

Essays on the Regulation of Digital Financial Reporting

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1. Introduction

1.1 Motivation and context

The digital transformation of financial reporting is reshaping how firms disclose financial information and how capital market participants access, process, and analyze it (IFRS Foundation, 2024). A key factor shaping this digital transformation is regulation. For example, in the European Union (EU), regulatory initiatives such as the European Single Electronic Format (ESEF) and the European Single Access Point (ESAP) aim to increase the accessibility, comparability, and machine-readability of firm disclosures (ESAP, Rec. 1; ESEF, Rec. 4). These developments form the foundation of digital financial reporting, defined as the preparation and dissemination of information in a structured, machine-readable format, typically using (inline) eXtensible Business Reporting Language (iXBRL/XBRL) (IFRS Foundation, 2024). Digital financial reporting, by standardizing and digitalizing, has the potential to create economic benefits, specifically by reducing the acquisition, processing, and dissemination costs faced by investors, analysts, regulators, and firms (Blankespoor et al., 2020).

This thesis examines key aspects of the regulation of digital financial reporting. By investigating how EU regulatory initiatives shape the digitalization and dissemination of financial reporting, the thesis addresses two overarching research questions: (1) Are the regulations implemented by the EU for digital financial reporting suitable for effectively achieving their intended consequences? And (2) does the regulatory setting in digital financial reporting in the EU impact firms' individual costs and benefits, affecting the cost-benefit trade-off of early ESEF adoption?

The first study (Section 2) investigates the timeliness of centralized electronic dissemination of financial reports in the EU, a key component of EU single market integration. Timeliness is a regulatory objective and has economic significance because it affects information processing costs. This topic is particularly salient as ESAP, once operational in mid-2027, will rely on national repositories, so-called Officially Appointed Mechanisms (OAMs), as its primary data source (ESAP, Art. 5). Consequently, differences in the setup and processes of OAMs may generate heterogeneity, potentially limiting ESAP's ability to achieve its intended goal of timely dissemination.

The second and third studies (Section 3 and 4) investigate the (expected) economic effects of ESEF. The ESEF mandate aims to enhance the usability of financial statements by enabling automated data extraction and analysis (ESEF, Rec. 4). It remains an open question whether,

and to what extent, the change to the ESEF reporting format impacts capital market liquidity and firms' information environments. Moreover, the Covid pandemic resulted in a one-year postponement of mandatory ESEF adoption in 23 of 27 member states (European Parliament, 2021). This regulatory modification created a setting to compare early adopting and late adopting countries and to analyze firm-, industry-, and country-level characteristics associated with early adoption of firms and its associated cost-benefit tradeoffs.

Taken together, the three studies shed light on how digital financial reporting regulations influence the dissemination, accessibility, and processing of financial information in the EU. The next section provides a broader overview of digital financial reporting and the regulatory environment in which these studies are embedded.

Information processing costs

Efficient capital markets depend on the timely and accurate processing of firm disclosures. Whether information is incorporated into prices ultimately hinges on the costs and benefits associated with its preparation, dissemination, and use (Bloomfield, 2002; Leuz & Wysocki, 2016). Following Blankespoor (2019), information processing costs can be categorized into awareness, acquisition, and integration costs, a framework that helps disentangle the different frictions that arise as information moves from preparers to capital market participants (Blankespoor et al., 2020).

Awareness costs relate to becoming informed that a disclosure exists. Fragmented disclosure channels, decentralized repositories, and competing information can make it difficult or costly for users to identify relevant firm reports (Blankespoor et al., 2020). Acquisition costs refer to the resources required to obtain information once a user has become aware of its existence. These costs are influenced, among other factors, by the format, quality, and accessibility of the disclosed information (Blankespoor et al., 2020; McClure et al., 2025). Integration costs denote the resources required to prepare, standardize, and transform acquired information so that it can be incorporated into valuation, forecasting, or monitoring decisions. These costs often arise because users must reformulate or recalculate elements of the data to generate decision-relevant inputs (Blankespoor et al., 2020).

Digital reporting formats relying on structured data, such as (i)XBRL, are designed to reduce acquisition and integration costs by embedding machine-readable tags that enable automated data extraction and comparability across firms. When implemented effectively, these formats substantially enhance data usability and improve transparency (Blankespoor, 2019; Efendi et al., 2014; Hoitash et al., 2021; Kim et al., 2012). Centralized digital reporting infrastructures

can also affect awareness and acquisition costs by offering more standardized access, reducing search frictions, and improving visibility of available disclosures (Goldstein et al., 2023; McClure et al., 2025; Sran et al., 2024).

National regulators, such as the Securities and Exchange Commission (SEC) in the United States (US), have increasingly sought to reduce user-side information processing costs through digitalization initiatives (SEC, 2009). Initiatives such as establishing the central database Electronic Data Gathering, Analysis, and Retrieval (EDGAR) and the mandatory adoption of XBRL were introduced to strengthen data accessibility and analytical efficiency (Gao & Huang, 2020a; Griffin et al., 2025). However, lowering the costs for users may simultaneously increase the costs borne by preparers, like preparation costs (Griffin et al., 2025). Structured reporting requires investments in tagging expertise, internal controls, software, workflow redesign, training, and quality assurance (Alles & Gray, 2012; Pinsker & Li, 2008). Prior research shows that these preparation costs can be substantial and may influence firms' reporting incentives and assurance decisions (Alles & Gray, 2012). Unlike user-side costs, which digitalization aims to reduce, preparer-side costs increase in the short term and require firms to allocate resources toward technical compliance and process transformation (Du et al., 2013; Janvrin & No, 2012; Pinsker & Li, 2008). Importantly, many of these costs have a sunk-cost component: once firms have invested in software and preparation workflows, these costs cannot easily be recovered if regulatory timelines change or if implementation is postponed.

Regulatory framework and economic foundations

Enhancing the accessibility and comparability of firm information has been a central objective of the EU's Capital Markets Union (CMU) agenda, which builds on the broader single market project (Commission, 2020a). A major early step toward harmonized disclosure was the Transparency Directive (TPD, 2004/109/EC), which required member states to establish national OAMs for disseminating regulated information. Although initially decentralized, the long-term vision already implied the possibility of a future EU-wide solution. A decisive shift toward digital reporting occurred with the amended Transparency Directive (ATPD, 2013/50/EU). It mandated the European Commission (Commission) and the European Securities and Markets Authority (ESMA) to (1) develop technical criteria to improve the functioning and accessibility of OAMs at EU level (ATPD, Rec. 15), and (2) create a harmonized electronic reporting format for financial statements prepared in International Financial Reporting Standards (IFRS) (ATPD, Rec. 26). ESMA, established in 2010 as an independent EU authority responsible for fostering stable financial markets and investor

protection (Regulation 1095/2010), thus became the central institution shaping digital financial reporting in the EU.

The European Single Access Point

ESAP aims to centralize the dissemination of digital financial reporting at EU level. Currently, OAMs serve as national repositories responsible for collecting and providing regulated information to the public. However, researchers, investors, and policymakers have long recognized that fragmentation across the 27 OAMs creates substantial costs (Commission, 2021; Sran et al., 2024). By establishing a centralized EU-wide portal for timely, reliable, and searchable information beginning in mid-2027 (ESAP, Rec. 1, 19; Art. 1 (1)), ESAP seeks to reduce awareness and acquisition costs by offering a single, easily usable repository. Awareness costs potentially decline because stakeholders no longer need to monitor multiple sources, such as diverse OAMs or firm websites, and centralized access reduces the processing capacity associated with dispersed information (Blankespoor et al., 2020). These benefits are further enhanced by multilingual search, extraction, and translation tools (ESAP, Rec. 17; Art. 7). Yet, because ESAP covers a wide range of firm-related information (excluding marketing materials), limits in user processing capacity may reduce usability if functionality is constrained (Sims, 2003).

By potentially lowering extraction costs through centralized access and standardized financial information across the EU, ESAP offers further reductions in acquisition costs. Users will be able to search the repository using various filters, such as industry or size category, thereby simplifying data structuring and retrieval (ESAP ITS, Art. 4, 5). Additionally, bulk downloads will be available, and each disclosure will include associated metadata (ESAP, Art. 7(1) lit f). These improvements interact with structured reporting formats, such as ESEF, to further reduce extraction and processing costs.

While centralized repositories can reduce awareness and acquisition costs by creating a single point of access, their effectiveness depends critically on the timeliness with which information is uploaded and made available (Bolandnazar et al., 2020; Rogers et al., 2017). Without timely dissemination, the benefits of centralization are potentially weakened: information arrives at the repository, but too late to reduce search, monitoring, or trading frictions (McClure et al., 2025). Timeliness thus represents a temporal dimension of information processing costs and can amplify the efficiency gains of centralized provision (Blankespoor et al., 2018). Because ESAP will rely on national OAMs as collection bodies, any heterogeneity in OAM-level timeliness may directly affect ESAP's overall impact on information processing costs.

Therefore, in Section 2, I investigate the timeliness of OAMs' provision of financial reports prior to ESAP entering into force.

The European Single Electronic Format

The aim of ESEF is to “further facilitate (...) accessibility, analysis, and comparability” of financial information by enabling automated data extraction and processing (ESEF, Art. 4), directly addressing acquisition and integration costs. ESEF requires firms listed on EU-regulated capital markets to publish their annual report in xHTML, and for those preparing IFRS consolidated financial statements, to tag these statements using iXBRL. By providing financial information in a structured, machine-readable format, ESEF allows automated extraction of tagged data, including note disclosures (ESEF, Rec. 10). Consequently, the costs associated with locating and extracting relevant information likely decrease (Blankespoor et al., 2020). Moreover, reliance on the ESEF taxonomy supports standardization, potentially lowering the costs of integrating information into valuation models (Blankespoor et al., 2020). However, fragmented dissemination channels within the EU may limit these benefits, implying that ESEF and ESAP jointly reduce information processing costs, affecting both capital-market outcomes and firms' information environments. In Section 3, I study the effects of ESEF implementation on various proxies for capital market liquidity and the information environment.

For preparers, implementing ESEF requires software, appropriate tagging procedures, and quality assurance, all of which generate one-time setup and recurring preparation costs (ESMA, 2015). In addition to these direct costs, indirect costs, such as proprietary costs, litigation risks, and strategic nondisclosure considerations, shape the cost-benefit trade-off underlying voluntary reporting decisions (Healy & Palepu, 2001; Leuz & Wysocki, 2016; Skinner, 1994). On the benefits side, economic theory predicts that credible increases in the precision, accessibility, or interpretability of information can reduce information asymmetry, improve liquidity, and lower firms' cost of capital (Diamond & Verrecchia, 1991; Healy & Palepu, 2001; Lang & Lundholm, 1993; Verrecchia, 1983). By allowing member states to postpone mandatory ESEF adoption by one year due to economic impacts of Covid pandemic, the regulatory framework may have shifted firms' cost-benefit calculus. Many firms were already (partially) prepared to produce ESEF compliant reports, which may have altered the relative importance of direct implementation costs. This staggered introduction creates a setting in which the specific role of direct costs in the overall cost-benefit trade-off can be examined. In Section 4,

I investigate the characteristics of early ESEF adopting firms, focusing on measures of direct costs, particularly the level of preparation at time of implementation postponement.

Taken together, ESEF and ESAP represent the EU's two-pillar approach to digital financial reporting: standardized, machine-readable reporting at the firm level, and centralized, user-friendly access at the EU level. Both initiatives are expected to lower information processing costs and support deeper capital market integration across member states (Commission, 2020a). However, it remains an open empirical question whether these expected net benefits of digital reporting will materialize in practice, and the studies included in the thesis aim to shed light on several aspects of it.

Empirical evidence on digital financial reporting

There is an extensive body of literature examining the effects of digital financial reporting and the dissemination of machine-readable data globally. However, the EU setting has been investigated in only a limited number of studies, and the institutional environments examined differ considerably.

Evidence on centralized disclosure provision

Centralized disclosure platforms play a key role in reducing frictions associated with accessing and processing firm information. By aggregating filings into a single, searchable repository, such systems may lower awareness costs, as users no longer need to monitor dispersed national or firm-level channels, and they may reduce acquisition costs through standardized and easily retrievable data. At the same time, excessively large data volumes can impose new challenges if users face information overload (Blankespoor et al., 2020; McClure et al., 2025; Sims, 2003).

Most empirical evidence on centralized disclosure provision comes from the US, where the SEC's EDGAR system has operated as the primary digital centralized repository for firm reporting for nearly three decades. A consistent finding across this literature is that the introduction and evolution of EDGAR significantly improved the dissemination of firm information. Studies show that greater electronic accessibility reduced information asymmetry and enhanced market-wide transparency (Asthana et al., 2004; Asthana & Balsam, 2001; Gao & Huang, 2020). Recent work demonstrates that the transition from paper-based to mandatory electronic filing mitigated disparities in information access, thereby leveling the playing field among market participants (Chang et al., 2023). Proxies of capital market liquidity also show improvements following EDGAR's implementation (Goldstein et al., 2023). The mechanisms underlying these effects are further clarified by research on information acquisition and

production. Gao and Huang (2020) show that widespread dissemination through EDGAR stimulates greater information production by firm outsiders. Complementing this, Gomez (2024) provides direct evidence that EDGAR reduces acquisition costs by simplifying access to filings. Some studies also document heterogeneous effects, with smaller or less sophisticated investors benefiting more than larger or more established ones (Asthana et al., 2004; Gomez, 2024).

The current system of national OAMs differs in several important respects from the US environment. Nonetheless, Sran et al. (2024) document that the decentralized OAM system in the EU reduced information processing costs relative to previously fragmented reporting channels, particularly for firms with initially high user-side costs. Even after ESAP introduces centralized access, the decentralized OAM structure will continue to collect firm data and feed it into ESAP. This may create frictions, as existing heterogeneity across member states will persist (Joint Committee, 2024). Moreover, with ESAP targeting data availability within 60 minutes after receipt at the OAM-level (ESAP ITS2, Art. 1(6)), real-time dissemination is not envisioned, meaning OAM-level differences may continue to matter. Against this backdrop, ESAP has the potential to reduce awareness and acquisition costs, harmonize access to financial and sustainability information, and strengthen cross-border investment flows. However, its effectiveness will depend critically on the quality and timeliness of the data supplied by OAMs, an issue that motivates the first study of this thesis.

Evidence on (i)XBRL reporting

(i)XBRL is a widely adopted and extensively studied digital reporting technology, offering valuable insights into how structured, machine-readable disclosures influence information processing (see literature review by Hoitash et al., 2021).

Research on the mandatory adoption of XBRL in the US beginning in 2009 provides mixed evidence regarding its effects on information processing costs. Several studies document benefits consistent with lowered user-side frictions: lenders face reduced information acquisition and processing costs (Chen et al., 2018), information asymmetry declines (Kim et al., 2012), and firms that rely more heavily on standardized taxonomy elements experience stronger improvements (Kim et al., 2019). Additional evidence indicates reductions in stock price crash risk (Zhang et al., 2019), lower post-announcement drift (Efendi et al., 2014) and improvements in analysts' information environments (Liu et al., 2014).

At the same time, Blankespoor et al. (2014) report increases in bid-ask spreads following mandatory implementation, consistent with higher information processing costs during early

adoption. Some studies hint that strong learning-curve effects play a relevant role, indicating problems in XBRL adoption in the first years of application (Blankespoor et al., 2014; Cheng et al., 2021). Especially in the first years of implementation, error rates were high and tagging quality was low (Debreceeny et al., 2010; Du et al., 2013). The absence of assurance requirements has been identified as a major contributor to these issues (Alles & Gray, 2012; Debreceeny et al., 2010). Nevertheless, the long-term benefits may have outweighed these early challenges (Liu et al., 2014).

The ESEF setting in the EU differs in several key respects from the US environment typically examined in prior research. ESMA has acknowledged these experiences in its feedback statements (ESMA, 2016), indicating that insights from the US XBRL adoption shaped expectations regarding ESEF's benefits and challenges. The literature highlights several limitations of the US XBRL framework. First, the absence of mandatory audit and required anchoring of extension elements to the broader taxonomy resulted in numerous errors, potentially reducing the usefulness and credibility of filings (Alles & Gray, 2012; Du et al., 2013; Plumlee & Plumlee, 2008). Second, missing anchoring weakened comparability due to the proliferation of firm-specific tags (Debreceeny et al., 2011; Li & Nwaeze, 2018). Third, because the US relies on EDGAR as a centralized repository, users receive real-time access to XBRL reports (Cong et al., 2018; Drake et al., 2015; Rogers et al., 2017), a structure that differs from the EU's decentralized OAM system.

Overall, the literature suggests that XBRL can meaningfully reduce information processing costs, but that these benefits hinge on reporting quality, standardization, and users' ability to process structured data. Given the substantial institutional differences, it remains an open question to what extent similar effects will materialize under ESEF.

Connection to information processing costs

Taken together, prior evidence on digital financial reporting technologies and centralized disclosure platforms shows that machine-readable formats and unified access channels can substantially reduce awareness, acquisition, and, in some cases, integration costs for capital market participants (Blankespoor et al., 2020). Section 2 examines the timeliness of digital financial reporting dissemination, while Section 3 investigates the effects of ESEF implementation on capital market liquidity and firms' information environments. Section 4 then analyzes the role of direct costs in a quasi-voluntary reporting setting created by the short-notice postponement of mandatory ESEF adoption.

1.2 Summary of results

The thesis comprises three studies. As outlined in Figure 1.1, the study proceeds as follows. The first paper examines the timeliness of the dissemination of annual financial reports through OAMs in EU member states (Section 2). The second paper investigates the effects of ESEF implementation on liquidity and information environment (Section 3). The third paper explores the firm characteristics associated with early adopting ESEF (Section 4). The final section concludes the thesis (Section 5).

Figure 1.1: *Content of the Thesis*

1. Introduction		Pages
	<ul style="list-style-type: none"> • Motivation and context • Summary of results 	1-12
Main objective of the study	Main findings of the study	Related literature
Section 2: Does the timely provision of electronic annual reports work? Cross-country evidence for the European Union		
Investigates the timeliness of dissemination of annual financial reports across EU member states and the implications for ESAP. Method: hand-collected archival data.	Timeliness varies substantially both within and between countries. Some countries show almost immediate publication, while others exhibit significant gaps, potentially limiting the effectiveness of ESAP as a centralized platform.	Howard & Zhou (2021, JIS) Sran et al. (2024, JAR)
		Pages 13-36
Section 3: Electronic Reporting and Firms' Information Environment: Evidence from the EU's ESEF regulation		
Examines how ESEF implementation affects firms' liquidity and analyst behavior in EU-regulated capital markets. Method: empirical-archival	ESEF influenced the information environment by concentrating analyst coverage and reducing forecast dispersion, while effects on market liquidity and forecast accuracy remain limited, indicating that the objectives of the ESEF mandate were not fully achieved.	Blankespoor et al. (2014, RAST) Liu et al. (2014, JAPP)
		Pages 37-97
Section 4: Why firms early adopt digital reporting: Evidence from the EU's ESEF mandate		
Examines why certain firms adopted ESEF early by analyzing firm-, industry-, and country-level determinants in a quasi-voluntary setting. Method: empirical-archival	Early adopters are typically larger, more profitable, less financially constrained, and concentrated in member states that announced the postponement later, highlighting the role of sunk preparation costs in driving early adoption.	Boritz & Timoshenko (2015, JIS) Premuroso & Bhattacharya (2012, IJAIS)
		Pages 98-135

5. Conclusion

- Summary of major findings and implications
- Limitations
- Outlook

Pages
136-142

Section 2: Does the timely provision of electronic annual reports work? Cross-country evidence for the European Union

The first paper is based on hand-collected data of publication dates of 2021 annual financial reports (released in 2022) obtained from both national OAMs as well as firm websites. The paper investigates the timeliness of centralized electronic dissemination of financial reports in the EU. This question is relevant for two main reasons: First, timeliness constitutes a critical component of information processing costs and therefore directly relates to ESAP's objective of enhancing the efficient functioning of capital markets (ESAP, Rec. 1). Second, in preparation for the forthcoming implementation of ESAP, OAMs will act as key data suppliers to the centralized repository. Delays or inconsistencies at the OAM level may therefore diminish ESAP's overall effectiveness. Focusing on reporting year 2021 allows the study to contribute to the ongoing policy debate surrounding the ESAP Regulation (2023/2859) and provides evidence on whether current OAM practices align with ESAP's goal of ensuring timely public access to regulated information (ESAP, Rec. 19).

The first part of the paper reviews existing evidence on the impact of centralized repositories on information processing costs, together with the regulatory development and institutional background relevant for centralized financial information provision in the EU. Despite common EU disclosure requirements, substantial differences persist across member states regarding technical implementation, database structure, and enforcement of reporting obligations. With the launch of ESAP, the EU aims to harmonize access to financial and sustainability information by establishing a single centralized portal (ESAP, Rec. 4), following in part the example of the SEC's EDGAR system in the US (Commission, 2021).

Building on this background, the second part of the paper empirically examines the timeliness of annual financial report dissemination across member states. Using data for 1,812 listed firms from 22 countries, the study compares the publication dates of annual reports disclosed on firm websites with those available on national OAMs. The results reveal substantial heterogeneity both within and across countries, reflecting differences in national disclosure practices and technical implementation. Overall, the findings indicate that the speed of financial report dissemination within the EU remains highly fragmented. Since OAMs will continue to serve as

data providers for ESAP, these disparities are likely to persist unless reporting processes and enforcement mechanisms become more closely harmonized.

Section 3: Electronic Reporting and Firms' Information Environment: Evidence from the EU's ESEF regulation

The second paper is an empirical-archival study examining the effects of ESEF on firms' capital market liquidity and information environment. The aim is to evaluate how a broad, cross-country electronic reporting mandate affects firms listed on EU-regulated capital markets. Using a difference-in-differences design with non-EU control firms, the study provides initial evidence on the consequences of ESEF adoption. Prior evidence from the US suggests a potentially decreasing of information processing costs by implementing a digital reporting format, motivating an examination of whether similar effects emerge in the EU.

The analysis examines two core outcomes: capital market liquidity and the information environment. Across several standard liquidity measures (e.g., Blankespoor et al., 2014; Daske et al., 2008; Krueger et al., 2024), the evidence does not indicate that ESEF improved liquidity as intended. Firms in early adopting countries even experience notable liquidity declines, while late adopters show no clear effects. These patterns appear stronger for firms typically associated with richer information environments. Institutional differences also matter: outcomes are more favorable when stock exchanges serve as OAMs, whereas other institutional arrangements perform less well. In contrast, OAM filing timeliness, documented in Section 2, explains little of the observed variation.

For the information environment, the results point to a redistribution of analyst attention rather than an overall improvement. Analyst following declines despite stable coverage, indicating a concentration of coverage among fewer analysts. Forecast dispersion decreases but forecast accuracy does not systematically improve. These shifts are most pronounced for firms with higher visibility or greater pre-ESEF information asymmetry. Institutional features of OAMs and reporting timeliness explain part of these tendencies, suggesting that ESEF alters how information intermediaries allocate effort without substantially enhancing information quality.

Taken together, the results provide limited support for ESEF's stated objective of strengthening EU capital markets (ESEF, Rec. 4). The findings contrast with prior research on XBRL adoption in the US (Blankespoor, 2019; Hoitash et al., 2021), pointing to differences in institutional context, technological development, and the lack of a centralized EU database. These results imply that regulatory mandates alone may be insufficient to enhance capital market liquidity or reduce information friction without harmonized infrastructure and broad market adoption.

Section 4: Why firms early adopt digital reporting: Evidence from the EU's ESEF mandate

The third paper examines the characteristics of firms that adopted ESEF before it became mandatory. At the end of 2020, EU legislators allowed member states to postpone mandatory ESEF reporting by one year due to the Covid pandemic. 23 of 27 countries made use of this option, creating a quasi-voluntary setting in which some firms adopted ESEF despite being allowed to delay (Commission, 2021). The study pursues two objectives: to identify early adopters using XBRL Europe's database, supported by manual validation, and to analyze which firm-, industry-, and country-level characteristics explain early adoption, with particular emphasis on sunk preparation costs.

Accurate identification of early adopters is essential. Because the EU still lacks a centralized repository for financial reporting (see Section 2), XBRL Europe is one of the few standardized cross-country data sources for ESEF filings. To assess its reliability, classifications for 2020-2022 were manually validated for a subsample using national OAMs and firm websites. The validation shows high accuracy. In 2021, about 85 percent of firms are correctly classified, with most errors involving firms incorrectly marked as non-reporters. Based on this, 262 firms are identified as early adopters, with the largest shares in Spain, Poland, and Finland, consistent with country-level evidence (e.g., Koskentalo & Penttinen, 2021; Miścikowska, 2021).

Next, the study examines which firm characteristics are associated with early adoption using descriptive statistics and logistic regressions. Guided by the voluntary disclosure literature, the analysis focuses on cost-benefit considerations. A key feature of the setting is the timing of postponement announcements. Firms in later announcing countries had already invested more in preparing for ESEF and therefore faced higher sunk costs. The results support this mechanism. Early adopters tend to be larger, more profitable, less financially constrained, and more widely held by institutional investors. These firms also appear more likely to have incurred substantial preparatory costs prior to the postponement.

Overall, the paper provides the first systematic evidence on early ESEF adoption in the EU. The short-notice postponement created conditions in which preparation status, and associated sunk costs, became central to adoption decisions. Early adopters are typically larger and financially stronger firms in late adopting countries, consistent with cost-based explanations. For regulators, the findings highlight that the timing of policy decisions can meaningfully influence adoption behavior when new reporting requirements are introduced.

2. Does the timely provision of electronic annual reports work? Cross-country evidence for the European Union

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Working Paper²

ABSTRACT: I investigate the timeliness of centralized electronic dissemination of financial reports in the EU. In 2023, the EU adopted the ESAP Regulation, which establishes a central EU-wide repository for firms' mandatory filings from mid-2027 onward. In this study, I document the existing structure of national central repositories in the EU, the so-called OAMs, in light of the forthcoming ESAP Regulation. Specifically, I investigate for both OAMs and firm websites the timeliness of providing financial reports, which is a key regulatory and economic requirement. For EU firms' 2021 annual reports, my findings document substantial heterogeneity both within and between member states. While some OAMs provide reports on release day or with minimal delay, others exhibit sizable time lags. Without adjustments to existing national structures, such delays may undermine the timeliness and ultimately the effectiveness of ESAP as a central access point.

JEL Classification: G14, G15, G18, M41, M48

Keywords: Information centralization, disclosure processing costs, disclosure regulation, OAM, European Single Access Point (ESAP), European Union (EU)

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2.1 Introduction

I investigate the timeliness of centralized electronic dissemination of financial reports in the EU. On December 20, 2023, the Regulation establishing ESAP (2023/2859) was published, representing the next stage towards creating a central repository for regulated firm information in the EU. From mid-2027 onward (ESAP, Art. 1(1)), financial and non-financial information will be made available centrally through ESAP. Currently, the dissemination of financial reports remains a national responsibility, resulting in a fragmented regulatory landscape.

By introducing ESAP, the EU seeks to provide reliable and structured access to firm-level information, increase the visibility of small and medium-sized enterprises, and strengthen the functioning of EU capital markets (ESAP, Rec. 1, 14). Among the objectives of the regulation, timeliness is explicitly highlighted as a regulatory objective (Commission, 2020a), referring to the timely provision of financial information to ESAP by OAMs (ESAP ITS, Art. 1(6), Rec. 10). The timely dissemination of financial reports was aimed at by the Transparency Directive (TPD, 2004/109/EC), but its implementation did not achieve the expected outcome (Joint Committee, 2024; Mazars, 2010). Therefore, the Commission started a new agenda to address this topic, among others. Following the ESEF,³ ESAP constitutes the second major regulatory initiative in digital financial reporting. Together, these measures support easy access to structured data, form an important step in the EU's digital transformation (ESAP, Rec. 2), and contribute to a stronger single market (Commission, 2020a).

Prior research investigates the effect of centralized provision of financial reports on information processing costs, a key driver of information asymmetries (Blankespoor, 2019). Evidence from the US EDGAR system⁴ shows that central repositories may reduce information acquisition costs and improve market outcomes (Asthana & Balsam, 2001; Goldstein et al., 2023; McClure et al., 2025). Thus, as intended by ESAP, smaller firms may benefit from central provision of financial reports (Sran et al., 2024). A relevant factor in the effect of centralization is the usability of the repository, for example by providing sufficient search functions (Sran et al., 2024). With respect to timeliness, a factor directly targeted by the Commission through ESAP and closely linked to information processing costs, research remains limited. Yet timeliness is

³ ESEF is an electronic reporting format for companies listed on EU-regulated capital markets, developed by ESMA. Based on iXBRL, certain elements of the annual report must be tagged and are therefore provided in a single human- and machine-readable format (see Sections 3 and 4).

⁴ EDGAR, the Electronic Data Gathering, Analysis, and Retrieval system, is operated by the Securities and Exchange Commission (SEC) as the primary system for the submission and dissemination of financial data in the US.

known to matter for capital market participants (Harris & Morsfield, 2012) and even short publication delays can have economically meaningful consequences (Bolandnazar et al., 2020; Howard & Zhou, 2021; Rogers et al., 2017). More broadly, the value of central databases depends not only on accessibility but also on when information becomes available, as delays can impact its ability to lower information processing costs.

These findings motivate the investigation of timeliness in the context of ESAP. By relying on the current system of national repositories, the OAMs, existing differences may lead to heterogeneity between member states, even under ESAP (Joint Committee, 2024). Besides timeliness, potential differences include aspects of data collection and validation checks at OAM level, the user-friendliness of providing sufficient function for searching and analyzing data, and the ease of retrieving information from the repository. Prior evidence indicates potential variation in OAM practices, motivating the analysis conducted in this study (Sran et al., 2024).

Taken together, the timeliness of digital provision of financial reports is a key regulatory concern, and rightfully so, given the critical role of timely information for price formation in capital markets. However, actual timeliness of digital provision of reports in the EU, and the variation therein, is an open question given the OAM system. Against this backdrop, the objective of this paper is twofold. First, I provide a detailed account of the regulatory development and background of the centralized provision of financial information in the EU, with a focus on the economic effects of introducing centralized repositories and their design, as well as the role and potential variation of timely information provision. Second, I empirically investigate the timeliness of annual report dissemination under the current system, focusing on audited consolidated annual financial statements for the 2021 reporting year.

By outlining the main arguments and structural features of ESAP, I highlight the intended consequences of the adoption of centralized financial reporting in the EU and identify potential problems with the current implementation approach, among which timeliness emerges as a key concern. Returning to OAMs and their implementation under the TPD, I highlight the role of centralized financial information for establishing a single market and describe the transition from the TPD framework to the ESAP Regulation. Last, I address the topic of potential heterogeneity in the ESAP context.

My empirical analyses provide descriptive evidence on heterogeneity at both firm and country level. For a sample of 1,812 firms from 22 member states, I document substantial differences

in the reporting gap between publication on firms' websites and at the OAM. In Malta, the average gap is zero days, whereas in Germany it is 36.48 days. Across all countries, the average gap is 9.41 days, largely driven by the German result. In most member states, the gap ranges between one and five days. Differences also emerge within countries: in Ireland, a few firms with large gap drive the national average, whereas in Slovakia many firms exhibit small gaps. Germany is again an outlier, with only one firm publishing its annual report on both databases on the same day. This is notable given that, across all countries, 56.82 percent of firms publish their reports at the same day on both platforms.

The findings of this study contribute to the literature on financial disclosure regulation and digital financial reporting in several ways. First, it documents the status quo of the regulatory framework for disseminating financial statements through national OAMs and outlines the institutional changes introduced by ESAP from mid-2027 onwards. Second, it provides evidence on the timeliness of financial reporting dissemination within the current OAM system, addressing a factor that will be central to ESAP's future usefulness. Third, it contributes to the ongoing discussion on ESAP by highlighting a potential concern associated with its planned implementation, namely the risk that heterogeneous national processes may undermine the effectiveness of the central database.

2.2 Literature on centralized provision of financial reporting and timeliness

Recital 1 of the ESAP Regulation emphasizes that ESAP seeks to strengthen the efficient functioning of EU financial markets by facilitating investment decision-making through easy, centralized, and structured access to financial data. By reducing information processing frictions, ESAP may accelerate investors' awareness and acquisition of relevant information, which contributes to more efficient capital markets (Fama, 1970). In addition, the timeliness of financial reporting can reduce information processing costs for capital market participants, as investors can rely on a single, centralized repository for firm data. This mechanism aligns with the broader objective of harmonizing and centralizing the dissemination of firm information across the EU (ESAP, Rec. 20; TPD, Rec. 5, 23). Accordingly, this section investigates the impact of centralized repositories on information processing costs, and the role of timeliness in supporting efficient capital market functioning.

The effect of centralized repositories on information processing costs

The centralized provision of financial reporting refers to a single point of access through which a variety of firm disclosures are made available (CESR, 2005; Sran et al., 2024). A central feature of such systems is their ability to reduce information processing costs, a major source of information asymmetries (Sims, 2003). Blankespoor (2019) distinguishes between three types of information processing costs: awareness, acquisition, and integration costs. Central repositories have the potential to lower especially awareness and acquisition costs by improving investors' access to information (Asthana et al., 2004; Asthana & Balsam, 2001). Reducing these costs may facilitate capital market liquidity (Roychowdhury et al., 2019; Sran et al., 2024) and influence firms' investment and financing decisions (Goldstein et al., 2023).

Consistent with the goal of improving market functioning, centralized repositories enhance the efficiency and timeliness of disseminating value relevant information (Asthana & Balsam, 2001), thereby strengthening firms' capital-market liquidity (Goldstein et al., 2023). They also stimulate information production by firm outsiders, supporting more efficient market outcomes (Gao & Huang, 2020a).

Timeliness of the dissemination

While centralized repositories reduce awareness and acquisition costs by creating a single point of access, their effectiveness depends critically on the timeliness with which information is uploaded and made available (Bolandnazar et al., 2020; Rogers et al., 2017). Without timely dissemination, the benefits of centralization are potentially undermined: information arrives in a centralized location, but too late to reduce search, monitoring, or trading frictions (McClure et al., 2025). Thus, timeliness represents the temporal dimension of information processing costs and potentially strengthens the efficiency gains of centralized provision (Blankespoor et al., 2018).

Timeliness refers to the period between the issuance of information by the firm and its availability in the repository.⁵ Following Harris & Morsfield (2012), most investors prefer access within a day or less. In their survey, 42 percent of respondents expect real-time

⁵ There are different definitions in the literature. For example, Du & Wu (2018) measure timeliness as the gap between the fiscal year-end and the publication of the annual report. Within ESAP, the Commission defines the gap as the time between the OAM receiving a report and its availability on ESAP (ESAP ITS2, Art. 1(6)).

availability of earnings releases and 21 percent expect same-day dissemination;. For 10-Ks, 28 percent expect real-time availability and 22 percent same-day availability.

Research shows that even short delays can matter. Bolandnazar et al. (2020) and Rogers et al. (2017) demonstrate that delays of only a few seconds in disseminating information can produce economically meaningful effects. Investors who receive information earlier can trade on it and benefit from the resulting timing advantage. Howard & Zhou (2021), measuring timeliness as the gap between XBRL and non-XBRL filings of the same information in the US, find negative market-adjusted stock returns for firms that do not publish timely. They interpret the lack of timeliness as a negative signal to the market.

User and usability of centralized provision of financial reporting

The effects of centralized repositories vary across users. On the firm side, Sran et al. (2024) show that repositories in the EU, the OAMs, improve liquidity particularly for small firms with low institutional ownership and limited press coverage, likely through reductions in information processing costs. This is consistent with the Commission's objectives for transparency and supporting SME's. Industry peers experience spillover effects as well (Goldstein et al., 2023; Sran et al., 2024).

On the user side, centralized dissemination of financial reporting via repositories may benefit less sophisticated investors by giving them access to the relevant information in a timely manner (Asthana et al., 2004; Gomez, 2024). At the same time, this information might have only been available to sophisticated investors beforehand, broadening its audience (Amiram et al., 2016). However, Gomez (2024) provides evidence for a stronger positive effect for sophisticated investors at the cost of unsophisticated ones. A possible explanation lies in integration costs: central repositories reduce awareness and acquisition costs, but do not eliminate integration costs. Consequently, sophisticated investors with greater ability to process information may still benefit disproportionately (Blankespoor, DeHaan, et al., 2020; Gomez, 2024).

The functionality of the repository also matters. More user-friendly repositories, proxied by advanced search features and structured data, exhibit stronger effects (McClure et al., 2025; Sran et al., 2024). The format of information matters too. Guo & Yu (2022) show that unsophisticated investors rely more on human-readable formats than on machine-readable data, indicating that accessibility and format are important in addition to availability.

In sum, prior research highlights that centralized provision of financial information can reduce information processing costs and improve market efficiency, consistent with the goals of the Commission. However, research regarding the role of timeliness remains relatively scarce. The next sections proceed as follows: Section 2.3 provides an overview of the ESAP Regulation with a focus on the role of OAMs in the setting. Section 2.4 investigates the timeliness of OAMs as one aspect of ESAP potentially crucial to its usefulness and a key to facilitating investment decision-making.

2.3 Centralized provision of financial information in the EU: Path towards ESAP

This chapter provides an overview of the regulatory background underlying the EU's efforts to centralize access to financial reporting. The adoption of the ESAP Regulation in 2023 marks an important step toward establishing a single EU-wide access point for firm disclosures and forms part of the EU's broader agenda to enhance the efficiency of the single market. The section first outlines the main features of the ESAP framework and then examines the role of OAMs, the national bodies responsible for receiving and disseminating regulated information under the Transparency Directive, and their function within the ESAP context.

European Single Access Point

ESAP represents the EU's most recent initiative to centralize access to financial and non-financial reporting. Introduced as Action 1 of the Capital Markets Union (CMU) Action Plan⁶, ESAP is intended to support deeper capital market integration and enhance market functioning by reducing information frictions across member states (Commission, 2020a). As discussed in Section 2.2, evidence from existing repositories shows that centralizing firm disclosures can lower information processing costs and improve liquidity, particularly for smaller firms with limited visibility. These findings underscore the economic rationale behind ESAP and motivate a closer examination of its regulatory design.

The ESAP Regulation (2023/2859) was published on December 20, 2023, with the repository scheduled to become operational from mid-2027 onward (ESAP, Art. 1(1)). A wide range of financial and non-financial information will be disseminated through ESAP, including voluntary disclosures, with the exception of marketing materials (ESAP, Rec. 4, 5). Firms are

⁶ The CMU Action Plan was adopted by the Commission in 2015 with the aim of creating a truly single market for capital across the EU. As a result of the COVID-19 pandemic, the plan received greater attention and was significantly expanded in 2020. Action 1 proposed the creation of the European Single Access Point (ESAP) to “tackle the lack of accessible and comparable company data for investors” (Commission, 2020a).

not required to submit additional information but must provide their disclosures in machine-readable or structured formats, such as ESEF (ESAP, Rec. 7, 12). ESAP aims to offer user-friendly access for a broad set of stakeholders, including investors, regulators, academics, and the general public (ESAP, Rec. 5). To accommodate this diverse user base, the regulation mandates search, translation, and retrieval functionalities (ESAP, Art. 7; ESAP ITS1, Art. 4, 5), requires the use of a Legal Entity Identifier to uniquely identify each firm (ESMA, 2025)⁷, and permits the introduction of user fees for large-volume access based on usage patterns (ESAP, Art. 8). Recital 19 emphasizes the importance of timely availability of information, an aspect that national OAMs are expected to ensure. Given this emphasis on timeliness, the effectiveness of ESAP will critically depend on the performance of OAMs in collecting and transmitting high-quality data.

ESAP continues to rely on OAMs as so-called collection bodies at member state level (ESAP, Rec. 2(2)). While OAMs are responsible for collecting disclosures and conducting automated validations of technical requirements, they do not verify the substantive content of filings (ESAP, Rec. 19; ESAP ITS2, Art. 1(3)). When issues related to content or scope arise, OAMs are required to act only once notified by a third party or by ESMA, which performs its own compliance checks (ESAP, Art. 10(3)). OAMs transmit data to ESAP through a single application programming interface (API) (ESAP, Art. 5(1) lit e; ESAP ITS1, Art 1) within a maximum of 60 minutes after receiving it (ESAP ITS2, Art. 6(1)).

In a consultation conducted by the Joint Committee of the European Supervisory Authorities (Joint Committee), investor representatives noted that, without real-time provision of information, they would continue to rely on costly third-party data. The Joint Committee responded that, due to the two-tier system consisting of OAMs and ESAP, real-time data provision is not feasible, and that most participants do not currently use ESAP for timely data (Joint Committee, 2024). Because the efficiency of the system depends on the performance of these national collection bodies, heterogeneity across member states may directly affect ESAP's overall reliability and usefulness for market participants.

⁷ In October 2025, ESMA published the Proposal for the ESAP Regulatory Technical Standards (RTS). After adoption, presumably in 2026, the RTS will specify additional aspects of the technological framework and data structure, complementing the Implementing Technical Standards (ITS) of ESAP, of which two were published in 2025 to clarify tasks of OAMs as well as technical aspects of ESAP implementation (ESMA, 2025).

Understanding the continued role of OAMs within ESAP therefore requires a closer look at their function, responsibilities, and historical development, which is discussed in the following subsection.

Officially Appointed Mechanisms

OAMs serve as national repositories responsible for storing and providing access to financial reports and other regulatory disclosures. They are operated either by a national competent authority or by a designated third party, such as a stock exchange. Each member state must designate at least one OAM (TPD, Art. 21(2)). Conceived as one-stop shops⁸, OAMs are intended to function as the primary publication venue for domestic issuers and to fulfil both a repository and a disclosure function (CESR, 2005). Accordingly, OAMs provide access to the same financial and regulatory disclosures that firms publish on their own websites⁹ (Sran et al., 2024). The repository function ensures mandatory long-term storage of financial information, enabling the monitoring of compliance with reporting deadlines. The disclosure function concerns making information publicly accessible, potentially in real time, although the TPD leaves member states discretion in determining whether real-time dissemination is required (Proposal TPD, 10).

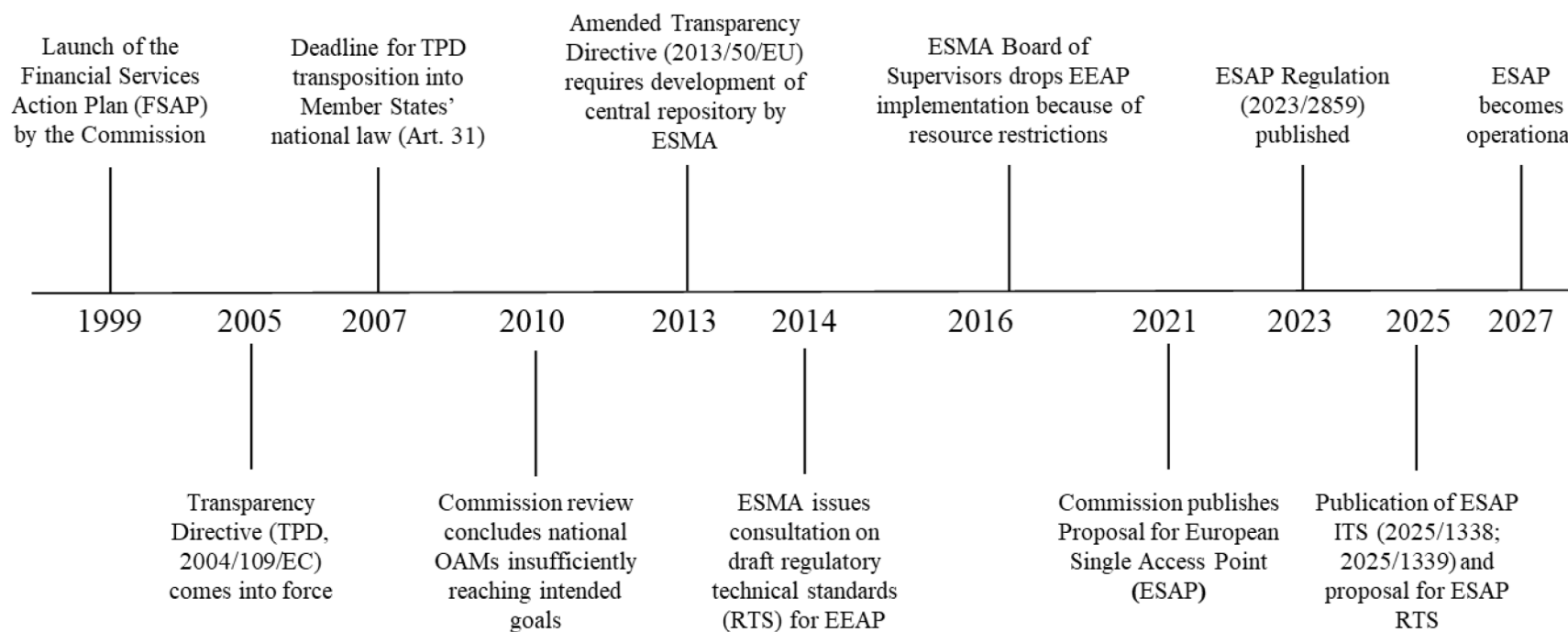
To understand the role OAMs will play within ESAP, it is necessary to examine their regulatory origins, the persistent heterogeneity in their design, and how these characteristics may influence ESAP's effectiveness. OAMs were established by the TPD (2004/109/EC) between 2005 and 2007. The Directive required member states to set up at least one filing and storage system (TPD, Rec. 23) and introduced minimum quality standards intended to ensure timely access to firms' financial information (TPD, Art. 21; Rec. 23). Prior to its adoption, national registers varied substantially, and many lacked a central access point. This fragmentation created obstacles for cross-border activity and represented "barriers preventing issuers from seeking access to the regulated markets in several Member States" (Commission, 2003, No. 9). The Commission explicitly referred to the US EDGAR system as a benchmark for simple, centralized access to disclosures (Commission, 2003).

⁸ A one-stop shop in the context of financial reporting refers to a central contact point for fulfilling reporting obligations. A firm submits all required regulatory documents there once, with no additional reporting obligations to other institutions.

⁹ For measuring timeliness in the OAM setting, I draw on this concept.

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Figure 2.1: *Timeline of ESAP adoption*



Note: This figure illustrates the timeline for the implementation of centralized dissemination of financial reports in the EU. The ESAP Regulation was adopted in 2023 and will enter into force in mid-2027. In 2025, the Commission published the ESAP ITS (Implementing Technical Standards) and ESAP RTS (Regulatory Technical Standards), which define the technical and regulatory requirements, particularly for national OAMs. (Own illustration)

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Despite the common regulatory framework, substantial heterogeneity across OAMs has persisted. This is largely due to differences in implementation choices, divergent institutional responsibilities (e.g., stock exchanges vs. competent authorities), the absence of detailed technical harmonization, and the retention of legacy national infrastructures. As a result, member states adopted distinct technological solutions, validation procedures, and user interfaces.

Post-implementation reviews confirm that the introduction of OAMs did not significantly improve cross-border access, particularly for smaller issuers, and that analysts and investors displayed limited interest in using national OAMs (Commission, 2010; Mazars, 2010).¹⁰ The continued existence of 27 separate systems imposed complexity and costs on users. Incompatible national standards created problems for timeliness, automated processing, and cross-border comparability (Commission, 2010). Compared with EDGAR, stakeholders highlighted significant shortcomings in usability and accessibility. These concerns became more pressing as the single market evolved and as the financial crisis underscored the need for accessible, high-quality financial information (Commission, 2010), to strengthen transparency in capital markets (Commission, 2009; IOSCO, 2010), prompting the Commission, with the assistance of ESMA, under the amended Transparency Directive (ATPD), to develop technical criteria aimed at improving the functioning of OAMs and ensuring effective access to regulated information at the Union level (ATPD, Rec. 15).

With ESAP scheduled to become operational in mid-2027, the platform will rely on data supplied by OAMs functioning as national collection bodies. In this role, OAMs may influence ESAP's effectiveness in two distinct ways. First, they determine information visibility and accessibility at the user level. Sran et al. (2024) highlight substantial heterogeneity across OAMs: some provide extensive search tools and user-friendly interfaces, while others offer only basic functionality.¹¹ Once ESAP is implemented, these user-facing features will be standardized, and national-level differences in accessibility are expected to disappear. Second, OAMs affect the quality and timeliness of the underlying data provided to ESAP. This includes ensuring that submissions conform to the correct data formats, that technical validations are error-free, and that information is made available in a timely manner. Unlike interface-related

¹⁰ The focus of analysts and investors remained on large firms, for which they were able to obtain the required information as they had previously (Commission, 2010).

¹¹ Evidence from Sran et al. (2024) indicates that firms in countries whose OAMs provide industry search filters experience the greatest improvements in liquidity following OAM implementation.

features, these aspects are tied directly to each OAM's operational processes and may continue to vary across member states even after ESAP is implemented. Such heterogeneity could influence the efficiency and reliability of ESAP as a centralized platform for financial reporting (Joint Committee, 2024).

Consequently, the next chapter investigates the timeliness of the provision of audited consolidated annual financial statements across OAMs, offering descriptive evidence on national differences that are likely to carry over into the ESAP environment.

2.4 Timeliness of OAM information provision in the EU: Cross-country evidence

Building on the previous section, which highlighted potential country-level heterogeneity among OAMs, this chapter investigates an economically relevant dimension of that variation: the timeliness of financial reporting dissemination. Under ESAP, OAMs continue to serve as national collection bodies, responsible for transmitting firms' disclosures to the central repository. Consequently, differences in the performance of OAMs may directly affect the effectiveness of ESAP. The aim of this chapter is to provide a descriptive analysis of the timeliness of financial reporting across member states. Specifically, I examine the time gap between the publication of audited consolidated annual financial statements on firms' websites and their subsequent availability at the national OAM. By doing so, I offer descriptive evidence on the current state of timeliness and highlight potential heterogeneity in reporting practices across OAMs.

2.4.1 Sample

I collected data on the publication dates of audited consolidated annual financial statements from both firms' websites and national OAMs. My focus is on firms listed on EU-regulated capital markets and, accordingly, subject to the ESEF mandate.¹² These firms attract attention from investors, analysts, regulators, and other stakeholders, and ESEF provides a structured format particularly suitable for future provision via ESAP.¹³ My study is based on 2021 annual financial statements, published in 2022.¹⁴ In April 2022, the feedback period regarding the

¹² For a more detailed discussion of the ESEF mandate, see Sections 3 and 4.

¹³ Although I study firms listed on EU-regulated capital markets based on ESMA data, and thus subject to the ESEF mandate, the data collection approach used in this study, as well as challenges related to the provision of ESEF reports by OAMs, does not allow restricting the sample to ESEF filings only. Consequently, corresponding annual reports provided in other formats are also included.

¹⁴ For companies whose financial year does not correspond to the calendar year, the most recent annual financial statement published with the OAM before October 1, 2022, was selected.

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Proposal for ESAP ended, and prior evidence from this study was used in a feedback letter to the Commission to highlight the relevance of OAM heterogeneity (see Volkmann (2022)).

To identify firms listed on EU-regulated capital markets, I use the 2021 FIRDS¹⁵ list provided by ESMA. Financial instruments other than equity were excluded, and duplicate firm-year observations were removed using ISIN as a unique identifier, yielding an initial sample of 4,037 firm-year observations. These were then merged with LSEG Workspace data to obtain firm names and additional firm-level information¹⁶, resulting in a final sample of 3,227 firm-year observations. Firms no longer actively engaged in business activities (e.g., delisting, liquidation, or merger) were subsequently removed.

As documented in Table 2.1, four OAMs were excluded due to data access limitations. The Bulgarian OAM could not filter results by firm because of the Cyrillic alphabet, and the alternative database referenced¹⁷ was not officially listed as an OAM by ESMA; therefore, Bulgaria was excluded. The Hungarian OAM only provides access to (1) the last 200 published ad-hoc notifications or (2) an archive in Hungarian containing data only up to 2008; Hungary was thus excluded. The Polish OAM can only be searched by individual days and not by firms, making data collection inefficient; Poland was excluded.¹⁸ The Swedish OAM only provides the upload dates when reports are re-uploaded after adjustments; otherwise, dates are unavailable, leading to Sweden's exclusion. This leaves 23 EU member states. For the Czech Republic, no firms listed on EU-regulated capital markets had corresponding data in LSEG Workspace. To identify the remaining OAMs and retrieve data, I accessed the linked websites from the official ESMA list.¹⁹ Two OAMs are listed for Italy, and I selected "IINFO". While collecting data, some unforeseen issues arose, these are noted only when they affect the measurement of timeliness.

¹⁵ The Financial Instruments Reference Data System (FIRDS) is a comprehensive database of instrument reference data collected by ESMA under Article 4 of the Market Abuse Regulation (MAR) and Article 27 of the Markets in Financial Instruments Regulation (MiFIR).

¹⁶ Unmatched financial instruments are manually reviewed on a sample basis and consist predominantly of preferred shares, funds, bonds, and REITs.

¹⁷ Reference provided via email following my inquiry.

¹⁸ Inquiries to the responsible Hungarian and Polish OAMs have not received a response to date.

¹⁹ ESMA provides a list of OAMs on its website (ESMA, n.d.).

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Table 2.1: *Sample Selection*

	EU-regulated Capital Market	LSEG Workspace	Individual Website	Percentage of Sample	OAM excluded
Austria	68	60	55	3,04	
Belgium	125	116	99	5,46	
Bulgaria	191	139	.	.	X
Croatia	104	79	60	3,31	
Cyprus	71	63	28	1,55	
Czech Republic	9	0	0	0,00	
Denmark	164	125	109	6,02	
Estonia	47	24	20	1,10	
Finland	158	127	123	6,79	
France	520	425	327	18,05	
Germany	506	407	337	18,60	
Greece	163	151	123	6,79	
Hungary	47	34	.	.	X
Ireland	43	22	13	0,72	
Italy	270	228	90	4,97	
Latvia	18	18	11	0,61	
Lithuania	28	28	25	1,38	
Luxembourg	34	34	30	1,66	
Malta	28	27	26	1,43	
Netherlands	141	116	95	5,24	
Poland	401	386	.	.	X
Portugal	42	38	31	1,71	
Romania	84	78	69	3,81	
Slovakia	37	15	10	0,55	
Slovenia	30	28	19	1,05	
Spain	177	135	112	6,18	
Sweden	531	314	.	.	X
Total	4,037	3,217	1,812	100.0	

Notes: This table reports the sample composition by EU member state and outlines the sample selection process. Column 2 shows the number of firms per country listed on EU-regulated capital markets in 2021, as identified in ESMA's FIRDS database. Column 3 presents the number of these firms that are covered by LSEG Workspace, from which additional firm-level information, such as the firm name, is retrieved. Column 4 indicates the number of firms for which information is available both on the firms' websites and in the national OAM. Column 5 shows each country's share of the final sample. Bulgaria, Hungary, Poland, and Sweden are excluded from the sample, as documented in Column 6, due to insufficient data availability.

2.4.2 Measurement of timeliness

To measure timeliness of annual financial statement provision, I compare each report's publication date on the firm's website with its publication date at the national OAM. The dataset

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consists of manually collected dates for audited consolidated annual financial statements for the 2021 financial year.

Data collection at OAMs

For each firm, I retrieved the publication date recorded by the relevant OAM. The primary objective was to identify the 2021 ESEF filing. If no ESEF report was available, I collected the publication date of the audited consolidated annual financial statements in PDF format. In cases with multiple uploads, I verified whether the entry reflected a re-upload or a partial filing and recorded the date corresponding to the upload of the main components of the financial statements. For firms listed on EU-regulated capital markets but without a corresponding report in the OAM, I manually investigated the reason. Most missing observations related to firms that had been delisted, liquidated, or acquired.

Data collection from firm websites

Firm websites were identified through OAM links where possible. Otherwise, firms were searched by ISIN on Google and finance-specific websites like Yahoo Finance. I applied a three-step procedure to identify the publication date: (1) I first checked the annual report download section, which often includes explicit publication timestamps (e.g., in France). (2) If no date was available, I searched the firm's news or regulatory announcements section. Many firms publish a brief press release summarizing key figures and indicating the date on which the full report was made available. (3) As a final step, I accessed the full annual report (ESEF or PDF) and recorded the later of the auditor, management, or board signature dates, typically the auditor's signature, when no other publication date was identifiable. Firms for which no date could be determined were classified as "No Reporting."

Variable construction

Based on these dates, I compute *PUBLICATION GAP*, defined as the number of days between the publication on the firm's website and the publication at the OAM. I do not adjust for weekends, holidays, or other aspects affecting OAM employees, as the dissemination of filings through OAMs should be (partly) automated. The variable is expressed in full days, as neither firm websites nor OAMs consistently provide timestamps at the intraday level. The second variable, *HIGH PUBLICATION GAP*, is a binary indicator equal to 1 for *PUBLICATION GAP* values exceeding six days and 0 otherwise. The threshold of one week is an intentionally simple, arbitrary cutoff designed to capture materially large delays in dissemination. Both

variables reflect one dimension of timeliness: differences in publication dates between firm websites and OAMs. Other potential aspects of timeliness are not examined in this study.

2.4.3 Results

Table 2.2 reports descriptive statistics for the *PUBLICATION GAP* at the firm level. Overall, the timeliness landscape is highly fragmented. While a large share of firms exhibits no gap between publication on the firm website and the OAM, many others show sizable gaps. Across all firms in the sample, the average *PUBLICATION GAP* is 9.42 days (Column I). Four countries, Denmark, Estonia, Finland, and Malta, display average gaps below 0.5 days, whereas only two countries show averages above 10 days: Germany and Ireland. Approximately 56.82 percent of all firms publish on both platforms on the same day, indicating no gap.

The cross-country differences are substantial. Malta exhibits a *PUBLICATION GAP* of 0.00 days, meaning that all firms publish on the website and at the OAM simultaneously. At the opposite end of the spectrum, Germany shows the highest average *PUBLICATION GAP* of 36.48 days, implying more than a month's delay on average. Other member states with comparatively large gaps include Ireland (11.62 days), Belgium (8.77 days), Romania (7.30 days), and the Netherlands (7.15 days).

The maximum values further illustrate the heterogeneity of delays. Some countries, such as Cyprus (3 days), Estonia (1 day), Latvia (5 days), and Slovenia (5 days), only exhibit short maximum gaps. By contrast, Belgium (103 days), and Germany (158 days) display extreme outliers, indicating that individual firms experience multi-month gaps. Notably, each member state has at least one firm with a *PUBLICATION GAP* of zero (Column II), suggesting that system-wide or structural issues at the OAM level alone are unlikely to fully explain cross-country variation.

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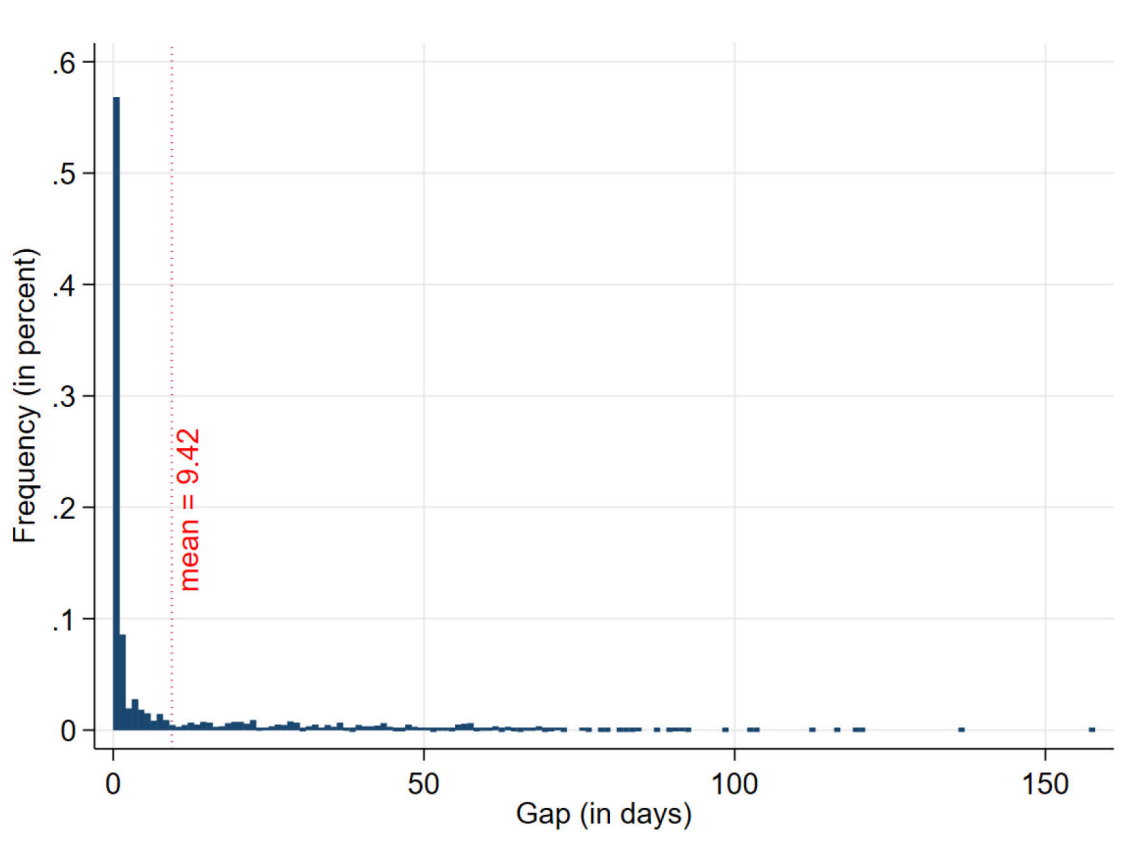
Table 2.2: Descriptive results for timeliness at OAMs

	Average PUBLICATION GAP	Minimum PUBLICATION GAP	Maximum PUBLICATION GAP	HIGH PUBLICATION GAP	Percentage of all firms
Austria	2.24	0	40	5	0.09
Belgium	8.77	0	103	29	0.29
Croatia	2.48	0	41	7	0.11
Cyprus	0.68	0	3	0	0.00
Denmark	0.26	0	21	1	0.01
Estonia	0.05	0	1	0	0.00
Finland	0.24	0	14	2	0.02
France	4.55	0	84	52	0.16
Germany	36.48	0	158	312	0.93
Greece	1.40	0	28	5	0.04
Ireland	11.62	0	70	3	0.23
Italy	0.67	0	22	3	0.03
Latvia	0.82	0	5	0	0.00
Lithuania	2.04	0	22	3	0.12
Luxembourg	3.90	0	50	3	0.10
Malta	0.00	0	0	0	0.00
Netherlands	7.15	0	90	19	0.20
Portugal	1.29	0	32	1	0.03
Romania	7.29	0	87	12	0.17
Slovakia	5.10	0	21	5	0.50
Slovenia	1.84	0	5	0	0.00
Spain	1.66	0	28	12	0.11
Total	9.42	0	158	474	0.33

Notes: Based on hand collected data from firms' websites and national OAMs, I identify the gap between both reporting days. The variable *PUBLICATION GAP* measures the distance between both days, the value is not adjusted for weekends, or bank holidays. Column 1 provides average gap per country, and Column 2 and 3 the minimum and maximum gap for each individual country. Identifying a minimum gap of zero for all countries provides a certainty that systematic issues in the dissemination process might not play a role. Column 4 provides the results for *HIGH PUBLICATION GAP*, a measure summing up the number of firms with seven or more days of gap. It's a measure for highly delayed publications. The threshold of one week is an intentionally simple, arbitrary cutoff designed to capture materially large delays in dissemination. In the last column, the percentage of *HIGH PUBLICATION GAP*-firms per country is calculated.

Turning to *HIGH PUBLICATION GAP*, defined as gaps of seven days or more, a total of 474 firms (approximately 33 percent of the sample) fall into this category (Columns IV and V). Germany accounts for 312 of these observations, representing roughly 93 percent of German firms in the sample. Several other countries also show notable shares of firms with large gaps, including Slovakia (50 percent), Belgium (29 percent), and Ireland (23 percent). Conversely, some member states exhibit none or only a small number of such cases.

Figure 2.2: EU-wide distribution of *PUBLICATION GAP*



Note: The histogram shows the distribution of dissemination gaps between publication on corporate websites and in the OAM for companies listed on EU-regulated capital markets in the full sample. A majority of annual reports are published on the same day (56.82%).

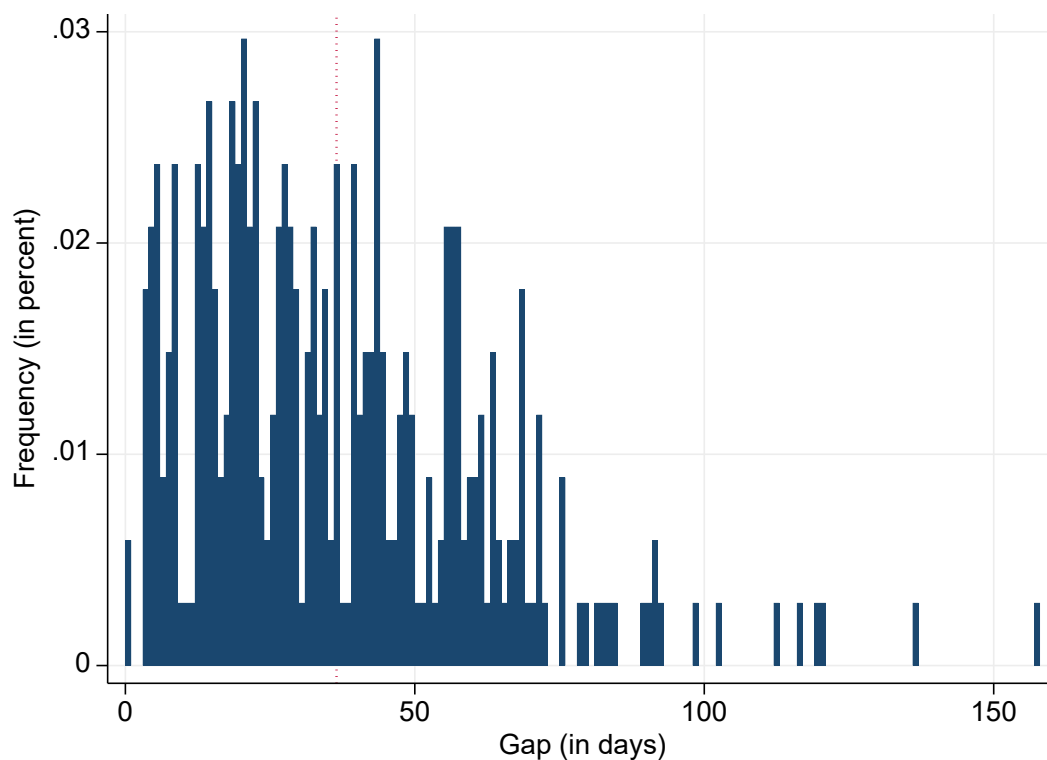
Figure 2.3 illustrates the distribution of the *PUBLICATION GAP* for the three largest EU economies, being Germany, France, and Italy, measured by gross domestic product. Focusing on these countries highlights differences in timeliness among member states that collectively represent a substantial share of EU capital markets. The figure underscores the distinct position of Germany, which exhibits both the highest average gaps and the widest dispersion. Only a single German firm reports a *PUBLICATION GAP* of zero, while several firms show gaps of up to 70 days.

In contrast, France and Italy display markedly different patterns. In both countries, the majority of firms publish their annual financial statements on the firm website and in the OAM on the same day, indicating high levels of timeliness. Although outliers exist, their magnitude is substantially lower than those observed in Germany, and the overall distribution is considerably more concentrated around zero.

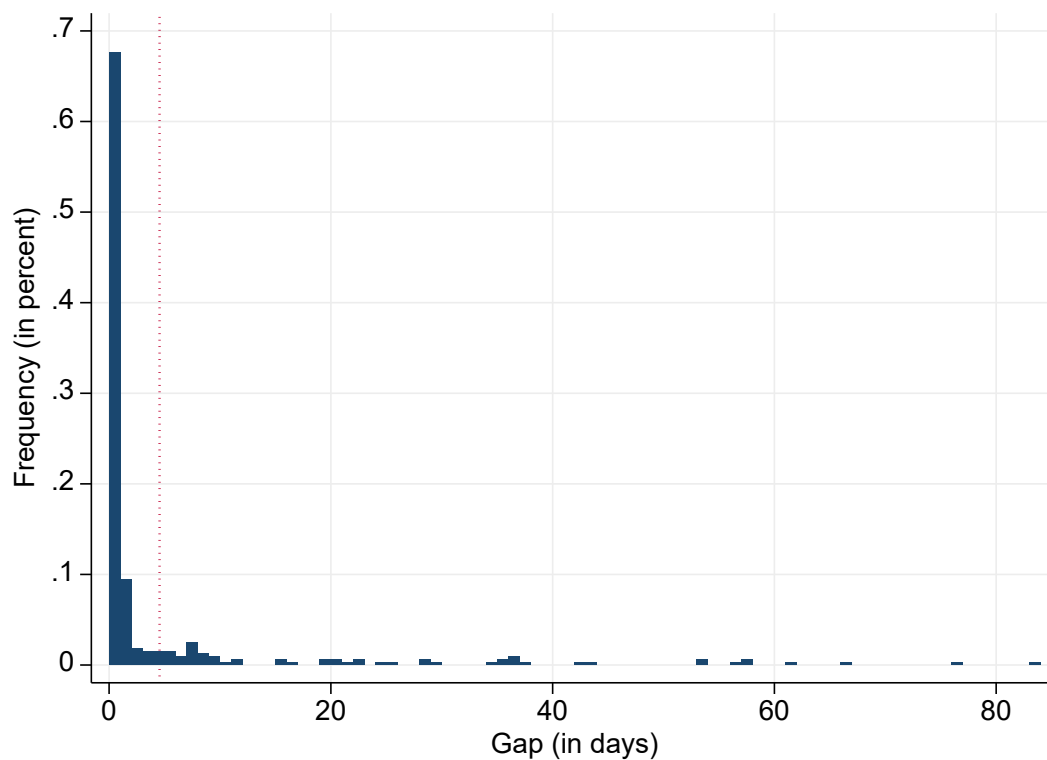
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Figure 2.3: *Distribution of PUBLICATION GAP for selected countries*

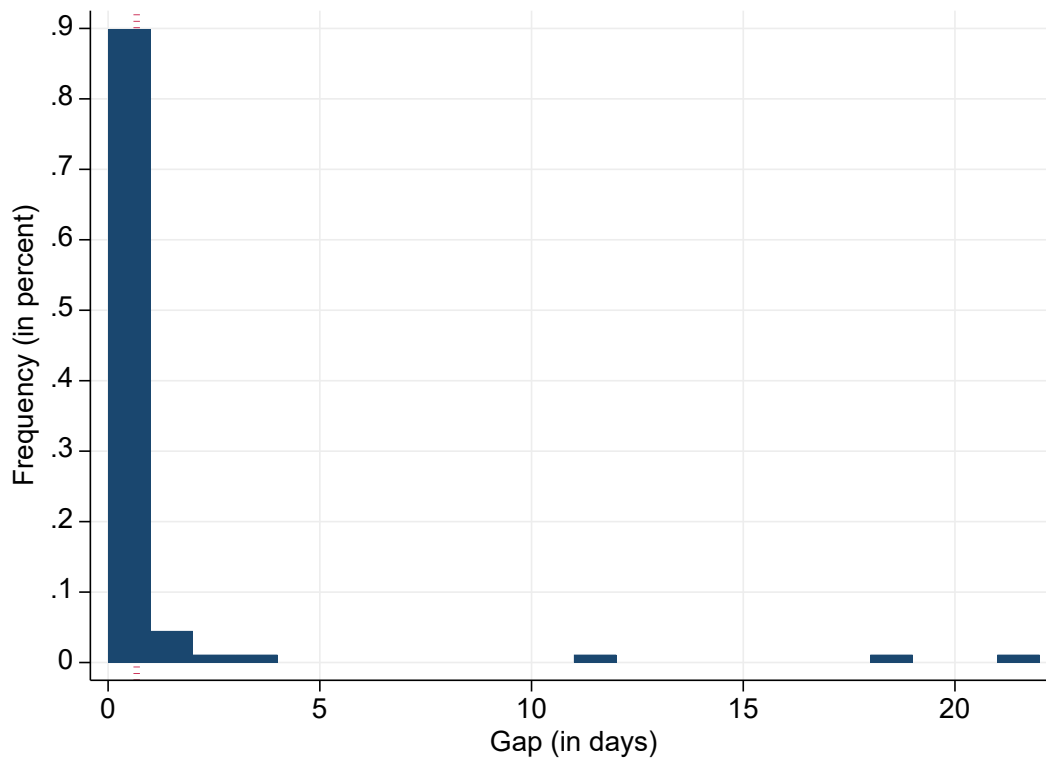
Panel A: Germany



Panel B: France



Panel C: Italy



Note: These three histograms show the distribution of dissemination gaps for the three largest EU countries by gross domestic product (GDP). While Germany exhibits a high number of large gaps and only one company with a gap of zero, France and Italy have more companies concentrated on the left side of the histogram, indicating fewer and smaller gaps.

Taken together, the figure reinforces the substantial cross-country heterogeneity already visible in Table 2.2 and highlights that reporting delays are not uniformly distributed across major EU capital markets. These descriptive findings raise questions about the underlying drivers of such differences and their implications for regulatory initiatives such as ESAP. The following Discussion section explores these issues in greater depth and considers potential explanations and policy implications.

2.4.4 Discussion

The descriptive evidence reveals substantial heterogeneity in publication gaps across EU member states. In the following, I provide a couple of non-exclusive explanations for the observed heterogeneity in publication gaps. I caveat that these explanations are selective and potentially subjective, and not backed up by empirical tests.

First, national regulations governing the submission and dissemination of financial reports may influence publication timing. Some jurisdictions require firms to transmit their annual financial

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statements to the competent authority rather than directly to the OAM, potentially introducing administrative delays. For example, in Romania, firms report that annual financial statements are forwarded by the regulator, and the underlying processes are not externally observable.²⁰ In Germany, the legally binding date is the date of submission to the OAM, not the date of upload; processing at the OAM can take several weeks. Such institutional arrangements may therefore contribute to systematically longer publication gaps.

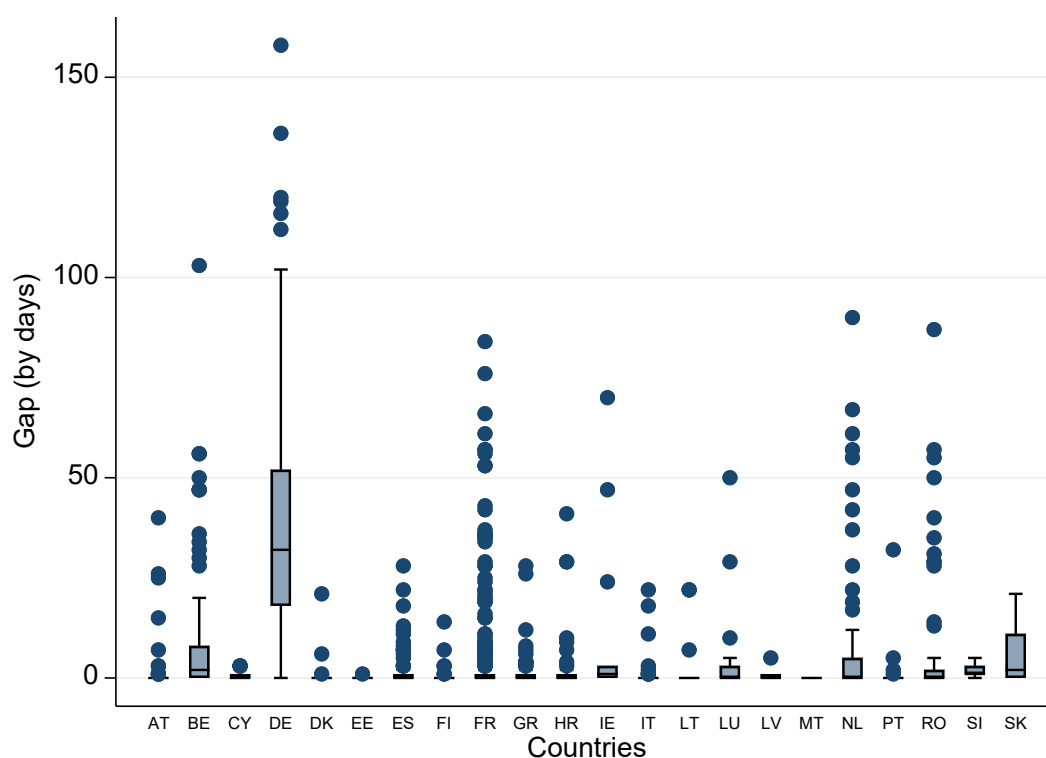
Second, operational processes at national OAMs may differ substantially. Although dissemination is intended to be largely automated, practical implementation varies across member states. Moreover, the transition to ESEF has introduced additional challenges (Joint Committee, 2024). Prior work documents technical bottlenecks and validation issues in early ESEF filings (Brass, 2021), which may delay processing and publication at OAMs. Firm feedback from Germany indicates that the OAM was, at least potentially, unable to process ESEF reports in a timely manner until June 2022. The observed heterogeneity in distribution, as well as the non-simultaneous publication of reports on firm websites and at the OAM, has been criticized by some respondents during the ESAP ITS feedback period (Joint Committee, 2024).

Third, differences at the firm level may also contribute to publication gaps. The submission of annual financial statements to the OAM is likely not automated but requires manual upload by firm staff. Firms with more complex organizational structures, decentralized reporting units, or slower internal approval workflows may therefore submit their reports to the OAM with a delay, even when the website publication occurs promptly. These firm-level frictions may explain part of the within-country variation observed in the data.

Taken together, these explanations underscore that reporting timeliness may be shaped not only by firm behavior but also by national regulatory structures, technical infrastructure, and institutional capacity. Understanding the origins of these differences is crucial for assessing potential frictions in ESAP implementation and designing mechanisms that ensure consistent and timely dissemination across member states.

²⁰ To verify the correct identification of the gaps, firms were contacted directly via email or through their websites. Due to the low response rate, the data obtained were excluded from the analysis. Nevertheless, some anecdotal insights could still be drawn.

Figure 2.4: *Distribution of PUBLICATION GAP by country*



Note: This boxplot shows the dissemination gaps between publication on firm websites and in the OAM for firms listed on EU-regulated capital markets in the respective countries. In many member states, both the median and the 25th percentile are zero. The results are driven by a few individual countries, while in others only a small number of gaps occur. The gaps are measured in days.

2.5 Conclusion

The paper provides an overview of the regulatory framework for the dissemination of audited consolidated annual financial statements in the EU, with a specific focus on the timeliness of OAMs. With the upcoming implementation of ESAP in mid-2027, OAMs will continue to serve as the primary collection body for regulatory and voluntary firm publications, transferring data via API to the central EU-wide register. Differences in timeliness at the national OAM level may therefore directly affect the usefulness of ESAP. A previously unexamined issue is whether OAMs provide financial reports promptly after publication or whether structural or procedural factors hinder timely dissemination. Evidence from EDGAR in the US suggests that even small delays can have measurable effects on capital markets (Rogers et al., 2017).

Descriptive evidence for 2021 shows a heterogeneous landscape regarding timeliness. Across all countries, 56.82 percent of companies had no gap between publication on the firm's website and the OAM. However, the average gap was 9.41 days, driven primarily by Germany (36.48

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days). At member state level, the picture is heterogeneous: in some countries there are only a few firms with a high gap (e.g. Ireland and Lithuania), while in other firms many companies show a small gap (e.g. Slovakia and Belgium).

There are several potential explanations, though all are subjective and based on anecdotal evidence. First, differences in national legislation or regulatory filing requirements may affect the results, particularly when the OAM is not the relevant point of formal submission. Second, OAM-level processes may contribute to gaps, for example if OAMs face technical challenges in processing ESEF reports or other internal inefficiencies. Finally, firm-level complexity or organizational structures may slow the manual upload of reports to the OAM, thereby generating additional delays.

The study contributes in several ways. First, it provides an in-depth overview of the regulatory setting surrounding ESAP and OAMs. Second, it documents the timeliness of national OAMs for 2021 audited consolidated annual financial statements, showing substantial variation between member states and across firms. These findings highlight a potential challenge for ESAP, as systematic delays at the national level may reduce the effectiveness of a centralized EU database. Third, by providing early evidence during the ESAP Proposal feedback period and contributing data for discussion, the study raised the potential issue of timeliness to regulators, potentially influencing the ongoing policy discussion.

Several limitations should be noted. First, identifying the publication date on firm websites is not always straightforward, as many firms do not publish explicit dates. Auditor signature dates were used in some cases, which may slightly affect results. Second, OAM-level identification sometimes posed challenges due to changes in identifiers, multiple filings, or re-uploads. Third, 2021 represented the first mandatory year for ESEF reporting in late adopting countries, and ongoing adjustments may have temporarily affected timeliness. Additionally, the ongoing effects of the Covid pandemic could have influenced reporting processes. Fourth, the availability of financial statements at firms' websites may be correlated with industry- and country-level. REITs and investment funds largely do not provide any reporting at their respective websites or are directly excluded from the sample due to missing LSEG Workspace data.

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Taken together, the evidence demonstrates that the EU landscape for the timeliness of financial report dissemination is fragmented and varies widely. Because ESAP will rely on national OAMs for data collection, these delays are likely to persist unless processes and enforcement are standardized. This has potential implications for the usefulness of ESAP for investors and underscores the need for a consistent and reliable foundation for the EU-wide database. Strengthening ESMA's oversight or harmonizing OAM processes may help mitigate these issues, although achieving such alignment remains politically sensitive across member states (Commission, 2020b).

3. Electronic Reporting and Firms' Information Environment: Evidence from the EU's ESEF mandate

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Working Paper²²

ABSTRACT: I investigate the effect of a broad cross-country electronic reporting mandate on firms' information environment. Beginning in 2021 for early adopting countries, the EU's ESEF regulation requires firms listed on EU-regulated capital markets to file their annual IFRS financial statements in a machine-readable format (iXBRL). Using a difference-in-differences design with non-EU control firms, I find no evidence of stock price liquidity effects of the ESEF regulation for late adopting countries and a negative effect for early adopters. The analysis of financial analysts' reactions to the regulation reveals a significant decline in analyst following, while overall firm coverage remains unchanged, indicating that fewer analysts cover the same number of firms. Forecast dispersion also declines, reflecting greater alignment in analyst expectations. These effects are most pronounced among firms with higher pre-ESEF information asymmetry, larger size, and greater prior analyst coverage. I further show that institutional characteristics of OAMs, national central databases, may affect the transmission of ESEF into the market, with stock exchange managed OAMs associated with stronger liquidity outcomes. Taken together, the findings do not support the stated objective of ESEF to strengthen capital markets and suggest that the introduction of the digital financial reporting format may even have had adverse effects.

JEL Classification: G18, G38, K22, L21, M41, M48, O52

Keywords: ESEF, iXBRL, information dissemination, information asymmetries, financial analysts, information processing costs, OAM

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²² First version of the working paper: September 2023. This version: October 2025.

3.1 Introduction

I examine the capital market effects of the EU's first mandatory digital financial reporting standard, the ESEF. Adopted in 2018, ESEF requires issuers on EU-regulated capital markets to prepare their consolidated IFRS annual financial statements in machine-readable iXBRL. Although initially intended to apply uniformly beginning in 2021, the EU's Covid-related postponement option created a staggered implementation across member states. Firms in four early adopting countries were required to report in ESEF starting with 2021, whereas firms in the remaining 23 late adopting member states began doing so in 2022 (European Parliament, 2021).

The regulation seeks to “further facilitate (...) accessibility, analysis, and comparability” (ESEF, Art. 4) of IFRS financial statements by enabling automated extraction and processing of disclosures (ESEF, Rec. 4). By eliminating frictions inherent in PDF-based reporting and reducing reliance on proprietary data, ESEF is expected to lower information acquisition costs and enhance information integration, consistent with theories of information processing cost and information asymmetries (Blankespoor et al., 2020). Yet, despite these regulatory objectives, it remains an open empirical question whether mandatory digital financial reporting yields measurable improvements in firms' information environments, particularly in the case of EU, where mandatory ESEF adoption is implemented comparably late and an established information environment may already limit the marginal impact of format changes. This uncertainty motivates an examination of how ESEF adoption affects liquidity and information environment.

The potential effects of ESEF on firms' information environment can be organized along three primary channels. First, *credibility* may improve when disclosures are consolidated into a single, audited, and machine-readable document. This format can reduce transcription errors and limit reliance on third-party data extraction. In the EU setting, however, the incremental credibility gains are uncertain because audit requirements were already in place and the extraction of spreadsheets and PDF filings was feasible, albeit potentially more time-consuming and prone to errors (Janvrin et al., 2013). Second, *comparability* may increase through the standardized tagging and anchoring of financial statement line items. At the same time, IFRS adoption in 2005 substantially enhanced comparability (Christensen et al., 2013), leaving unclear whether ESEF yields additional improvements. Third, *accessibility* may rise as structured reports allow automated extraction and analysis, thereby lowering information

acquisition and integration costs. Nonetheless, fragmented dissemination channels for financial reporting within the EU may reduce these benefits, as discussed in Section 2. Taken together, these considerations suggest that although ESEF incorporates mechanisms capable of improving firms' information environments, the institutional context creates considerable uncertainty about both the magnitude and even the existence of significant effects on liquidity and information environment.

Prior evidence on capital market implications of machine-readable reporting is mixed, particularly in the US setting where XBRL was introduced more than a decade ago (Hoitash et al., 2021). Some studies document improvements in information accessibility and market outcomes (Blankespoor et al., 2014; Hoitash & Hoitash, 2018), whereas others find limited or inconsistent effects, often attributed to concerns about the quality of early filings and the absence of mandatory assurance (Alles & Gray, 2012; Plumlee & Plumlee, 2008). Moreover, technological advances in data extraction and analytics since the initial US rollout may have diminished the incremental value of structured reporting over time (Harris & Morsfield, 2012; Janvrin et al., 2013). ESMA has acknowledged these experiences in its feedback statements (ESMA, 2016), indicating that insights from the US implementation informed expectations about ESEF's potential benefits and challenges in the EU context.

In my analysis, I exploit the staggered implementation of ESEF across EU member states to examine its effects on liquidity and information environment. The treatment group consists of 62,711 firm-quarter observations (2,711 unique firms) across 27 EU member states between 2018 and 2023, while a sample of non-EU firms serves as the control group. Following the Covid pandemic, member states were granted the option to postpone ESEF implementation by one year.²³ 23 of the 27 member states exercised this option, mandating ESEF reporting from 2022, whereas four early adopting countries implemented the mandate in 2021. This variation allows for the identification of early versus late adopters. I exploit this setting using a basic difference-in-differences framework, comparing treated EU firms to non-EU firms not subject to ESEF. To mitigate potential confounding from the Covid pandemic, the analysis focuses on late adopting countries. The analysis focuses on two dimensions potentially most directly affected by digital reporting: capital market liquidity and information environment, as proxied by financial analysts. Regression models include firm and quarter/year fixed effects to control

²³ The official dates of notification of the delay are published by the EU Commission. Only four countries opted against the option: Austria, Czech Republic, Germany, and Slovenia (ESMA, n.d.).

for unobserved heterogeneity across firms and over time, and a set of control variables previously associated with XBRL adoption in the literature. This design isolates the incremental effect of the mandate from broader trends in global capital markets.

First, I examine the effects of ESEF adoption on capital market liquidity. Overall, I find no significant effects on liquidity for most measures. Heterogeneity analyses suggest that negative liquidity effects are concentrated among larger firms and those with higher analyst coverage pre-ESEF, whereas smaller and less widely covered firms exhibit no significant effect in liquidity. Pre-ESEF liquidity level seems not to account for differences in liquidity effect. Variation across member states may also arise from the type of OAM responsible for disseminating financial statements. Consistent with this, liquidity improves significantly when stock exchanges serve as OAMs, while dissemination through competent authorities or company registers is generally associated with decreased liquidity. Accounting for OAM timeliness does not reveal a systematic pattern. Taken together, the results provide limited support for the notion that ESEF achieved its stated objectives of enhancing market efficiency and reducing information asymmetry. Differences in OAMs appear to moderate these effects: firms in countries with stock exchanges as OAMs experience improved liquidity, potentially reflecting the dual role of stock exchanges as both market intermediaries and providers of reporting infrastructure, which may make them more attuned to the needs of capital market participants.

Second, I examine the effects of ESEF adoption on the information environment, focusing on four measures of analyst activity. I observe a reduction in analyst following, while overall firm coverage remains stable, suggesting increased concentration of coverage among fewer analysts. Forecast dispersion decreases, indicating greater alignment of earnings expectations, but there is no systematic improvement in forecast accuracy. These patterns are most pronounced among larger firms, those with higher pre-ESEF information asymmetry, and firms with greater prior analyst coverage. Examining heterogeneity by OAM type reveals mixed results. Analyst following decreases for firms in countries with OAMs operated by competent authorities or stock exchanges and for countries with lower timeliness, whereas coverage does not change significantly. Forecast dispersion is consistently reduced across specifications, while forecast accuracy remains unaffected. Overall, the evidence does not provide a clear indication that ESEF systematically improved the information environment and, in certain instances, points to potential unintended or negative consequences of the regulation.

This study contributes to the literature on financial disclosure regulation and digital financial reporting in several ways. First, it provides the first large-scale evidence on ESEF, a regulatory initiative that differs from prior XBRL mandates in both scope and institutional design. By using this new setting, I follow the call by Leuz (2018) to investigate new regulatory settings. Second, by jointly examining liquidity and information environment, the analysis captures how ESEF affects both market reactions and professional information intermediaries, addressing two central mechanisms through which disclosure regulation is expected to influence capital markets. Third, the study highlights how national dissemination channels, or OAMs, moderate the effectiveness of digital reporting mandates, demonstrating that member state-level variation is a key feature of the EU regulatory environment. More broadly, the findings suggest that technological innovations in reporting do not automatically enhance market efficiency, but their impact depends on contextual factors such as timing, implementation quality, and supporting institutional infrastructure.

3.2 Institutional Background

3.2.1 The EU's ESEF regulation

iXBRL mandate

On December 17, 2018, the Commission adopted the “Commission delegated Regulation 2018/815”, which sets out the Regulatory Technical Standards (RTS) for ESEF. This ESEF Regulation supplements the amended Transparency Directive (ATPD, 2013/50/EU) by specifying the requirements for the digital reporting format.²⁴ Under ESEF, firms with securities listed on EU-regulated capital markets are required to file their full annual report by using XHTML (ESEF, Art. 3), and their IFRS consolidated financial statements must be filed using iXBRL (ESEF, Art. 4 (1)). Because ESEF is a regulation²⁵, it applies directly in all member states without the need for national transposition, resulting in a uniform legal framework across the EU. Approximately 4,000 firms are affected (ESMA, 2022). The task of developing ESEF Taxonomy was delegated to ESMA (ESEF, Art. 7), which anchored its taxonomy on the IFRS Taxonomy.

²⁴ For details on the implementation timeframe, see Figure 3.1. Adoption prior to 2021 is not an issue. As shown in Section 3.4, the ESEF Taxonomy was published only in late 2019, and no annual reports in ESEF are identified for years before 2021.

²⁵ Under the EU legal framework, a regulation is a binding legislative act that applies directly and uniformly across all member states. Unlike directives, regulations do not require transposition into national law and enter into force immediately upon adoption at the EU level (EU, n.d.).

Although iXBRL is not a new technology and some EU firms and authorities had experience with it prior to the mandate, iXBRL filings were not previously publicly accessible in the EU.²⁶ Thus, the mandatory publication of tagged annual reports represents a substantive change for both firms and users.

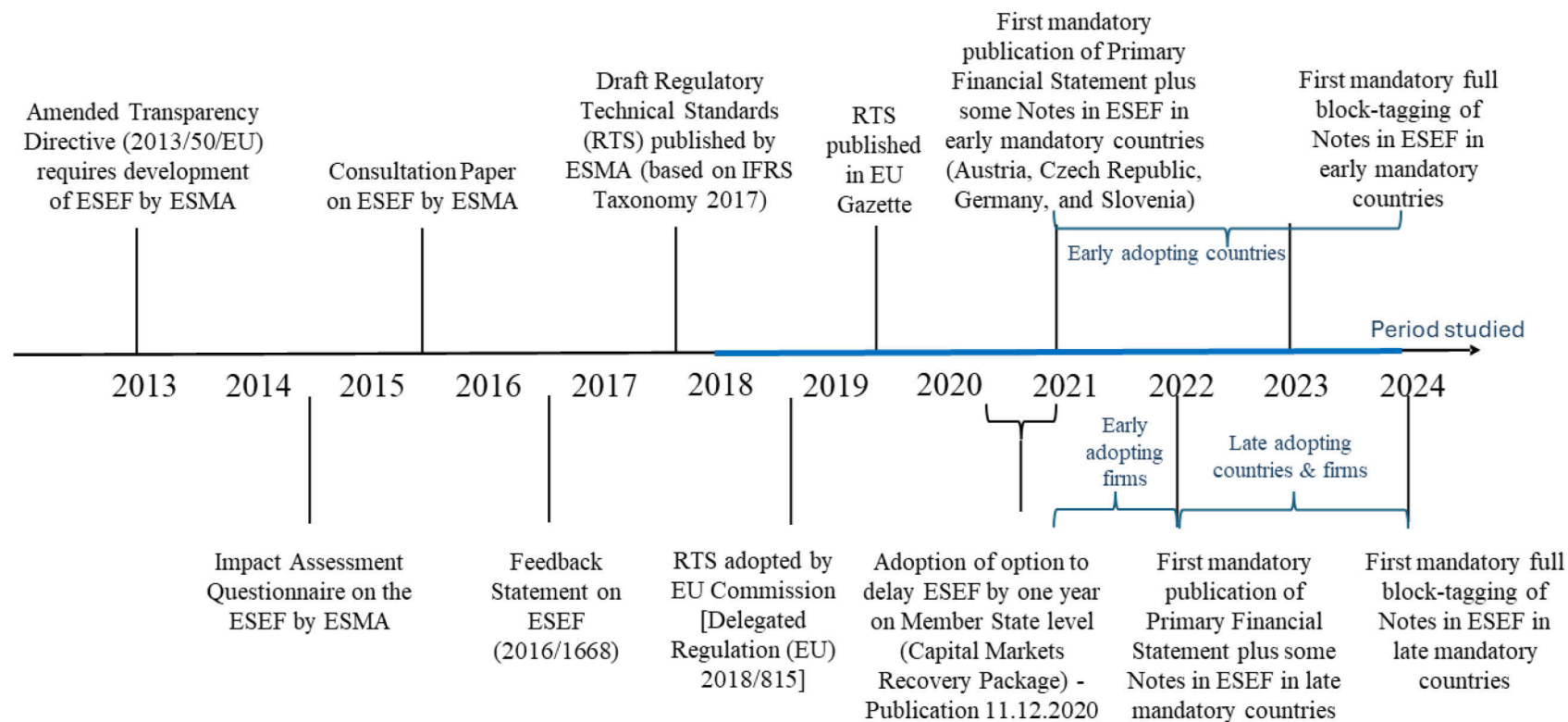
Under the ESEF Regulation, all elements of the IFRS consolidated financial statements must be tagged, with specific provisions for note disclosures (ESEF, Rec. 12). Most notes are subject to “block tagging”, where entire sections are tagged collectively, although firms may voluntarily apply more granular tagging. Note tagging was phased in: only a limited set was mandatory at initial adoption, while full note disclosure took effect in 2023. Art. 4(2) further permits the use of extension taxonomies to allow firms to reflect reporting specifics not covered by the core taxonomy. To prevent misuse, extensions must be anchored to existing taxonomy elements, may not duplicate their meaning or scope, and must be identifiable by their creator.

Assurance and Enforcement

Although the ESEF Regulation itself does not explicitly mandate an audit of the tagged report, the obligation follows from the “Audit Directive” (2006/43, Art. 28). In practice, auditors must certify both the existence of the annual report or consolidated financial statements in ESEF format and the correct “ESEF-compliant” rendering in all material respects (European Commission, 2020). Member states retain discretion over enforcement structures and sanctions under the Transparency Directive (TPD, Rec. 23). Thus, while the design and implementation of ESEF itself leaves no room for national discretion, national enforcement and sanctioning mechanisms may nonetheless generate discrepancies both across and within member states (Labro & Pierk, 2025).

²⁶ For example, in Germany, firms have been interacting with XBRL since 2006. The OAM accepted XBRL-based financial reports on a preferential basis (EHUG), including interim and quarterly reports from capital market-oriented firms (TUG). In Spain, companies were required to submit half-year financial statements in XBRL. However, (i)XBRL documents were not made publicly available. The new mandate to publish iXBRL-tagged reports therefore represents novel territory for firms and stakeholders within the EU (ESMA, 2016).

Figure 3.1: *Timeline of ESEF adoption*



Note: This figure illustrates the timeline of ESEF adoption in the EU. The study includes data from 2018 to 2023. Firms in early adopting countries were required to report in ESEF starting in 2021, whereas firms in late adopting countries could either adopt early from 2021 onward or postpone adoption until 2022. (Own illustration)

Preparation and Dissemination

Although the ESEF Regulation applies uniformly, differences at the national level may influence filing practices and the accessibility of ESEF reports. First, at the member state level, annual reports are published via OAMs, whose core functions are harmonized under the Transparency Directive but whose technical implementations differ.²⁷ Each member state is required to establish such a national database for the disclosure of regulated information (TPD, Art. 19). These differences are expected to diminish once ESAP becomes operational in mid-2027 (see Section 2).

Coming into force

The ESEF Regulation was initially required for fiscal years beginning on or after January 1, 2020. In response to the Covid pandemic, however, the “Capital Markets Recovery Package” (European Parliament, 2021) allowed member states to postpone mandatory implementation by one year. Four member states did not exercise this option, thereby “early adopting” ESEF countries in 2020. In the remaining 23 member states (“late adopting countries”), firms could either voluntarily apply ESEF in 2020 (“early adopting firms”) or defer adoption until fiscal year 2021 (“late adopting firms”). Firms opting for early adoption were required to comply fully with all ESEF provisions, including the assurance requirement (see Section 4).

The initial mandate covered the primary financial statements and a limited set of note disclosures. From fiscal years beginning on or after January 1, 2023, the tagging requirement expanded to include all note disclosures.

3.2.2 Conceptual background

The following section outlines the growing literature on the adoption and use of XBRL in the US. The Commission frequently refers to US evidence when discussing the design and expected effects of ESEF, for example, in consultations during the implementation process (ESMA, 2016). Accordingly, this section focuses primarily on insights from the US setting. Because the applicability of these findings to the EU context depends on similarities and differences between the two environments, the second part of the section highlights key

²⁷ For instance, while no OAM permits bulk downloads, Germany actively restricts scraping, whereas other countries do not. In Section 2, I assess OAM quality by examining the timeliness of annual report publications and identify substantial differences across member states.

distinctions. Additional background on the US XBRL mandate is provided in Section 4 and in the literature review by Hoitash et al. (2021).

Mandatory XBRL adoption in the US

A large body of research examines whether mandatory XBRL reduced information processing costs and information asymmetry and thereby improved market efficiency (Chen et al., 2018; Hoitash et al., 2021; Kim et al., 2012; Zhang et al., 2019). Evidence on information processing costs is mixed. Some studies find a negative effect, thereby an increase in information processing costs. Liu et al. (2014) document reduced analyst forecast accuracy, and Blankespoor et al. (2014) report higher abnormal bid-ask spreads, lower abnormal liquidity, and reduced abnormal trading volume during the first year of the mandate, particularly for small trades. The findings are in line with the notion of larger and more sophisticated investors benefitting more from the implementation of XBRL. Other studies document reduced information processing costs and information asymmetry (Bhattacharya et al., 2018; Blankespoor et al., 2020; Cho et al., 2025; Dong et al., 2016; Kim et al., 2019) and enhanced market efficiency (Cong et al., 2014; Kim et al., 2012). Efendi et al. (2014) show an improved information efficiency post-XBRL mandate through a reduced post-earnings announcement drift. Additional evidence includes lower return volatility (Huang et al., 2021; Kim et al., 2012), shorter reporting lag for accelerated filers (Du & Wu, 2018), and lower stock return synchronicity (Dong et al., 2016).

Financial analysts are among the most sophisticated users of financial statements (Liu et al., 2014; Yu, 2010). As specialized information intermediaries, they are commonly used as proxies for a firm's information environment and information quality (Core, 2001; Francis et al., 2002; Li & Nwaeze, 2018; Liu et al., 2014). Liu et al. (2014) provide evidence for a significant positive association between mandatory XBRL adoption and both analyst following and forecast accuracy. The effect might be driven by an improvement of accessibility to incorporate firms' financial data and, therefore, an increase in coverage (Baldwin & Trinkle, 2011). Besides accessibility, lower information acquisition costs (Roulstone, 2003), and improved information quality through standardized tagging (Kim et al., 2012; Vasarhelyi et al., 2012; Yoon et al., 2011).

Evidence regarding the usefulness of extended tagging is mixed (Debreceeny et al., 2010a; Debreceeny et al., 2011; Li & Nwaeze, 2018; Scherr & Ditter, 2017). Johnston (2020) shows a decrease in forecast errors and forecast dispersion measures when extensions are used more

extensively, while Li & Nwaeze (2018) provide evidence that abnormal extensions are positively associated with analyst following and forecast accuracy, particularly for more complex firms.

A recurring question is whether investors and other market participants actually use XBRL-tagged data. Evidence is again mixed. Chen & Zhou (2019) document increased EDGAR usage following XBRL implementation, and Yen & Wang (2015) observe stronger market reactions to unexpected earnings for later-stage adopters, consistent with improved information access. In contrast, surveys suggest that firms and some CFOs question whether analysts or investors rely heavily on XBRL data (Chasan, 2012; Janvrin & Mascha, 2014). Harris & Morsfield (2012) find that large institutional investors are the primary users. For retail investors Guo & Yu (2022) provide evidence for a stronger focus on human-readable formats than XBRL. Finally, Willis (2013), as cited in Yen & Wang (2015) notes that retail analysts often rely on third-party platforms that process XBRL data for them. XBRL US (2019) and Easterwood (2024) confirm the central role of data vendors in aggregating and redistributing XBRL filings. Overall, XBRL implementation in the US achieved many of its intended goals. In a 2021 speech, SEC Commissioner Crenshaw characterized XBRL as a success, noting improved data accessibility, lower acquisition costs, and enhanced comparability. Remaining concerns mainly relate to data quality (Crenshaw, 2021).

US XBRL mandate vs. EU ESEF Setting

The applicability or generalizability of results for the US XBRL mandate to the EU setting is not obvious. Yet, the Commission mentions findings from the US in their feedback statement regarding ESEF implementation multiple times (ESMA, 2016).

Credibility. In contrast to the US, where XBRL filings supplemented PDF reports, ESEF replaces PDF filings entirely for regulatory purposes. Firms thus provide a single authoritative document that is both human- and machine-readable. Moreover, unlike the US, ESEF disclosures are subject to statutory audit, which is expected to reduce tagging errors; an issue documented in the US setting where no assurance was mandated (Debreceeny et al., 2010; Du et al., 2013; Plumlee & Plumlee, 2008).

Comparability. ESEF aims to enhance the comparability of EU financial reporting. IFRS standards allow considerable heterogeneity in presentation across firms. By introducing uniform tags for identical items, which, however, may be labeled or structured differently

across firms, ESEF mitigates this heterogeneity. Furthermore, the use of the IFRS taxonomy as baseline for ESEF Taxonomy ensures alignment with an internationally recognized standard. Tagging also helps reduce discrepancies arising from differences in terminology or language. The anchoring process requires firm-specific extensions to be incorporated into the existing taxonomy and linked appropriately, which reduces susceptibility to errors and allows users to interpret the hierarchical and logical structure of extensions. Overall, the EU's approach appears stricter in terms of reporting quality and facilitates data aggregation for vendors and other users. Nevertheless, Heichl et al. (2025) note remaining constraints on comparability, including misuse of extensions and the continued use of domestic languages.

Accessibility. Another important difference concerns the accessibility of reports. When XBRL was first introduced in the US, the central EDGAR platform was significantly upgraded to accommodate mandatory XBRL reporting (Tallapally et al., 2011). In contrast, EU firms must file through decentralized OAMs until ESAP becomes operational in mid-2027.²⁸ This may hinder accessibility and create cross-country variation. Experiences from the U.S. suggest that centralized access improves usability (Blankespoor, deHaan, et al., 2020), though high disclosure volume can also create search frictions. At the same time, the introduction of ESEF posed significant challenges for OAMs and preparers. For example, in Germany, the “Unternehmensanzeiger” revised its submission standards in the first year of ESEF reporting to address commonly identified issues (Brass, 2021). In Section 2, I document differences in the timeliness of data provision across member states. Another important consideration is the accessibility of PDFs. When XBRL was first introduced in the US, extracting data from PDFs posed substantial challenges; over time, improvements in technology have reduced these difficulties, which may have attenuated the relative usefulness of XBRL tagging (Janvrin et al., 2013).

In summary, ESEF marks a fundamental change in EU financial reporting. The evidence from the US indicates potentially positive effects in various fields of liquidity and analyst measures. Yet, more than 10 years after the introduction of mandatory XBRL reporting in the US, other digital tools may be in place and lowering the usefulness of a digital reporting format. Therefore, it is an open question to what extent investors use ESEF reports and whether the decentralized provision of ESEF reports reduces their usefulness.

²⁸ ESAP will provide centralized electronic access to a variety of firm information (ESAP, Art. 1).

3.3 Sample and Research Design

Sample

For the analysis, I construct a panel of firm-quarter observations covering fiscal years ending between January 1, 2018, and December 31, 2023. This window provides sufficient pre-treatment periods prior to the introduction of ESEF. The dataset includes all firms available in LSEG Workspace that are headquartered in the EU27 and, for comparison, firms from a set of G11 countries over the same period.

The ESEF mandate applies to firms with securities listed on EU-regulated capital markets. To identify these firms, I rely on ESMA's FIRDS²⁹ list for 2020 and 2021, assuming that firms listed in either year are continuously listed during the sample period. This procedure yields 2,711 EU27 firms, which I match to LSEG Workspace data using ISINs and, when necessary, standardized firm names to address outdated identifiers. The matched dataset provides information on firm characteristics, accounting data, capital market outcomes, and analyst coverage. Daily capital market data are aggregated to the quarterly level, and annual accounting data are distributed across quarters based on fiscal year-end.

To construct a control group, I use firms from G11 countries. These countries did not implement changes to mandatory digital reporting formats or to the accessibility of financial statements during the sample period. From the broader G20, I exclude France, Germany, and Italy (captured within the EU27 sample), the EU as a supranational entity, Indonesia (XBRL extension in 2019; Saragih et al. (2021)), Russia (economic disruptions and financial isolation following the war of aggression against Ukraine), Turkey (changes at national reporting platforms), the United Kingdom (parallel adoption of structured reporting), and the United States (staggered iXBRL adoption in 2020-2021). The resulting control group contains 20,742 unique firms from the remaining G11 countries.

The final sample includes firms from the EU27 treatment group and the G11 control group for which all required variables are available in LSEG Workspace. In total, I obtain 665,816 firm-quarter observations (31,400 unique firms). Of these, 3,443 firms (73,704 observations) are

²⁹ The Financial Instruments Reference Data System (FIRDS) is a comprehensive database of instrument reference data collected by ESMA under the Market Abuse Regulation (MAR) Article 4 and the Markets in Financial Instruments Regulation (MiFIR) Article 27.

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listed on EU-regulated capital markets. The working sample used in regressions includes 494,802 firm-quarter observations from 23,453 firms (Table 3.1).

Table 3.1: *Sample Description*

Panel A: Sample Selection	EU 27	G11
Quarterly observations within study period (2018-2023)	127,120	538,696
For EU27: Not EU-regulated market	53,416	.
Market Capitalization < 1 Mio. USD	1,048	29,916
Use of reporting standard*	2,863	2,732
4 or less observations over period studied	540	3,668
At least 1 observation before and after treatment	5,149	21,655
No liquidity data available	1,981	48,046
	62,123	432,679

* G11: No standard displayed or reporting under US GAAP; EU27: reporting not under IFRS

Panel B: Sample distribution per quarter			
Quarter	Obs.	Percent	Cum.
2018 Q1	17,974	3.63	3.63
2018 Q2	18,178	3.67	7.31
2018 Q3	18,420	3.72	11.03
2018 Q4	18,699	3.78	14.81
2019 Q1	18,954	3.83	18.64
2019 Q2	19,066	3.85	22.49
2019 Q3	19,225	3.89	26.38
2019 Q4	19,427	3.93	30.30
2020 Q1	19,757	3.99	34.30
2020 Q2	19,874	4.02	38.31
2020 Q3	20,154	4.07	42.39
2020 Q4	20,409	4.12	46.51
2021 Q1	20,941	4.23	50.74
2021 Q2	21,296	4.30	55.05
2021 Q3	21,604	4.37	59.41
2021 Q4	21,934	4.43	63.85
2022 Q1	22,119	4.47	68.32
2022 Q2	22,286	4.50	72.82
2022 Q3	22,484	4.54	77.36
2022 Q4	22,701	4.59	81.95
2023 Q1	22,069	4.46	86.41
2023 Q2	22,237	4.49	90.91
2023 Q3	22,411	4.53	95.44
2023 Q4	22,583	4.56	100.00
	494,802	100.00	

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Panel C: Sample distribution per country			
Country	Firm-Quarter	Percentage	Unique Firms
Argentina	1,756	0.35	74
Australia	38,026	7.69	1,792
Austria	1,313	0.27	56
Belgium	2,338	0.47	102
Brazil	7,831	1.58	367
Bulgaria	3,262	0.66	141
Canada	40,856	8.26	2,064
China	103,928	21.00	5,265
Croatia	1,538	0.31	67
Cyprus	1,000	0.20	43
Czech Republic	273	0.06	12
Denmark	2,562	0.52	113
Estonia	20	0.00	1
Finland	2,700	0.55	118
France	8,112	1.64	352
Germany	7,533	1.52	332
Greece	2,906	0.59	123
Hungary	626	0.13	27
India	79,990	16.17	3,767
Ireland	484	0.10	21
Italy	4,578	0.93	198
Japan	91,687	18.53	4,154
Korea South	54,695	11.05	2,580
Latvia	165	0.03	8
Lithuania	613	0.12	26
Luxembourg	593	0.12	30
Malta	413	0.08	18
Mexico	3,344	0.68	144
Netherlands	1,999	0.40	92
Poland	6,966	1.41	299
Portugal	814	0.16	35
Romania	1,442	0.29	62
Saudi Arabia	5,304	1.07	307
Slovakia	144	0.03	6
Slovenia	365	0.07	16
South Africa	5,262	1.06	228
Spain	2,799	0.57	120
Sweden	6,565	1.33	293
	494,802	100.00	23,453

Notes: This table provides sample selection details. Panel A provides the sample selection. For G11 countries, any reporting standard except US GAAP is sufficient, while EU27 are required to report in IFRS. Panel B distributes the sample over quarters. Panel C provides countries of origin by quarter-firm observation. G11 countries, which function as a control group, are highlighted in grey within Panel C.

Difference-in-differences model

To examine the effect of ESEF implementation, I employ a difference-in-differences (DiD) design that exploits the regulatory shock created by the delayed implementation across EU member states. While the regulatory setting involves staggered adoption, with firms in four member states required to apply ESEF in 2021 and firms in the remaining 23 member states in 2022, my estimation relies on a basic DiD design rather than a fully-fledged staggered DiD estimator.³⁰ The short notice postponement reduces concerns about anticipatory behavior by firms or investors.³¹ Moreover, using firm-quarter panel data allow me to incorporate the exact timing based on each firm's fiscal year-ends. As a benchmark, I include firms from G11 countries, which did not experience changes in digital reporting mandates or in the accessibility of financial statements during the sample period. This control group helps isolate the effects of broader global trends.

³⁰ Strictly speaking, only the first set of regressions exploits the staggered timing of the ESEF mandate, comparing early and late adopters before and after adoption. While the regulatory setting involves staggered implementation across countries, the subsequent analyses do not rely on a staggered DiD estimator but instead use sample splits within the group of late adopters.

³¹ The setting is discussed in more detail in Section 4.

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Table 3.2: Descriptive statistic and correlation

Panel A: Descriptive statistics for variables used in the liquidity and information environment regressions								
	<i>N</i>	<i>Mean</i>	<i>Std. dev.</i>	<i>P1</i>	<i>P25</i>	<i>Median</i>	<i>P75</i>	<i>P99</i>
<i>Dependent variables (liquidity, full):</i>								
Bid-ask spread	477,684	0.024	0.053	0.000	0.002	0.004	0.019	0.308
Zero returns	465,619	0.223	0.257	0.015	0.076	0.108	0.242	1.000
Price impact	431,617	4.841	24.869	0.000	0.000	0.001	0.197	138.910
Liquidity factor	427,976	0.000	1.000	-0.584	-0.451	-0.371	-0.039	4.774
<i>Dependent variables (liquidity, EU27):</i>								
Bid-ask spread	59.808	0.030	0.065	0.000	0.001	0.010	0.023	0.388
Zero returns	62.123	0.265	0.301	0.000	0.012	0.123	0.354	1.000
Price impact	58.456	8.152	32.794	0.000	0.000	0.164	1.657	199.362
Liquidity factor	57.961	0.083	1.144	-0.610	-0.579	-0.310	0.102	5.622
<i>Dependent variables (liquidity, G11):</i>								
Bid-ask spread	417.876	0.023	0.051	0.000	0.002	0.004	0.018	0.286
Zero returns	403.496	0.217	0.249	0.015	0.077	0.108	0.227	1.000
Price impact	373.161	4.323	23.343	0.000	0.000	0.001	0.076	127.932
Liquidity factor	370.015	-0.013	0.975	-0.581	-0.448	-0.375	-0.068	4.582
<i>Dependent variables (inf. env., full):</i>								
Analyst Following	172,634	5.654	6.273	0	1	3	8	28
Coverage	172,634	0.881	0.324	0	1	1	1	1
Forecast dispersion	120,318	55.931	388.235	0.000	0.050	0.200	3.100	1,374.000
Forecast accuracy	148,476	-0.122	1.506	-1.283	-0.048	-0.015	-0.005	-0.000
<i>Dependent variables (inf. env., EU27):</i>								
Analyst Following	35,579	6.537	6.761	0	2	4	9	26
Coverage	35,579	0.940	0.238	0	1	1	1	1
Forecast dispersion	27,637	0.815	7.355	0.000	0.050	0.150	0.390	6.830
Forecast accuracy	32,761	-0.098	0.439	-0.977	-0.072	-0.025	-0.009	-0.000
<i>Dependent variables (inf. env., G11):</i>								
Analyst Following	137,055	5.425	6.119	0	1	3	8	28
Coverage	137,055	0.865	0.342	0	1	1	1	1
Forecast dispersion	92,681	72.366	441.000	0	0.040	0.270	6.000	1,810.000
Forecast accuracy	115,715	-0.129	1.689	-1.169	-0.042	-0.013	-0.004	-0.000

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Independent variable (full):

Size	484,809	11.988	2.306	6.669	10.408	12.129	13.589	17.100
Financial leverage	486,037	0.232	0.260	0.000	0.039	0.178	0.347	1.094
Analyst following	494,802	2.123	4.778	0	0	0	2	23
Return Volatility	465,158	0.030	0.021	0.000	0.017	0.025	0.036	0.116
Institutional Hld.	460,247	38.980	25.098	0	18	40	59	93
Operating CashFlow	489,625	0.000	0.337	-1.247	-0.012	0.043	0.098	0.408
Loss	494,802	0.290	0.454	0	0	0	1	1
TobinsQ	484,753	1.947	2.361	0.395	0.940	1.259	2.054	11.576
Book-to-Market	484,761	0.889	1.218	-2.698	0.312	0.627	1.198	5.400

Independent variables (EU27):

Size	60,456	12.464	2.445	6.673	10.746	12.419	14.241	17.204
Financial leverage	60,930	0.267	0.232	0.000	0.098	0.238	0.380	0.959
Analyst following	62,123	3.837	6.034	0.000	0.000	1.000	5.000	25.000
Return Volatility	62,089	0.024	0.017	0.000	0.014	0.020	0.029	0.092
Institutional Hld.	59,436	49.345	27.467	0.000	28.000	53.000	71.000	95.000
Operating CashFlow	61,330	0.049	0.181	-0.565	0.010	0.057	0.113	0.416
Loss	62,123	0.246	0.431	0.000	0.000	0.000	0.000	1.000
TobinsQ	60,436	1.625	1.868	0.398	0.934	1.127	1.605	9.489
Book-to-Market	60,436	0.960	1.225	-2.289	0.358	0.727	1.271	5.525

Independent variables (G11):

Size	424,353	11.921	2.277	6.667	10.367	12.084	13.519	17.005
Financial leverage	425,107	0.227	0.264	0.000	0.033	0.168	0.341	1.121
Analyst following	432,679	1.837	4.279	0.000	0.000	0.000	1.000	22.000
Return Volatility	403,069	0.031	0.021	0.000	0.017	0.026	0.037	0.117
Institutional Hld.	400,811	37.442	24.355	0.000	17.000	38.000	57.000	89.000
Operating CashFlow	428,295	-0.007	0.354	-1.365	-0.017	0.041	0.096	0.406
Loss	432,679	0.296	0.456	0.000	0.000	0.000	1.000	1.000
TobinsQ	424,317	1.993	2.419	0.395	0.941	1.288	2.119	11.874
Book-to-Market	424,325	0.879	1.217	-2.853	0.306	0.613	1.186	5.400

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Panel B: Pearson's correlation coefficients between variables used in the liquidity and information environment regression

	<i>Zero returns</i>	<i>Price impact</i>	<i>Liquidity Factor</i>	<i>Analyst Following</i>	<i>Coverage</i>	<i>Forecast Dispersion</i>	<i>Forecast Accuracy</i>
<i>Bid-ask spread</i>	0.7097	0.6244	0.9089	-0.1701	-0.2387	-0.0434	-0.1166
<i>Zero returns</i>	1.000	0.4986	0.8579	-0.2469	-0.3314	0.0252	-0.0802
<i>Price impact</i>		1.0000	0.8150	-0.0861	-0.1342	-0.0132	-0.0407
<i>Liquidity Factor</i>			1.0000	-0.1993	-0.2706	-0.0091	-0.1001
<i>Analyst Following</i>				1.0000	0.6005	0.0986	0.0293
<i>Coverage</i>					1.0000	0.0006	0.0000
<i>Forecast Dispersion</i>						1.0000	-0.0076

Notes: This table presents descriptive statistics and correlation coefficients. Panel A reports the dependent and independent variables used in the analysis for the full sample as well as separately for the EU27 and G11 groups. Differences between EU27 and G11 firms may arise from the fact that EU27 firms are listed on EU-regulated markets, typically the most publicly visible trading venues, whereas no such listing restriction applies to G11 firms. Additionally, even after winsorizing at the 1st and 99th percentiles, some values remain relatively high (e.g., price impact for G11).

My analysis proceeds in two steps. First, I examine the effect on market liquidity. Second, I assess impacts on information environment. I estimate the following baseline specification:

$$Liquidity/Information\ Environment = \beta_0 + \beta_1 (MANDATORY \times ESEF) + \sum \beta_j Controls_j + \sum \beta_i Fixed\ Effects_i + \varepsilon \quad (1)$$

Equation (1) is estimated using OLS with heteroscedasticity-robust standard errors clustered at the firm level and includes firm and quarter fixed effects. The dependent variable *Liquidity* is a composite measure capturing multiple aspects of capital-market effects of ESEF adoption (Section 3.4). To assess *Information Environment*, I use four established measures of financial analysts (Section 3.5)³².

Following Daske et al. (2008), treatment is assigned uniformly at the firm level once the respective member state adopts ESEF. I define the binary variable *MANDATORY* as equal to 1 for firm-quarters after the respective member state's adoption date, based on each firm's individual fiscal year-end. The subsequent calendar quarter marks the first reporting period under the mandate. In the DiD framework, the interaction term *MANDATORY* × *ESEF* captures the treatment effect of mandatory ESEF adoption. Both main effects (*MANDATORY* and *ESEF*) are absorbed by firm fixed effects, consistent with a generalized DiD framework (Armstrong et al., 2022).

Standard errors are clustered at the firm level, reflecting the fact that treatment varies across and within countries but is ultimately determined at the firm level. Although this clustering approach is appropriate, I acknowledge that correlated country-level shocks cannot be fully excluded. Country-level clustering would yield more conservative inferences, and I note this as a limitation (Abadie et al., 2023; Conley et al., 2018).³³

3.4 Liquidity effects of ESEF

The Commission introduced ESEF to improve the accessibility, analysis, and comparability of IFRS financial statements (ESEF, Rec. 4). Consistent with this objective, the first part of my analysis examines liquidity as a key economic outcome. Quarterly liquidity measures are well suited for this setting (Christensen et al., 2013, 2016). They (1) align with the EU's objective

³² Only firms with at least one analyst following in the year prior to mandatory ESEF adoption are included in the regression.

³³ The EU explicitly ruled out substantive national deviations in the implementation of ESEF (e.g., audit mandates for ESEF reports). Any residual differences are more likely attributable to institutional features such as national registers, stock exchanges, or related infrastructures or to firm level characteristics.

of strengthening capital allocation, are (2) sensitive to changes in information asymmetry, and (3) can be reliably measured over short horizons (Christensen et al., 2013, 2016; Wurgler, 2000). Moreover, liquidity is (4) less forward-looking than outcomes such as cost of capital or firm value, making it a timely proxy for regulatory effects (Christensen et al., 2013).³⁴ Leveraging quarterly liquidity helps exploiting differing fiscal year ends while ensuring reliable liquidity assessments (Christensen et al., 2016).

Liquidity measures and controls

The dependent variable, *Liquidity*, proxies for capital market effects of ESEF implementation. Following prior literature, I employ three established proxies that reflect distinct dimensions of market liquidity (Le & Gregoriou, 2020), including Bid-Ask Spread, Zero Returns, and Price Impact (Bai et al., 2014; Blankespoor et al., 2014; Christensen et al., 2013; Daske et al., 2008; Krueger et al., 2024; Liu et al., 2017; Yoon et al., 2011).

I calculate each liquidity proxy as follows. *Bid-Ask Spread* is a widely recognized measure and measures transaction costs arising from information asymmetry. For each trading day, I compute the quoted percentage spread as the difference between closing bid and ask prices, divided by their midpoint. Quarterly spreads are then obtained as the average across daily observations (Christensen et al., 2016). *Zero Returns* capture illiquidity associated with limited trading. They are defined as the proportion of days within a quarter with zero daily returns relative to the total number of trading days (Christensen et al., 2016). *Price Impact* reflects the sensitivity of stock prices to trading activity. Following Christensen et al. (2016), I compute the Amihud (2002) measure as the daily absolute return divided by trading volume and average this ratio across days within each quarter.

To combine these dimensions into a comprehensive liquidity measure, I follow Daske et al. (2008) and Krueger et al. (2024). Specifically, I conduct factor analysis with oblique rotation and extract the first (and only) factor with an eigenvalue greater than one. The resulting factor scores serve as the dependent variable in the analysis. This approach accommodates correlations across liquidity proxies and captures their common variation, thereby enhancing both robustness and interpretability (Hair et al., 2010). Control variables include firm

³⁴ “While investors likely adjust market valuations or cost of capital estimates as soon as their expectations about future corporate transparency change, liquidity is less anticipatory because investors primarily worry about adverse selection and, hence, the level of transparency at the time they trade. It is of course possible that investors anticipate when buying shares that future improvements in transparency will reduce adverse selection at the time they sell. But this anticipatory effect is likely small.” (Christensen et al., 2013, p. 152)

characteristics such as size and additional firm-specific factors, as suggested by prior work (Blankespoor et al., 2014). These controls mitigate the influence of confounding effects unrelated to ESEF adoption.

Main effect

Table 3.3 reports the estimates of model (1) for three liquidity measures and the compound liquidity factor for the full sample of ESEF adopter. Across two of the three individual liquidity measures, mandatory ESEF adoption is associated with statistically significant declines in market liquidity. Based on the regression estimates, bid-ask spreads for treated firms are about 0.11 percent higher relative to control firms. Zero-return days increase by approximately 0.7 percent, indicating reduced trading activity. The liquidity factor likewise exhibits a positive and significant coefficient of 2.22 percent relative to the control group³⁵, consistent with a modest deterioration in overall liquidity. Taken together, these results indicate that ESEF adoption is associated with a decline in liquidity for treated firms relative to controls.

To examine whether these effects differ across adoption regimes, I re-estimate the DiD model separately for early mandatory and late mandatory adopters (Table 3.4). For early adopters, all three liquidity measures and liquidity factor load positively and significantly at the 1% level, with larger effect sizes than in the pooled analysis. Based on the regression coefficients, early ESEF adoption is associated with a 9.65 percent decline in the liquidity factor relative to control firms. For individual liquidity measures, estimated declines are smaller, ranging from 0.22 to 1.84 percent. For late adopters, the results differ markedly. No significant effects are observed for the bid-ask spread, price impact, or the liquidity factor, while zero-return days increase modestly by 0.46 percent. Overall, the evidence suggests that the observed liquidity decline is concentrated among early adopters. These firms experienced significant reductions in liquidity, implying increased information asymmetry, whereas no robust effects can be detected for late adopters. Both patterns deviate from the regulatory objective of ESEF, and the negative effect for early adopters even contradicts the intended goal of improving market liquidity.³⁶

³⁵ As in Christensen et al. (2013), the percentage effect on liquidity factor is calculated as $(e^{0.0222} - 1) = 0.0222$.

³⁶ For late adopting countries, firms had the option to adopt ESEF early in 2021 (Section 4). To account for this, I re-estimate the regression excluding early adopting firms. The results in Annex 8 are broadly consistent with the main specification; for price impact, I find a significant negative effect ($p < 0.10$), and the positive effect on zero return days becomes stronger ($p < 0.01$).

Table 3.3: *Liquidity effects of EU ESEF regulation*

	BA	PI	ZRD	Liq. Factor
MANDATORY x ESEF	0.0011** (2.29)	-0.0343 (-0.11)	0.0071*** (3.63)	0.0222** (2.45)
Size	-0.0137*** (-33.70)	-7.0093*** (-23.29)	-0.0663*** (-44.54)	-0.3282*** (-38.49)
Financial leverage	0.0007 (0.47)	0.6734 (0.59)	0.0068 (1.20)	0.0187 (0.58)
Analyst following	0.0003*** (10.87)	0.1195*** (7.51)	0.0000 (0.17)	0.0032*** (4.79)
Institutional Hld.	0.0000* (1.89)	0.0009 (0.14)	-0.0002*** (-3.93)	-0.0000 (-0.15)
Operating Cash Flow	0.0047*** (6.10)	3.6014*** (8.06)	0.0070*** (2.89)	0.1203*** (8.51)
Loss	-0.0003 (-1.15)	-0.3056* (-1.82)	0.0003 (0.29)	-0.0097* (-1.95)
TobinsQ	0.0005*** (4.84)	0.3295*** (4.66)	0.0033*** (6.38)	0.0119*** (5.89)
Book-to-Market	-0.0012*** (-4.94)	-0.2650 (-1.31)	-0.0020* (-1.79)	-0.0220*** (-4.16)
Constant	0.1862*** (37.25)	87.4141*** (23.76)	0.9979*** (54.28)	3.8888*** (37.25)
N	436,665	394,598	418,695	391,810
Adjusted R ²	0.747	0.547	0.811	0.790
Firm & Quarterly FE	YES	YES	YES	YES
Clustered at firm level	YES	YES	YES	YES

(continued on next page)

3 Electronic Reporting and Firms' Information Environment: Evidence from the EU's ESEF mandate

Notes: In this table, the overall effect of mandatory ESEF implementation on four liquidity measures is estimated. Mandatory is a dummy for the reporting quarters under ESEF mandate for each individual firm (post variable). ESEF assumes the value of 1 for EU27 firms (treat variable). Results for balanced sample deviate in significance level for Bid-Ask spread and liquidity factor. Zero Return Days show a significantly negative result on 5% level (see Annex 1).

***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests and standard errors clustered at the firm level. t-Statistics are provided in parentheses.

Table 3.4: *Liquidity effects for early and late adopting countries of EU ESEF regulation*

	BA	PI	ZRD	Liq. Factor
Early adopting	0.0028*** (3.04)	2.2160*** (3.99)	0.0182*** (5.02)	0.0921*** (5.48)
Late adopting	0.0008 (1.35)	-0.5205 (-1.53)	0.0046** (2.13)	0.0070 (0.68)
Size	-0.0137*** (-33.70)	-7.0071*** (-23.30)	-0.0663*** (-44.54)	-0.3281*** (-38.51)
Financial leverage	0.0007 (0.47)	0.6704 (0.59)	0.0068 (1.20)	0.0186 (0.58)
Analyst following	0.0003*** (10.98)	0.1247*** (7.83)	0.0001 (0.31)	0.0034*** (5.03)
Institutional Hld.	0.0000* (1.88)	0.0008 (0.12)	-0.0002*** (-3.94)	-0.0000 (-0.16)
Operating Cash Flow	0.0047*** (6.10)	3.6005*** (8.06)	0.0070*** (2.89)	0.1203*** (8.51)
Loss	-0.0003 (-1.15)	-0.3048* (-1.82)	0.0003 (0.30)	-0.0097* (-1.95)
TobinsQ	0.0005*** (4.85)	0.3298*** (4.66)	0.0033*** (6.38)	0.0119*** (5.90)
Book-to-Market	-0.0012*** (-4.95)	-0.2678 (-1.32)	-0.0020* (-1.80)	-0.0221*** (-4.18)
Constant	0.1861*** (37.25)	87.3765*** (23.77)	0.9978*** (54.28)	3.8876*** (37.27)
N	436,665	394,598	418,695	391,810
Adjusted R ²	0.747	0.547	0.811	0.790
F-test for differences [p-value]	[0.0507]	[0.0000]	[0.0010]	[0.0000]
Firm & Quarterly FE	YES	YES	YES	YES
Clustered at firm level	YES	YES	YES	YES

(continued on next page)

3 Electronic Reporting and Firms' Information Environment: Evidence from the EU's ESEF mandate

Notes: In this table, the liquidity effect of mandatory ESEF implementation on early and late adopting countries is measured. Early/late adopting is a dummy for the reporting quarters under ESEF mandate for each individual firm (post variable). ESEF assumes the value of 1 for EU27 firms (treat variable). For early adopting countries, results for balanced sample deviate in significance level for Price Impact and Zero Return Days (see Annex 2). For late adopting countries, I find strongly varying results except of the liquidity factor as measure covering the other three.

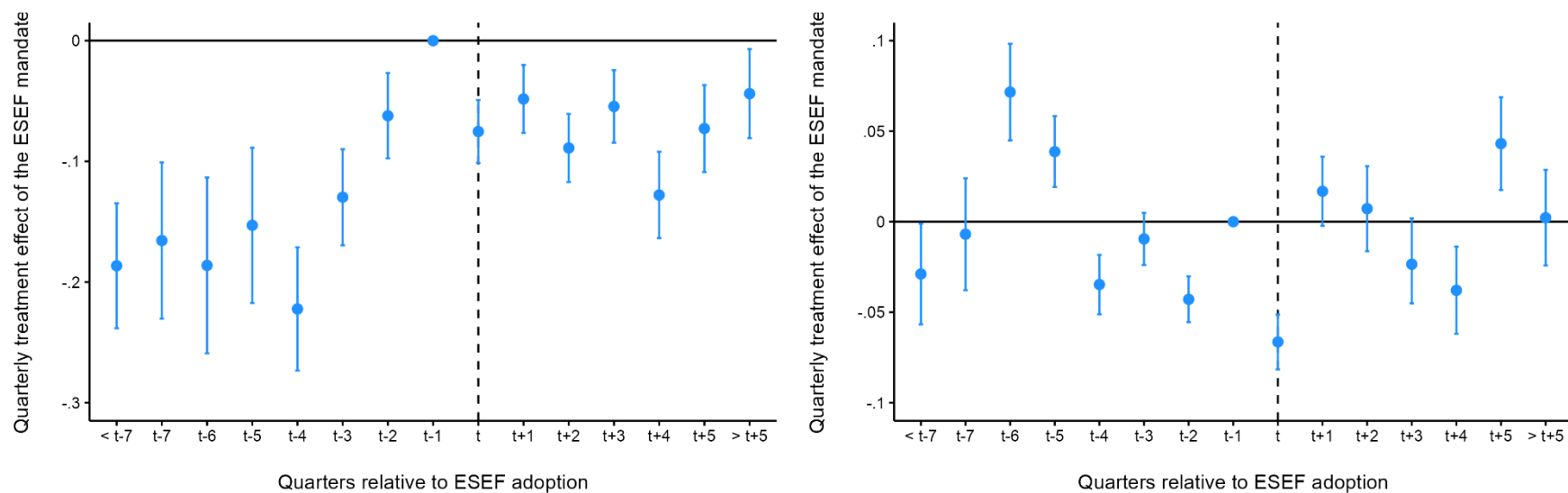
***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests and standard errors clustered at the firm level. t-Statistics are provided in parentheses.

To assess potential pre-trends and better understand the timing of effects, I estimate an event-study specification with leads and lags around the first mandatory ESEF filing for the compound liquidity effect (Figure 3.2). For early adopting countries, the lead coefficients show negative liquidity coefficients/positive liquidity effect compared to control firms already before ESEF becomes effective, including a pronounced decline in the quarters immediately preceding adoption. Because these changes occur prior to treatment, they are unlikely to reflect the regulation itself. Instead, they align with the Covid timing, which caused substantial volatility and liquidity disruptions across global markets in 2020 (Gofran et al., 2022). Liquidity subsequently settles at a new, higher equilibrium. I conclude that the negative effect on liquidity measures for early adopting countries (relative to control group) may be heavily driven by Covid pandemic, substantiating the tentative conclusion of a “pre trend” driving negative liquidity findings. Two aspects strengthen this interpretation: (1) Validating my identification of firms in Section 4, I control for 2020 reporting for a subsample and do not find any pre-ESEF reporting in the format. And (2) because ESEF constitutes only a change in format and not in content of annual reports, there is no reason to expect anticipation effects (Section 4.3.2).

For late adopters, the event study results exhibit a similar spike roughly one year before implementation, again consistent with the assumption of Covid related turbulence rather than anticipatory behavior. Following the spike, liquidity fluctuates but gradually moves back toward pre-Covid levels. Crucially, the lag coefficients around the actual adoption quarter do not show systematic deterioration, reinforcing the interpretation that ESEF did not have a material causal impact on liquidity for these firms.

Overall, I find strong evidence for a Covid effect before ESEF implementation and a setback in the following quarters that heavily contradicts the liquidity effect measured in my study. For early mandatory firms, a higher equilibrium after treatment occurs. It is not clear if another effect, besides Covid pandemic, triggers the outcome. To conduct further research on the topic, it seems reasonable to include late adopting countries only to deal with the potential effect of ESEF, and to interpret the results with caution.

Figure 3.2: Quarterly difference in differences estimation of Liquidity Factor



Note: Figure 3.2 reports the quarterly effect of the liquidity factor for early adopting countries (left) and late adopting countries (right). Quarter $t-1$ serves as the baseline period and represents the quarter prior to mandatory ESEF adoption for the respective country. G11 firms are included as benchmarks.

Cross-sectional analyses

In an additional test, I conduct cross-sectional analyses to assess whether the statistically insignificant average treatment effect masks economically meaningful heterogeneity in treatment responses. The aim is to examine whether firms more susceptible to disclosure-related changes respond differently to the ESEF mandate.

Since my primary outcome of interest is information asymmetry, proxied by liquidity measures, I construct three ex ante indicators of firms' pre-ESEF information asymmetry: liquidity, analyst coverage, and firm size. Liquidity reflects both a direct outcome and a proxy for market information asymmetry. Analyst coverage serves as a complementary measure, as greater coverage may improve the information environment by interpreting and disseminating firm-specific data. Firm size is a more indirect proxy, based on the notion that larger firms typically benefit from richer information environments through greater media visibility, reporting quality, and institutional monitoring. For each indicator, I classify firms into high and low groups using median splits in the quarter preceding mandatory adoption.

The results, reported in Table 3.4, reveal no consistent pattern across all splits. For liquidity-based splits, bid-ask spreads increase significantly for low-liquidity firms, while zero-return days increase among high-liquidity firms; however, the liquidity factor remains insignificant. Splitting by analyst following yields similarly mixed results, though firms with higher analyst coverage show a modest decline in liquidity, as indicated by a significantly positive liquidity factor. By contrast, size-based splits reveal clearer differences: larger firms exhibit significantly higher bid-ask spreads and liquidity factors, while among smaller firms only zero-return days increase.

Taken together, these results suggest that the negative liquidity effects of ESEF are more pronounced for firms traditionally associated with stronger information environments: those that are larger and more closely followed by analysts. This finding points to the possibility that the regulation imposes unexpected frictions precisely where information asymmetry was already comparatively low.

3 Electronic Reporting and Firms' Information Environment: Evidence from the EU's ESEF mandate

Table 3.5: Liquidity effects of EU ESEF regulation for late adopting countries split by (1) liquidity, (2) analyst following, and (3) size

	(1)				(2)				(3)			
	BA	PI	ZRD	Liq. Factor	BA	PI	ZRD	Liq. Factor	BA	PI	ZRD	Liq. Factor
Low Liquidity	0.0010*** (3.35)	-0.0347 (-0.21)	-0.0031 (-1.57)	-0.0002 (-0.04)								
High Liquidity	0.0005 (0.43)	-1.1109 (-1.69)	0.0133*** (3.46)	0.0129 (0.68)								
Low Analyst Following					0.0012** (2.52)	-0.0938 (-0.49)	0.0030 (0.93)	0.0149 (1.63)				
High Analyst Following					0.0010*** (2.59)	-0.1935 (-1.14)	0.0014 (0.69)	0.0134* (1.77)				
Small firms									0.0014 (1.35)	-0.8349 (-1.21)	0.0100*** (2.64)	0.0141 (0.70)
Large firms									0.0015*** (3.39)	0.2928 (1.43)	0.0032 (1.50)	0.0237*** (2.95)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	427,388	385,194	409,711	382,424	407,672	366,512	388,851	364,109	427,399	385,619	409,267	382,842
Adjusted R ²	0.748	0.542	0.810	0.787	0.735	0.517	0.793	0.780	0.736	0.534	0.796	0.772
F-test for differences [p-value]	[0.0036]	[0.2396]	[0.0004]	[0.7904]	[0.0037]	[0.5222]	[0.5448]	[0.0867]	[0.0017]	[0.1517]	[0.0141]	[0.0117]
Firm & Quarterly FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Clustered at firm level	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: In this table, the effect of mandatory ESEF implementation on late adopting countries split by their (1) liquidity, (2) analyst following, and (3) size is estimated. The classification is based on the quarter preceding the ESEF mandate, using a median split within the group of late adopters to create binary indicators for high and low values. These indicators are then interacted with the ESEF*MANDATORY treatment variable. All firms are included in the analysis, irrespective of whether they are followed by analysts. In Annex 3, I provide the results for a balanced sample. For liquidity factor, I find even weaker evidence for an effect on liquidity.

***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests and standard errors clustered at the firm level. t-Statistics are provided in parentheses.

3 Electronic Reporting and Firms' Information Environment: Evidence from the EU's ESEF mandate

Table 3.6: Liquidity effects of EU ESEF regulation for late adopting countries split by (1) Type of OAM, (2) private or public OAM, and (3) Timeliness of OAM

	(1)				(2)				BA	PI	ZRD	Liq. Factor
	BA	PI	ZRD	Liq. Factor	BA	PI	ZRD	Liq. Factor				
Competent Authority	0.0009 (1.17)	0.3381 (0.88)	0.0075** (2.50)	0.0253** (2.01)								
Stock Exchange	-0.0044*** (-3.36)	-4.2778*** (-3.25)	-0.0139*** (-2.89)	-0.1347*** (-4.20)								
Company Register	0.0037*** (4.54)	-0.0061 (-0.01)	0.0101*** (3.27)	0.0541*** (3.57)								
Private OAM					0.0008 (0.89)	-2.5811*** (-3.00)	-0.0056 (-1.61)	-0.0445** (-2.07)				
Public OAM					0.0007 (1.13)	0.2005 (0.59)	0.0081*** (3.15)	0.0244** (2.19)				
Lower timeliness									0.0013* (1.75)	-2.2061*** (-3.46)	0.0022 (0.65)	-0.0216 (-1.28)
Higher timeliness									-0.0004 (-0.44)	0.4731 (0.86)	0.0123*** (3.24)	0.0287 (1.64)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	427,762	385,916	409,723	383,135	427,762	385,916	409,723	383,135	412,421	371,086	394,263	368,322
Adjusted R ²	0.749	0.549	0.810	0.790	0.749	0.549	0.810	0.790	0.735	0.540	0.803	0.783
F-test for differences [p-value]	[0.0000]	[0.0094]	[0.0000]	[0.0000]	[0.3691]	[0.0087]	[0.0013]	[0.0086]	[0.1891]	[0.0016]	[0.0046]	[0.1047]
Firm & Quarterly FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Clustered at firm level	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

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3 Electronic Reporting and Firms' Information Environment: Evidence from the EU's ESEF mandate

Notes: In this table, the effect of mandatory ESEF implementation on late adopting countries split by the (1) type of OAM, (2) whether the OAM is run privately or publicly, and (3) timeliness of publication at OAM is estimated. The classification is based on the quarter preceding the ESEF mandate, using a country-based split within the group of late adopters to create binary indicators. These indicators are then interacted with the ESEF*MANDATORY treatment variable. Firms from five EU states are not included in the analysis, due to problems in data availability. In Annex 4, I provide the results for a balanced sample. Overall, in the balanced sample most results are weaker while still supporting the underlying interpretation of the results.

***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests and standard errors clustered at the firm level. t-Statistics are provided in parentheses.

Dissemination of ESEF

After examining the overall effect of the ESEF mandate, I extend the analysis by assessing whether institutional differences in OAMs shape the regulation's impact on market liquidity. A key distinction between the EU and US disclosure environment is that, while US filings are centrally disseminated through EDGAR, EU firms continue to rely on national OAMs and will do so until the launch of ESAP (see Section 2). This fragmented dissemination system may affect the accessibility of financial data and thereby the effectiveness of ESEF. To explore this topic, I compare OAMs along three dimensions: (i) the type of institution designated as OAM, (ii) whether the OAM is publicly or privately managed (ownership), and (iii) the timeliness with which filings are made available, based on prior evidence on publication delays relative to firm websites.³⁷ As in previous tests, the analysis is restricted to late adopters.

Five late adopting member states are excluded from the tests due to limited data availability. Reasons are a lack of access to the OAM itself (e.g., the Bulgarian OAM link provided by ESMA is non-functional), only a restricted subset of filings is available (e.g., Hungary provides free access to only the most recent 100 reports), or necessary date information is missing (e.g., Sweden provides upload dates only for re-uploads).

Table 3.6(1) reports the cross-sectional results by OAM type³⁸. In countries where stock exchanges operate the OAM, firms exhibit significantly stronger improvements across all four liquidity measures, including the liquidity factor. By contrast, OAMs run by competent authorities or company registers are associated with deteriorations in liquidity, reflected in wider bid-ask spreads and more zero-return days. These findings suggest that institutional design may influence how effectively ESEF implementation translates into secondary market outcomes. However, OAM type is unlikely to be exogenous, as the designation of OAMs often reflects broader institutional characteristics (Sran et al., 2024). Accordingly, these results should be interpreted as evidence of institutional heterogeneity rather than causal effects.

Table 3.6(2) examines liquidity outcomes by ownership structure of OAMs. Privately managed OAMs are associated with liquidity improvements, reflected in lower price impact and a decline in the liquidity factor. In contrast, publicly managed OAMs exhibit deteriorations in

³⁷ Timeliness is measured using a median split based on the OAM-level average gap identified in Section 2.4. OAMs with delays above the median are coded as 1, and those below as 0.

³⁸ The OAM classification follows ESMA guidance. I distinguish between (i) competent authorities, which are national regulatory bodies such as Belgium's FSMA, (ii) stock exchanges serving as OAMs, including some Nordic exchanges operated by NASDAQ, and (iii) company registers designated as OAMs, for example, Germany's "Unternehmensregister".

zero return days and the liquidity factor. These differences may reflect variation in operational incentives and responsiveness: private entities may be more inclined to invest in user-friendly dissemination systems. As with OAM type, which is closely related to this proxy, these results should not be interpreted causally because ownership structure is likely correlated with broader institutional and market conditions.

Finally, Table 3.6(3) examines whether the timeliness of OAM filings affects liquidity. I classify OAMs based on their median publication delay relative to firm websites. Firms in jurisdictions with longer delays experience wider bid-ask spreads but lower price impact, whereas firms in countries with shorter delays show increases in zero-return days. The liquidity factor is insignificant in both groups. Overall, these findings suggest that timeliness, as measured here, has limited explanatory power for liquidity outcomes. Investors may rely on alternative channels, such as firm websites or proprietary data providers, rather than OAMs for timely access to financial statements.

Discussion

In summary, the evidence reveals a statistically significant decline in liquidity for early adopting countries across all four liquidity measures. Supplementary analysis, including the quarterly lead-lag model, suggest that this effect may be influenced by the Covid pandemic rather than the ESEF mandate itself. By contrast, no economically meaningful liquidity changes are observed for firms in late adopting member states. These results are overall robust to a balanced sample design.³⁹ The findings align with parts of US literature, which documents increases in abnormal bid-ask spreads following the introduction of XBRL (Blankespoor et al., 2014), although subsequent US evidence is mixed (Hoitash et al., 2021). Several factors may explain the EU results.

First, prior research indicates that technical issues and tagging errors occurred during the early years of ESEF implementation. Heichl et al. (2025) document problems related to *comparability* and *credibility* at the firm level. As a result, market participants may have continued to rely on traditional formats or failed to fully benefit from the new system. US experience suggests that learning-curve effects may materialize in the years following adoption, which can facilitate smoother implementation and greater awareness of potential

³⁹ See Annex 1-3. The results from the balanced sample are largely consistent with those from the unbalanced sample. The only exception is the overall effect of ESEF implementation on the liquidity factor, which is not statistically significant in the balanced sample (compared to a significant positive effect in the unbalanced sample).

issues (Dong et al., 2016). Second, information *accessibility* remains fragmented across member states. In some countries, such as Germany, OAMs do not provide bulk-download functionality for ESEF filings. Moreover, the absence of a centralized disclosure platform, pending the implementation of ESAP in mid-2027 (see Section 2.2), likely increases search and extraction costs for investors compared to the US setting. At the same time, ongoing advances in data scraping and text-mining tools may reduce the marginal informational value of ESEF filings, particular given that just block tagging of notes is required from 2023 onwards, limiting the usability of the most information-rich parts of financial statements (Blankespoor, 2019). Consistent with these institutional frictions, the analysis shows more pronounced liquidity effects in countries where stock exchanges operate the OAM. provide bulk-download functionality for ESEF filings. Third, the transition process itself may have imposed frictions. For some stakeholders, ESEF may have increased data extraction costs relative to established formats. This issue is especially relevant given that the mandate applies only to firms listed on EU-regulated markets, reducing network effects and limiting incentives for early adoption by data intermediaries.

3.5 Effects of ESEF on Information Environment

The dependent variable *Analyst* captures a firm's information environment through the activity of financial analysts. Financial analysts serve as central information intermediaries who process, interpret, and disseminate firm-specific information to investors. Because analyst-based measures are well established in the literature and readily observable in practice, they provide a reliable and tractable way to assess changes in the information environment (Liu et al., 2014; M. Yu, 2010). Consistent with prior work, I examine both the extent of analyst coverage and the quality of analyst forecasts (Johnston, 2020; Li & Nwaeze, 2018; Liu et al., 2014; Yu, 2010).

In the context of iXBRL reporting, analysts may play an even more prominent role. Although structured, machine-readable disclosures are intended to reduce information processing costs and facilitate automated data extraction, analysts remain essential for contextualizing financial statements, assessing their credibility, and producing forward-looking insights. Prior research emphasizes that analysts' reliance on iXBRL reporting depends critically on the quality, consistency, and granularity of tagged financial data (Li & Nwaeze, 2018; Liu et al., 2014).

Analyst measures and controls

Unlike the liquidity analysis, which relies on quarterly data, the analyst analysis uses firm-year observations because the ESEF mandate applies exclusively to annual financial reports. Analyst coverage also varies primarily at the annual level, further motivating the use of yearly data. I operationalize the analyst measures as follows.

Analyst following reflects the richness of a firm's information environment by capturing both demand for analyst services as well as the quality and accessibility of firm-provided information (Liu et al., 2014; Yu, 2010). Following Ernstberger et al. (2017), I define it as the maximum number of individual analyst estimates included in a firm's consensus earnings forecast during the fiscal year, based on I/B/E/S data. *Coverage* is a binary indicator equal to 1 if at least one analyst issued earnings estimate for a firm in a given fiscal year and 0 otherwise, thereby capturing whether a firm is subject to any external monitoring.

To assess the quality of analyst forecasts, I use *forecast accuracy* and *forecast dispersion*. Following Liu et al. (2014), *forecast accuracy* is defined as the negative absolute forecast error, where the forecast error is the absolute difference between actual and consensus forecasted earnings per share, scaled by the stock price at the beginning of the fiscal year to enhance comparability across firms. *Forecast dispersion* reflects heterogeneity in analysts' expectations and serves as an additional measure of the information environment (Yu, 2010). Following Nallareddy et al. (2021), I measure dispersion as the standard deviation of individual analyst forecasts within a fiscal year.

The set of control variables follows prior research and is tailored to address potential confounding factors and endogeneity concerns (Blankespoor et al., 2014). In contrast to the liquidity setting, I replace analyst following as a control with return volatility to mitigate the possibility that liquidity-related effects drive the analyst results.

Main effect

Next, I examine whether ESEF influences the information environment through financial analysts, who serve as key intermediaries in processing and disseminating firm-specific information. Analyst activity provides a valuable proxy for assessing broader changes in the information environment. If ESEF enhances the accessibility and comparability of financial data, one might expect shifts in analyst coverage as well as improvements in forecast quality, as captured by dispersion and accuracy.

Table 3.7 reports results for both early and late adopters. While the main focus is on late adopters (given potential confounding effects for early adopters), their results are included for completeness. Only firms with at least one analyst following in the year prior to mandatory ESEF adoption are included in the regression. Patterns are generally similar across both groups, with the notable exception of analyst coverage.

For late adopters, I find a significant decline in the number of analysts following each firm. The decrease of 0.17 analysts corresponds to an estimated effect size of approximately 3 percent to mean of control group. Importantly, this effect is not mirrored in the binary coverage indicator, which remains unchanged. Thus, although the breadth of analyst coverage across firms is unaffected, the depth of coverage per firm declines. This suggests that the introduction of ESEF, while intended to enhance the accessibility and usability of financial disclosures, does not stimulate broader analyst coverage. Turning to forecast dispersion, I document a significant decline in forecast dispersion after ESEF adoption by 46.3 units, associated with a 64 percent reduction in forecast dispersion relative to control group. This result indicates greater convergence among analysts, which may reflect either improved consistency in interpreting financial disclosures or compositional shifts in the analyst community, such as the exit of lower-accuracy forecasters. In contrast, forecast accuracy exhibits a negative but statistically insignificant effect, consistent with the notion that ESEF introduces no fundamentally new information but instead standardizes the presentation of existing disclosures.⁴⁰

⁴⁰ For late adopting countries, firms had the option to adopt ESEF early by publishing their 2020 annual report in ESEF (see Section 4). To account for this, I re-estimate the regression excluding early adopting firms. The results in Annex 8 are broadly consistent with the main specification; however, no effect on analyst following is identifiable for late-adopting countries.

Table 3.7: *Information Environment effects of EU ESEF regulation for early and late adopting countries*

	Analyst Following	Coverage	Forecast Dispersion	Forecast Accuracy
Early adopting	-0.7963*** (-5.73)	-0.0851*** (-8.27)	-40.5353*** (-8.01)	-0.0058 (-0.37)
Late adopting	-0.1688** (-2.45)	-0.0000 (-0.00)	-46.3354*** (-8.23)	-0.0229 (-1.08)
Size	0.8408*** (17.92)	0.0860*** (14.51)	-1.8297 (-0.38)	0.0229 (0.19)
Return Volatility	-3.0999*** (-3.98)	-0.9573*** (-7.23)	129.3846 (1.11)	-5.3965*** (-3.65)
Financial Leverage	0.7980*** (4.53)	0.0825*** (3.44)	-0.6197 (-0.03)	-0.6238* (-1.71)
Institutional Hld.	-0.0044** (-2.48)	0.0000 (0.01)	-0.5302* (-1.86)	-0.0016 (-1.00)
Operating Cash Flow	0.0862 (1.32)	0.0804*** (5.16)	-44.3601*** (-2.91)	-0.0938 (-0.74)
Loss	0.1019** (2.50)	0.0114** (2.07)	-6.9454 (-0.98)	0.0163 (0.34)
TobinsQ	-0.1761*** (-12.29)	-0.0165*** (-10.02)	1.4614 (1.50)	-0.0198 (-1.60)
Book-to-Market	0.2839*** (6.08)	0.0381*** (7.29)	14.9115 (1.46)	-0.1436 (-0.59)
Constant	-5.4914*** (-8.11)	-0.2729*** (-3.24)	96.3091 (1.28)	0.0452 (0.02)
N	154,065	154,065	110,040	138,376
Adjusted R ²	0.926	0.434	0.75	0.500
F-test for differences [p-value]	[0.0000]	[0.0000]	[0.0087]	[0.3565]
Firm & Quarterly FE	YES	YES	YES	YES
Clustered at firm level	YES	YES	YES	YES

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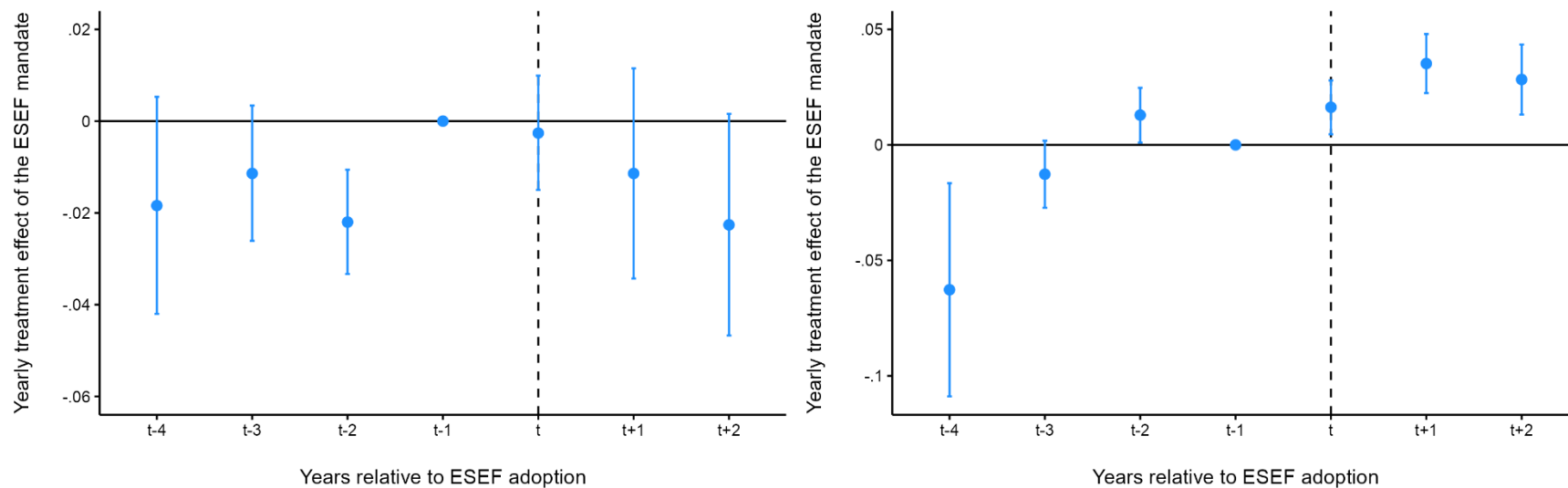
3 Electronic Reporting and Firms' Information Environment: Evidence from the EU's ESEF mandate

Notes: In this table, the effect of mandatory ESEF implementation for early and late adopting countries on information environment measures is estimated. Early/late adopting is a dummy for the reporting quarters under ESEF mandate for each individual firm (post variable). ESEF assumes the value of 1 for EU27 firms (treat variable). The results for a balanced sample are estimated in Annex 5, deviating especially in the effect on analyst following for late adopting countries. Due to the structure of the balanced sample, only firms with analyst following are included in the estimation.

***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests and standard errors clustered at the firm level. t-Statistics are provided in parentheses.

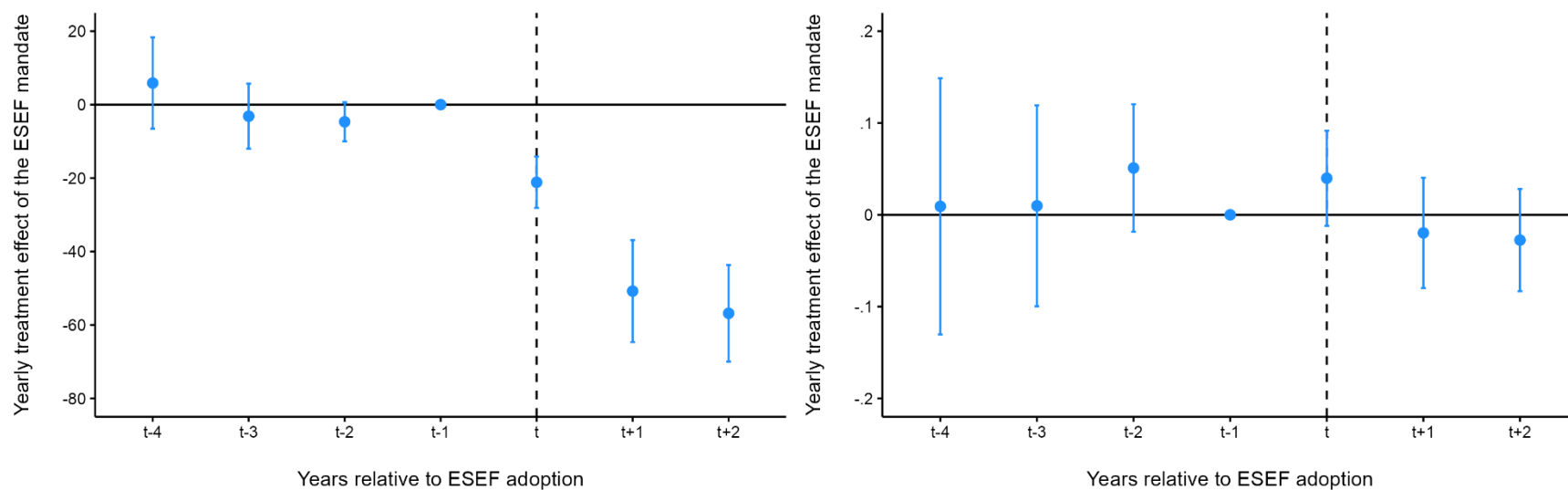
Figure 3.3: Yearly difference in differences estimation for Information Environment

Panel A: Yearly difference in differences estimates of Analyst Following (left) and Coverage (right)



Note: Panel A of Figure 3 reports the yearly effect of information environment measured by *AnFol* (left) and *Coverage* (right) for late adopting countries. Quarter $t-1$ serves as the baseline period and represents the quarter prior to mandatory ESEF adoption for the respective group. Only firms with coverage in the year before treatment are included. The year $t-1$ serves as the baseline period, only firms with coverage in this quarter are included. G11 firms are included as benchmarks.

Panel B: Yearly difference in differences estimates of Forecast Dispersion (left) and Forecast Accuracy (right)



Note: Panel B of Figure 3 reports the yearly effect of information environment measured by FORDIS (left) and FORACC (right) for late adopting countries. Quarter $t-1$ serves as the baseline period and represents the quarter prior to mandatory ESEF adoption for the respective group. Only firms with coverage in the year before treatment are included. The year $t-1$ serves as the baseline period, only firms with coverage in this quarter are included. G11 firms are included as benchmark.

As done in Section 4, I examine potential pre-trends and the timing of effects by estimating an event-study specification with leads and lags around the first mandatory ESEF implementation of late adopting countries. Figure 3.3 reports the year-by-year coefficients. For analyst following, no significant yearly estimates appear except for a significant decline in $t-1$, which is consistent with broader disruptions from the Covid pandemic. For coverage, a clear distinction emerges between pre- and post-treatment periods: pre-treatment estimates vary in sign and significance, whereas post-treatment coefficients are significantly positive. For forecast dispersion, coefficients turn significantly negative after the treatment year, in line with the main findings. Finally, forecast accuracy does not display any significant yearly effects. Finally, forecast accuracy does not show any significant yearly estimates.

Overall, I find evidence of ESEF effects on coverage and forecast dispersion for firms in late-adopting countries, while differences in analyst following and forecast accuracy before and after treatment are less pronounced. This provides some confidence that other factors, aside from the Covid pandemic addressed in the previous chapter, may influence the results. Still, the findings for the information environment should be interpreted with caution.

Cross-sectionals

Table 3.8 presents cross-sectional results for late adopting countries based on median splits of pre-treatment liquidity, analyst following, and firm size. The sample is restricted to firms with analyst coverage in the quarter immediately preceding the ESEF mandate.

In Table 3.8(1), I find broadly similar results across high- and low-liquidity firms. However, F-tests indicate significant differences between the groups for analyst following and forecast dispersion. Firms with higher pre-treatment liquidity exhibit a more pronounced decline in analyst following, whereas the other analyst-related measures behave alike across subgroups.

Table 3.8(2) stratifies firms by pre-treatment analyst following. Here, heterogeneity is more pronounced. Firms with high pre-treatment coverage experience significant decreases in analyst following, forecast dispersion, and forecast accuracy. In contrast, firms with low pre-treatment coverage show a significant decline only in forecast dispersion. These results suggest that the aggregate reduction in analyst following is largely driven by firms that previously attracted substantial attention. One interpretation is that analysts covering high-visibility firms adjusted their allocation of effort in response to the new reporting format. At the same time, the shift to ESEF may have introduced frictions for analysts less equipped to integrate the modified disclosures into their workflows, contributing to a contraction in analyst participation.

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Table 3.8: Information environment effects of EU ESEF regulation for late mandatory countries split by (1) liquidity, (2) analyst following, and (3) size

	(1)				(2)				(3)			
	Analyst Following	Coverage	Forecast Dispersion	Forecast Accuracy	Analyst Following	Coverage	Forecast Dispersion	Forecast Accuracy	Analyst Following	Coverage	Forecast Dispersion	Forecast Accuracy
Low Liquidity	-0.2318** (-2.12)	-0.0005 (-0.08)	-53.8239*** (-5.20)	-0.0221 (-1.17)								
High Liquidity	-0.1464** (-2.07)	0.0027 (0.21)	-51.7589*** (-5.37)	-0.0225 (-0.79)								
Low Analyst Following					0.0306 (0.52)	0.0005 (0.04)	-47.6733*** (-8.23)	-0.0106 (-0.39)				
High Analyst Following					-0.4808*** (-3.71)	0.0024 (0.52)	-47.6575*** (-8.13)	-0.0377** (-2.00)				
Small firms									-0.0216 (-0.34)	0.0025 (0.19)	-47.8581*** (-8.03)	-0.0119 (-0.39)
Large firms									-0.3485*** (-3.10)	-0.0005 (-0.09)	-47.5594*** (-8.20)	-0.0324* (-1.85)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	146,729	146,729	103,832	131,344	146,885	146,885	103,944	131,472	146,765	146,765	103,844	131,372
Adjusted R ²	0.925	0.434	0.624	0.500	0.925	0.517	0.750	0.500	0.925	0.434	0.750	0.500
F-test for differences [p-value]	[0.0214]	[0.9707]	[0.0000]	[0.4989]	[0.0006]	[0.8690]	[0.0000]	[0.0798]	[0.0082]	[0.9739]	[0.0000]	[0.1348]
Firm & Quarterly FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Clustered at firm level	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: In this table, the overall effect of mandatory ESEF implementation is measured for a split sample. A median split for all measures is conducted. Liquidity split is based on liquidity factor. The split variables are derived by first performing a median split within the group of late adopting countries (resulting in binary indicators for high and low values) and then interacting these indicators with the ESEF*MANDATORY treatment variable. For the liquidity split, no differences between both groups are identified. Yet, for both other tests, I find a significant negative effect for firms with higher pre-analyst following and larger size in analyst following. And forecast accuracy. The results for a balanced sample are estimated in Annex 6.

***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests and standard errors clustered at the firm level. t-Statistics are provided in parentheses.

In Table 3.8(3), firms are split by size. Larger firms display significant decreases in analyst following, forecast dispersion, and forecast accuracy, whereas smaller firms exhibit no significant effects other than a decline in forecast dispersion. This pattern indicates that larger firms, despite typically benefitting from richer information environments, may be more exposed to shifts in reporting infrastructure introduced by the ESEF mandate.

Additional tests

Turning to institutional features of national OAMs, the results reveal systematic differences across OAM types. As shown in Table 8(1), analyst following declines significantly in countries where competent authorities or stock exchanges serve as OAMs, whereas no statistically significant effect emerges for company registers. Forecast dispersion decreases across all OAM types, indicating greater alignment in analysts' earnings expectations, while the remaining analyst measures show no consistent changes. These patterns may reflect variation in how effectively different OAM types facilitate access to structured data. However, because OAM type is likely correlated with broader institutional characteristics, these results should be interpreted cautiously.

Table 8(2) compares privately and publicly managed OAMs. Analyst following declines significantly for public OAMs, whereas no significant effect is observed for privately managed OAMs. Forecast dispersion decreases for both ownership types, indicating increased convergence in forecasts regardless of ownership structure. The effects, however, are less pronounced than those documented for liquidity, consistent with the idea that analyst behavior is less sensitive to dissemination infrastructure than market-wide trading outcomes.

Finally, Table 8(3) examines OAM timeliness. In countries with longer publication delays, both analyst following and forecast dispersion decline significantly, whereas in countries with shorter delays, only forecast dispersion exhibits a consistent change. These findings align with the notion that slower dissemination of ESEF filings may impede analysts' ability to incorporate structured disclosures efficiently. Still, because timeliness likely reflects broader country-level factors, these results should be interpreted with appropriate caution.

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Table 3.9: Information environment effects of EU ESEF regulation for late mandatory countries split by (1) Type of OAM, (2) private or public OAM, and (3) Timeliness of OAM

	(1)				(2)				(3)			
	Analyst Following	Coverage	Forecast Dispersion	Forecast Accuracy	Analyst Following	Coverage	Forecast Dispersion	Forecast Accuracy	Analyst Following	Coverage	Forecast Dispersion	Forecast Accuracy
Competent Authority	-0.3123*** (-3.25)	-0.0023 (-0.22)	-47.0807*** (-8.05)	-0.0318 (-1.57)								
Stock Exchange	-0.3359** (-2.46)	-0.0179 (-0.82)	-47.5098*** (-8.08)	-0.0777 (-1.25)								
Company Register	0.0654 (0.63)	0.0148 (1.62)	-48.5508*** (-8.32)	0.0109 (0.46)								
Private OAM					-0.0181 (-0.17)	0.0007 (0.05)	-47.6668*** (-8.23)	-0.0317 (-0.76)				
Public OAM					-0.2458*** (-3.02)	0.0015 (0.18)	-47.6633*** (-8.16)	-0.0200 (-1.02)				
Lower timeliness									-0.1924* (-1.81)	0.0113 (0.94)	-46.7749*** (-8.10)	-0.0345 (-0.96)
Higher timeliness									-0.0872 (-0.76)	0.0044 (0.45)	-49.0048*** (-8.25)	-0.0175 (-0.84)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	146,885	146,885	103,944	131,472	146,885	146,885	103,944	131,472	140,145	140,145	99,108	125,140
Adjusted R ²	0.925	0.435	0.750	0.500	0.925	0.434	0.750	0.500	0.925	0.439	0.750	0.500
F-test for differences [p-value]	[0.0009]	[0.2956]	[0.0000]	[0.1381]	[0.0102]	[0.9838]	[0.0000]	[0.5467]	[0.1634]	[0.6076]	[0.0000]	[0.5823]
Firm & Quarterly FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Clustered at firm level	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: In this table, the effect of mandatory ESEF implementation on late adopting countries split by the (1) type of OAM, (2) whether the OAM is run privately or publicly, and (3) timeliness of publication at OAM is estimated. The classification is based on the quarter preceding the ESEF mandate, using a country-based split within the group of late adopters to create binary indicators. These indicators are then interacted with the ESEF*MANDATORY treatment variable. Firms from five EU states are not included in the analysis, due to problems in data availability. In Annex 7, I provide the results for a balanced sample. Overall, in the balanced sample most results are weaker while still supporting the underlying interpretation of the results. Only firms with coverage in quarter before treatment included.

***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests and standard errors clustered at the firm level. t-Statistics are provided in parentheses.

Discussion

Taken together, the evidence points to a significantly negative effect of the ESEF mandate on analyst following. Although the regulation aimed to improve data accessibility through a machine-readable format, the results suggest that this shift may have altered the perceived benefits from covering a given firm. The decline in the number of analysts per firm, alongside stable overall firm coverage, indicates a concentration of analyst activity rather than an expansion of coverage. One plausible interpretation is that lower information processing costs reduce the marginal value of multiple analysts covering the same firm.

These patterns must be considered alongside the results for forecast dispersion and forecast accuracy. Forecast dispersion declines consistently across specifications, indicating greater alignment in analysts' earnings expectations. This convergence may reflect more homogeneous interpretations of firm fundamentals or, alternatively, a shrinking pool of contributors. Forecast accuracy, by contrast, is generally unaffected in the full sample. However, when stratifying by pre-treatment analyst following and firm size, declines in accuracy emerge for firms with richer information environments, those with higher prior coverage and larger size. This pattern is consistent with a shift toward more standardized, less interpretive processing of disclosures, or with reduced analyst competition lowering incentives to generate highly precise forecasts.

Turning to institutional features of national OAMs, the results indicate that ownership and type influence the alignment of analyst expectations more than analysts' coverage decisions. Timeliness appears to play a secondary role, suggesting that analysts may rely on alternative information channels, such as firm websites or commercial databases, when accessing timely disclosures. Overall, these findings highlight that while ESEF improves the technical accessibility of reporting data, analysts respond selectively, reflecting complex interactions between disclosure format, institutional design, and the economics of information intermediation.

3.6 Conclusion

This paper examines the capital market effects of the staggered adoption of EU's ESEF mandate across member states in 2021 and 2022. ESEF may affect markets through credibility, comparability, and accessibility channels⁴¹, shaping both liquidity and the information

⁴¹ The three channels are identified by comparing XBRL reporting in the US with ESEF (Section 3.2). For ESEF, no credible differences exist across member states, except for OAM-level variation. Consequently, only the tests

environment. Results show that early adopters experience significant reductions in liquidity across multiple measures, whereas late adopters exhibit no consistent effects. Cross-sectional analyses indicate that liquidity declines are more pronounced for firms with higher pre-existing information asymmetry. National OAM design also affects outcomes, with privately managed and stock exchange-operated OAMs providing more effective data access, while timeliness plays a secondary role. For analysts, coverage remains stable, but the number of analysts per firm declines and forecast dispersion decreases, suggesting a concentration of monitoring rather than broader improvements. Overall, the findings highlight that institutional design and firm-specific characteristics may shape the economic impact of ESEF, and that digital reporting does not automatically strengthen capital market efficiency.

This study contributes in several ways. First, it provides the first cross-country examination of liquidity and information environment effects of mandatory digital financial reporting in the EU, extending the literature on (i)XBRL reporting with a more recent implementation example. Second, the dual perspective on liquidity and information environment offers a comprehensive assessment of how ESEF affects information flows. Third, the analysis demonstrates that a change in reporting format does not automatically improve liquidity or the information environment, as institutional and operational frictions may limit the impact. Fourth, the unique OAM setting allows me to account for the moderating role of OAM type, although this variable may also capture other country-specific institutional factors and should be interpreted with caution.

The study also has several limitations. First, it covers only a limited number of years after ESEF's entry-into-force. Second, the introduction coincided with the Covid pandemic, creating unusual volatility and disruptions in capital markets that are difficult to disentangle from the regulatory intervention. Third, liquidity effects capture aggregated market reactions rather than direct user interaction with ESEF, and participants may rely on data vendors as alternative dissemination channels. Fourth, the study focuses on the existence of ESEF filings, not their quality or completeness. Early XBRL evidence from the US suggests learning curve effects may be important. Fifth, the analysis does not identify firms from late adopting countries that engaged in early adoption of ESEF. Although firm fixed effects absorb time-invariant differences, pre-existing reporting practices may moderate treatment effects in ways the study

exploiting differences in OAMs allow for a more meaningful investigation of the accessibility channel at the EU level.

cannot explicitly isolate. Sixth, firm-level outcomes may reflect cross-country heterogeneity in enforcement, market structure, and OAM technological readiness, which remain difficult to fully separate from the measured effects.

Limitations aside, this study provides the first evidence of ESEF's impact on liquidity and the information environment in the EU, offering regulators and researchers insights into one of the most significant recent changes in digital financial reporting.

3.7 Appendix

Definition of Variables

Variable	Description
Dependent variables:	
<i>Bid-ask spread</i>	Following Christensen et al. (2016), I obtain the closing bid and ask prices for each trading day and compute the daily quoted percentage spread as the difference between these prices divided by the midpoint. To derive the quarterly Bid-Ask Spread, I average all daily spreads within the quarter for each firm.
<i>Zero returns</i>	In line with Christensen et al. (2016), Zero Returns are defined as the proportion of trading days with zero daily stock returns out of all potential trading days in a quarter.
<i>Price impact</i>	According to Christensen et al. (2016), this measure is computed as the quarterly mean of the Amihud (2002) illiquidity measure, which is the daily absolute stock return divided by the trading volume in US dollars.
<i>Liquidity Factor</i>	The variable derives from the first (and only) factor with an Eigenvalue greater than 1 serve as the dependent variable (Daske et al., 2008). Employing oblique rotation allows me to account for potential correlations among these measures, thereby enhancing the robustness and interpretability of my liquidity measure (Hair et al., 2010). To evaluate the suitability of the underlying variables, I apply the Kaiser-Meyer-Olkin measure (KMO). A value above 0.6 indicates that the variables are highly correlated with each other, suggesting that they are suitable for factor analysis. I estimate a KMO of 0.7227 for my data.
<i>Analyst Following</i>	Following Ernstberger et al. (2017), I measure analyst following as the maximum number of individual analyst estimates included in a firm's consensus earnings forecast during the fiscal year, based on data from the I/B/E/S database.
<i>Coverage</i>	A binary variable that takes the value of 1 if a firm has at least one analyst following in a given quarter, and 0 otherwise.
<i>Forecast Dispersion</i>	Following Nallareddy et al. (2021), I measure forecast dispersion as the standard deviation of analyst forecast errors within a fiscal year.
<i>Forecast Accuracy</i>	Following Liu et al. (2014), I define forecast accuracy as forecast error multiplied by minus one, where forecast error is the absolute difference between actual and forecasted earnings per share (EPS), scaled by the stock price at the beginning of the fiscal year.
Independent variable:	
<i>Size</i>	The natural logarithm of the market value of equity (WC07210) at the end of the previous fiscal year (in thousands of US\$).

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<i>Financial leverage</i>	The ratio of total liabilities (wc03251 + wc03051) to total assets (wc02999) following Daske et al. (2008)
<i>Institutional Hdl.</i>	Percent of shares outstanding held by institutions, as measured by LSEG Workspace (NOSHFF)
<i>Operating CashFlow</i>	Cash flow from operations (WC04860) to total assets (WC02999) at the end of the previous fiscal year (in percent).
<i>Loss</i>	Indicator variable equal to 1 for firms with income before extra items/preferred dividends (wc01551) less than zero, and 0 otherwise
<i>TobinsQ</i>	Following Daske et al. (2008), I compute TobinsQ as (total assets (WC02999) - book value of equity (WC03501) + market value of equity (WC08001)) scaled by total assets (WC02999).
<i>Book-to-Market</i>	Book-to-market ratio, defined as book value of common equity (WC03501) to market value (WC08001) at the end of the fiscal year.
<i>Return volatility</i>	Calculated as the standard deviation of daily stock returns within a given quarter

Model (2)

<i>Low Liquidity</i>	Median split for liquidity factor. Takes a value of 1 for firms with a value lower than median for Q4 2021.
<i>High liquidity</i>	Median split for liquidity factor. Takes a value of 1 for firms with a value higher than median for Q4 2021.
<i>Low Analyst Following</i>	Median split for independent variable analyst following measure by late mandatory firms. Takes a value of 1 for firms with a value lower than median for Q4 2021.
<i>High Analyst Following</i>	Median split for independent variable analyst following measure by late mandatory firms. Takes a value of 1 for firms with a value higher than median for Q4 2021.
<i>Small firm</i>	Median split for independent size measure by late mandatory firms. Takes a value of 1 for firms with a value lower than median for Q4 2021.
<i>Large firm</i>	Median split for independent size measure by late mandatory firms. Takes a value of 1 for firms with a value higher than median for Q4 2021.

Model (3)

<i>Competent Authority</i>	National OAMs are classified as competent authority based on ESMA data. If type is not clearly expressed, manually controlled at OAMs website. (Source: https://www.esma.europa.eu/publications-and-data/databases-and-registers)
<i>Stock Exchange</i>	National OAMs are classified as stock exchange based on ESMA data. If type is not clearly expressed, manually controlled at OAMs website. (Source: https://www.esma.europa.eu/publications-and-data/databases-and-registers)

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Company Register	National OAMs are classified as company register based on ESMA data. If type is not clearly expressed, manually controlled at OAMs website. (Source: https://www.esma.europa.eu/publications-and-data/databases-and-registers)
Private OAM	Following ESMA's classification, I manually checked (1) who is running the OAM, and (2) if there are connections to public entities or agencies. If they do not exist, the OAM is framed as private.
Public OAM	Following ESMA's classification, I manually checked (1) who is running the OAM, and (2) if there are connections to public entities or agencies. If connections exist or the OAM is directly run by an agency, the OAM is framed as public.
Lower timeliness	Median split for average delay on member state level between the publication of financial statements at company website and OAM in 2021. The data is extracted from Section 2.4. Member states with higher-than-average delay are classified as "lower timeliness".
Higher timeliness	Median split for average delay on member state level between the publication of financial statements at company website and OAM in 2021. The data is extracted from Section 2.4. Member states with lower-than-average delay are classified as "higher timeliness".

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Appendix 1: Liquidity effects of EU ESEF regulation (balanced sample)

	BA	PI	ZRD	Liq. Factor
MANDATORY x ESEF	0.0020*** (4.57)	-0.3903 (-1.40)	-0.0043** (-2.26)	0.0020 (0.23)
Size	-0.0118*** (-22.25)	-4.5863*** (-12.96)	-0.0472*** (-32.34)	-0.2475*** (-23.20)
Financial leverage	-0.0014 (-0.79)	-0.0520 (-0.04)	-0.0084 (-1.59)	-0.0273 (-0.71)
Analyst following	0.0002*** (5.46)	0.1096*** (7.76)	0.0002 (1.35)	0.0036*** (5.44)
Institutional Hld.	0.0000 (1.51)	0.0094 (1.04)	0.0001 (1.28)	0.0005 (1.54)
Operating Cash Flow	0.0033** (2.52)	1.9705*** (2.61)	0.0031 (0.83)	0.0611** (2.36)
Loss	0.0000 (0.10)	-0.2782* (-1.77)	0.0015 (1.49)	-0.0013 (-0.25)
TobinsQ	0.0002 (1.52)	0.1864** (2.46)	0.0009** (1.98)	0.0062** (2.31)
Book-to-Market	-0.0010*** (-3.17)	-0.4999** (-2.20)	-0.0035*** (-3.93)	-0.0217*** (-3.39)
Constant	0.1593*** (24.07)	57.4288*** (12.91)	0.7351*** (40.03)	2.8337*** (21.21)
N	254,232	254,232	254,232	254,232
Adjusted R ²	0.720	0.501	0.814	0.772
Firm & Quarterly FE	YES	YES	YES	YES
Clustered at firm level	YES	YES	YES	YES

Notes: In this table, the overall effect of mandatory ESEF implementation on four liquidity measures is estimated. Deviating from Table 3, I use a balanced sample. Mandatory is a dummy for the reporting quarters under ESEF mandate for each individual firm (post variable). ESEF assumes the value of 1 for EU27 firms (treat variable).

***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests and standard errors clustered at the firm level. t-Statistics are provided in parentheses.

Appendix 2: *Liquidity effects for early and late adopting countries of EU ESEF regulation (balanced sample)*

	BA	PI	ZRD	Liq. Factor
Early adopting	0.0033*** (3.81)	1.0670* (1.79)	0.0079** (2.17)	0.0568*** (3.15)
Late adopting	0.0016*** (3.51)	-0.7148** (-2.30)	-0.0070*** (-3.28)	-0.0102 (-1.05)
Size	-0.0118*** (-22.26)	-4.5871*** (-12.97)	-0.0473*** (-32.36)	-0.2475*** (-23.21)
Financial leverage	-0.0014 (-0.80)	-0.0606 (-0.05)	-0.0085 (-1.60)	-0.0276 (-0.72)
Analyst following	0.0002*** (5.57)	0.1140*** (8.05)	0.0003 (1.58)	0.0037*** (5.68)
Institutional Hld.	0.0000 (1.51)	0.0094 (1.04)	0.0001 (1.28)	0.0004 (1.54)
Operating Cash Flow	0.0033** (2.53)	1.9761*** (2.62)	0.0031 (0.84)	0.0613** (2.37)
Loss	0.0000 (0.11)	-0.2759* (-1.76)	0.0015 (1.51)	-0.0012 (-0.23)
TobinsQ	0.0002 (1.52)	0.1864** (2.46)	0.0009** (1.98)	0.0062** (2.31)
Book-to-Market	-0.0010*** (-3.19)	-0.5043** (-2.22)	-0.0036*** (-3.97)	-0.0219*** (-3.42)
Constant	0.1593*** (24.08)	57.4295*** (12.91)	0.7351*** (40.05)	2.8337*** (21.23)

(continued on next page)

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N	254,232	254,232	254,232	254,232
Adjusted R ²	0.720	0.501	0.814	0.772
F-test for differences [p-value]	[0.0000]	[0.0131]	[0.0004]	[0.0033]
Firm & Quarterly FE	YES	YES	YES	YES
Clustered at firm level	YES	YES	YES	YES

Notes: In this table, the liquidity effect of mandatory ESEF implementation on early and late adopting countries is measured. I use a balanced sample, compared to Table 4. Early/late adopting is a dummy for the reporting quarters under ESEF mandate for each individual firm (post variable). ESEF assumes the value of 1 for EU27 firms (treat variable).

***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests and standard errors clustered at the firm level. t-Statistics are provided in parentheses.

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Appendix 3: Liquidity effects of EU ESEF regulation for late adopting countries split by (1) liquidity, (2) analyst following, and (3) size (balanced sample)

	(1)				(2)				(3)			
	BA	PI	ZRD	Liq. Factor	BA	PI	ZRD	Liq. Factor	BA	PI	ZRD	Liq. Factor
Low Liquidity	0.0017*** (4.52)	0.0747 (0.36)	-0.0105*** (-6.07)	-0.0077 (-1.07)								
High Liquidity	0.0006 (0.47)	-1.2073 (-1.38)	0.0050 (0.90)	-0.0118 (-0.47)								
Low Analyst Following					0.0020*** (3.80)	-0.2482* (-1.70)	-0.0071*** (-2.61)	-0.0007 (-0.08)				
High Analyst Following					0.0018*** (4.82)	-0.3294*** (-2.75)	-0.0060*** (-4.36)	-0.0015 (-0.24)				
Small firms									0.0019** (2.29)	-0.9667* (-1.65)	-0.0041 (-1.09)	-0.0070 (-0.40)
Large firms									0.0018*** (4.09)	-0.3338 (-1.45)	-0.0088*** (-4.65)	-0.0068 (-0.77)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	247,392	247,392	247,392	247,392	234,144	234,144	234,144	234,144	247,392	247,392	247,392	247,392
Adjusted R ²	0.720	0.503	0.812	0.771	0.725	0.470	0.805	0.768	0.706	0.492	0.802	0.756
F-test for differences [p-value]	[0.0000]	[0.1581]	[0.0000]	[0.1716]	[0.0000]	[0.0206]	[0.0000]	[0.9721]	[0.0001]	[0.1048]	[0.0000]	[0.7027]
Firm & Quarterly FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Clustered at firm level	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: In this table, the effect of mandatory ESEF implementation on late adopting countries split by their (1) liquidity, (2) analyst following, and (3) size for the balanced sample is estimated. The classification is based on the quarter preceding the ESEF mandate, using a median split within the group of late adopters to create binary indicators for high and low values. These indicators are then interacted with the ESEF*MANDATORY treatment variable. All firms are included in the analysis, irrespective of whether they are followed by analysts.

***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests and standard errors clustered at the firm level. t-Statistics are provided in parentheses.

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Appendix 4: Liquidity effects of EU ESEF regulation for late adopting countries split by (1) Type of OAM, (2) private or public OAM, and (3) Timeliness of OAM (balanced sample)

	(1)				(2)							
	BA	PI	ZRD	Liq. Factor	BA	PI	ZRD	Liq. Factor	BA	PI	ZRD	Liq. Factor
Competent Authority	0.0017*** (3.16)	0.0906 (0.29)	-0.0049* (-1.65)	0.0062 (0.56)								
Stock Exchange	-0.0028** (-2.07)	-4.4154*** (-3.26)	-0.0286*** (-5.54)	-0.1397*** (-4.24)								
Company Register	0.0041*** (4.94)	-0.2846 (-0.66)	0.0007 (0.25)	0.0295* (1.94)								
Private OAM					0.0024*** (2.63)	-2.6991*** (-3.19)	-0.0162*** (-4.48)	-0.0503** (-2.33)				
Public OAM					0.0014*** (2.73)	-0.0368 (-0.13)	-0.0040 (-1.61)	0.0034 (0.33)				
Lower timeliness									0.0027*** (3.92)	-2.2090*** (-3.71)	-0.0076** (-2.37)	-0.0254 (-1.55)
Higher timeliness									0.0005 (0.60)	0.1989 (0.36)	-0.0010 (-0.26)	0.0054 (0.31)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	247,392	247,392	247,392	247,392	247,392	247,392	247,392	247,392	236,256	236,256	236,256	236,256
Adjusted R ²	0.720	0.503	0.813	0.772	0.720	0.503	0.813	0.772	0.721	0.503	0.813	0.771
F-test for differences [p-value]	[0.0000]	[0.0110]	[0.0000]	[0.0001]	[0.0014]	[0.0062]	[0.0000]	[0.0598]	[0.0004]	[0.0009]	[0.0599]	[0.2795]
Firm & Quarterly FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Clustered at firm level	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

(continued on next page)

Notes: In this annex, the effect of mandatory ESEF implementation on late adopting countries split by the (1) type of OAM, (2) whether the OAM is run privately or publicly, and (3) timeliness of publication at OAM is estimated on base of the balanced sample. The classification is based on the quarter preceding the ESEF mandate, using a country-based split within the group of late adopters to create binary indicators. These indicators are then interacted with the ESEF*MANDATORY treatment variable. Firms from five EU states are not included in the analysis, due to problems in data availability. In Table 6, I provide the results for an unbalanced sample.

***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests and standard errors clustered at the firm level. t-Statistics are provided in parentheses.

3 Electronic Reporting and Firms' Information Environment: Evidence from the EU's ESEF mandate

Appendix 5: Information environment effects of EU ESEF regulation for early and late adopting countries (balanced sample)

	Analyst Following	Coverage	Forecast Dispersion	Forecast Accuracy
Early mandatory	-0.7906*** (-4.42)	.	-53.3034*** (-7.24)	0.0023 (0.23)
Late mandatory	-0.1374 (-1.19)	.	-58.9940*** (-7.02)	0.0080 (0.30)
Size	1.0574*** (10.61)	.	5.7712 (0.74)	0.1630 (1.38)
Return Volatility	4.4058* (1.79)	.	183.9090 (0.79)	-3.2672** (-2.50)
Financial Leverage	0.5852 (1.53)	.	11.5326 (0.36)	-0.1873 (-1.43)
Institutional Hld.	-0.0195*** (-4.59)	.	-0.4056* (-1.79)	-0.0012 (-0.77)
Operating Cash Flow	-0.7573** (-2.26)	.	-41.6149 (-1.62)	0.0154 (0.15)
Loss	0.1305* (1.66)	.	0.7720 (0.08)	-0.0836*** (-4.01)
TobinsQ	-0.1244*** (-3.81)	.	-2.1613 (-0.97)	-0.0184 (-1.26)
Book-to-Market	0.2747*** (2.90)	.	34.0370** (2.36)	0.1581 (1.18)
Constant	-5.4225*** (-3.57)	.	-17.0468 (-0.14)	-2.3801 (-1.34)
N	61,932	.	61,932	61,932
Adjusted R ²	0.918	.	0.734	0.532
Firm & Quarterly FE	YES	.	YES	YES
Clustered at firm level	YES	.	YES	YES

Notes: In this table, the effect of mandatory ESEF implementation for early and late adopting countries on information environment measures is estimated. The estimation is based on a balanced sample. Early/late adopting is a dummy for the reporting quarters under ESEF mandate for each individual firm (post variable). ESEF assumes the value of 1 for EU27 firms (treat variable). No estimate for coverage possible due to lack of variation.

***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests and standard errors clustered at the firm level. t-Statistics are provided in parentheses.

3 Electronic Reporting and Firms' Information Environment: Evidence from the EU's ESEF mandate

Appendix 6: Information environment effects of EU ESEF regulation for late adopting countries split by (1) liquidity, (2) analyst following, and (3) size (balanced sample)

	(1)				(2)				(3)			
	Analyst Following	Coverage	Forecast Dispersion	Forecast Accuracy	Analyst Following	Coverage	Forecast Dispersion	Forecast Accuracy	Analyst Following	Coverage	Forecast Dispersion	Forecast Accuracy
Low Liquidity	-0.1534 (-0.90)	.	-66.8173*** (-6.50)	0.0079 (0.33)								
High Liquidity	-0.2026 (-1.50)	.	-63.8544*** (-6.13)	0.0093 (0.27)								
Low Analyst Following				0.3258*** (2.84)	.		-61.9215*** (-6.92)	0.0227 (0.72)				
High Analyst Following				-0.7002*** (-3.82)	.		-61.8813*** (-6.99)	-0.0060 (-0.22)				
Small firms									-0.1298 (-0.99)	.	-61.8166*** (-6.94)	0.0232 (0.64)
Large firms									-0.2256 (-1.31)	.	-61.4891*** (-6.95)	-0.0059 (-0.27)
Controls	YES	.	YES	YES	YES	.	YES	YES	YES	.	YES	YES
N	57,336	.	57,336	57,336	57,096	.	57,096	57,096	57,336	.	57,336	57,336
Adjusted R ²	0.917	.	0.656	0.533	0.920	.	0.734	0.533	0.925	.	0.734	0.533
F-test for differences [p-value]	[0.2577]	.	[0.0000]	[0.9471]	[0.0000]	.	[0.0000]	[0.2046]	[0.0082]	.	[0.0000]	[0.2091]
Firm & Quarterly FE	YES	.	YES	YES	YES	.	YES	YES	YES	.	YES	YES
Clustered at firm level	YES	.	YES	YES	YES	.	YES	YES	YES	.	YES	YES

Notes: In this table, the overall effect of mandatory ESEF implementation is measured for a split balanced sample. A median split for all measures is conducted. Liquidity split is based on liquidity factor. The split variables are derived by first performing a median split within the group of late adopting countries (resulting in binary indicators for high and low values) and then interacting these indicators with the ESEF*MANDATORY treatment variable. Measure for coverage omitted due to balancing.

***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests and standard errors clustered at the firm level. t-Statistics are provided in parentheses.

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Appendix 7: Information environment effects of EU ESEF regulation for late adopting countries split by (1) Type of OAM, (2) private or public OAM, and (3) Timeliness of OAM (balanced sample)

	(1)				(2)				(3)			
	Analyst Following	Coverage	Forecast Dispersion	Forecast Accuracy	Analyst Following	Coverage	Forecast Dispersion	Forecast Accuracy	Analyst Following	Coverage	Forecast Dispersion	Forecast Accuracy
Competent Authority	-0.3934** (-2.41)	.	-61.1620*** (-6.86)	0.0077 (0.29)								
Stock Exchange	-0.2750 (-1.14)	.	-61.0785*** (-6.92)	-0.0516 (-1.05)								
Company Register	0.1338 (0.81)	.	-62.7539*** (-7.00)	0.0289 (0.95)								
Private OAM					0.0761 (0.42)	.	-60.9880*** (-7.05)	-0.0281 (-0.84)				
Public OAM					-0.2613* (-1.94)	.	-61.9966*** (-6.93)	0.0197 (0.69)				
Lower timeliness									-0.2324 (-1.39)	.	-59.4979*** (-7.02)	0.0074 (0.25)
Higher timeliness									-0.0524 (-0.29)	.	-63.6662*** (-6.96)	0.0126 (0.38)
Controls	YES	.	YES	YES	YES	.	YES	YES	YES	.	YES	YES
N	57,264	.	57,264	57,264	57,264	.	57,264	57,264	54,696	.	54,696	54,696
Adjusted R ²	0.917	.	0.734	0.533	0.917	.	0.734	0.533	0.916	.	0.733	0.533
F-test for differences [p-value]	[0.0432]	.	[0.0000]	[0.1602]	[0.1170]	.	[0.0000]	[0.1097]	[0.3774]	.	[0.0000]	[0.9273]
Firm & Quarterly FE	YES	.	YES	YES	YES	.	YES	YES	YES	.	YES	YES
Clustered at firm level	YES	.	YES	YES	YES	.	YES	YES	YES	.	YES	YES

Notes: In this annex, the effect of mandatory ESEF implementation on late adopting countries split by the (1) type of OAM, (2) whether the OAM is run privately or publicly, and (3) timeliness of publication at OAM is estimated on base of the balanced sample. The classification is based on a country-based split within the group of late adopters to create binary indicators. These indicators are then interacted with the ESEF*MANDATORY treatment variable. Firms from five EU states are not included in the analysis, due to problems in data availability. In Table 7, I provide the results for an unbalanced sample.

***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests and standard errors clustered at the firm level. t-Statistics are provided in parentheses.

Appendix 8: *Liquidity and information environment effects for early and late adopting countries of EU ESEF regulation without early adopting firms*

	BA	PI	ZRD	Liq. Factor	Analyst Following	Coverage	Forecast Dispersion	Forecast Accuracy
Early adopting	0.0029*** (3.05)	2.2450*** (4.04)	0.0181*** (5.00)	0.0927*** (5.51)	-0.8026*** (-5.77)	-0.0862*** (-8.36)	-40.9411*** (-7.98)	-0.0057 (-0.36)
Late adopting	0.0009 (1.39)	-0.6420* (-1.66)	0.0065*** (2.76)	0.0087 (0.76)	-0.0667 (-0.94)	0.0002 (0.02)	-46.7446*** (-8.26)	-0.0181 (-0.84)
Size	-0.0137*** (-33.67)	-7.0564*** (-23.29)	-0.0665*** (-44.39)	-0.3299*** (-38.43)	0.8440*** (17.83)	0.0872*** (14.51)	-1.8478 (-0.37)	0.0235 (0.19)
Financial leverage	0.0007 (0.50)	0.7128 (0.62)	0.0069 (1.20)	0.0198 (0.61)	0.8128*** (4.56)	0.0825*** (3.38)	-0.6956 (-0.03)	-0.6449* (-1.72)
Analyst following	0.0003*** (11.03)	0.1284*** (7.81)	0.0001 (0.38)	0.0035*** (5.10)				
Return Volatility					-3.1950*** (-4.08)	-0.9478*** (-7.08)	132.1076 (1.11)	-5.4528*** (-3.60)
Institutional Hld.	0.0000* (1.92)	0.0005 (0.07)	-0.0002*** (-3.98)	-0.0000 (-0.19)	-0.0039** (-2.20)	0.0000 (0.07)	-0.5447* (-1.85)	-0.0016 (-1.00)
Operating Cash Flow	0.0047*** (6.10)	3.5943*** (8.04)	0.0070*** (2.88)	0.1203*** (8.50)	0.0906 (1.39)	0.0807*** (5.15)	-45.2733*** (-2.92)	-0.0878 (-0.69)
Loss	-0.0003 (-1.21)	-0.3066* (-1.81)	0.0005 (0.42)	-0.0097* (-1.93)	0.1032** (2.50)	0.0105* (1.86)	-7.1744 (-0.98)	0.0201 (0.41)
TobinsQ	0.0005*** (4.86)	0.3335*** (4.69)	0.0033*** (6.36)	0.0119*** (5.91)	-0.1783*** (-12.32)	-0.0166*** (-10.00)	1.4806 (1.50)	-0.0202 (-1.59)
Book-to-Market	-0.0012*** (-4.90)	-0.2672 (-1.31)	-0.0020* (-1.79)	-0.0221*** (-4.15)	0.2842*** (6.00)	0.0387*** (7.26)	15.4108 (1.46)	-0.1474 (-0.59)
Constant	0.1869*** (37.22)	87.8788*** (23.77)	0.9997*** (54.13)	3.9053*** (37.23)	-5.6044*** (-8.21)	-0.2908*** (-3.41)	98.2244 (1.26)	0.0452 (0.02)

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3 Electronic Reporting and Firms' Information Environment: Evidence from the EU's ESEF mandate

N	430,722	388,676	412,752	385,888	149,962	149,962	106,452	134,4
Adjusted R ²	0.748	0.547	0.811	0.790	0.926	0.434	0.750	0.500
F-test for differences [p-value]	[0.0728]	[0.0000]	[0.0057]	[0.0000]	[0.0000]	[0.0000]	[0.0118]	[0.5284]
Firm & Quarterly FE	YES	YES	YES	YES	YES	YES	YES	YES
Clustered at firm level	YES	YES	YES	YES	YES	YES	YES	YES

Notes: In this table, the liquidity effect of mandatory ESEF implementation on early and late adopting countries is measured excluding early adopting firms. Early/late adopting is a dummy for the reporting quarters under ESEF mandate for each individual firm (post variable). ESEF assumes the value of 1 for EU27 firms (treat variable). Early adopting firms, so firms from late adopting countries voluntarily disclosing their 2020 annual report in ESEF, are identified by the database filings.xbrl.org (see Section 4.3).

***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests and standard errors clustered at the firm level. t-Statistics are provided in parentheses.

4. Why firms early adopt digital reporting: Evidence from the EU's ESEF mandate

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Working Paper⁴³

ABSTRACT: I investigate firms' early adoption of the ESEF, the EU's mandatory digital reporting standard. Originally mandated for 2021, EU member states were permitted to postpone implementation by one year on short notice, giving firms in these countries a choice between early adoption and postponement. First, using 2,514 firms from countries that opted to postpone, I document that about ten percent adopted ESEF in 2021. Second, I examine determinants of early adoption and find a strongly cost-driven pattern: early adopters are larger, more profitable, and less financially constrained. Distinctive to the ESEF setting, firms that had already incurred direct implementation costs, measured by the timing of postponement announcement in the respective country, are significantly more likely to adopt early, underscoring the central role of partially sunk costs in adoption timing. Institutional ownership is also positively associated with early adoption, while cross-listing, analyst following, and market concentration show no meaningful effects. Overall, the findings suggest that early ESEF adoption reflects firms' resource capacity and sunk implementation costs rather than competitive incentives. The study contributes to providing the first large scale evidence on quasi-voluntary ESEF adoption and by isolating the role of direct implementation costs in digital reporting decisions.

JEL Classification: C21, G18, G38, K22, L21, M41, M48, O52

Keywords: ESEF, iXBRL, information dissemination, early adoption, voluntary reporting, disclosure costs

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4.1 Introduction

In late 2020, the Commission permitted member states to postpone the mandatory implementation of digital reporting by one year in response to the Covid pandemic, creating a temporary two-tier environment in which firms could either early adopt ESEF in 2021 or defer adoption until 2022 (Commission, 2021).⁴⁴ Of the 27 EU member states, 23 exercised this option (Commission, 2021), and they announced their decision to postpone (or maintain the original date) between January and March 2021, creating substantial variation in announcement timing. As prior surveys show, firms began preparing well before the first publication of an ESEF-compliant annual report, incurring considerable preparation costs (Koskentalo & Penttinen, 2021; Miścikowska, 2021).⁴⁵ Therefore, it is very likely that the variation in member states' announcement of postponement generated country-level differences in the extent to which preparation costs had already become sunk. I exploit this setting to examine firm characteristics associated with the costs and benefits of early ESEF adoption in the EU.

A broad theoretical framework for voluntary reporting decisions rests on a cost-benefit trade-off (Healy & Palepu, 2001; Verrecchia, 1983). In digital reporting, direct costs arise from the implementation of structured reporting, such as investments in software, staff training, and external advisory services (Pinsker & Li, 2008). Additionally, indirect costs, such as proprietary costs, litigation exposure, and strategic nondisclosure concerns, may shape the cost-benefit trade-off (Healy & Palepu, 2001). The ESEF setting differs fundamentally from digital reporting settings examined in prior research, particularly US XBRL adoption. First, whereas in the US mandatory XBRL adoption was announced only after the voluntary program was underway, ESEF firms were aware of the mandatory implementation a year ahead. This shifts the focus from *whether* to adopt to *when* to bear preparation costs. Second, as pointed out in the previous paragraph, the EU's short-notice postponement option created cross-country heterogeneity in the level of preparatory costs already incurred at the time the postponement became known. For firms in late announcing countries, a larger share of direct costs had already become sunk, effectively shifting the cost-benefit trade-off away from direct costs, as they have already incurred.

⁴⁴ On 11 December 2020, the EU agreed to permit a one-year deferral of ESEF, which was formally published on 16 February 2021 (Accountancy Europe, 2021).

⁴⁵ Based on a survey conducted by (ESMA, 2015), regulators and market participants estimated that between 26 and 48 percent of total ESEF implementation costs would be one-off, primarily related to IT, process adjustments, and consultancy expenses. For a Polish setting, Miścikowska (2021) reports that firms had already begun preparatory work for ESEF and made upfront investments in software and staff training.

Consistent with this notion of a cost-benefit trade-off, prior research on voluntary XBRL adoption documents that early adopters weigh direct and indirect costs against benefits such as improved transparency and market perception. Firms expected software, tagging, and training costs to be substantial (Pinsker & Li, 2008; Troshani & Rao, 2007), although *ex post* studies reveal lower-than-anticipated costs and efficiency gains (Bonsón et al., 2009a; Choi et al., 2008; Pinsker & Li, 2008). Archival evidence similarly shows that larger, more profitable, and better governed firms were more likely to adopt voluntarily (Boritz & Timoshenko, 2015; Callaghan & Nehmer, 2009; Efendi et al., 2013; Kaya, 2014), whereas findings on leverage, auditor type, and industry effects remain mixed (Boritz & Timoshenko, 2015b; Callaghan & Nehmer, 2009; Chatterjee et al., 2021; Premuroso & Bhattacharya, 2008; Ragothaman, 2012). Collectively, these studies highlight the role of direct costs for implementation, indirect costs, and anticipated benefits. Because prior studies proxy implementation costs indirectly using variables such as size and profitability⁴⁶, the ESEF setting provides a unique opportunity to examine direct costs more explicitly by incorporating the role of sunk preparatory expenditures arising from the late postponement announcement.

First, I document the extent of early adoption in ESEF. By using the open XBRL Europe database, which compiles filings from national repositories and provides standardized access across member states, I identify firms providing their annual report in 2021 in ESEF. Public access to digital financial reports remains fragmented in the EU (see Section 2), making the use of third-party resources necessary. Although the XBRL Europe database excludes Germany and Ireland, it remains the most comprehensive publicly available source of ESEF filings. I manually validate a subsample of 701 firms and document an error rate of approximately 8.5 percent, mainly due to underidentification of early adopters. Given the centrality of distinguishing early from late adopters, this validation provides confidence that the database forms a credible basis for analysis. Overall, early adopters represent approximately 10 percent (262 firms) of the firms identified as falling under ESEF mandate.

Second, having identified early adopting firms, I investigate firm characteristics that shape early adoption decisions, *i.e.*, firm characteristics that plausibly correlate with costs and benefits of implementing ESEF. The univariate and multivariate analyses consistently reveal that central role of direct implementation costs in this decision. Early adopters are, on average, significantly larger, more profitable, and financially less constrained, suggesting that such firms

⁴⁶ These variables are inherently noisy and may capture factors beyond direct implementation costs.

possess greater resource capacity and flexibility to absorb the fixed and largely non-recoverable setup costs associated with ESEF. The analyses further show that preparatory costs incurred prior to the postponement announcement, captured by cost incurred, are strongly and positively associated with early adoption. This finding indicates that firms that had already invested in XBRL software, tagging activities, or auditor coordination prior to learning of the postponement had incurred (partially) sunk costs, which shifted their cost-benefit calculus: with costs already realized, completing the filing in 2021 became economically more attractive than delaying implementation. Institutional ownership exhibits a similarly positive association, consistent with the notion that sophisticated investors demanded timely compliance and increase the perceived benefits of early adoption. In contrast, analyst following, cross-listing, and industry concentration do not significantly explain adoption choices, suggesting that information demand and competitive environment play a more limited role in this quasi-voluntary environment than in fully voluntary regimes such as the US Voluntary Filing Program (VFP). Taken together, the evidence indicates that early ESEF adoption is driven predominantly by cost considerations, both the ability to bear implementation costs and the extent of preparatory costs already incurred, rather than by broader visibility, external information demand, or capital-market pressures.

This paper contributes to the literature in several ways. First, it provides the first large-scale evidence on early ESEF adoption across EU member states and evaluates the reliability of the XBRL Europe database for empirical research. Second, by leveraging a setting in which preparatory costs partially became sunk due to regulatory timing, the study examines the role of direct costs more directly than prior literature (e.g., Boritz & Timoshenko, 2015; Kaya, 2014; Premuroso & Bhattacharya, 2008). Third, I provide a comprehensive determinant analysis linking early adoption to firm-, industry-, and country-level factors within a unified cost-benefit framework. Together, these contributions advance understanding of strategic digital reporting adoption under regulatory discretion and extend the voluntary disclosure literature to the ESEF environment.

4.2 Background & Institutional setting

4.2.1 Economic Costs and Benefits of Voluntary Reporting

Research on voluntary disclosure provides a useful foundation for understanding firms' decisions to adopt new reporting practices. In a frictionless setting, firms would disclose all value-relevant information, whether voluntary or mandatory (Grossman, 1981; Milgrom,

1981). In practice, disclosure entails various direct and indirect costs, and voluntary disclosure choices reflect a trade-off between expected benefits and associated costs (Healy & Palepu, 2001; Verrecchia, 1983). A specific case of voluntary disclosure is the introduction of a digital reporting format. Although digital reporting does not directly alter disclosure content, adjusting the format affects both the costs and benefits of reporting (Blankespoor et al., 2020). Both the introduction of XBRL in the US and ESEF in Europe initially allowed firms to choose whether to participate, based on their assessment of the associated costs and benefits (Commission, 2021; Premuroso & Bhattacharya, 2008).

Direct implementation costs associated with digital reporting mandates such as ESEF or XBRL are substantial and front-loaded. These costs include investments in software, tagging and validation tools, staff training, external advisory services, and process adjustments necessary to produce machine-readable financial statements (ESMA, 2015; Pinsker & Li, 2008; Shan et al., 2015). Firms that had already undertaken preparatory activities before member states exercised the option to postpone the mandate effectively converted a portion of these investments into sunk costs. The resulting reduction in marginal implementation costs can strengthen incentives for early adoption, as firms that have already incurred most of the cost burden face lower incremental costs to complete the transition.

Indirect costs, such as proprietary costs, litigation costs, or strategic nondisclosure concerns, also shape the cost-benefit trade-off underlying firms' voluntary reporting choices (Healy & Palepu, 2001; Leuz & Wysocki, 2016; Skinner, 1994). These costs arise from the strategic consequences of making information publicly accessible, including the potential revelation of competitively sensitive data, heightened litigation risk, and increased scrutiny from analysts, regulators, and other stakeholders (Dye, 1985; Healy & Palepu, 2001; Verrecchia, 1983). Structured, machine-readable formats such as XBRL or ESEF can amplify these indirect costs by making disclosures easier to analyze and compare (Cong et al., 2014). Firms facing higher proprietary or monitoring risk may therefore be less inclined to adopt ESEF early. The magnitude of these indirect costs plays a distinct but complementary role alongside direct implementation costs in shaping strategic timing decisions.

Benefits also influence voluntary disclosure choices. Economic theory predicts that credible increases in the precision, accessibility, or interpretability of information can reduce information asymmetry, improve liquidity, and lower firms' cost of capital (Diamond & Verrecchia, 1991; Healy & Palepu, 2001; Lang & Lundholm, 1993; Verrecchia, 1983). Structured, machine-readable reporting formats such as XBRL or ESEF enhance these effects

by increasing the usability and comparability of financial data, thereby strengthening capital-market responses (Hao et al., 2014; Yoon et al., 2011). Beyond informational benefits, early adoption may function as a signal of preparedness, reporting quality, or technological sophistication, attributes valued by investors, auditors, and regulators (Hoitash et al., 2021). Governance mechanisms, particularly monitoring by institutional investors, can reinforce these incentives. Together, these potential benefits contribute to firms' cost-benefit calculus and can encourage early adoption ahead of mandatory deadlines.

Taken together, the cost-benefit framework provides a coherent lens for examining early ESEF adoption. High direct implementation costs or limited resources may prompt firms to delay adoption, whereas sunk preparatory costs reduce incremental costs and increase the likelihood of early adoption. Complementarily, benefits can outweigh residual costs, further impacting the cost-benefit calculus. These dynamics suggest that early adoption under ESEF is primarily shaped by (1) implementation capacity, (2) sunk preparatory costs, and (3) governance and capital-market incentives, a framing consistent with prior studies on voluntary XBRL adoption and supporting the empirical analysis that follows. This framing aligns closely with observed determinants in prior studies on voluntary XBRL adoption and supports the empirical analysis in subsequent sections.

4.2.2 Literature on determinants of digital reporting adoption

Research on digital financial reporting, and voluntary XBRL adoption in particular, draws primarily on evidence from the US. This section first outlines the adoption of XBRL in the US and then synthesizes findings from prior studies that examine the determinants of voluntary XBRL adoption.⁴⁷

XBRL adoption in the US

The US experience with XBRL adoption provides an example of a typical voluntary setting in which firms could freely choose whether to adopt a new reporting technology without facing a binding regulatory deadline.⁴⁸

On March 16, 2005, the VFP was launched by the SEC (SEC, 2005). The program permitted firms to submit supplemental XBRL-tagged financial statements alongside mandatory filings,

⁴⁷ In Appendix 1, the firm characteristics covered by the main studies included in this chapter are drawn up.

⁴⁸ Only in 2009, the final decision for a mandatory implementation of XBRL reporting was made public in the US (SEC, 2009).

with the aim of generating evidence on the benefits of structured data for firms, investors, and regulators (Debreceeny et al., 2005). Importantly, participation was entirely voluntary, with no predetermined mandate or fixed compliance timeline (Boritz & Timoshenko, 2015). Participation in the VFP remained very limited with only 137 out of more than 10,000 firms choosing to adopt XBRL reporting during the VFP (Bonsón et al., 2009b). The program ended on April 13, 2009, when XBRL reporting became mandatory for US filers (SEC, 2009).

Prior Research on the US setting

A consistent theme in the literature is that the direct costs of implementation constitute a major barrier to voluntary XBRL adoption. Surveys document that firms perceived software investments, tagging, staff training, and external consultancy as substantial initial burdens (Pinsker & Li, 2008; Troshani & Rao, 2007). However, ex post surveys reveal that actual costs were often lower than anticipated and that some firms experienced internal process efficiencies after adoption (Bonsón et al., 2009a; Choi et al., 2008; Pinsker & Li, 2008; Stantial, 2007). Archival studies find that larger firms, which are better positioned to absorb fixed setup costs and typically operate more sophisticated reporting infrastructures, were substantially more likely to adopt voluntarily (Boritz & Timoshenko, 2015; Callaghan & Nehmer, 2009; Efendi et al., 2013; Premuroso & Bhattacharya, 2008; Ragothaman, 2012). Evidence on financial conditions is more mixed: some studies document that early adopters exhibit stronger liquidity positions or lower leverage (Callaghan & Nehmer, 2009; Premuroso & Bhattacharya, 2008), whereas others report no systematic relationship or even contradictory effects (Premuroso & Bhattacharya, 2008; Ragothaman, 2012).

Voluntary adopters frequently used XBRL to show technical sophistication and transparency. Survey-based research indicates that early adoption generated positive media attention and allowed firms to differentiate themselves from peers (Bonsón et al., 2009a; Henderson et al., 2011; Pinsker & Li, 2008). Archival evidence likewise shows that firms with greater market visibility, including more innovative firms (Boritz & Timoshenko, 2015; Efendi et al., 2013; Kaya, 2014) and firms with more extensive analyst coverage (Boritz & Timoshenko, 2015b), were more inclined to adopt voluntarily. Some research links voluntary adoption to capital-market benefits, including improved information environments and lower cost of capital (Hao et al., 2014). In addition, competitive forces matter: firms in less competitive industries appear more willing to adopt, consistent with lower proprietary cost concerns (Chatterjee et al., 2021).

Corporate governance characteristics also influence firms' cost-benefit considerations related to voluntary XBRL adoption. Prior studies show that adopters often exhibit stronger governance mechanisms, such as more independent boards and higher-quality internal reporting systems (Boritz & Timoshenko, 2015; Premuroso & Bhattacharya, 2008). These structures may lower internal coordination and monitoring costs, making the implementation of a new reporting technology less burdensome and enhancing the expected reliability of the digital output. Conversely, firms with weaker governance may adopt XBRL to bolster external credibility or to offset concerns about the quality of their financial reporting, effectively treating adoption as a reputational investment (Callaghan & Nehmer, 2009). Evidence on the role of auditors is inconclusive: Big 4 auditor presence is not consistently associated with voluntary adoption (Premuroso & Bhattacharya, 2008; Ragothaman, 2012). Ownership structure has received less direct attention in the XBRL literature, but studies hint that greater institutional monitoring may support voluntary adoption through higher demand for transparent and machine-readable disclosure (Efendi et al., 2013; Luo et al., 2023), which may shift the cost-benefit calculus toward voluntary adoption by increasing the expected payoff from enhanced data usability and reduced information asymmetry.

Taken together, prior research indicates that voluntary XBRL adoption is shaped by a combination of cost-benefit trade-offs, with direct costs of implementation playing a major role. Early adopters are typically larger, more profitable, less financially constrained, and more visible to capital market participants. These determinants closely mirror the theoretical disclosure framework and provide a useful benchmark for analyzing early ESEF adoption in the EU, where the decision was embedded in a transitional phase before a uniform mandate took effect.

4.2.3 The EU's ESEF regulation as a voluntary disclosure setting

ESEF requires firms listed on EU-regulated capital markets to prepare and disclose their consolidated IFRS annual financial statements in a machine-readable iXBRL format. The mandate is anchored in the Transparency Directive (2004/109/EC) and implemented through the Delegated Regulation (EU) 2019/815, which applies directly in all member states without national transposition. The objective is to enhance the accessibility, comparability, and automated analysis of financial information across the EU. Consistent with Recital 4 of the regulation, digital reporting is expected to reduce information processing costs and support more efficient capital markets.

The original implementation date of ESEF was set for financial years beginning in 2020. As part of the EU's "Capital Markets Recovery Package" in late 2020, member states were granted the option to postpone ESEF enforcement by one year (European Parliament, 2021). A total of 23 out of 27 member states exercised this option, while four adhered to the original schedule (Commission, 2021).⁴⁹ This created a two-tier regulatory environment: firms in early adopting countries were required to comply from 2021 onwards, whereas firms in late adopting countries could choose to adopt early in 2021 or to wait until 2022. This cross-country variation results in quasi-experimental conditions useful for examining early adoption decisions. In late adopting countries, firms retained discretion over whether to apply the new format one year before the mandate became binding.

Table 4.1: *Announcement of ESEF postponement by member state*

	<i>(1) ESEF adopting at country level</i>		<i>(2) Notification to ESMA</i>	
	Early adopting	Late adopting	Date	Median split
Austria	1	0	n.a.	n.a.
Belgium	0	1	29.01.2021	0
Bulgaria	0	1	27.01.2021	0
Croatia	0	1	05.02.2021	0
Cyprus	0	1	28.01.2021	0
Czech Republic	1	0	n.a.	n.a.
Denmark	0	1	22.02.2021	1
Estonia	0	1	04.03.2021	1
Finland	0	1	18.03.2021	1
France	0	1	05.02.2021	0
Germany	1	0	n.a.	n.a.
Greece	0	1	29.01.2021	0
Hungary	0	1	16.02.2021	1
Italy	0	1	02.03.2021	1
Latvia	0	1	12.03.2021	1
Lithuania	0	1	25.01.2021	0
Luxembourg	0	1	10.02.2021	0
Malta	0	1	03.02.2021	0
Netherlands	0	1	26.01.2021	0
Poland	0	1	15.03.2021	1

(continued on next page)

⁴⁹ The four early adopting countries were Austria, Czech Republic, Germany, and Slovenia (Commission, 2021).

Portugal	0	1	27.01.2021	0
Romania	0	1	18.02.2021	1
Slovakia	0	1	10.02.2021	0
Slovenia	1	0	n.a.	n.a.
Spain	0	1	12.02.2021	1
Sweden	0	1	11.03.2021	1

Notes: The table presents country-level characteristics of the ESEF implementation setting. Column (1) distinguishes between early and late adopting countries under the ESEF mandate. Only firms located in late adopting countries were eligible for early adoption and are therefore examined in this study. Column (2) reports the timing of ESEF postponement announcements across EU member states, measured by the date on which each country officially notified ESMA of its decision to defer the implementation of ESEF.

The timing of the postponement shapes the cost-benefit trade-off. The member state option first appeared in the final compromise text on 10 December 2020 (European Parliament, 2021).⁵⁰ By that point, many firms in late adopting countries had already undertaken substantial preparation activities, such as implementing XBRL software, training staff, coordinating with auditors, and adjusting internal reporting processes (Koskentalo & Penttinen, 2021; Miścikowska, 2021). Consequently, a large share of direct setup and recurring compliance costs had already been incurred or could not be avoided⁵¹, regardless of whether a firm chose to file in iXBRL in 2021 or 2022. This timing creates a distinct cost-benefit trade-off. Once significant preparation expenditures are committed, these costs become (partially) sunk and therefore no longer influence the adoption decision. Firms in countries that announced the postponement late may thus face a shifted implementation equilibrium, making early adoption comparatively more attractive than in countries where the postponement was communicated earlier.

Overall, this combination of constrained timing and partially sunk costs creates a quasi-voluntary environment that differs substantially from conventional voluntary disclosure programs, such as the VFP in the US. The setting provides an opportunity to examine the effect direct costs in early adoption decision, which is a novel feature of the ESEF implementation.

⁵⁰ The possibility of postponing ESEF enforcement was first publicly discussed by the Council of the European Union in a press release dated 21 October, 2020 (Council of the European Union, 2020), and received attention from industry participants around that time (Smith, 2020).

⁵¹ In a survey, ESMA estimates that between 26 and 48 percent of total ESEF costs are one-off direct costs (ESMA, 2015). Pinsker & Li (2008) report that actual implementation costs were minor, although XBRL adoption led to efficiency gains in internal processes. Choi et al. (2008) find that firms in the VFP typically required six months to prepare for their first XBRL filing.

4.3 Evidence on the early adoption of the ESEF mandate

4.3.1 EU firms subject to mandatory ESEF reporting

Key to investigate characteristics of early adopting firms is to identify those listed in late adopting countries and chose to adopt early. In a first step, I identify firms subject to the ESEF mandate by selecting those whose securities are traded on an EU-regulated capital market (ESEF, Rec. 1). To accurately identify the firms subject to the mandate, I use ESMA's FIRDS⁵² database for 2020 and 2021, which contains reference data on securities admitted to trading on EU-regulated markets. Using two years of data ensures comprehensive coverage and distinguishes firms subject to the mandate from those outside its scope, which is essential for identifying both early and late adopters. A total of 2,977 firms are identified.⁵³ Due to the one-year postponement of mandatory ESEF reporting granted at the member-state level, four EU member states required ESEF reporting in 2021, while 23 countries deferred adoption to 2022. Firms in the latter group therefore had discretion to adopt ESEF early or postpone adoption by one year. The total number of firms with the option to adopt early is 2,537⁵⁴.

4.3.2 Identification of early adopting firms

Identifying early adopters requires access to ESEF reports, which remains fragmented at the EU level because ESAP is not yet operational. OAMs at member state level vary substantially in accessibility and technical structure, limiting consistent public retrieval of machine-readable reports.⁵⁵ Public access to machine-readable ESEF reports is therefore limited and highly dependent on data access at individual OAMs.

To address this constraint, XBRL Europe, the European branch of XBRL International⁵⁶, maintains an open database of ESEF filings. The initiative collects and standardizes reports retrieved from OAMs and, where OAM access is restricted, from alternative public sources. The platform provides uniform access via an application programming interface (API) and performs automated checks on filing validity and accessibility. This database is the only

⁵² FIRDS is ESMA's database of instrument reference data collected under the Market Abuse Regulation (MAR) Article 4 and the Markets in Financial Instruments Regulation (MiFIR) Article 27.

⁵³ ESMA identified 3,860 IFRS issuers for 2020 that potentially fall under the ESEF mandate (ESMA, 2022).

⁵⁴ For the validated subsample, 91 percent of firms provide an ESEF report, while the remainder either do not report in ESEF or cannot be verified due to missing or inaccessible disclosures. This high verification rate supports the reliability of the identification of firms subject to the ESEF mandate (see Section 3.2).

⁵⁵ For a broader introduction to, and assessment of, the timeliness of data provision, see Section 2.

⁵⁶ XBRL International is a global non-profit consortium that develops and maintains the XBRL standard for structured, machine-readable business reporting.

publicly available, cross-country source of ESEF reports and is therefore central to identifying early adopters.⁵⁷

For identification, it is necessary to assess the completeness and reliability of the database. Several structural limitations may affect report availability. First, filings from Germany and Ireland are not included because no suitable public source allows automated or comprehensive retrieval. Second, some OAMs do not support automated extraction, requiring the use of alternative sources (e.g., in Denmark), which may lead to gaps in coverage. Third, technical issues in parsing or importing filings can cause occasional omissions.

To evaluate accuracy, I manually collected annual reports for a subsample of 701 firms headquartered in late adopting countries, covering financial years 2020 to 2022. The subsample represents approximately 28 percent of the full set of firms in late adopting member states. Ireland is excluded from the group of late adopting countries because its reports are not available in the XBRL Europe database, and Bulgaria is excluded from the manual check due to inaccessible national OAM data and limited website availability in English language. The subsample was constructed to balance coverage and representativeness, with larger countries sampled at roughly 25% of firms and smaller countries at slightly higher rates. Selection was guided by the need to ensure sufficient coverage of early adopters, to limit number of false-positive early adopters, and mitigate known data limitations (e.g., Finland), rather than by random sampling. As a result, some countries (e.g., Finland and Hungary) are more heavily represented than others (e.g., France), reflecting practical constraints and the goal of capturing meaningful variation in adoption behavior.

Table 4.2: *Validation of early adopter identification in the XBRL Europe database*

	<i>Sample description</i>			<i>2020</i>		
	Full sample	Control sample	Quota	ESEF Reporting	Non-ESEF reporting	Missing data
Belgium	111	30	27.03%	0	29	1
Bulgaria*	164	0	0.00%	.	.	.
Croatia	75	23	30.67%	0	20	3
Cyprus	56	21	37.50%	0	20	1
Denmark	122	28	22.95%	0	25	3
Estonia	1	1	100.00%	0	1	0

(continued on next page)

⁵⁷ For example, Heichl et al. (2025) and Kobiela-Pionnier & Karwowski (2024) use data from the database to access ESEF reports and identified tagging choices of firms.

4 Why firms early adopt digital reporting: Evidence from the EU's ESEF mandate

Finland	124	117	94.35%	0	111	6
France	375	47	12.53%	0	38	9
Greece	142	35	24.65%	0	34	1
Hungary	31	28	90.32%	0	25	3
Italy	225	60	26.67%	0	56	4
Latvia	11	8	72.72%	0	8	0
Lithuania	28	13	46.43%	0	11	2
Luxembourg	31	10	32.26%	0	9	1
Malta	27	10	37.04%	0	9	1
Netherlands	95	29	30.53%	0	26	3
Poland	334	78	23.35%	0	70	8
Portugal	38	15	39.47%	0	15	0
Romania	75	30	40.00%	0	28	2
Slovakia	11	6	54.55%	0	6	0
Spain	132	33	25.00%	0	32	1
Sweden	306	79	25.82%	0	68	11
Total	2,514	701	27,88%	0	641	60

Panel B: Observations for 2021 (early adopter)

	<i>Correct</i>		<i>False</i>		<i>No data</i>	<i>False quota</i>
	early adopting	late adopting	falsely early adopting	falsely late adopting		
Belgium	8	19	0	2	1	6.67%
Bulgaria
Croatia	0	21	0	0	2	0.00%
Cyprus	0	20	0	0	1	0.00%
Denmark	5	17	1	2	3	10.71%
Estonia	0	1	0	0	0	0.00%
Finland	24	51	0	38	4	32.48%
France	13	25	3	0	6	6.38%
Greece	0	34	0	0	1	0.00%
Hungary	0	23	0	2	3	7.14%
Italy	0	58	0	0	2	0.00%
Latvia	1	7	0	0	0	0.00%
Lithuania	1	11	0	0	1	0.00%
Luxembourg	0	9	0	0	1	0.00%
Malta	0	9	0	0	1	0.00%
Netherlands	10	15	1	0	3	3.45%
Poland	18	51	2	2	5	5.13%
Portugal	0	11	0	1	3	6.67%
Romania	0	29	0	1	0	3.33%
Slovakia	0	6	0	0	0	0.00%
Spain	19	11	0	2	1	6.06%
Sweden	0	69	0	3	7	3.80%
Total	99	497	7	53	45	8.56%

Panel C: Observations for 2022 (mandatory ESEF reporting)

	ESEF	No ESEF	No data
Belgium	29	0	1
Bulgaria	.	.	.
Croatia	23	0	0
Cyprus	20	0	1
Denmark	27	0	1
Estonia	1	0	0
Finland	117	0	0
France	39	7	1
Greece	34	0	1
Hungary	22	4	2
Italy	50	8	2
Latvia	8	0	0
Lithuania	13	0	0
Luxembourg	9	0	1
Malta	9	0	1
Netherlands	27	0	2
Poland	63	9	6
Portugal	14	0	1
Romania	23	7	0
Slovakia	3	1	2
Spain	32	0	1
Sweden	75	1	3
Total	638	37	26

Notes: This table reports results from a manual verification of XBRL Europe's database for a subsample of 701 firms. The validation confirms the absence of ESEF filings in 2020 and assesses the accuracy of XBRL Europe's identification of 2021 early adopters. The manual check reveals a misclassification rate of 8.56 percent, primarily due to unrecognized early adopters, with most discrepancies observed in Finland. Bulgaria is excluded from the control sample due to limited data availability and challenges in accessing filings from the national OAM and firms' websites.

The validation proceeds in three steps. First, for 2020, before ESEF reporting was technologically feasible⁵⁸, no ESEF filings should exist. Consistent with expectations, the database contains no 2020 entries, and 91 percent of manually inspected firms report in PDF

⁵⁸ No ESEF Taxonomy was available. A first draft based on 2017 IFRS Taxonomy was published in March 2019, the updated 2019 version in December 2019 (ESMA, 2019).

or HTML formats. The remaining firms have no publicly accessible report, likely due to delisting, insolvency, or incomplete national coverage (Table 4.2, Panel A). Second, in 2022, when ESEF became mandatory, the database correctly captures the majority of reporters: 91 percent of firms provide an ESEF report, while 5 percent publish an annual report in non-ESEF format, leaving it unclear whether these firms were misidentified in FIRDS or failed to comply. Another 4 percent of firms cannot be verified due to insolvencies, M&A activity, or missing disclosures (Table 4.2, Panel C). Third, the key validation concerns 2021, the potential early adoption year in late adopting countries. The database correctly classifies 85 percent of firms as early or late adopters. Six percent cannot be verified manually, and nine percent are misclassified. Misclassification is asymmetric: early adopters are primarily under-identified. For 53 firms, the database records no ESEF report even though an ESEF filing is available in other sources, whereas only seven firms are falsely classified as early adopters. Errors arise mainly in Finland, where the database substantially understates early adoption (Table 2, Panel B). This pattern is consistent with practitioners' evidence for a subsample of EU countries, with notable discrepancies in Estonia and comparatively high identification of early-adopting firms in Finland (Bagul, 2021; Dédiniénè, 2021; Gierczak & Kobiela-Pionnier, 2021; RK & Bagul, 2021).

Taken together, the validation demonstrates that the XBRL Europe database provides a reliable, though conservative, basis for identifying early adopters. The primary classification risk lies in under-identifying early adopters rather than erroneously labeling late adopters. Some noise arises from firms for which data cannot be verified. Certain firms may have entered bankruptcy or been involved in M&A transactions, and for others, no website exists or technical issues prevented access to their reports. The manual review shows no evidence of back-filing or delayed submission, further supporting the conclusion that the database offers a reliable foundation for identifying early adopters.

4.3.3 Early adoption of ESEF: Country-level evidence

Next, I examine the proportion of early adopting firms in late adopting countries. Although the regulatory framework created a uniform option to adopt in 2021, the actual use varies markedly across member states. These cross-country patterns may reflect the broader institutional, regulatory, and market environments in which firms operate and therefore represent an important component of the empirical setting.

Across countries, only nine of the 22 late adopting member states covered in the study exhibit early adopters (Table 4.3, Panel B). Early adoption is concentrated in Spain (35 percent), followed by Poland (34 percent) and Finland (19 percent). Neither geographical nor economic factors clearly explain these differences.

The Finnish setting has received particular attention in practitioner and industry reports. Some authors attribute Finland's comparatively high uptake to its technologically advanced reporting environment (Koskentalo & Penttinen, 2021). The authors report that by January 2021, 43 percent of software-provider clients had completed the XBRL preparation process, while only 2 percent had not yet begun, indicating that technological readiness was not a binding constraint. Complementing this, RK & Bagul (2021) analyze Finnish filings and find that the XBRL Europe database under-identifies early adopters, consistent with the results of my manual validation in Section 4.3.2. Together, these findings point to a context in which many firms were operationally prepared to file early, and costs of preparation have already been incurred.

In Poland, (Gierczak & Kobiela-Pionnier, 2021) find that larger firms began preparation earlier (some in 2018) to ensure high-quality filings, whereas smaller firms relied on external software solutions in late 2020. For these smaller firms, early adoption was primarily driven by regulatory considerations, with no additional perceived benefit.

4.4 Which factors shape firm decisions to early adopt ESEF?

4.4.1 Variable classification and measurement

This section examines the characteristics associated with firms' early adoption of ESEF reporting prior to the mandate. Early adoption is captured by the indicator variable *EarlyAdopting*, which equals 1 if the firms' 2020 annual report appears in the XBRL Europe database, and 0 otherwise. Firms located in countries that mandated ESEF already in 2020, as well as Ireland, are included when computing industry-level variables but excluded from the final sample for the study. The final sample comprises 2,514 firms.⁵⁹

⁵⁹ The final sample comprises all firms from late-adopting countries, with the exception of Ireland, resulting in a total of 2,514 firms.

Table 4.3: Sample Description

Panel A: Sample Selection	Early adopting countries	Late adopting countries
Observations in 2020	861	4,571
No listing at EU-regulated market	386	1,903
Market Capitalization < 1 Mio. USD	7	32
No IFRS reporting	28	99
	440	2,537

Panel B: Sample distribution per country			
Country	No. of Firms	Early adopting	Percentage
Austria	57	*	n.a.
Belgium	111	8	7.21
Bulgaria	164	0	0
Croatia	75	0	0
Cyprus	56	0	0
Czech Republic	12	*	n.a.
Denmark	122	7	5.74
Estonia	1	0	0
Finland	124	24	19.35
France	375	48	12.80
Germany	349	*	n.a.
Greece	142	0	0
Hungary	31	0	0
Ireland	23	**	n.a.
Italy	225	0	0
Latvia	11	1	9.09
Lithuania	28	1	3.57
Luxembourg	31	0	0
Malta	27	0	0
Netherlands	95	12	12.63
Poland	334	115	34.43
Portugal	38	0	0
Romania	75	0	0
Slovakia	11	0	0
Slovenia	22	*	n.a.
Spain	132	46	34.85
Sweden	306	0	0
	2,977	262	10.42***

Notes: The analysis covers the EU 27, with early adopting firms identified via the XBRL Europe database. Firms from early adopting countries are excluded because, under the ESEF regulation, they could not voluntarily adopt ESEF. Yet, they are included in measuring industry-level variables (*). The database does not include Ireland; therefore, Ireland is excluded from the main analysis but retained for industry-level measures (**). The overall percentage of early adopters is calculated solely on countries allowing for early adoption and covered by XBRL Europe database (***).

To study firms' adoption decisions, I compare characteristics of early- and late-adopting firms through univariate analyses (Section 4.4.2) at the country, industry, and firm level, followed by a logistic regression (Section 4.4.3). Following the cost-benefit framework for voluntary disclosure (Healy & Palepu, 2001), the variables reflect direct costs, indirect costs, and potential benefits. Features specific to ESEF, such as partially sunk preparatory costs and a uniform regulatory framework with heterogeneous timing, allow for a detailed examination of how these factors shape firms' incentives. Although several variables may capture overlapping mechanisms, the framework offers a coherent structure for empirical design.

Size

Firm size captures the idea that larger firms generally possess greater organizational capacity to absorb reporting-related investments and face stronger incentives to maintain a transparent information environment (Healy & Palepu, 2001; Lang & Lundholm, 1993). Larger firms also tend to have more sophisticated reporting infrastructure and are subject to more intense scrutiny from capital market participants (Bushman & Smith, 2001; Dye, 1985). Prior research consistently documents positive associations between size and early adoption of digital financial reporting (Callaghan & Nehmer, 2009; Kaya, 2014; Premuroso & Bhattacharya, 2008; Ragothaman, 2012). I therefore expect a positive association between *SIZE* and early ESEF adoption. *SIZE* is measured as the natural logarithm of total assets. In robustness checks, market value of equity (*MVE*) and industry-adjusted total assets (*adj. SIZE*) are used as alternative measures.

Costs Incurred

COST INCURRED indicates the extent to which firms had already invested in ESEF preparation before member states announced the legally binding postponement decision. Because national announcements were made at different times, firms in late announcing countries had less ability to delay preparatory work and thus faced higher sunk costs. These firms may find early adoption more natural or less costly because substantial groundwork was already completed. Survey evidence confirms preparation often started months or even years earlier (Gierczak & Kobiela-Pionnier, 2021). *COSTS INCURRED* are measured by an indicator equal to one for firms in countries that announced the postponement later than the median EU announcement date. I expect a positive relationship between *COSTS INCURRED* and early ESEF adoption. While discussions started earlier in some jurisdictions, only the formal

notification represents a binding and publicly observable commitment. Thus, announcement dates proxy for when firms could adjust their reporting plans.

Performance

PERFORMANCE captures a firm's financial capacity and its potential to benefit from credibility enhancing disclosures. More profitable firms may be better able to undertake reporting adjustments and may place greater value on demonstrating compliance readiness. In addition, better performing firms may be more capable of absorbing the direct costs of implementation, for example by allocating resources efficiently to adapt reporting systems, reducing operational burdens, and mitigating compliance risk (Bushman & Landsman, 2010; Diamond & Verrecchia, 1991; Healy & Palepu, 2001; Kaya, 2014). Prior evidence from voluntary reporting settings suggests that firms with higher profitability are more likely to adopt new reporting initiatives (Bernard, 2016; Boritz & Timoshenko, 2015; Kaya, 2014; Luo et al., 2023).

Accordingly, I expect a positive association between *PERFORMANCE* and early ESEF adoption. In the baseline model, *PERFORMANCE* is captured by Return on Assets (ROA), while alternative specifications include industry-adjusted ROA (*adj. PERFORMANCE*), and Return on Equity (*ROE*) to capture multiple dimensions of financial capacity (Aerts & Tarca, 2010).

Financial Constraints

Financial constraints proxy for the firm's ability to allocate resources to reporting-related investments. Firms with limited liquidity or higher short-term constraints have fewer resources available for early implementation and therefore stronger incentives to postpone. The results in literature are mixed: While Wallace et al. (1994) and Camfferman & Cooke (2002) provide evidence for firms with lower liquidity ratios to provide more information in firm disclosure, Malone et al. (1993) find no significant relationship. According to Cooke (1989), the higher a firm's liquidity, the higher its incentives to disclose. Premuroso & Bhattacharya (2008) follow this definition and find a significant positive relationship for early XBRL adopters in the US, whereas Kaya (2014) finds no significant relationship.

To capture short-term financial inflexibility, *FINANCIAL CONSTRAINTS* is measured as the inverse of the current ratio. Higher values reflect greater constraints and thus a lower ability to absorb implementation costs. As an alternative, I employ *FINANCIAL LEVERAGE*, which

reflects medium-term financial pressure. I expect both measures to be negatively associated with early ESEF adoption.

Cross-listing

Cross-listing captures a firm's exposure to foreign capital markets with stricter disclosure environments. Firms listed in jurisdictions with higher reporting and enforcement standards, especially the US, face stronger scrutiny and must comply with extensive disclosure requirements (Aerts & Tarca, 2010; Lang et al., 2003). US exposure may also reduce the incremental costs of ESEF adoption due to prior experience with, and implemented reporting structures for, XBRL-based reporting at the SEC. I therefore expect firms with US capital market exposure to be more likely to adopt ESEF early. *CROSSLISTING* equals 1 if a firm filed a Form 20-F in 2020 or 2021.

Analyst Following

Analyst following reflects external information demand and monitoring intensity (Lang et al., 2003; Lang & Lundholm, 1996). Firms followed by more analysts operate in information environments in which timely, machine-readable reporting may provide tangible benefits, and analysts may exert pressure to adopt accessible reporting formats (Brown et al., 2015; Yu, 2008). High analyst coverage may thus strengthen incentives to adopt ESEF early. Prior evidence is mixed: Boritz & Timoshenko (2015) find a significant positive association between analyst coverage and voluntary XBRL adoption, whereas (Luo et al., 2023) document an insignificant negative relation for the introduction of iXBRL in the US.

To capture the information environment, I measure *ANALYST FOLLOWING* as the number of analysts covering the firm in 2020. In line with both the information environment and monitoring channels, and consistent with prior studies, I predict a positive association between analyst coverage and early ESEF adoption.

Ownership structure

Ownership captures the governance environment in which adoption decisions are made. Institutional investors typically possess greater analytical resources and stronger incentives to monitor management, which can reduce agency frictions and encourage firms to adopt disclosure practices that enhance transparency and credibility (Healy & Palepu, 2001; Jensen & Meckling, 1976). Stronger monitoring may increase pressure on managers to appear prepared for regulatory changes and to avoid reputational setbacks (Burns et al., 2010).

However, institutional investors may have private access to management, which can provide them with private information and reduce the incremental benefit of public disclosure. This private information channel for blockholders can weaken the incentives for early adoption if institutional owners rely less on standardized public reports (Ge et al., 2021). The theoretical effect of institutional ownership on voluntary digital reporting is therefore ambiguous *ex ante*, as it may depend on the channel used by institutional investors. Empirical evidence on associations between institutional ownership and voluntary XBRL reporting is rare. For the switch to iXBRL in the US, Luo et al. (2023) provide evidence for a positive but statistically insignificant effect. *OWNERSHIP STRUCTURE* is measured as the percentage of shares held by institutional investors. Due to competing mechanisms, I do not predict the direction of the association.

Market Concentration

Market concentration captures the competitive structure of an industry and is often used to proxy for potential proprietary costs. The theoretical prediction for its effect on disclosure is ambiguous (Lang & Sul, 2014). Verrecchia & Weber (2006) argue that firms in less concentrated markets, i.e., more competitive environments, have stronger incentives to hide information, implying that higher concentration may facilitate disclosure and, by extension, could encourage early adoption of new reporting requirements. In contrast, Harris (1998) suggests the opposite: in highly concentrated markets, firms protect their comparative advantage more aggressively and therefore disclose less. Dedman & Lennox (2009) provide empirical evidence consistent with this view. *MARKET CONCENTRATION* is measured using the Herfindahl–Hirschman Index (HERF) based on two-digit SIC industries and total sales. Given conflicting theoretical arguments, I do not make a directional prediction.

4.4.2 Descriptives and univariate analyses

Table 4.4 presents descriptive statistics and univariate analyses for the full sample of 2,514 firms. Overall, data availability is high, although the variable *FINANCIAL CONSTRAINTS* has slightly lower coverage (2,008 observations) compared to other measures. Missing observations are concentrated among late adopters, whereas early adopters constitute a stable subsample of approximately 262 firms.

Across the eight main independent variables used in the baseline model, five exhibit statistically significant mean differences between early and late adopters. Early adopters tend

to be larger (*SIZE*), have already incurred more preparation costs (*COST INCURRED*), are more profitable (*PERFORMANCE*), and are followed by more analysts (*ANFOL*). Firms with higher *FINANCIAL CONSTRAINTS* show significantly lower early adoption rates. Industry-level *MARKET CONCENTRATION* is marginally associated with early adoption ($p < 0.10$), while *CROSSLISTING* or *OWNERSHIP STRUCTURE* show no significant differences.

Examining alternative measures reinforces these patterns. All three size measures (*SIZE*, *adj. SIZE*, and *MVE*) indicate that early adopters are statistically larger than late adopters. For performance, *PERFORMANCE* and *ROE* are significantly higher among early adopters, whereas *adj. PERFORMANCE* does not differ substantially. Short-term *FINANCIAL CONSTRAINTS*, measured as the inverse current ratio, are significantly lower for early adopters, while medium-term *FINANCIAL LEVERAGE* is lower but not statistically significant.

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Table 4.4: Descriptive statistics for measures of cost and benefit

	(1) Total Sample			(2) Early Adopter			(3) Late Adopter			<i>t</i> -test	
	Obs.	Mean	SD	Obs.	Mean	SD	Obs.	Mean	SD	Diff. in Means	t-value
SIZE	2,508	12.7881	2.4738	262	13.9678	2.2812	2,246	12.6505	2.4592	1.3174	8.27***
Adj. SIZE	2,508	0.8769	2.2975	262	1.8424	1.7469	2,246	0.7642	2.3277	1.0782	7.26***
MVE	2,340	-1.6108	2.4991	261	-0.4914	2.1913	2,079	-1.7513	2.5004	1.2600	7.77***
COST INCURRED	2,514	0.5414	0.4984	262	0.7366	0.4413	2,252	0.5187	0.4998	0.2180	6.76***
PERFORMANCE	2,421	0.0212	0.1450	258	0.0534	0.1135	2,163	0.0173	0.1479	0.0360	3.78***
Adj. PERFORMANCE	2,421	0.2075	0.6892	258	0.2430	0.6798	2,163	0.2033	0.6904	0.0397	0.87
ROE	2,309	1.6607	30.4742	251	8.0340	20.2175	2,058	0.8834	31.4127	7.1506	3.52***
FINANCIAL CONSTRAINTS	2,008	0.9315	0.9662	220	0.7861	0.4214	1,788	0.9493	1.0119	-0.1633	-2.37**
FINANCIAL LEVERAGE	2,470	0.2870	0.2264	260	0.2725	0.1845	2,210	0.2887	0.2308	-0.0162	-1.09
CROSSLISTING	2,514	0.0139	0.1172	262	0.0229	0.1499	2,252	0.0129	0.1128	0.0100	1.31
ANALYST FOLLOWING	2,514	3.1408	5.5340	262	5.7748	6.9159	2,252	2.8344	5.2672	2.9404	8.25***
OWNERSHIP STRUCTURE	2,329	50.2538	27.5559	257	52.5720	26.6503	2,072	49.9662	27.6588	2.6058	1.43
MARKET CONCENTRATION	2,514	1.8164	1.6383	262	1.9972	1.7148	2,252	1.7954	1.6282	0.2017	1.88*

Notes: This table reports descriptive statistics for all independent variables. Column (1) presents the full sample, while Columns (2) and (3) report statistics separately for early and late adopters. The final column provides two-sample *t*-tests for differences in means between both groups. *COST INCURRED* and *CROSSLISTING* are binary variables. *SIZE*, *adj. SIZE*, and *MVE* are measured as the natural logarithm of the respective firm-size indicator. *PERFORMANCE*, *adj. PERFORMANCE*, and *ROE* capture firm profitability, while *FINANCIAL CONSTRAINT* and *FINANCIAL LEVERAGE* measure short- and medium-term financial pressure. *ANALYST FOLLOWING* is the number of analysts following the firm, *OWNERSHIP* reflects the percentage of institutional shareholders, and *MARKET CONCENTRATION* is measured using the Herfindahl index. The descriptive statistics are based on late-adopting countries (excluding Ireland); however, the full dataset is used to construct industry-level variables and to winsorize continuous variables at the 1st and 99th percentiles.

*, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

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Table 4.5: Pearson correlation coefficient for measures of cost and benefit

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) SIZE	1.000												
(2) Adj. SIZE	0.749	1.000											
(3) MVE	0.872	0.758	1.000										
(4) COST INCURRED	0.020	0.249	0.055	1.000									
(5) PERFORMANCE	0.146	0.173	0.168	0.091	1.000								
(6) Adj. PERFORMANCE	0.014	0.026	0.052	0.072	0.223	1.000							
(7) ROE	0.122	0.143	0.185	0.091	0.765	0.148	1.000						
(8) FINANCIAL CONSTRAINTS	-0.047	-0.080	-0.161	-0.038	-0.155	-0.034	-0.155	1.000					
(9) FINANCIAL LEVERAGE	0.103	0.044	-0.016	-0.054	-0.160	-0.021	-0.221	0.468	1.000				
(10) CROSSLISTING	0.130	0.127	0.156	-0.027	-0.093	0.014	-0.063	-0.048	-0.024	1.000			
(11) ANALYST FOLLOWING	0.687	0.545	0.714	0.028	0.063	0.050	0.049	-0.041	0.057	0.233	1.000		
(12) OWNERSHIP STRUCTURE	-0.087	-0.133	-0.173	-0.011	0.077	0.008	0.031	0.048	0.052	-0.115	-0.296	1.000	
(13) MARKET CONCENTRATION	0.105	-0.032	0.021	0.002	-0.029	-0.136	-0.049	0.116	0.088	-0.015	0.075	0.001	1.000

Notes: This table presents the Pearson correlation coefficients for all variables used in the analysis. The alternative *SIZE* measures (1)–(3) exhibit high mutual correlations, and *ANALYST FOLLOWING* is likewise strongly correlated with firm size.

Values shown in bold are statistically significant at $p < 0.05$ (two-tailed).

The correlation matrix (Table 4.5) indicates that multicollinearity is unlikely to affect the multivariate analysis. All three size measures are highly correlated (above 0.74), and performance measures exhibit strong correlations as well. Financial constraint measures correlate moderately (0.47). Among baseline variables, the strongest cross-construct correlations are observed between *SIZE* and *ANFOL* (0.69), *ANFOL* and *OWNERSHIP STRUCTURE* (0.30), and *CROSSLISTING* and *ANFOL* (0.23).⁶⁰ All other pairwise correlations are close to or below 0.10, indicating limited concern for multicollinearity (Belsley et al., 1980).

Taken together, these descriptive statistics suggest that early adopters differ systematically from late adopters in terms of size, preparatory costs, profitability, financial flexibility, and analyst coverage. These patterns are broadly consistent with theoretical predictions and prior evidence from voluntary disclosure and digital reporting literature (e.g., Blankespoor et al., 2014; Boritz & Timoshenko, 2015), providing a foundation for the multivariate analysis.

4.4.3 Determinants of early adoption ESEF reporting

Main findings

To assess the determinants of early adoption, I estimate a logistic regression using the firm-level dataset from fiscal year 2020. This model examines whether firm-, industry-, and country-level characteristics are associated with the probability of adopting ESEF prior to the mandatory implementation in 2021. The specification follows prior studies on voluntary XBRL adoption in the US (e.g., Boritz & Timoshenko, 2015; Kaya, 2014; Premuroso & Bhattacharya, 2008), providing a benchmark to compare determinants across institutional contexts.

The baseline specification is:

$$P(\text{EarlyAdoption} = 1) = F(\beta_0 + \beta_1\text{SIZE} + \beta_2\text{COST INCURRED} + \beta_3\text{PERFORMANCE} + \beta_4\text{FINANCIAL CONSTRAINTS} + \beta_5\text{CROSSLISTING} + \beta_6\text{ANALYST FOLLOWING} + \beta_7\text{OWNERSHIP STRUCTURE} + \beta_8\text{MARKET CONCENTRATION})$$

Table 4.6 presents the results from estimating the baseline model. Overall, five variables provide statistically significant associations with early adoption. *SIZE*, *COST INCURRED*, *PERFORMANCE*, and *OWNERSHIP STRUCTURE* are significantly positively associated with

⁶⁰ To further address potential multicollinearity, *ANFOL* is excluded in an unpublished robustness test for the multivariate analysis. The results remain largely unchanged, with the t-values for *SIZE* and *OWNERSHIP STRUCTURE* increasing slightly.

early adoption, indicating that early adopters tend to be larger, more profitable, have already incurred higher preparation costs, and exhibit higher institutional ownership. *FINANCIAL CONSTRAINTS* is significantly negatively associated with early adoption, indicating that early adopting firms are less financial constraint compared to late adopting firms.

Table 4.6: Predictions and determinant model for baseline specification

	Predicted Sign	Baseline Results
SIZE	+	0.1928*** (4.29)
COST INCURRED	+	0.97733*** (5.77)
PERFORMANCE	+	1.4204** (2.04)
FINANCIAL CONSTRAINTS	-	-0.2742** (-2.45)
CROSSLISTING	+	-0.1141 (-0.16)
ANALYST FOLLOWING	+	0.0239 (1.41)
OWNERSHIP STRUCTURE	?	0.0100*** (2.87)
MARKET CONCENTRATION	?	0.0552 (1.31)
Constant		-5.6388*** (-9.02)
N		1,671
Adjusted R ²		0.077
Clustered at firm level		YES

Notes: This table reports the predicted signs and logistic regression results for the baseline specification. *SIZE* is measured as the natural logarithm of total assets. *COST INCURRED* is a binary variable indicating whether a firm is located in a country whose official postponement notification occurred after the sample-wide median announcement date. *PERFORMANCE* is measured as ROA. *FINANCIAL CONSTRAINTS* is proxied by the inverse current ratio. *ANALYST FOLLOWING* is defined as the number of analysts covering the firm. *OWNERSHIP STRUCTURE* reflects the percentage of shares held by institutional investors. *MARKET CONCENTRATION* is measured using the Herfindahl–Hirschman Index. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Baseline findings are robust to various alternative variable specifications, such as the use of alternative size measures, including *adj. SIZE* and *MVE* (Table 4.7). For *PERFORMANCE*, the positive association holds when using *ROE*; however, *adj. SIZE*, while being positive, is not statistically significant. *FINANCIAL CONSTRAINTS*, capturing short-term liquidity

limitations, is negatively associated with early adoption. The alternative measure of financial constraints, *FINANCIAL LEVERAGE*, which reflects medium-term financing structure, obtains a negative coefficient, but not conventional levels of significance.

For the remaining variables, no statistically significant associations with early adoption are observed. *CROSSLISTING* yields a negative but insignificant coefficient, while *ANALYST FOLLOWING* and *MARKET CONCENTRATION* are positive but insignificant.

Type of Regression

As a robustness check, I re-estimate the main specification using ordinary least squares regression (OLS) and add industry- and country-fixed effects in additional specifications. Although the binary nature of the dependent variable makes the logit model the more appropriate estimator, OLS serves as a useful linear benchmark to assess the stability of coefficient signs and magnitudes. This approach also allows for the inclusion of country and industry fixed effects to control for unobserved heterogeneity. Given potential endogeneity and omitted-variable concerns, the OLS results are not interpreted causally but provide an additional sensitivity test of the baseline findings.

Table 4.8 reports the results for several specifications. Column (1) reproduces the baseline logit model for comparison, while Columns (2)-(5) present OLS estimates with the incremental inclusion of country and industry fixed effects. Across models, the direction and statistical significance of the main variables remain broadly consistent with the baseline logit results. *SIZE* and *FINANCIAL CONSTRAINTS* remain highly significant across specifications. *COST INCURRED* is omitted in specifications including country fixed effects due to collinearity, but in other models it remains highly significant. Introducing country fixed effects also affects *PERFORMANCE* and *OWNERSHIP STRUCTURE*, removing their statistical significance. *CROSSLISTING* and *MARKET CONCENTRATION* remain insignificant in all OLS models, with *MARKET CONCENTRATION* being omitted once industry fixed effects are included. For *ANALYST FOLLOWING*, the OLS estimations produce a marginally significant positive coefficient in the specification without fixed effects and in the model including industry fixed effects only.

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Table 4.7: *Determinants model for alternative variable specifications*

	Baseline	(1) SIZE I	(2) SIZE II	(3) PERF. I	(4) PERF. II	(5) CONST.
SIZE	0.1928*** (4.29)			0.1940*** (4.36)	0.1834*** (3.91)	0.1456*** (4.03)
Adj. SIZE		0.0860** (2.09)				
MVE			0.1341*** (3.16)			
COST INCURRED	0.9733*** (5.77)	0.8485*** (4.82)	0.9141*** (5.45)	1.0125*** (6.03)	0.9799*** (5.75)	0.9782*** (6.23)
PERFORMANCE	1.4204** (2.04)	1.2915** (2.07)	1.0925* (1.85)			1.6340*** (2.63)
Adj. PERFORMANCE				0.0394 (0.42)		
ROE					0.0080*** (2.90)	
FINANCIAL CONSTRAINTS	-0.2742** (-2.45)	-0.2348** (-2.34)	-0.1872* (-1.84)	-0.3293*** (-2.87)	-0.2293* (-1.68)	
FINANCIAL LEVERAGE						-0.3850 (-1.05)
CROSSLISTING	-0.1141 (-0.16)	-0.1688 (-0.24)	-0.1080 (-0.16)	-0.1955 (-0.29)	-0.0732 (-0.11)	-0.1461 (-0.23)
ANFOL	0.0239 (1.41)	0.0571*** (4.00)	0.0345** (2.08)	0.0265 (1.57)	0.0289* (1.67)	0.0388*** (2.68)
OWNERSHIP STRUCTURE	0.0100*** (2.87)	0.0115*** (3.27)	0.0115*** (3.25)	0.0105*** (3.01)	0.0121*** (3.39)	0.0117*** (3.63)

(continued on next page)

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MARKET CONCENTRATION	0.0552 (1.31)	0.0758* (1.83)	0.0723* (1.73)	0.0519 (1.22)	0.0662 (1.54)	0.0626 (1.55)
Constant	-5.6388*** (-9.02)	-3.4252*** (-11.21)	-3.1009*** (-9.65)	-5.6146*** (-9.21)	-5.7008*** (-8.84)	-5.3947*** (-10.14)
N	1,671	1,671	1,633	1,671	1,613	2,026
Adjusted R ²	0.077	0.069	0.069	0.073	0.078	0.079
Clustered at firm level	YES	YES	YES	YES	YES	YES

Notes: This table reports the results of the determinant model using alternative variable specifications. Specifically, I re-estimate the baseline logit regression with different measures of *SIZE* (columns 1–2), *PERFORMANCE* (columns 3–4), and *FINANCIAL CONSTRAINTS* (column 5). *Adj. SIZE* are calculated as the natural logarithm of a firm's Total Assets minus the industry average (1). *MVE* is measured as the natural logarithm of Market Value of Equity (2). *Adj. PERFORMANCE* is computed as the natural logarithm of a firm's ROA minus the industry average (3). ROE reflects Return on Equity as reported in LSEG Workspace (4). To capture medium-term financial constraints, I employ financial leverage, measured as the ratio of total liabilities to total assets (5). All continuous variables are winsorized at the 1st and 99th percentiles. See Appendix B for variable definitions.

Table 4.8: *Determinant model for OLS regression*

	(1) LOGIT	(2) OLS	(3) OLS + FE	(4) OLS + FE	(5) OLS + FE
SIZE	0.1928*** (4.29)	0.0144*** (2.99)	0.0293*** (5.87)	0.0112** (2.16)	0.0274*** (5.02)
COST INCURRED	0.9733*** (5.77)	0.0927*** (6.02)	.	0.0809*** (4.92)	.
PERFORMANCE	1.4204** (2.04)	0.1094** (2.12)	0.0422 (0.85)	0.1230** (2.07)	0.0532 (0.94)
FINANCIAL CONSTRAINTS	-0.2742** (-2.45)	-0.0146*** (-3.13)	-0.0160*** (-2.86)	-0.0166*** (-3.02)	-0.0191*** (-3.22)
CROSSLISTING	-0.1141 (-0.16)	-0.0080 (-0.10)	-0.0551 (-0.73)	-0.0295 (-0.38)	-0.0729 (-0.95)
ANFOL	0.0239 (1.41)	0.0047* (1.95)	0.0002 (0.07)	0.0064** (2.56)	0.0014 (0.61)
OWNERSHIP STRUCTURE	0.0100*** (2.87)	0.0008*** (2.79)	-0.0001 (-0.23)	0.0009*** (2.92)	0.0001 (0.16)
MARKET CONCENTRATION	0.0552 (1.31)	0.0065 (1.30)	0.0048 (1.02)	.	.
Constant	-5.6388*** (-9.02)	-0.1691*** (-3.06)	-0.2382*** (-4.10)	-0.1158* (-1.95)	-0.2132*** (-3.32)
N	1,671	1,671	1,671	1,668	1,668
Adjusted R ²	0.077	0.049	0.212	0.060	0.213
Country FE	NO	NO	YES	NO	YES
Industry FE	NO	NO	NO	YES	YES
Clustered at firm level	YES	YES	YES	YES	YES

Notes: This table reports an alternative estimation using an OLS linear probability model (LPM) to assess the robustness of the baseline logit specification. Column (1) reproduces the baseline logistic regression. Columns (3)-(5) present OLS estimates with different combinations of fixed effects. Because the dependent variable is binary, OLS is used solely as a robustness test, and all standard errors are computed using heteroscedasticity-robust estimators. Results remain qualitatively similar across the logit and OLS specifications. See Appendix B for variable definitions.

Summary

Overall, the multivariate evidence indicates that early adoption is primarily driven by firm size, preparatory costs, financial capacity, and, to some extent, institutional ownership. These results are consistent with the notion that early ESEF adoption reflects the ability to absorb direct costs, manage indirect costs, and respond to governance pressures rather than simply regulatory compulsion.

4.5 Discussion

Finally, the empirical results are discussed in light of previous studies from voluntary reporting settings as well as initial country-level evidence of ESEF implementation. The findings provide insights into the determinants of early ESEF adoption in the EU, highlighting both firm-specific factors and the unique regulatory context. Compared to the VFP in the US, the share of early adopters in the EU is substantially higher. This difference likely reflects the short horizon between the regulatory announcement and the mandatory adoption date, combined with staggered member-state decisions, which created a quasi-voluntary environment where firms could strategically choose whether to adopt early or defer implementation.

This study contributes to the literature on digital financial reporting and voluntary disclosure in three ways. First, it provides firm-level evidence on early adoption under a quasi-voluntary regulatory framework, extending prior research that focused primarily on voluntary XBRL adoption in the US (e.g., Boritz & Timoshenko, 2015; Kaya, 2014). Second, it demonstrates the important role of preparatory, partially sunk costs. Firms that had likely ready invested in software, tagging processes, staff training, or external consulting were significantly more likely to adopt ESEF early. This finding illustrates how the timing of regulatory announcements interacts with prior investments to influence adoption decisions. In the US setting, no prior preparation existed, which might help to explain the lower share of early adopting firms compared to the ESEF setting. Third, the study examines the relative importance of firm-, industry-, and country-level factors, revealing that size, profitability, and institutional ownership are strong predictors of early adoption, whereas cross-listing, market concentration, and analyst following are largely insignificant. These results refine the understanding of voluntary disclosure determinants by showing that certain factors, which matter in fully voluntary US settings, may be less relevant in the ESEF context.

Cost-related factors emerge as particularly important. Cost incurred captures preparation costs already incurred before the postponement decision. Survey evidence indicates that many firms had begun preparing for ESEF before the announcement of the one-year deferral (Gierczak & Kobiela-Pionnier, 2021; Koskentalo & Penttinen, 2021). Given the requirement to publish annual reports within four months after fiscal year-end (TPD, Art. 4(1)), firms in late announcing countries had already advanced in their preparation. The strong positive association supports the notion that sunk or partially sunk costs increased the likelihood of early adoption.

A similar mechanism appears for financial constraints. Firms with limited short-term liquidity are less likely to adopt early, consistent with the idea that postponement offered an opportunity to delay discretionary implementation costs. By contrast, financial leverage, which reflects a medium-term financing structure, does not exhibit a significant effect. This distinction is consistent with prior studies showing that liquidity, rather than leverage, influences voluntary technology adoption in reporting (Boritz & Timoshenko, 2015; Kaya, 2014; Luo et al., 2023; Premuroso & Bhattacharya, 2008).

Size captures both resource capacity and potential disclosure benefits. Larger firms may find it easier to absorb fixed implementation costs, consistent with declining marginal costs of providing additional information (Lang & Lundholm, 1993). At the same time, larger firms face stronger market incentives to appear transparent and prepared, given their visibility and the greater informational demands of capital markets (Bushman & Smith, 2001; Dye, 1985). The consistently positive size effect aligns with prior evidence on XBRL adoption (Kaya, 2014; Luo et al., 2023; Premuroso & Bhattacharya, 2008; Ragothaman, 2012).

The positive association for performance suggests that better-performing firms may seek credibility through timely compliance and are better positioned to absorb implementation costs, aligning with prior findings (Boritz & Timoshenko, 2015; Luo et al., 2023). Ownership structure likewise exhibits a strong positive effect. Greater monitoring pressure from sophisticated investors may prompt firms to appear prepared for regulatory change and avoid potential reputational consequences (Burns et al., 2010).

In contrast, cross-listing, analyst following, and market concentration do not show significant associations with early adoption. This result partially aligns with US evidence on iXBRL adoption (Luo et al., 2023), although higher analyst following plays a role in the VFP examined by Boritz & Timoshenko (2015).

Taken together, the results indicate that early ESEF adoption is shaped primarily by firms' ability to absorb implementation costs and by their exposure to capital market monitoring. The late timing of member state postponement decisions caused a period of regulatory uncertainty, and the subsequent clarification effectively converted preparatory investments into sunk costs. This mechanism created stronger incentives for early adoption among firms that had already committed resources to implementation. The setting thus offers a useful quasi-voluntary context that enriches our understanding of disclosure choices under regulatory timing frictions. By bridging the EU and US experiences, the study offers new insights into how firms respond

strategically to digital reporting mandates and informs both policymakers and researchers about the interaction between cost structures, monitoring pressures, and disclosure incentives.

4.6 Conclusion

This paper investigates the determinants of early adoption of the ESEF regulation among firms in EU member states that had discretion over the timing of implementation. Exploiting the member state option to postpone mandatory adoption, I infer firm-, industry-, and country-level characteristics associated with firms' decisions to early adopt digital reporting.

The findings highlight the central role of implementation costs, resource capacity, and monitoring pressures in shaping firms' adoption decisions. Early adopters tend to be larger, more profitable, subject to higher institutional ownership, and are more likely to have incurred preparatory costs prior to the postponement announcement. Financial constraints exhibit a negative association with early adoption in the short term, while medium-term financing structure does not appear to influence firms' timing choices. Together, the results indicate that early ESEF adoption reflects a strategic response to cost-benefit considerations.

This study contributes to the literature on voluntary disclosure and digital financial reporting in several ways. First, it extends prior evidence from the US setting by documenting how quasi-voluntary behavior emerges in a regulatory environment where compliance is mandatory but the timing is partially flexible across jurisdictions. Second, it demonstrates the importance of partially sunk costs and preparatory investments as key drivers of early adoption, offering a novel mechanism for understanding firm behavior under impending regulatory change. Third, it provides comprehensive descriptive and multivariate evidence on characteristics of early adopters, thereby enriching the understanding of strategic adoption in a cross-country digital reporting regime.

The study also has limitations. For one thing, while the analysis incorporates variables commonly used in prior research and includes a measure tailored to the ESEF context, unobserved factors not captured in the empirical design may also influence adoption decisions and correlate with the independent variables. Second, although the identification of early adopters is validated using a subsample of manually verified observations, incomplete public disclosure by firms may still lead to under-identification in some jurisdictions. Systematically under-identifying early adopters in a particular country may affect the independent variable *COST INCURRED*, which captures country-level differences. Finally, given the observational

nature of the setting, the study does not establish causal effects but documents associations between firm characteristics and early adoption behavior.

Overall, the evidence demonstrates that costs incurred, resource availability, and capital-market monitoring jointly shape early ESEF adoption, and that firms' reporting choices reflect both strategic considerations and partially irreversible preparatory investments. Unique to the ESEF setting, these findings highlight how regulatory uncertainty and resulting sunk costs influence adoption decisions. The variable *COST INCURRED* is strongly associated with early adoption, indicating the potentially unintended consequence of a relatively high number of early adopters in this quasi-voluntary setting. These insights provide important guidance for policymakers designing digital reporting mandates and offer researchers a clearer understanding of the interplay between regulation, technology adoption, and disclosure incentives.

4.7 Appendix

Appendix 9: Overview of prior studies examining determinants of voluntary (i)XBRL adoption

	(1) Premuroso & Bhattacharya	(2) Boritz & Timoshenko	(3) Ragothaman	(4) Kaya	(5) Efendi et al.	(6) Luo et al.	(7) Bernard
SIZE	***	+	+	***	+	***	***
COST INCURRED							
PERFORMANCE	+	**		+	+	**	***
FINANCIAL CONSTRAINTS	** / -	! / -		+/.		./ -	***
CROSSLISTING							
ANFOL		***				-	
OWNERSHIP STRUCTURE						+	
MARKET CONCENTRATION							***
Additional variables included?	YES	YES	YES	YES	YES	YES	YES

Notes: This table summarizes key descriptive and empirical studies examining determinants of voluntary XBRL adoption under the SEC's Voluntary Filing Program (VFP). In addition, Luo et al. (2023) analyze the implementation of iXBRL in the United States, while Bernard (2016) investigates a voluntary, non-digital reporting setting in Germany. Variable definitions and measurement approaches differ across studies but generally reflect the underlying constructs used in this paper. For FINANCIAL CONSTRAINTS, results for short-term liquidity measures are reported first, followed by medium-term leverage-based measures. Studies using the current ratio interpret higher values as lower liquidity constraints; for comparability, directional signs are aligned accordingly.

*, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Appendix 10: *Dependent and independent variables used in paper*

	Calculation	Interpretation
<i>Dependent variable:</i>		
Early Adopting	The binary variable takes on the value of 1 for firms identified as early adopting by XBRL Europe's database, and 0 if not.	The variable indicates whether a firm early adopts ESEF or waits until mandatory ESEF implementation. Only firms from late adopting countries are included in the study
<i>Independent variables:</i>		
SIZE	The variable is calculated as natural logarithm of total assets.	Firm size captures the idea that larger firms generally possess greater organizational capacity to absorb reporting-related investments and face stronger incentives to maintain a transparent information environment (Healy & Palepu, 2001; Lang & Lundholm, 1993). Larger firms also tend to have more sophisticated reporting infrastructure and are subject to more intense scrutiny from capital-market participants (Bushman & Smith, 2001; Dye, 1985).
adj. SIZE	The variable is calculated as natural logarithm of total assets minus industry-average of total assets.	Following SIZE but includes the aspect of industry average. It's a measure to control for size dependent on two-digits SIC.
MVE	The variable is calculated as natural logarithm of market value of equity.	Another measure for SIZE, for interpretation see above.
COST INCURRED	The binary variable takes on the value of 1 for countries announcing the legally binding postponement to EU Commission after median of countries, and 0 if communicated before.	The variable reflects the extent to which firms had already invested in ESEF preparation before member states announced the legally binding postponement decision. Because national announcements were made at different times, firms in late announcing countries had fewer opportunities to delay preparatory activities and thus faced higher sunk or unavoidable costs. These firms may find early adoption more natural or less costly because substantial groundwork was already completed.

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PERFORMANCE	The variable is measured as earnings before interest and taxes to total assets at the end of the previous fiscal year (in percent).	The variable captures a firm's financial capacity and its potential to benefit from credibility enhancing disclosures. More profitable firms may be better able to undertake reporting adjustments and may place greater value on demonstrating compliance readiness. In addition, better performing firms may be more capable of absorbing the direct costs of implementation, for example by allocating resources efficiently to adapt reporting systems, reducing operational burdens, and mitigate compliance risk (Bushman & Landsman, 2010; Diamond & Verrecchia, 1991; Healy & Palepu, 2001; Kaya, 2014).
adj. PERFORMANCE	The variable is measured as earnings before interest and taxes to total assets at the end of the previous fiscal year and adjusted for average industry profitability (in percent).	Following PERFORMANCE but includes the aspect of industry average. It's a measure to control for performance dependent on two-digit SIC.
ROE	The variable is calculated by dividing net income by average shareholders' equity (in percent).	Another measure for PERFORMANCE, for interpretation see above.
FINANCIAL CONSTRAINTS	The variable is measured as the inverse of the current ratio by dividing current liabilities by current assets.	Financial constraints proxy for the firm's ability to allocate resources to reporting-related investments. Firms with limited liquidity or higher short-term constraints may have fewer resources available for early implementation and therefore stronger incentives to postpone. FINANCIAL CONSTRAINTS covers short-term financial inflexibility.
FINANCIAL LEVERAGE	The variable is measured by dividing total liabilities by total assets.	See FINANCIAL CONSTRAINTS. Yet, FINANCIAL LEVERAGE captures medium-term financial inflexibility.
CROSSLISTING	The binary variable equals 1 if a firm filed a Form 20-F in 2020 or 2021, or 0 otherwise.	The variable captures a firm's exposure to foreign capital markets with stricter disclosure environments. Firms listed in jurisdictions with higher reporting and enforcement standards, especially the US, face stronger scrutiny and must comply with extensive disclosure requirements (Aerts & Tarca, 2010; Lang et al., 2003). US exposure may also reduce the incremental costs of ESEF adoption due to prior experience with XBRL-based reporting at the SEC.
ANALYST FOLLOWING	The variable is measured as the number of analysts covering the firm in 2020.	The variable reflects external information demand and monitoring intensity (Lang et al., 2003; Lang & Lundholm, 1996). Firms followed by more analysts operate in information environments in which timely, machine-readable reporting may provide tangible benefits, and analysts may exert pressure to adopt accessible reporting formats (Brown et al., 2015; Yu, 2008).

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OWNERSHIP STRUCTURE	The variable is measured as the percentage of shares held by institutional investors.	The variable the governance environment in which adoption decisions are made. Institutional investors typically possess greater analytical resources and stronger incentives to monitor management, which can reduce agency friction and encourage firms to adopt disclosure practices that enhance transparency and credibility (Healy & Palepu, 2001; Jensen & Meckling, 1976).
MARKET CONCENTRATION	The variable is measured using the Herfindahl–Hirschman Index (HERF) based on two-digit SIC industries and total sales.	The variable captures the competitive structure of an industry and is often used to proxy for potential proprietary costs. The theoretical prediction for its effect on disclosure is ambiguous (Lang & Sul, 2014). Verrecchia & Weber (2006) argue that firms in less concentrated markets, i.e., more competitive environments, have stronger incentives to hide information, implying that higher concentration may facilitate disclosure and, by extension, could encourage early adoption of new reporting requirements. In contrast, Harris (1998) suggests the opposite: in highly concentrated markets, firms protect their comparative advantage more aggressively and therefore disclose less. Dedman & Lennox (2009) provide empirical evidence consistent with this view.

5. Conclusion

5.1 Summary of major findings and implications

The digital transformation of financial reporting is changing both the ways firms disclose financial information and how capital market participants potentially access, process, and utilize these disclosures. Within the EU, initiatives such as ESEF and ESAP aim to enhance the accessibility, comparability, and machine-readability of firm reports. These regulatory changes are expected to reduce information processing costs for investors, analysts, and regulators and to create a more harmonized EU reporting environment. This thesis investigates key aspects of financial reporting digitalization and dissemination within the EU. It addresses two overarching questions: (1) Are the regulations implemented by the EU for digital financial reporting suitable for effectively achieving their intended consequences? And (2) does the regulatory setting in digital financial reporting in the EU impact firms' individual costs and benefits, affecting the cost-benefit trade-off of early ESEF adoption? On the basis of three papers, the thesis contributes to three streams of literature. The first stream examines centralized provision of financial reporting and related institutional structures (e.g., Goldstein et al., 2023; Sran et al., 2024). The second stream investigates economic effects of implementing a digital reporting format, namely ESEF (e.g., Blankespoor, 2019; Hoitash et al., 2021; Liu et al., 2014). The third stream relates to voluntary reporting practices in financial accounting (e.g., Hao et al., 2014; Premuroso & Bhattacharya, 2008).

With regard to the first stream of literature, Section 2 investigates the timeliness of financial report provision through central data storage by leveraging the EU setting of national OAMs. The OAM framework was implemented under the TPD, and prior research has examined some economic implications of this system (Sran et al., 2024). However, with the upcoming implementation of ESAP in mid-2027, new questions emerge regarding the quality and timeliness of data pushed from OAMs into the centralized platform. ESAP relies on national OAMs to collect, automatically validate, and provide firm disclosures (ESAP, Rec. 19), which makes timely dissemination critical. Section 2 examines this timeliness and identifies substantial heterogeneity in reporting gaps between firm homepages and OAMs. A large heterogeneity of gaps in reporting at firm homepages and OAMs is identified. For most countries, the gap is zero or close to zero, but in some cases, such as Germany, it is pronounced.

These findings are relevant for regulators and market participants, highlighting a potential risk for the effective functioning of ESAP if OAM processes are not adequately aligned.⁶¹

With regard to the second stream of literature, Section 3 leverages the implementation of ESEF to examine its effects on capital market liquidity and information environment for firms listed on EU-regulated capital markets. Although ESEF shares technological features with earlier XBRL mandates, such as in the US (Hoitash et al., 2021), it differs in timing, institutional context, and digital infrastructure. Therefore, it's an open question whether the implementation of ESEF creates comparable results. Section 3 provides little evidence that ESEF improved market outcomes in the early years. Firms in early adopting countries experience declines in liquidity across several measures, whereas firms in late adopting countries exhibit no discernible effects. Evidence for changes in the information environment is similarly weak, and the findings do not support the expectation that ESEF reduced information processing costs. This stands in contrast to US evidence, where XBRL adoption is generally associated with improvements in information efficiency.

Several contextual factors may help explain these muted effects. First, during its initial years ESEF covered only the primary financial statements and limited note disclosures, information that was already relatively easy to extract from PDFs even pre-ESEF due to its standardization. Second, prior research on US XBRL suggests that benefits often emerge only after filers and users progress along the learning curve (Dong et al., 2016). Early ESEF evidence indicates frequent technical errors (Heichl et al., 2025), suggesting that EU markets may still be in the initial adjustment phase. Third, sophisticated market participants frequently rely on data vendors for timely and high-quality data (Joint Committee, 2024). Because ESEF applies only to firms listed on EU-regulated markets, already the most visible and widely covered firms, vendors may have offered structured data prior to ESEF, limiting the incremental value of the new format (Easterwood, 2024). Finally, the absence of an EU-wide public repository imposes additional search and access frictions, unlike the centralized SEC EDGAR system in the US. Taken together, these factors suggest that ESEF has not yet reduced information processing costs sufficiently to improve liquidity or the information environment. The divergence from US findings appears driven less by contradictory effects and more by differences in institutional infrastructure, data availability, and the stage of market learning.

⁶¹ The author submitted a feedback letter in response to the European Commission's call for comments on the ESAP regulation in 2022. Preliminary results from Section 2 were included in the submission.

With regard to the third stream of literature, Section 4 exploits the postponement of mandatory ESEF reporting in late adopting countries to examine which firms chose to adopt ESEF early when deferral was permitted. The short notice nature of the postponement allows the construction of a proxy for preparation costs captured by whether a firm operates in a country that announced the delay after the median announcement date, and thereby enabling an analysis of sunk costs typically unobservable in voluntary disclosure settings. Descriptive and multivariate evidence shows that early adopters are systematically different from late adopters: they are larger, more profitable, less financially constrained, and characterized by higher institutional ownership. Importantly, early adopters disproportionately are domiciled in countries that announced the postponement later, consistent with firms having already incurred substantial preparation costs and thus facing a shifted cost-benefit equilibrium. This pattern aligns with the economic notion of sunk costs, whereby firms that have already invested in implementation are more likely to proceed despite the option to delay. Overall, the study provides the first systematic evidence on early ESEF adoption in the EU and highlights how policy timing can shape firm behavior when new reporting technologies are introduced.

5.2 Limitations

The studies in this thesis are subject to several limitations that should be considered when interpreting the results. First, Section 2 and 4 rely (partly) on hand-collected data, which introduces limitations related to data completeness and comparability. In particular, the identification of early adopting firms under the ESEF mandate and the collection of publication dates from national OAMs depend on the availability and accessibility of information at the member state level. Considerable variation exists in reporting traditions, database structures, and disclosure practices across EU countries, which may affect the consistency of the underlying data. Although cross-validation procedures were employed to ensure accuracy, residual measurements error cannot be fully ruled out.

Second, all three studies are conducted within a highly heterogeneous regulatory environment. Differences in national implementation and enforcement of the TPD and ESEF regulation may influence firms' reporting behavior and the observed outcomes. Moreover, the Covid pandemic had a direct institutional impact on the research setting. The temporary postponement of ESEF implementation by most member states, as well as disruptions in reporting and auditing processes during the pandemic years, may have affected both the timing and quality of firm disclosures. Consequently, it is difficult to disentangle the regulatory effects from those related to the extraordinary circumstances surrounding the pandemic.

Third, regulatory changes such as the introduction of the ESEF mandate do not represent perfectly clean shocks. For example, firms and investors could have anticipated the regulation or adjusted behavior prior to its formal enforcement (Leuz & Wysocki, 2016). Moreover, overlapping reporting reforms and varying national transposition timelines may have influenced the observed effects. This issue is addressed in the studies by carefully ruling out overlapping timeframes of regulations and directives (Labro & Pierk, 2025) and, where applicable, validating the data through hand-collected information to ensure accurate timing of reporting events. Nevertheless, these factors introduce some uncertainty regarding the precise timing of responses and should be considered when interpreting the causal implications of the findings.

Fourth, the generalizability of the findings is limited. The results are first and foremost specific to the EU institutional setting and the period surrounding the initial adoption of ESEF. The identification of firms subject to the ESEF mandate relies on the FIRDS list for 2020 and 2021 to capture entities listed on EU-regulated markets. This approach may underestimate the actual population of firms within the ESEF scope, as some listings or delistings may not be fully reflected in the dataset. It also differs from other studies that identify target firms solely based on database outputs. Additionally, data limitations within the LSEG Workspace may influence the regression results. Consequently, caution should be exercised when extending the results to other regulatory environments, such as non-EU jurisdictions, firms listed on different stock exchange segments, later years, or other disclosure regimes. Moreover, the documented effects may evolve over time as digital reporting practices mature and as the implementation of ESAP advances.

Fifth, as with most empirical-archival studies, potential endogeneity concerns cannot be entirely ruled out (Gippel et al., 2015). Firms' decisions to adopt ESEF early, as well as differences in reporting behavior, may be influenced by time-varying unobserved firm characteristics such as investments in internal reporting systems prior to ESEF or other digitalization efforts around the time. Although the use of a difference-in-differences design, fixed effects, and various control variables helps to mitigate these issues, the possibility of omitted variable bias remains.

Overall, while these limitations do not invalidate the conclusions, they highlight important boundary conditions for interpreting the results and point to areas where future research can refine and extend the analyses presented in this dissertation.

5.3 Outlook

The findings of this thesis point to several opportunities for future research on the digitalization and dissemination of firm reporting in the EU. In particular, the EU's evolving regulatory landscape around ESEF and the forthcoming ESAP provides an opportunity to study if and how digital infrastructures affect the availability, quality, and use of financial information.

With the upcoming launch of the ESAP in mid-2027, future research will have the opportunity to assess whether and to what extent the regulation achieves its central objectives of improving the timeliness, accessibility, and uniform quality of firm disclosures (ESAP, Rec. 19). This includes evaluating the effectiveness of existing national infrastructures, such as OAMs, as data providers, and examining how institutional and technical heterogeneity across member states affects the overall functioning of ESAP. Once ESAP becomes operational, it will also allow researchers to study the actual use of the database by investors, intermediaries, and regulators, thereby contributing to a deeper understanding of how market participants rely on centralized and machine-readable disclosure systems.

ESAP will constitute the first EU-wide public database for financial reporting, environmental disclosure and other voluntary firm information, excluding marketing information (ESAP, Rec. 4). For research, this will have two main implications: First, ESAP could become an important and freely accessible source of firm data for researchers (and other interested parties). Depending on the quality and datatypes, ESAP might reduce dependence on proprietary databases. Second, by integrating financial and non-financial information, ESAP will make more firm disclosures available and, therefore, potentially raise the awareness, acquisition (and integration) of such information.

At the firm level, the ESEF mandate provides a natural starting point for exploring the determinants and consequences of digital reporting adoption. Future research could investigate how structured reporting affects firms' internal reporting processes, investor communication, and audit practices. Moreover, the interaction between ESEF and the Corporate Sustainability Reporting Directive (CSRD) presents an especially promising topic. As sustainability disclosures will also be prepared in a digital format, future research can examine whether the lessons from financial reporting digitalization are transferable to the environmental, social, and governance context or whether distinct challenges arise.

Starting in 2023, the tagging requirements for ESEF reporters increased and may provide a valuable setting to explore how digital reporting affects information processing costs in a new

regulatory environment. Building on the evidence from the US, Blankespoor (2019) examines firms' voluntary decisions to extend tagging under the XBRL mandate. In contrast, the EU case differs in that the change is mandatory, requiring all firms to expand their tagging scope regardless of whether they perceive the additional tagging as beneficial. This creates a setting to investigate how firms adapt to regulatory-driven increases in disclosure granularity and whether such requirements improve information processing costs for investors and other stakeholders.

Bringing the main topics of the dissertation together, the EU setting in many ways follows the earlier implementation of XBRL in the US. However, while in the US the improvement of the EDGAR system and the introduction of XBRL occurred simultaneously in the late 2000s, the EU has taken a sequential approach. The implementation of ESEF and the forthcoming establishment of ESAP occur several years apart. This sequencing provides two aspects that may be of particular interest to researchers and policymakers. First, by separating the processes of digitalization and centralization, future studies can better isolate the individual effects of each mechanism on the information environment. Second, given the substantial time lag and the evolution of digital technologies and data use, it remains an open question to what extent the EU initiatives can achieve outcomes comparable to or even exceeding those observed in the US.

Overall, the digital transformation of firm reporting offers fertile ground for interdisciplinary accounting research. By examining how technological, institutional, and behavioral factors jointly shape the flow of information in capital markets, future studies can enhance both academic understanding and evidence-based policymaking. In doing so, they can contribute to the EU's broader goal of creating a more transparent, efficient, and integrated single market.

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