Mandatory ESG Disclosure$^{Comply}_{c,t}$* equals one starting from the first year in which a country introduced mandatory ESG disclosure if the disclosure is on a full-compliance basis (not on a comply-or-explain basis), and zero otherwise; and vi) *Mandatory ESG Disclosure $^{Comply-or-Explain}_{c,t}$* equals one starting from the first year in which a country introduced mandatory ESG disclosure if the disclosure is on a comply-or-explain basis (not on a full-compliance basis), and zero otherwise. The sample consists of firm-year observations from 65 countries between 2002 and 2020. Data Appendix A defines all variables. Standard errors, reported in parentheses, are clustered at the firm level. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively.

TABLE 7

Introduction of Mandatory ESG Disclosure: Role of Public Debate and ESG Incidents

| | Mandatory ESG Disclosure Year$_{c,t}$ | | | | | |
	(1)	(2)	(3)	(4)	(5)	(6)
Google Search$^{CSR}_{c,t-1}$ ($\times 10^4$)	-0.196			0.148		
	(0.280)			(0.380)		
Google Search$^{Corp.\ Soc.\ Resp.}_{c,t-1}$ ($\times 10^4$)		-0.259			0.127	
		(0.260)			(0.344)	
Google Search$^{ESG}_{c,t-1}$ ($\times 10^4$)			-0.603			-0.967
			(0.796)			(0.757)
ESG Incidents$_{c,t-1}$ ($\times 10^5$)	-0.001	-0.002	0.001	-0.023	-0.021	-0.004
	(0.014)	(0.014)	(0.013)	(0.016)	(0.013)	(0.015)
Sample	Mand. ESG disc. countries	Mand. ESG disc. countries	Mand. ESG disc. countries	Mand ESG Disc. All-at-Once Countries	Mand ESG Disc. All-at-Once Countries	Mand ESG Disc. All-at-Once Countries
# Observations	452	452	452	257	257	257
# Countries	35	35	35	20	20	20
Adj. R-squared	-0.004	-0.004	-0.004	-0.006	-0.006	-0.005

This table reports regressions at the country-year level to investigate the impact of public debate surrounding CSR or ESG topics and ESG incidents on the introduction of mandatory ESG disclosure in a country. We use the following dependent variable: *Mandatory ESG Disclosure Year$_{c,t}$* equals one in the year in which a country introduced mandatory ESG disclosure, and zero otherwise. We use the following independent variables: i) *Google Search$^{CSR}_{c,t}$* is a measure of the Google search volume for the term "CSR" in a country-year; ii) *Google Search$^{Corp.\ Soc.\ Resp.}_{c,t}$* is defined accordingly but for the term "corporate social responsibility;" iii) *Google Search$^{ESG}_{c,t}$* is defined accordingly for the term "ESG;" and iv) *ESG Incidents$_{c,t}$* is the number of ESG incidents in a country-year documented by RepRisk. The sample in columns 1 to 3 consists of country-year observations from 35 countries that introduced mandatory ESG disclosure between 2002 and 2020, and in columns 4 to 6 it consists of country-year observations from 20 countries that introduced mandatory ESG disclosure all at once between 2007 and 2020. However, the regressions contains only country-years between 2007 and 2020 due to data availability. Data Appendix A defines all variables. Standard errors, reported in parentheses, are clustered at the country level. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively.
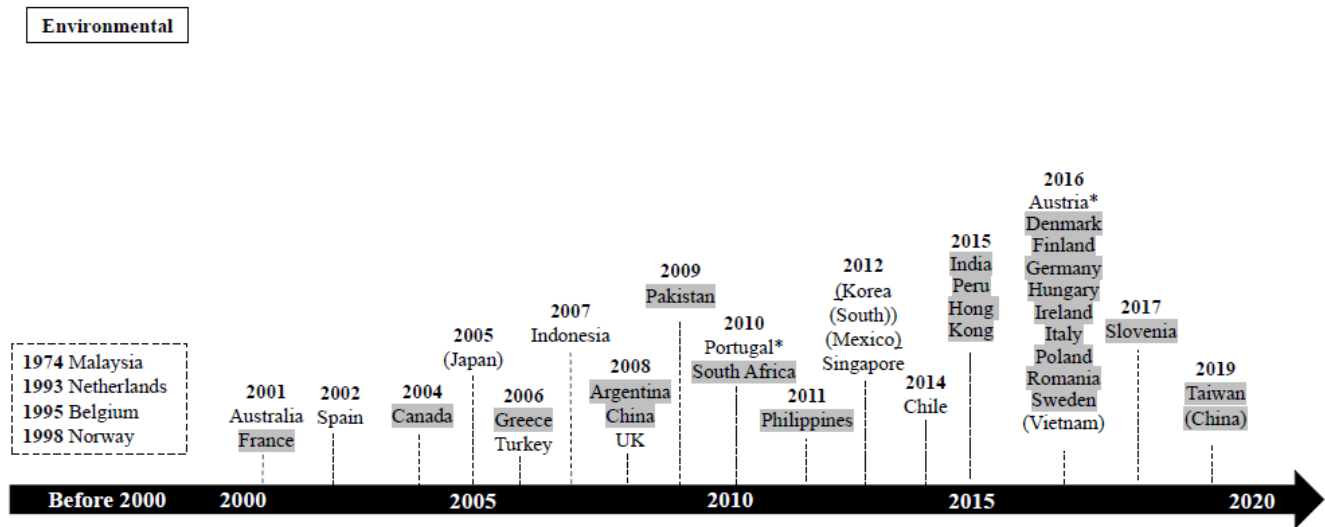
TABLE 8

Introduction of Mandatory ESG Disclosure: Alternative Estimators

| | Illiquidity Factor$_{i,c,t+1}$ | | | |
| | Callaway & Sant'Anna Estimator | | Stacked Regressions | |
	(1)	(2)	(3)	(4)
Mandatory ESG Disclosure$_{c,t}$	-0.050***	-0.105***	-0.137***	-0.129***
	(0.008)	(0.016)	(0.009)	(0.008)
Controls	No	Yes	No	Yes
Year fixed effects	Yes	Yes	No	No
Firm fixed effects	Yes	Yes	No	No
Firm × stack fixed effects	No	No	Yes	Yes
Year × stack fixed effects	No	No	Yes	Yes

Following Baker, Larcker, and Wang [2022], this table reports static effect estimates using the Callaway and Sant'Anna (2021) estimator and the stacked regression approach. We use the following dependent variable: *Illiquidity Factor$_{i,c,t+1}$*, is an aggregate illiquidity factor constructed as the score of a single factor extracted from the three liquidity measures *Bid-Ask Spread$_{i,c,t+1}$*, *Price Impact$_{i,c,t+1}$*, and *Zero Return$_{i,c,t+1}$*. We use the following key independent variable: *Mandatory ESG Disclosure$_{c,t}$* equals one starting from the first year in which a country implemented mandatory ESG disclosure, and zero otherwise. These estimation procedures in the table address possible Type 1 and Type 2 errors arising from estimating staggered DiD effects using OLS when heterogeneous treatment effects and/or variation in treatment timing are present. The control groups in these regressions are never treated and not-yet treated firms. Data Appendix A defines all variables. Standard errors, reported in parentheses, are clustered at the firm level. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively.

Panel A: Introduction of Mandatory E Disclosure

Environmental

1974 Malaysia
1993 Netherlands
1995 Belgium
1998 Norway

2001 Australia France
2002 Spain
2004 Canada
2005 (Japan)
2006 Greece Turkey
2007 Indonesia
2008 Argentina China UK
2009 Pakistan
2010 Portugal* South Africa
2011 Philippines
2012 (Korea (South)) (Mexico) Singapore
2014 Chile
2015 India Peru Hong Kong
2016 Austria* Denmark Finland Germany Hungary Ireland Italy Poland Romania Sweden (Vietnam)
2017 Slovenia
2019 Taiwan (China)

Before 2000 2000 2005 2010 2015 2020

Panel B: Introduction of Mandatory S Disclosure

Social

1994 Malaysia
1998 Norway

2001 Australia France
2002 (US)
2003 Turkey
2004 Canada Portugal
2006 Greece
2007 Indonesia
2008 Argentina China Belgium
2009 Pakistan
2010 UK South Africa
2011 Philippines (Brazil)
2012 Spain*
2015 India Chile* Hong Kong Peru
2016 Austria* Denmark Finland Germany Hungary Ireland Italy Netherlands* Poland Romania Singapore* Sweden (Switzerland) (UAE) (Vietnam)
2017 Slovenia
2019 Taiwan (China)

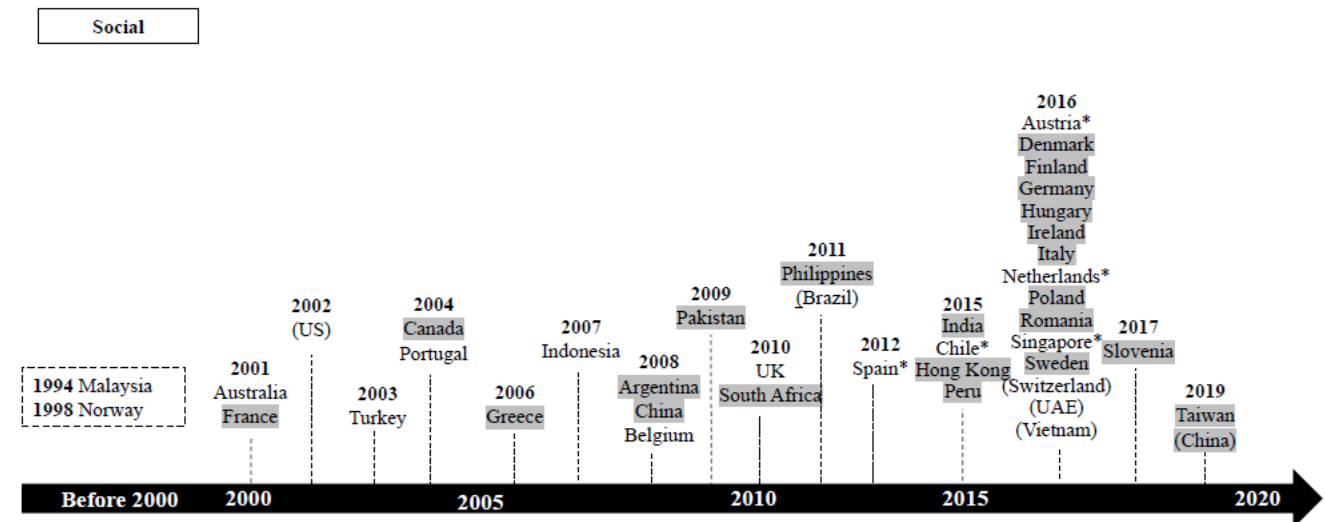Before 2000 2000 2005 2010 2015 2020

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FIG 1— *Continued*
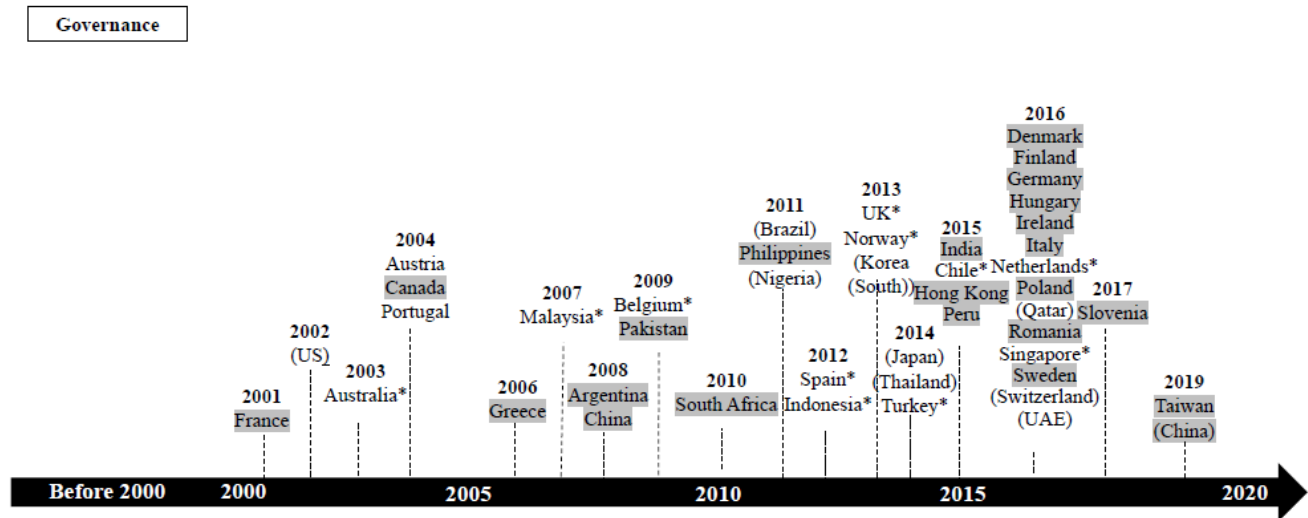
Panel C: Introduction of Mandatory G Disclosure

FIG 1—Timelines of the introduction of mandatory ESG disclosure regulations around the world. This figure exhibits the timeline of the introduction of mandatory environmental (panel A), social (panel B), and governance (panel C) disclosure around the world during our sample period. France (shaded country name) indicates sample countries that implemented mandatory E, S, and G disclosure all at once. The remaining countries implemented mandatory disclosure gradually one by one. (Japan) (country name in brackets) indicates sample countries that did not implement mandatory ESG disclosure on all three topics during the sample period. Australia* (country name with asterisk) indicates that the last of the three disclosure types (E, S, or G) is introduced. Estonia (2017) and Slovakia (2015) introduced mandatory ESG disclosure, but both countries are not listed in the figures as they are not included in the regression sample due to missing data.
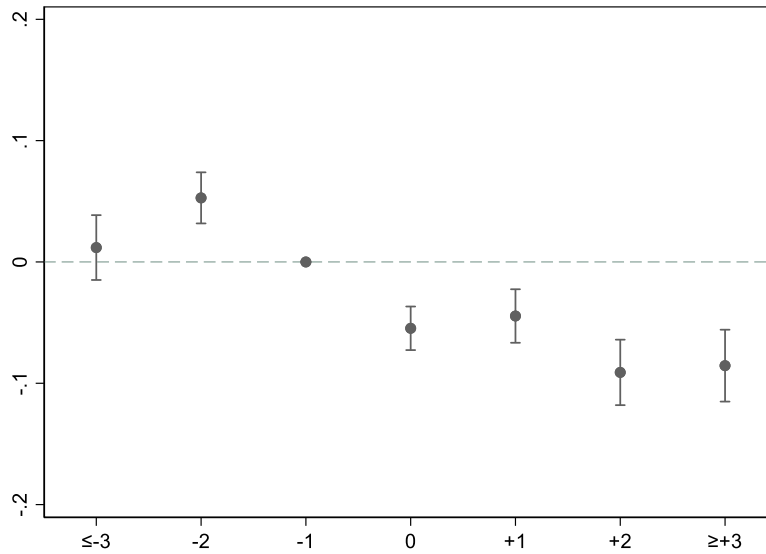
FIG 2— Mandatory ESG disclosure and stock liquidity: Event-time effects. This figure displays event time effects of mandatory ESG disclosure on *Illiquidity Factor*$_{i,c,t}$, which is an aggregate illiquidity factor constructed as the score of a single factor extracted from the three liquidity measures *Bid-Ask Spread*$_{i,c,t}$, *Price Impact*$_{i,c,t}$, and *Zero Return*$_{i,c,t}$. Year $t=-1$ acts as the benchmark year. Standard errors are clustered at the firm level. The estimation is based on regression specification in table 3, column 5, but with individual year indicators (relative to the introduction of mandatory ESG disclosure in year $t=0$) instead of *Mandatory ESG Disclosure*$_{c,t}$. The figure plots the coefficient estimates for each event-time year together with 99% confidence intervals.

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Online Appendix

for

The Effects of Mandatory ESG Disclosure around the World

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Online Appendix A: Data Preparation and Sample Screening Procedures

Our analysis builds on data from Refinitiv Datastream, Eikon, and Worldscope. Specifically, equity price data is pulled from Datastream and Eikon, while accounting data is pulled from Worldscope. The detailed screening procedures are as follow.

Step 1: Create Static Firm List

Following Ince and Porter [2006], we use Datastream constituent lists to construct our list of firms. The lists include dead and active firms. We then search in the Datastream navigator for all stocks and only include i) stocks that are domestic, ii) securities that are of the equity type (i.e., we exclude other non-equity securities), iii) stocks that have a major listing in a given stock exchange, and iv) stocks from a domestic exchange. This procedure is also applied by Schmidt et al. [2019]. A detailed step-by-step filtering procedure is reported in OA Table A1.

Step 2: Extract Equity Data from Eikon and Dynamic Filtering

We then pull global equity data from Eikon using the firm list after applying the static filtering. The detailed filtering procedures are reported in OA Table A2.

Step 4: Calculate Liquidity Measures

We calculate the liquidity variables using daily equity data following the definitions in Data Appendix A.

Step 5: Merge with Firm Fundamental Data

We pull firm fundamental data from Worldscope and calculate variables following the definitions in Data Appendix A.

Creation of Static Firm List

Static Screening ID	Static Screening Procedures	Items Involved
SS1	Delete firms that are not indicated as major listings.	Type of Instrumental = Equity Major Security Flag = Major Major = "1"
SS2	Delete firms that are not located on the domestic market.	
SS3	Keep the security whose type is equity.	TYPE = "EQ"
SS4	Delete stocks without adjusted price data.	ADP = "1"
SS5	Keep the ISIN of the primary listing in case of multiple ISINs.	ISINID = "P"
SS6	Keep the securities that are traded in the major equity exchanges in a country. Delete stock exchanges with less than 30 listed firms in our sample. Major exchanges in each country are reported in OA Table A3 (the table includes countries that are not included in our final sample).	Exchange Market Code (BOURSEMNEMONIC)
SS6	Delete stocks that are not listed on domestic exchanges.	Datastream Exchange Mnemonic (EXMNEM)
SS7	Delete firms whose extended names contain suspicious word parts (Campbell et al. [2010, p. 3089].	Extended Name (ENAME)
SS8	Follow Griffin, Kelly, and Nardari's [2010] rule to exclude non-common equity securities. Detailed non-common equity security codes and industry codes for investment vehicles are obtained from Griffin, Kelly, and Nardari's [2010] Appendix Table B.1 (p. 3272). The country-specific identifiers for excluding non-common equity securities are obtained from Griffin, Kelly, and Nardari's [2010] Appendix Table B.2. (p. 3273).	Extended Name (ENAME) Industry Code (INDG)

This table reports the static screening procedures to create our global sample.

Application of Dynamic Filtering Procedure

Dynamic Screening ID	Dynamic Screening Procedures	Items Involved
DS1	Delete observations with missing daily close prices, negative daily close prices, or daily close prices < US$ 0.1 (penny stocks) (Ince and Porter [2006]).	TR.CLOSEPRICE (Adjusted=0 Curn=USD)
DS2	Set the daily total return to missing if it is greater than 200%.	TR.TotalReturn
	Delete abnormal return reversals. If Ret_t or $Ret_{t-1} > 100\%$ and $(1 + Ret_t)(1 + Ret_{t-1}) - 1 < 20\%$, set Ret_t and Ret_{t-1} to a missing value (Ince and Porter [2006], Lee [2011], Amihud et al. [2015]).	
DS3	Set bid (ask) price to missing if bid (ask) price is negative.	TR.BIDPRICE (Adjusted=1), TR.ASKPRICE (Adjusted=1)
DS4	Set daily share trading volume to missing if daily dollar trading volume is lower than US$100 (Amihud et al. [2015]).	TR.Volume, TR.CLOSEPRICE (Adjusted=0 Curn=USD)

This table reports the dynamic filtering procedures to create our global sample.

Primary Stock Exchanges

Country/Region	Primary Equity Exchanges	Exchange Code
Argentina	Buenos Aires Stock Exchange	BUE
Australia	Sydney Stock Exchange	ASX
Austria	Vienna Stock Exchange	WBO
Bahrain	Bahrain Stock Exchange	BAH
Belgium	Brussels Stock Exchange	BRU
Brazil	Sao Paulo Stock Exchange	BSP
Bulgaria	Sofia Stock Exchange	BUL
Canada	Canadian National Securities Exchange; Toronto Stock Exchange; TSX Venture	CNQ;TSE; TSX;
Chile	Santiago Stock Exchange	SGO
China	Shenzhen Stock Exchange; Shanghai Stock Exchange	SHE; SHG
Colombia	Bogota Stock Exchange	BOG
Cyprus	Cyprus Stock Exchange	CYS
Denmark	Copenhagen Stock Exchange	CSE
Egypt	Cairo Stock Exchange	CAI
Finland	Helsinki Stock Exchange	HEL
France	Paris Stock Exchange	PAR
Germany	Frankfurt Stock Exchange; Hamburg Stock Exchange; Munich Stock Exchange	FRA; HAM; MUN
Greece	Athens Stock Exchange	ATH
Hong Kong	Hong Kong Stock Exchange	HKG
Hungary	Budapest Stock Exchange	BUD
India	Bombay Stock Exchange; National India Stock Exchange	BOM; NSE
Indonesia	Indonesia Stock Exchange	IDX
Ireland	Dublin Stock Exchange	DUB
Israel	Tel-Aviv Stock Exchange	TAE
Italy	Milan Stock Exchange	MIL
Japan	Tokyo Stock Exchange; JASDAQ; Osaka Stock Exchange; Nagoya Stock Exchange	TKS; JAS; OSE; NGO
Jordan	Amman Financial Market	AMM
Kazakhstan	Kazakhstan Stock Exchange	KAZ
Kenya	Nairobi Stock Exchange	NAI
Malaysia	Kuala Lumpur Stock Exchange	KLS
Mauritius	Stock Exchange of Mauritius	MAU
Mexico	Mexico Stock Exchange	MEX
Morocco	Casablanca Stock Exchange	CAS
Netherlands	Amsterdam Stock Exchange	AMS
New Zealand	New Zealand Stock Exchange	NZE
Nigeria	Nigerian Stock Exchange	NSA
Norway	Oslo Stock Exchange	OSL
Oman	Muscat Securities Market	MUS
Pakistan	Pakistan Stock Exchange	KAR
Peru	Lima Stock Exchange	LIM
Philippines	Philippine Stock Exchange	PHS
Poland	Warsaw Stock Exchange; Warsaw Continuous Stock Exchange	WAR; WAS
Portugal	Euronext.liffe Lisbon Stock Exchange	LIS
Romania	Bucharest Stock Exchange; RASDAQ;	BSE; RAS
Russian Federation	Micex Stock Exchange; Russian Trading System	MIS; RTS

Saudi Arabia	Riyadh Stock Exchange	XRY
Singapore	Stock Exchange of Singapore; Singapore Catalist Market	SES; XSS
Slovenia	Bratislava Stock Exchange; Ljubljana Stock Exchange	BRA; LJU
South Africa	Johannesburg Stock Exchange	JSE
Spain	Madrid Stock Exchange	MAD
Sri Lanka	Colombo Stock Exchange	COL
Sweden	Spotlight Stock Market; Stockholm Stock Exchange; Nordic Growth Market	AKT; OME; NGM
Switzerland	Six Swiss Exchange	SWX
Taiwan (China)	Taiwan Stock Exchange; Taiwan OTC	TAI; XTO
Thailand	Stock Exchange of Thailand	BKK
Tunisia	Tunis Stock Exchange	TUN
Turkey	Istanbul Stock Exchange	IST
Ukraine	PFTS Stock Exchange	PFT
United Arab Emirates	Abu Dhabi Stock Exchange; Dubai Financial Market	ADS; DFM
United Kingdom	Aquis Stock Exchange; London Stock Exchange	AQS; LON
United States	New York Stock Exchange; NASDAQ; NYSE Market	NYS; NAS; ASE
Vietnam	Hanoi Stock Exchange; Ho Chi Minh Stock Exchange	HST; XHC

This table reports the major exchanges used in step SS6 in OA Table OA1. The table includes countries that are not included in our final sample.

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Online Appendix B: Additional Tables

OA TABLE B1

Overview of Mandatory ESG Disclosure Regulations

Country/Region	Mandatory ESG disclosure year	Disclosure venue	Regulation	Issuing institution
Argentina	2008	Sustainability Reports	Ley N 2594 de balance de responsabilidad social y ambiental	Buenos Aires City Council
Australia	2003	Annual Report	Listing Rule 4.10.3, Australian Stock Exchange	Australian Stock Exchange
Austria	2016	Management Report; Non-Financial Report	Transposition of EU NFR Directive: Sustainability and Diversity Improvement Act 257/ME	Ministry of Justice
Belgium	2009	Annual Report	The 2009 Belgian Code on Corporate Governance	Corporate Governance Committee
Canada	2004	Data Disclosure	The TSX Timely Disclosure Policy	Stock Exchange
Chile	2015	Annual Report	Norma de Caracter General N 385/386	Superintendencia de valores y seguros
China	2008	Annual Social Responsibility Report	Guidelines on Listed Companies' Environmental Information Disclosure	Shanghai Stock Exchange (SSE)
Denmark	2016	Annual Report	Transposition of EU NFR Directive: Executive order No. 558	Governments (Danish Business Authority)
Finland	2016	Annual Report	Transposition of EU NFR Directive: HE 208/2016 Government proposal to Parliament for Amendments to Accounting Act and certain related Acts	Governments (Ministry of Economic Affairs and Employment)
France	2001	Annual Report	New Economic Regulations Act (NRE)	Parliament
Germany	2016	Annual Report	Transposition of EU NFR Directive: CSR Directive Implementation Act	Governments (Ministry of Justice and Consumer Affairs)
Greece	2006	Annual Report	Law 3487, 2006	Parliament
Hong Kong	2015	Directors' Report, ESG Report	HKEX Listing Rules Disclosure of Financial Information	Hong Kong Stock Exchange
Hungary	2016	Annual Report	Transposition of EU NFR Directive: Amendments to Accounting Act C of 2000	Governments (Ministry of National Economy, accounting and supervision)
India	2015	Sustainability Report	Circular No. CIR/CFD/CMD/10/2015 Format for Business Responsibility Report	Securities and Exchange Board of India (SEBI)
Indonesia	2012	Annual Report	Rule No.KEP-431/BL/2012 concerning the obligation to submit annual reports for issuers of public companies	Capital Market and Financial Institutions Supervisory Agency (Bapepam-LK)
Ireland	2016	Non-financial Statement, Director Report	Transposition of EU NFR Directive (1)	Governments (Department of Jobs, Enterprise and Innovation)
Italy	2016	Management Report	Transposition of EU NFR Directive: legislative Decree 30 December 2016, n.254	Ministry of Economic Affairs

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Malaysia	2007	Annual Report	Main Markets listing requirements CSR description	Bursa Malaysia Securities Berhad
Netherlands	2016	Annual Management Report	Transposition of EU NFR Directive	Ministry of Security and Justice
Norway	2013	Annual and Sustainability Reports	Act amending the Norwegian Accounting Act	Norwegian Parliament
Pakistan	2009	Directors' Report	Companies (Corporate Social Responsibility) general order	Securities and Exchange Commission of Pakistan
Peru	2015	Sustainability Reports	Resolucion SMV No 033-2015-SMV/01	Peruvian Capital Markets Superintendency
Philippines	2011	Annual Report	Corporate Social Responsibility Act, 2011	Committee on Trade and Commerce
Poland	2016	Annual Report	Transposition of EU NFR Directive: Amendments to the Accounting Act	Governments
Portugal	2010	Annual Report	The Financial Reporting Accounting Standard n 26	Commission for Accounting Normalization
Romania	2016	Directive Report	Transposition of EU NFR Directive: Act No 1938 as "Order regarding changes and additions to existing accounting regulations"	Governments (Ministry of Public Finance)
Singapore	2016	Sustainability Reports	SGX0ST Listing Rules Practice Note 7.6 Amendments to sustainability reporting guide	Singapore Stock Exchange (SGX)
Slovenia	2017	Annual Reports	Transposition of EU NFR Directive: Amending the Companies Act	Governments
South Africa	2010	Integrated/Sustainability Report	Johannesburg Stock Exchange Listing Requirement 2010	Johannesburg Stock Exchange (JSE)
Spain	2012	Annual Report/Sustainability Report	Spanish Sustainable Economy Law (revision of 2011)	The National Securities Market (CNVM)
Sweden	2016	Annual Report, Sustainability Report	Transposition of EU NFR Directive: Corporate sustainability reporting and diversity policy	Governments (Ministry of Industries and Innovation)
Taiwan (China)	2019	Sustainability Reports	Taiwan Stock Exchange Corporation Rules Governing the Preparation and Filing of Corporate Social Responsibility Reports by TWSE Listed Companies	Taiwan Stock Exchange (TWSE)
Turkey	2014	GHG Report/Annual Report	GHG Monitoring Regulation/Communique on corporate governance principles	Capital Markets Board of Turkey
United Kingdom	2013	Strategic Report; Director's Report	The companies Act 2006 Regulations 2013	Secretary of State

This table reports information on the mandatory ESG disclosure regulations across 35 countries that introduced such disclosure mandates between 2002 and 2020.

OA TABLE B2

Mandatory ESG Disclosure and Stock Liquidity: Robustness

	Illiquidity Factor$_{i,c,t+1}$						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mandatory ESG Disclosure$_{c,t}$	-0.132***	-0.098***	-0.114***	-0.085***	-0.085***	-0.085***	-0.095***
	(0.007)	(0.009)	(0.008)	(0.019)	(0.028)	(0.011)	(0.008)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry × year fixed effects	No	No	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	No	No	Yes	Yes	Yes	Yes	Yes
Industry × country fixed effects	Yes	Yes	No	No	No	No	No
Time trend (squared) × country fixed effects	No	Yes	No	No	No	No	No
Standard error clustering	Firm	Firm	Firm	Country-year	Country	Industry-year	Firm
Sample	All countries	All countries	Exclude US, Japan, UK, Korea (South)	All countries	All countries	All countries	All countries, exclude year $t=-1$
# Observations	139833	139833	74237	136269	136269	136269	132496
# Unique firms	21244	21244	9861	17680	17680	17680	17567
% Never-treated firms	43%	43%	12%	44%	44%	44%	45%
# Countries	65	65	61	65	65	65	65
Adj. R-squared	0.738	0.746	0.872	0.897	0.897	0.897	0.897

This table reports regressions at the firm-year level to investigate the impact of mandatory ESG disclosure on stock liquidity. We use the following dependent variable: *Illiquidity Factor$_{i,c,t+1}$* is an aggregate illiquidity factor constructed as the score of a single factor extracted from the three liquidity measures *Bid-Ask Spread$_{i,c,t+1}$*, *Price Impact$_{i,c,t+1}$*, and *Zero Return$_{i,c,t+1}$*. We use the following key independent variable: *Mandatory ESG Disclosure$_{c,t}$* equals one starting from the first year in which a country introduced mandatory ESG disclosure, and zero otherwise. The sample consists of firm-year observations from 65 countries between 2002 and 2020 (unless indicated differently). Data Appendix A defines all variables. Standard errors, reported in parentheses, are clustered at the firm level (unless indicated differently). *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively.

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