CESifo WORKING PAPERS

9344
2021

Original Version: October 2021
This Version: March 2022

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CESifo

**Impressum:**

CESifo Working Papers
ISSN 2364-1428 (electronic version)
Publisher and distributor: Munich Society for the Promotion of Economic Research - CESifo GmbH
The international platform of Ludwigs-Maximilians University's Center for Economic Studies and the ifo Institute
Poschingerstr. 5, 81679 Munich, Germany
Telephone +49 (0)89 2180-2740, Telefax +49 (0)89 2180-17845, email office@cesifo.de
Editor: Clemens Fuest
https://www.cesifo.org/en/wp
An electronic version of the paper may be downloaded
· from the SSRN website: www.SSRN.com
· from the RePEc website: www.RePEc.org
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CESifo *Working Paper No. 9344*

# Disclosure Deregulation of Quarterly Reporting


## Abstract

In this article we investigate the deregulation efforts resulting from the 2015 transposition of the EU's Transparency Directive into German law and analyze whether a reduction in the minimum content requirements for quarterly reporting increases information asymmetries and decreases firm value. Using a novel dataset of firms listed on the Frankfurt Stock Exchange we manually examine firms' quarterly reports for their content elements and construct a new quarterly reporting measure with an ordinal quality dimension. The results reveal that during the period from 2012 to 2019 lower quarterly reporting levels due to the deregulation on average increase information asymmetry and reduce firm value. We find that this effect is stronger for first-tier stocks and firms with high media coverage which makes quarterly reporting more important for these firms. The results are robust to potential selection effects regarding firms' choice of quarterly reporting content levels.


JEL-Codes: G140, G320.

Keywords: quarterly reporting, disclosure deregulation, financial reporting, interim management statement, transparency directive.

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# I. INTRODUCTION

The regulatory consensus on disclosure is crumbling. While the academic literature has widely documented beneficial effects of increased disclosures (e.g., Leuz and Verrecchia 2000; Botosan and Plumlee 2002; Brown and Hillegeist 2007; Butler et al. 2007; Daske et al. 2008; Ernstberger et al. 2012; Fu et al. 2012), authorities have begun to retrench disclosure requirements amid criticisms of cost and complexity (Kraft et al. 2018; Kajüter et al. 2019). Recently, investors in the EU have faced reduced reporting frequencies and, in Singapore, diminished amounts of mandatory information. In this article, we answer the question of whether a reduction in minimum content requirements for quarterly reporting increases information asymmetries and decreases firm value.

Regulators have consistently sought to increase the attractiveness of stock markets, to which low information asymmetry decisively contributes. Yet insight into how lower quarterly reporting levels as a result of *deregulation* affect information asymmetries is lacking. Fu et al. (2012) addressed voluntary retrenchments of quarterly reporting among firms in US in the 1950s and 1960s and found that a lower reporting frequency has no effect on information asymmetry. More recently, Knappstein et al. (2021) documented that the deregulation of quarterly disclosures corresponds to higher information asymmetry in the short run. Using an event study method, however, they neglect to tackle the question whether information asymmetry persists over time. In a similar vein, Hitz and Moritz (2019) find evidence that information asymmetries are increasing for firms that discontinue quarterly reporting as a result of deregulation. However, previous studies have used rather crude dichotomous measures to examine how lower quarterly reporting affects information asymmetries, rather than testing a more fine-grained ordinary quality dimension and/or long-term market effects. Lang and Stice-Lawrence (2015) show that a higher extent of information in annual reports leads to reduced information asymmetries while quarterly reporting per se increases information asymmetries. Considering an ordinary quality dimension of quarterly reporting might therefore better address the question of how reduced quarterly reporting levels affect information asymmetries.

The empirical evidence on how deregulation and subsequent lower reporting levels affect firm value is mixed. Several studies document improved liquidity as a result of higher reporting frequencies and content, but often at additional costs to firms in the form of preparation costs and low stock returns resulting in reduced market value (e.g., Bushee and Leuz 2005; Iliev 2010; Brüggemann et al. 2017; Kajüter et al. 2019; Breuer 2021). With respect to quarterly reporting in particular, Kraft et al. (2018), Ernstberger et al. (2017), and Fu et al. (2020) document myopic management behavior that results from quarterly reporting; that is, higher

reporting frequencies lead to short-termism, a decline in innovation, and, consequently, a reduction in investments. Hitz and Moritz (2019) find an increase in long-term investments in firms that choose to stop quarterly reporting, which suggests that mandatory quarterly reporting has a negative impact on firm value. By contrast, Greenstone et al. (2006) and Downar et al. (2018) document improved firm performance and firm value because of mandatory disclosure requirements, which makes the expected effect of reduced quarterly reporting levels ambiguous. Our study extends previous findings by investigating the long-term effects of deregulation and the type of firms that are particularly affected. More precisely, we investigate how reduced minimum content requirements for quarterly reporting affect information asymmetry and firm value over a period of four years after deregulation for first-tier and second-tier stocks

In our empirical analysis, we consider effects of the 2015 transposition of the EU's Transparency Directive Amending Directive (2013/50/EU) into German law. The regulatory change resulted in the repeal of mandatory quarterly reporting, and the Frankfurt Stock Exchange (FSE) consequently mandated only descriptive quarterly management statements for firms listed in the Prime Standard. While some firms preserved full quarterly reporting, others reduced the information provided for investors, constituting the quasi-natural experiment that we take advantage of in our empirical analysis.[1] Most prior studies on quarterly reporting requirements assume a causal relationship between regulatory changes and capital market effects (Bushee and Leuz 2005; Iliev 2010; Fu et al. 2012; Ernstberger et al. 2017; Kajüter et al. 2019; Knappstein et al. 2021), whereas we follow the call of Leuz and Wysocki (2016) and first link the regulatory change to changes in firms' disclosure practices and then estimate capital market effects through the changes in disclosure. Because firms can circumvent the lifting of mandatory disclosure through voluntary disclosure, we also consider firms that voluntarily report the same level of information after the deregulation in 2015 as a control group. We follow previous research by manually constructing a disclosure measure (Botosan 1997; Hail 2002; Francis et al. 2006). More precisely, we analyze firms' quarterly reports from 2016 to 2019 regarding their content elements and manually construct a new ordinal reporting measure that captures the quality of quarterly reports based on the previous requirements for mandatory quarterly reporting.

[1] While firms' *ex-post* choice to adopt a certain level of disclosure is endogenous, the *ex-ante* mandatory quarterly reporting constitutes an exogenous policy treatment, which is why we refer to the empirical setting as a quasi-natural experiment. Some firms that would otherwise have chosen a lower level of disclosure where exogenously forced to comply with higher levels of disclosure before the year 2015.

Overall, our findings confirm that reduced quarterly disclosure on average increases information asymmetry and diminishes firm value. The increase in information asymmetry is in line with prior findings that the removal of quarterly reporting increases information asymmetries (Hitz and Moritz 2019; Knappstein et al. 2021). Our results are also in line with the conjecture that the accuracy and quantity of information provided to investors affect the amount of private information in the market (Brown and Hillegeist 2007). However, we cannot confirm earlier results indicating that quarterly reporting has negative consequences for firm value (Bushee and Leuz 2005; Iliev 2010; Breuer 2021). By contrast, and in line with Greenstone et al. (2006) and Downar et al. (2018), our results indicate that disclosure requirements such as mandatory quarterly reporting increase firm value; however, firms opting for lower quarterly reporting levels face a decrease in firm value. We thus show that the observed capital market effects do not result from deregulation itself but from firms' new disclosure practices. We evidence that mandatory quarterly reporting is overall beneficial for market participants. Compliance costs, which are often argued to be burdensome especially for smaller firms (Leuz and Wysocki 2016), generally do not exceed the positive effects of steady information provision and enforcement.

Ample empirical studies show that capital market effects at a certain level of disclosure depend on firm characteristics such as firm size and analyst coverage (e.g., Bushee 1989; Lang and Lundholm 1996; Botosan 1997; Kajüter et al. 2019). Firm characteristics such as ownership concentration create firm-specific levels of agency costs, which imply different levels of informational demand (Jensen and Meckling 1976). Therefore, we analyze whether capital market effects are stronger for firms with a high or low information demand and show substantial heterogeneity with regard to informational demand. First-tier stocks and firms with high media coverage display stronger effects for liquidity and firm value. Thus, we also extend previous research on disclosure regulation by showing that information asymmetry increases and firm value decreases for first-tier stocks and firms with high media coverage, but not for firms that are smaller and less visible in the public eye. We also add to the understanding of the heterogeneity of regulatory action—namely, that quarterly reporting is more relevant for some stocks but not for others: first-tier stocks and stocks with high media coverage benefit from deregulation, whereas reducing quarterly reporting is irrelevant for smaller and less visible firms. Our results are opposite those of Knappstein et al. (2021), who find an increase in information asymmetries immediately after deregulation, especially for small firms. However, our results are consistent with those of Kajüter et al. (2019) and show information benefits of mandatory quarterly reporting for large firms.

The remainder of the paper is structured as follows. In the next section, we provide an overview of the regulation of quarterly financial reporting in Germany. Section 3 reviews the literature and develops our hypotheses. Section 4 describes our data and method. Section 5 reports results of our analysis and section 6 concludes the paper.

## II. INSTITUTIONAL FRAMEWORK

Quarterly reporting has a short tradition in Germany. German firms began publishing quarterly reports voluntarily only in the 1990s.[2] In 1998, quarterly reports became a regulatory requirement at the FSE for firms listed in the market segment "Neuer Markt." At this time, however, quarterly reports were not mandated by law. The Transparency Directive (2004/109/EC) ultimately harmonized the disclosure requirements for firms listed in a regulated market throughout the European Economic Area (EEA). In 2007, the transposition of this directive into German law required firms in the regulated market to publish a quarterly Interim Management Statement. The FSE expanded the quarterly reporting requirements to the publication of a full quarterly report for firms listed in the market segment "Prime Standard." Besides an Interim Management Report, a full quarterly report must include a condensed financial statement in accordance with IAS 34, consisting of a condensed statement of financial positions, which includes a comprehensive income statement, a cash flow statement, a change in equity statement, and explanatory notes. The Interim Management Report has to be prepared in accordance with German commercial law and contains information on significant opportunities and risks and their effect on the firm's future development as well as information on significant transactions with related parties.

Following criticism by the industry that the quarterly reporting requirements based on the Transparency Directive were too high and constitute a burden for small and medium-sized firms (European Commission 2013), the revised Transparency Directive (2013/50/EU) and its transposition into national law in 2015 resulted in a significant change in regular financial reporting. Disclosure requirements were drastically reduced by eliminating the obligation to publish an Interim Management Statement. The FSE responded with a deregulation of quarterly reporting and now requires only Interim Management Statements for firms listed in the Prime Standard.

Since 2016, firms listed in the Prime Standard have had various options for quarterly financial reports. To fulfill the minimum requirements, a descriptive presentation of the current

[2] For example, Volkswagen AG already published quarterly reports voluntarily in the 1990s.

business situation is sufficient. Firms may also voluntarily exceed the minimum requirements by reporting certain interim financial statement elements such as a condensed statement of financial positions, a comprehensive income statement, a cash flow statement, a change in equity statement, and explanatory notes. If all interim financial statement elements are included, the quarterly report constitutes an interim financial statement in accordance with IAS 34. Firms can voluntarily publish a complete quarterly financial report by adding an Interim Management Report to the interim financial statement. Thus, the deregulation has left firms with a wide range of reporting options, ranging from a descriptive quarterly report to a complete quarterly financial report. This deregulation has given rise to major differences in quarterly reports among firms listed in the Prime Standard, constituting the variation we use to empirically investigate the capital market effects of firms' disclosure decisions.

## III. HYPOTHESES

The underlying problem making financial reporting necessary is that insider information leads to information asymmetries in capital markets, which result in market inefficiency and, in the worst case, market failure (Glosten and Milgrom 1985; Kyle 1985). When less-informed investors are expected to trade with better-informed investors, they are no longer able to make efficient investment decisions (Kim and Verrecchia 1994; Easley and O'Hara 2004). As a result, they either exit the market or demand a price discount to compensate for their exposure to risk. Thus, adverse selection results in reduced liquidity because it becomes more difficult to trade shares quickly at low costs and with little price impact (Kyle 1985; Glosten and Milgrom 1985; Leuz and Verrecchia 2000; Leuz and Wysocki 2016). When the information acquisition of investors is viewed as exogenous, the relevance of financial reporting increases because it can reduce information asymmetries and the resulting adverse selection through the disclosure of information (Diamond 1985; Bushman 1991; Lundholm 1991; La Porta et al. 2000).

The theoretical link between financial reporting and liquidity can also be extended to firms' cost of capital and firm value (Amihud et al. 2005). High bid–ask spreads and low liquidity impose higher trading costs, for which investors demand a compensation in equilibrium, which in turn increases the required return and cost of capital (Amihud and Mendelson 1986; Gârleanu and Pedersen 2004). The adverse selection problem also transfers to primary markets, because investors are less willing to pay for a security at the time at which the firm issues shares, resulting in lower firm value (Baiman and Verrecchia 1996; Verrecchia 2001). In addition to the liquidity channel, there is a direct link between disclosure and both cost of capital and firm value. Because of incomplete information, some investors are not able to consider all firms in

the economy, resulting in inefficient and incomplete risk sharing. However, increased financial reporting of lesser-known firms can enrich a firm's investor base and improve risk sharing in the market, leading to lower cost of capital and higher firm value (Leuz and Wysocki 2016). There is also a direct link between disclosure and cost of capital arising from the estimation of risk (Brown 1979; Barry and Brown 1984, 1985). As the quality and quantity of firm-specific disclosure increases, uncertainty of future cash flows decreases, thereby moving the cost of capital closer to the risk-free rate and lowering betas (Lambert et al. 2007).

In recent decades, debate about the need to regulate corporate disclosures and, in particular, corporate quarterly reporting has intensified. While many scholars believe in the efficiency of markets (Sharpe 1964; Jensen 1968; Fama 1970), evidence indicates that markets do not always operate in the social interest (Gaffikin 2005). Examples of the need for regulatory intervention are the call for a mandatory quarterly reporting regime in the EU in the early 2000s, which led to the Transparency Directive in 2004, and calls by market participants for regulation of non-financial reporting (e.g., Jackson et al. 2020). The primary goal of disclosure requirements is to provide minimum information, in a timely manner, to parties that do not have access to information to make efficient decisions in financial markets (Financial Accounting Standards Board 2010).

Theory predicts both advantages and disadvantages of a mandatory reporting regime. On the one hand, by bringing a variety of information into a uniform format, disclosure regulation increases comparability and thus enables investors to allocate their capital more efficiently (Beaver 1998). Moreover, mandatory quarterly reporting implies a commitment to reveal information in good times and bad times, which increases information flow (Mahoney 1995; Rock 2002). The mandatory character of disclosure reflects a low-cost commitment tool, because in the case of voluntary commitment, investors anticipate the residual of withheld information (Leuz and Wysocki 2008). On the other hand, mandatory quarterly reporting comes at a compliance cost to firms, which can be very high especially for smaller firms (Beaver 1998). Without mandatory regulation, disclosure would be more flexible and compliance costs for some firms lower. Nevertheless, market participants would in some cases be confronted with disclosure levels below minimum standards and large differences between quarterly reports in terms of their quality. Moreover, under a voluntary reporting regime, only market participants themselves can reward or penalize erroneous disclosures, for example, through their buying and selling decisions. Although theoretical arguments suggest that quarterly reporting is related to management myopia, leading to short-termism and a decline in investments (Gigler et al. 2014), the mandatory character of disclosure regulation offers access

to penalties and remedies, which are limited or do not exist in private contracts (Leuz and Wysocki 2016). Thus, costs from fraud and agency conflicts can be mitigated through the enforcement systems of mandatory disclosure. Moreover, when information production is left to firms, there is a risk of information over- or underproduction that is not socially desirable (Beaver 1998; Healy and Palepu 2001; Leuz and Wysocki 2008).

While regulators strive to balance the costs and benefits of disclosure regulation, mandatory disclosure is particularly beneficial if firms are uniformly interested in disclosing information because, under these circumstances, the costs of compliance are lower for all firms (Leuz and Wysocki 2008). Furthermore, mandatory disclosure requirements are more beneficial if investors differ in their level of sophistication. Regulators may be concerned about the social welfare of investors and therefore use minimum disclosure requirements to narrow the information gap between informed and uninformed investors (Beaver 1998; Healy and Palepu 2001). Moreover, mandatory disclosure through standardization reduces the information processing costs for investors in a similar vein, as accounting standard provide a generally accepted language for the communication between management and investors (Healy and Palepu 2001). Mandatory disclosure regulation can therefore attract additional investors to the market and increase the available capital to the firm, which ultimately reduces the cost of equity and increases firm value.

Consistent with the theoretical conjecture that more disclosure increases liquidity, a wealth of literature documents a positive association between voluntary and mandatory disclosure, in terms of both content and frequency of disclosure and liquidity (e.g., Healy et al. 1999; Bushee and Leuz; 2006; Brown and Hillegeist 2007; Fu et al. 2012; Lang and Stice-Lawrence 2015). However, in the case of quarterly reporting, most empirical studies have examined the capital market effects of increased disclosure requirements (Butler et al. 2007; Fu et al. 2012; Kajüter et al. 2019); relatively few articles have studied the capital market effects of reduced levels of financial disclosure (for noteworthy exceptions, see Fu et al. 2012, Hitz and Moritz 2019; Knappstein et al. 2021). While Fu et al. (2012) find that an increase in reporting frequency is associated with lower information asymmetries, they cannot identify a significant change in information asymmetries for firms that voluntarily decrease their reporting frequency. Knappstein et al. (2021) find for firms listed at the FSE that reduced quarterly reporting affects information asymmetry as measured by bid-ask spreads and price impact. However, they only look at a short period between the publication of the quarterly report and the publication of the subsequent half-year report. Hitz and Moritz's (2019) results suggest that the increase in information asymmetries due to the removal of mandatory quarterly reporting in the EU also

holds over the longer term. However, they investigate firms that have generally stopped quarterly reporting. Our analysis improves on their study by considering the quality dimension of quarterly reporting using a more refined ordinal scale of information disclosure instead of a rough dichotomous measure. Furthermore, because many firms still implement changes in their quarterly reporting strategy four years after the deregulation, we consider a longer period than the two-year period in Hitz and Moritz (2019).

While quarterly reporting can be expected to decrease information asymmetries, the effects of disclosure on cost of equity and firm value are less clear. Several studies demonstrate improved liquidity as a result of quarterly reporting but often at an additional cost to companies, as the information gathering and cost of preparing a report result in reduced profits and, consequently, lower firm value (e.g., Bushee and Leuz 2005; Iliev 2010; Brüggemann et al. 2017; Kajüter et al. 2019; Breuer 2021). With respect to quarterly reporting in particular, Hitz and Moritz (2019) find an increase in long-term investments for firms that choose to stop quarterly reporting in the EU. In a similar vein, Kraft et al. (2018), Ernstberger et al. (2017), and Fu et al. (2020) document a positive relation between quarterly reporting and myopic managerial behavior. While these studies find that quarterly reporting in the sense of higher disclosure requirements lead to managerial myopia and have a negative effect on firm value, Greenstone et al. (2006) and Downar et al. (2018) document improved firm performance and/or firm value as a result of additional disclosure requirements.

The mixed results of empirical studies indicate that the theoretical debate over capital market effects of reduced mandatory disclosure is still unresolved and requires further empirical evidence. The current deregulation trend in quarterly reporting provides another piece of evidence that complements the many empirical studies investigating the capital market effects of tightening regulations. The majority of theoretical studies indicate that the accuracy and quantity of information provided to investors play a decisive role in reducing information asymmetries (Diamond and Verrecchia 1991; Kim and Verrecchia 1994; Easley and O'Hara 2004). Lang and Stice-Lawrence (2015) argue that a lower extent of information in annual reports and a reduced comparability leads to negative economic outcomes. As a result of the deregulation of quarterly reporting in 2015, firms can respectively reduce both the accuracy and quantity of information in quarterly reports. We expect that, on average, firms' quarterly reports are less accurate, provide less information to investors, and can no longer be easily compared with one another, requiring the provision of more private information to the market. Therefore, we hypothesize:

**H1a:** Lower quarterly disclosure levels increase information asymmetry.

**H1b:** Lower quarterly disclosure levels reduce firm value.

In addition to the general effects of lower quarterly disclosure on information asymmetries and firm value, it is unclear whether capital market effects of a lower disclosure level depend on specific firm characteristics. As previous research has shown, other factors such as firm size and analyst coverage can influence the relationship between lower quarterly reporting levels and information asymmetries and firm value, respectively (e.g., Lang and Lundholm 1996; Botosan 1997; Kajüter et al. 2019; Knappstein et al. 2021).

In theory, the capital market effects resulting from a mandatory quarterly reporting regime may be firm-specific. On the one hand, with mandatory quarterly reporting, lesser-known firms can credibly commit to a certain transparency level, making it easier for them to raise capital (Ferrel 2004; Leuz and Wysocki 2008). Because smaller firms are covered by fewer analysts (Bhushan 1989), they suffer from a weaker information environment, and therefore more quarterly reporting can increase their visibility in the capital market. On the other hand, a one-size-fits-all regulation of quarterly reporting may cause problems if the differences between firms are too great. For smaller firms, mandatory quarterly reporting can be overly burdensome due to high compliance costs such as preparation costs (Leuz and Wysocki 2016). Moreover, the shortage of financial analysts implies that information reaches investors in an unfiltered manner, which increases the abilities and incentives among investors to acquire private information, resulting in higher information asymmetries (Lang and Lundholm 1996). Because of the concentrated ownership structure of small firms (Demsetz and Lehn 1985), the content of quarterly reports only provides new information for a few investors, because large block holders typically have more timely access to superior information (Kajüter et al. 2019).

Larger companies with more public exposure can in theory show opposing capital market effects as a result of mandatory quarterly reporting. The impact of a lower quarterly reporting level on information asymmetries and firm value may be smaller due to their generally better information environment through greater analyst and media coverage (Collins et al. 1987; Bhushan 1989). Alternative information channels could reduce the relevance of quarterly reports in providing novel information (Brown and Hillegeist 2007). However, it may be precisely the large investor base and the high analyst and media coverage that create demand for more information (Firth 1979). According to agency theory, large firms have higher agency costs because they have more contracts that are also more complex and exhibit a more heterogeneous ownership structure than smaller firms (Jensen and Meckling 1979). Higher

agency costs imply a higher demand for disclosure of larger firms, because financial disclosure is a means by which managers' activity can be monitored and agency costs can be reduced (Jensen and Meckling 1976; Depoers 2000). Under the premise that larger firms use voluntary disclosure and continue to publish at the quarterly reporting level the same as under a mandatory quarterly reporting system, negative capital market effects due to withheld information could be avoided (Bertomeu and Cheynel 2013). By contrast, if these firms do not voluntarily disclose information and opt for a lower quarterly reporting level, the information supply to the capital market decreases, which would lead to negative capital market effects.

Empirical research suggests that firm size affects the impact of disclosure on capital market effects (Botosan 1997; Kajüter at al. 2019; Knappstein et al. 2021). Using a self-constructed disclosure index, Botosan (1997) finds a negative effect of disclosure on cost of equity for firms that are covered by fewer analysts, which highlights the importance of quarterly reporting for small firms. Brown and Hillegeist (2007) find that investor relation activities reduce information asymmetries as measured by the number of informed trades, which evidences the relevance of alternative disclosure activities. However, the transferability of the results to today's media environment is in doubt given the sample period from 1986 to 1996, because the higher frequency of information through Twitter and other media channels leads to more information supply and potentially also information overload among investors (Blankespoor et al. 2014; Rakowski et al. 2021). Knappstein et al. (2021) find that quarterly reporting is more important for small firms in Germany, which are prone to higher information asymmetries in the short run. This finding is in line with Iliev (2010) and Kajüter et al. (2019), who evidence that small firms incur relatively higher compliance costs as a result of increased reporting requirements, which in turn their firm value. Regarding the capital market effects of disclosure requirements for large firms, Kajüter et al. (2019) find that large firms in Singapore with greater analyst coverage and more dispersed ownership experience informational benefits of mandatory quarterly reporting.

Because both the theoretical and empirical literature show differential effects for the relationship between firm characteristics and disclosure, further empirical evidence is necessary. As mentioned previously, firms only benefit from mandatory quarterly reporting if they have a rather similar interest in the disclosure of information (Leuz and Wysocki 2008). In 2019, 316 firms were part of the FSE's Prime Standard.[3] Some of these firms have additional listings, such as in the benchmark index DAX, as a result of their market capitalization, which

[3] Historical listings of the FSE's Prime Standard firms were collected from www.dax-indices.com.

indicates that firms that are part of a benchmark index are more homogeneous than the entire universe of Prime Standard firms. Because agency costs differ as a result of stronger differences in firm characteristics, we assume a more diverse demand for information from Prime Standard firms than from firms that are part of a benchmark index. Consequently, the firms of a benchmark index should benefit more from higher quarterly reporting because they have a more heterogeneous investor base and suffer on average from higher agency costs. The theoretical argument that the demand for information increases with increasing agency costs is also supported by Kajüter et al.'s (2019) empirical study, which suggests a greater relevance of quarterly reporting in terms of information benefits for larger firms. Consequently, we assume stronger capital market effects of reduced quarterly reporting levels for firms with a higher demand for information and higher agency costs. We therefore hypothesize:

**H2:** The increase in information asymmetry and the reduction in firm value are stronger for firms with a high demand for information.

## IV. DATA AND METHOD

### Data

We identified all firms that have been listed in the Prime Standard of the FSE from 2012 to 2019 and consider them in our empirical analysis. For price and accounting information, we use data from Thomson Reuters Datastream.[4] To investigate firms' quarterly reporting level, we manually examined quarterly reports from firm websites. For our analysis of firms' information environment, we collected yearly information of index listings.[5] Our final sample consists of 361 firms over the period 2012 to 2019, resulting in 2,005 firm-year observations. In addition to index listings, we collected a number of press releases and newswires for each firm from Lexis Nexis to investigate firms' media coverage.

[4] We use XETRA as a basis for price information.
[5] Historical index listings are adopted from www.dax-indices.com.

## Variables

### *Dependent Variables*

We test H1 by analyzing the effect of lower quarterly disclosure levels on information asymmetry (H1a) and firm value (H1b). H1a is specified by two common liquidity measures: the bid–ask spread and price impact. In line with Daske et al. (2008) and Ernstberger et al. (2012), we calculate daily relative bid–ask spreads as the mean of daily differences between bid and ask prices divided by their average ((ask-bid)/(ask+bid)/2)).[6] We use the relative spread because total spreads possibly increase as the price of the securities increases (Gros and Wallek 2015). Our second variable is price impact, which measures illiquidity by the capacity to trade stocks without affecting the price. We follow Daske et al. (2008) and Fu et al. (2012) in calculating price impact as the yearly median of the Amihud (2002) illiquidity measure.

We test H1b using two common measures of firm value. Our first measure is the market-to-book ratio (MTB), which is the ratio between the market value of a firm's equity to the book value of its equity. Assuming that lower information risk leads to lower cost of equity and/or higher expectations of future cash inflows, a higher ratio suggests a higher valuation. The second measure is Tobin's Q, which captures the ratio between the market value of a firm and the replacement costs of all assets. A higher ratio captures a greater willingness of investors to provide funds for shares, thereby suggesting a higher firm value.

We test H2 using our liquidity and firm valuation measures as dependent variables to identify possible differences in quarterly reporting levels for different information environments. All our dependent variables are winsorized at the top and bottom 1% to account for outliers.

### *Explanatory Variables*

To test H1a and H1b, we need an adequate measure for the quality and extent of firms' quarterly reporting. In early studies, disclosure scores were often subject to measurement error (Leuz and Wysocki 2016). To mitigate this problem, the capital market effect of regulatory changes was estimated directly and roughly with the regulatory change as such. However, this approach led to further statistical concerns, because capital market effects are possibly linked to unrelated shocks. We do not rely on these reduced-form approaches. Rather, we first link the regulatory change of the transposition of the EU's Transparency Directive into German law to changes in reporting (i.e., changes in quarterly reporting). In a second step, we estimate the

[6] Results remain unchanged when we follow Fu et al. (2012) and regress our raw spread measure on the daily absolute return for each firm year and use the estimated intercept term.

capital market effects, which enables us to explore the mechanisms through which these effects occur. We thus respond to the call of Leuz and Wysocki (2016) to provide further evidence that a regulatory change indeed operates through disclosure changes and not through an unobserved event at the time of the regulatory change.

Because no established measure for quarterly reporting quality exists in the literature, we follow earlier literature and establish a self-constructed disclosure measure (Botosan 1997; Hail 2002; Francis et al. 2005). By focusing on quarterly reporting, which constitutes a specific type of disclosure, we construct a measure that has an ordinal quality dimension. Before deregulation, all firms listed in the FSE Prime Standard were required to publish a quarterly financial report, and a consistent quarterly reporting level was in place until 2015. Since the abolishment of mandatory quarterly financial reports, their content has been regulated in a more basic form. From 2016 onwards, only a descriptive presentation of financial position and performance and an explanation of material events and transactions and their effect on the financial position of the business have been required. As a result, firms have greater freedom with regard to the content elements in quarterly reports, and they could in principle also stick with the previously mandatory highest quarterly reporting level. This is the variation we use in our empirical analysis and which we contrast with the earlier mandatory disclosure regime. Therefore, we manually examined the quarterly reports of FSE Prime Standard firms for their content elements and coded the elements published in quarterly reports by firms from 2016 to 2019. To classify the content elements of quarterly reports, we follow the former regulatory requirements for quarterly financial reports. In particular, we analyze whether quarterly reports contain the following elements: interim financial statement in accordance with IAS 34, balance sheet, income statement, statement of cash flows, statement of changes in equity, notes, and interim management report.

Consequently, we generate the variable *QLevel*, which takes values from 1 (low quarterly reporting level) to 4 (high quarterly reporting level). Firms' quarterly reports are classified at *QLevel 4* (Quarterly Financial Report) if an interim financial statement and an interim management report are included, which corresponds to the previous mandatory requirements. Reports that follow IAS 34 but do not have an interim management report are classified at *QLevel 3* (Quarterly Report). If at least a balance sheet, an income statement, and a cash flow statement are included, the reports are classified at *QLevel 2* (Quantitative Quarterly Report). Reports with only two of the three elements are classified at *QLevel 1* (Descriptive Quarterly Report). Figure 1 gives an overview of the precise classification of *QLevel*.

[Figure 1 About Here]

To test H2, we need a measure that captures firms' demand for information. A large number of firm characteristics, such as firm size, financial needs, and ownership structure, determine the extent of agency costs and, thus, also the demand for information (Jensen and Meckling 1976). To examine whether capital market effects of quarterly reporting are stronger for firms with high information demand, we consider a measure in which as many firm characteristics as possible are homogeneous for a subsample of firms, which indicates a higher demand for information provision. We regard the listing in a benchmark index as such a measure. Based on market capitalization and stock exchange turnover, Prime Standard firms are entitled to be additionally listed in a benchmark index, such as DAX, MDAX, SDAX, or TecDAX, and thus receive greater visibility and public interest without having additional disclosure requirements. According to Botosan (1997), the listing in a benchmark index constitutes a valid proxy for the quality of the information demand because of the corresponding greater analyst coverage. Furthermore, we assume a more uniform firm size for index firms, because the market capitalization is per definition higher, and therefore the financial needs and ownership structure are also more similar for index firms. We therefore create the dummy variable *Index*, which is coded as 1 for firms that are part of an index and 0 otherwise. To test H2, we consider an interaction term of our variable of interest *QLevel* with the dummy variable *Index*.

In addition to the Index listing, we use a second measure to test the information demand of firms as outlined in H2. Namely, we measure firms' media coverage using the information flow through press releases and newswires, which is a measure of the public's demand for information that goes beyond professional investors' information demand. If public interest is greater and media covers the firm to a greater extent, we can assume that firms are more similar in that regard. Moreover, public information demand potentially goes beyond the demand for information that is justified by agency costs resulting from contractual relations. We manually count the sum of press releases and newswires for each firm *i* in year *t* and generate the variable *High_MC*, which equals 1 if the respective firm operates in a news environment with above-median media coverage and 0 otherwise.[7] Subsequently, we examine the interaction term of *QLevel* and *High_MC*.

[7] We use the median to compute this variable to account for potential outliers of firms with a high number of press releases and newswires.

### *Control Variables*

In line with prior research (Leuz and Verrecchia 2000; Daske et al. 2008; Fu et al. 2012), we use firm size, share turnover, and return volatility as control variables when testing H1a. *Size* is the natural logarithm of the average market value of firms' equity for the prior calendar year. Share turnover is calculated as the natural logarithm of the yearly median value of daily share trading volume divided by the market capitalization on that day. Return volatility is the natural logarithm of the standard deviation of daily returns during the year.

We follow Daske et al. (2008) and Meser et al. (2015) in using firm size, leverage, return on asset (*ROA*), and firm growth as control variables when testing H1b. In line with Fu et al. (2012), we calculate leverage as the total liabilities divided by the sum of total liabilities and beginning-of-year market value of equity.[8] *ROA* is defined as a firm's net income divided by its total assets. We measure firm growth as the natural logarithm of one plus the percentage change in book value of equity.[9] All of our control variables are winsorized at the top and bottom 1% to account for outliers.[10]

## Method

### *Baseline Model*

As a starting point, we estimate a pooled OLS regression explaining information asymmetry and firm value with quarterly reporting levels. Because the relation between our dependent and explanatory variables might depend on the particular information environment of a firm, we include index fixed effects. Our basic regression model is as follows:

$$DV_{Information\ Asymmetry/Firm\ Value\ it} = \alpha + \beta_1 QLevel_{it} + \beta_2 \mathbf{Controls}_{it} + \varepsilon_{it}, \quad (1)$$

where *DV* is the dependent variable measuring information asymmetry or firm value; *QLevel* is our variable of interest measuring the level of quarterly reporting; and **Controls** is a vector of control variables.

In the next step, we follow Fu et al. (2012) and control for time-invariant unobserved variation. A Hausman test (1978) indicates that random effects would be inconsistent, which is why we estimate a fixed effects regression with clustered standard errors at the firm level.

[8] Results remain unchanged if we calculate leverage following Daske et al. (2008) as the ratio of total liabilities to total assets.
[9] Results remain unchanged if we use asset growth as an alternative.
[10] Results remain unchanged if we use unwinsorized values.

***Causal Inference***

Quarterly financial reporting in the Prime Standard is no longer mandatory after the year 2015; hence the observed level of quarterly reporting reflects firms' deliberate choices. Because only those firms that benefit the most from it might decide to reduce the content level of quarterly financial reporting, the pooled and panel regression estimates of *QLevel* potentially suffer from endogeneity in the form of selection bias. We address this concern in two ways: (1) we implement an instrumental variable (IV) approach, and (2) we generate an artificial control group of firms.

For the instrumental variable approach to be successful, we need to find a valid instrument. A valid instrument is strongly correlated with the endogenous variable (*relevance*), but uncorrelated with the error term (*exogeneity*). We follow Fu et al. (2012) and use Year Index as the instrumental variable, which is calculated as the calendar year of the respective quarterly report minus 2019, the year when our sample period ends. Thus, the Year Index is 0 for observations from the year 2019 and 7 for the year 2012. We assume that the FSE's action to abolish mandatory quarterly financial reporting starting in 2016 was to some degree unexpected and therefore led to decreasing quarterly reporting levels over time. This implies a positive relation between the quarterly reporting level *QLevel* and the Year Index (*relevance*). At the same time, the year index should not systematically affect liquidity and firm value (*exogeneity*).

While the exogeneity assumption of the instrument cannot be statistically tested, we investigate the first-stage regression to test for the relevance of our instrument. According to Bound et al. (1995), values of partial $R^2$ are a useful indicator of the quality of the instrument. The partial $R^2$ for our information asymmetry model is 39.7% and for our firm value model 39.5%, which indicates that the instrument is sufficiently robust. In addition to the partial $R^2$ statistics, we follow Stock and Yogo (2005) and test for the relevance of our instrumental variable by performing a Wald test. Our results lead us to reject the null hypothesis of weak instruments for both our information asymmetry and firm value models. In all cases, the resulting F-statistics are greater than 10, which indicates that the instruments have an influence on the endogenous variable that can be distinguished from 0. Thus, both tests suggest that we do not have a weak instrument problem. We estimate two-stage least squares (2SLS) simultaneously with heteroscedasticity-robust standard errors (Papies et al. 2017).

Given Fu et al.'s (2012) assertion that the year index does not systematically affect liquidity and firm value cannot be tested, we consider another way to establish causality. In line with Daske et al. (2008), we use a difference-in-differences approach to examine the change in information asymmetry and firm value. In a first step, we test the parallel trend assumption and

compare differences between treatment and control firms that have not changed their quarterly reporting level for the period before and after the change in mandatory quarterly reporting, respectively. Treatment and control firms should share parallel trends in information asymmetry and firm value in the absence of treatment (Angrist and Pirschke 2008). To analyze this assumption, we compute the mean values of our dependent variables for information asymmetry and firm value for each year of the pre-treatment period. Panel A of Figure 2 shows the trend for bid–ask spread and price impact and panel B for MTB and Tobin's Q. The panels show parallel trends for all variables except MTB. The mean values of MTB show a somewhat larger decrease from 2014 to 2015 for the control group than for the treatment group. We test the difference in the decrease for MTB from 2014 to 2015 between the control and treatment groups and find no statistically significant differences ($p = 0.5219$).

While the parallel trends give us confidence that the difference-in-differences regression produces valid results, we use a matched control sample approach to provide further robustness for our identification strategy. Following Fu et al. (2012) and Knappstein et al. (2021), we generate an artificial control group using propensity score matching. The matched control sample compares changes in information asymmetry and firm value for firms that reduced their quarterly reporting level with otherwise similar firms that did not. Put differently, firms that have not changed their quarterly reporting level serve as a control group. We require the matched observations to have the same year-industry combination as the treatment observation, which allows us to capture intertemporal changes in industry- and market-wide factors. Furthermore, we match firms that are closest to the treatment observation in terms of firm size and use a one-to-many matching procedure to increase precision regarding the similarity in firm size.[11] We also control for other possible time-variant drivers of information asymmetry and firm value by adding additional control variables such as share turnover, return volatility, *ROA*, leverage, and firm growth.

We estimate the following difference-in-differences regression:

$$DV = \alpha + \beta_1 Post_{it} + \beta_2 Treat_{it} + \beta_3 Post_{it} \times Treat_{it} + \beta_4 \mathbf{Controls}_{it} + \varepsilon_{it}, \quad (2)$$

where *DV* is our dependent variable measuring information asymmetry or firm value. *Post* equals 1 for the periods after the change in quarterly reporting level starting in 2016 and 0

[11] Because control firms are a smaller group than the treatment firms, one-to-one matching would result in a stark loss of observations. The results remain unchanged when we use a kernel matching procedure to identify control group firms. We also consider time trends in our difference-in-differences design, and the results remain unchanged.

otherwise. *Treat* equals 1 if the firm changed its quarterly reporting level and 0 otherwise. The interaction term produces our coefficient of interest, which represents the incremental effect of quarterly reporting on bid–ask spread, price impact, *MTB*, and *Tobin's Q* not resulting from time trends, firm size, and industry factors. **Controls** is a vector of control variables.

[Figure 2 About Here]

***Interaction Effects***

To investigate H2, we interact our variable of interest *QLevel* with the dummy variable *Index*. The interaction between *QLevel* and the dummy variable *Index* captures the impact of the overall information environment on the effect of information disclosure. We estimate the following regression:

$$DV_{IA/FVit} = \alpha + \beta_1 QLevel_{it} + \beta_2 Index_{it} + \beta_3 QLevel_{it} \times Index + \beta_4 \mathbf{Controls}_{it} + \varepsilon_{it}, \quad (3)$$

where *DV* is our dependent variable measuring information asymmetry or firm value and *QLevel* and *Index* are the variables of interest and respectively capture the quarterly reporting level and whether firms are listed in a benchmark index. Following Botosan (1997) and Burks et al. (2019), we include both constitutive terms *QLevel* and *Index* as independent variables in our model, because omitting the constitutive term will result in biased and inconsistent estimates (Greene 2003). **Controls** is a vector of control variables.

We further test H2 with the interaction of *QLevel* and *High_MC,* which captures the impact of quarterly reporting level conditional on the extent of media coverage and press releases. We estimate the following regression:

$$DV_{IA/FVit} = \alpha + \beta_1 QLevel_{it} + \beta_2 High\_MC_{it} + \beta_3 QLevel_{it} \times High\_MC + \beta_4 \mathbf{Controls}_{it} + \varepsilon_{it}, \quad (4)$$

All regressions include firm fixed effects, and standard errors are clustered at the firm level.

## V. RESULTS

### Descriptive Statistics

Table 1 presents the composition of the variable *QLevel*, which measures the content elements of quarterly reports for the sample firms. Because quarterly financial reporting was mandatory until 2015, all firms' quarterly reports from 2012 to 2015 contain all relevant content elements. Immediately after deregulation, we find that many firms chose to stop preparing interim financial statements in accordance with IAS 34. Nevertheless, most firms still prepared a balance sheet, income statement, and cash flow statement. In addition, half the firms immediately took advantage of the deregulation to dispense with condensed notes and an interim management report. After the regulatory change, we observe a steady decline in reporting with the exception of the condensed balance sheet and income statement. In 2019, only about one-third of the firms listed in the FSE's Prime Standard still prepared interim financial statements in accordance with IAS 34 and an interim management report.

Table 2 shows the distribution of firms in our sample by the content level of quarterly reports. In the period from 2012 to 2015, when quarterly financial reporting was mandatory for Prime Standard firms, 100% of our sample firms reported at the highest quarterly reporting level. After the year 2015, when quarterly financial reporting was no longer mandatory, the content of quarterly financial reports declined steadily. In 2016, 44% of the Prime Standard firms still published quarterly reports at level four of *QLevel*, while the remaining firms reduced their reporting content. The level of quarterly reports persistently declined over the years, potentially because many firms first wanted to observe the market effects when peer firms deviated from the mandatory reporting regime. Finally, in 2019, only 24% of Prime Standard firms voluntarily published a quarterly report at level four of *QLevel*.

[Tables 1 & 2 About Here]

Table 3 presents descriptive statistics. The mean values of our information asymmetry measures (bid–ask spread and price impact) are 0.97 and 9.21. The values are in line with other studies (Knappstein et al. 2021) and appear reasonable for firms listed in the Prime Standard. Price impact, however, is high in comparison with older samples and international standards (Daske et al. 2008; Fu et al. 2012). Our measures for firm value, *Tobin's Q* and *MTB*, have mean values of 1.76 and 2.9. The mean balance sheet size (*Size*) is 5,033,659 EUR.[12] Our

[12] To give an intuitive interpretation, we present unlogarithmised values of *Size* for the descriptive statistics.

control variables *LnVolatility* and *LnTurnover* have mean values of –4.11 and –6.98, respectively, which are comparable to the sample used by Fu et al. (2012). The mean values of *LnLeverage* and *LnGrowth* are –1.02 and 0.04. *ROA* has a mean value of 0.21. All these values are within plausible ranges.

Table 4 reports Spearman and Pearson correlation coefficients for our dependent and explanatory variables. The correlation between the level of quarterly reporting and the variables measuring information asymmetry and firm value implies that information asymmetry is higher and firm value is lower for firms with a high quarterly reporting level, providing the first evidence in line with our hypotheses. Our two information asymmetry measures and the two firm value measures are respectively positively correlated, indicating that they are measuring the same theoretical concepts. In addition, the content level of quarterly reporting is weakly negatively correlated with *LnSize* and *LnLeverage* and weakly positively correlated with *LnTurnover*, *LnVolatility*, *ROA* and *LnGrowth*, indicating that multicollinearity is not a severe problem.

[Tables 3 & 4 About Here]

**Regression Results**

Table 5 presents regression results for our information asymmetry measures with bid–ask spreads as the dependent variable in panel A and price impact as the dependent variable in panel B. The "Pooled" column reports results of the OLS regression with index fixed effects, the "fixed effects" column reports results from the OLS fixed effects panel regression, and "2SLS" reports the results of our IV approach. In panel A, we find negative coefficients for our variable of interest *QLevel* across all regression models. Its value ranges from –0.029 to –0.053, suggesting that bid–ask spreads increase between 0.029 and 0.053 when quarterly reporting levels decrease by one level. The coefficient of *QLevel* is significant at the 1% level for our pooled OLS, fixed effects panel, and IV regression. In line with our expectation that quarterly reporting level affects bid–ask spreads negatively (Fu et al. 2012; Hitz and Moritz 2019; Knappstein et al. 2021), these results provide evidence that information asymmetry increases when quarterly reporting level decreases. All regressions show statistically significant coefficients for our control variables *LnSize*, *LnTurnover* and *LnVolatility* at the 1% level, implying that they provide a significant contribution in explaining bid–ask spreads. The signs of the coefficients are in line with prior literature (Daske et al. 2008; Fu et al. 2012; Ernstberger et al. 2012; Knappstein et al. 2021).

In panel B, coefficients of *QLevel* in the OLS regressions are negative and not significant in any of the regression models. With regard to bid–ask spreads, we find some evidence in line with H1a—that quarterly reporting levels have a negative effect on price impact (Fu et al. 2012; Knappstein et al. 2021). All control variables show statistically significant coefficients.

In line with the results of the bid–ask spread regressions, our results in Table 5 indicate that the deregulation of quarterly reporting and the subsequently reduced quarterly reporting levels are associated with higher information asymmetries in the long run. While we take into account that firms may keep up with high quarterly reporting levels voluntarily, we find a negative effect for firms that reduce the accuracy and quantity of information in quarterly reports in response to deregulation. Our findings are thus in line with prior studies showing higher information asymmetries for firms that have eliminated quarterly reports in response to the deregulation in the EU (Hitz and Moritz 2019; Knappstein et al. 2021). They are also consistent with results that highlight the relevance of accuracy and quantity of information to mitigate information asymmetries (Lang and Stice-Lawrence 2015). Our findings indirectly contrast with theoretical and empirical evidence that quarterly reporting increases private information in the market (Brown and Hillegeist 2007). Rather, less detailed quarterly reports lead to higher information asymmetries, presumably causing some investors to gather private information. Thus, we find evidence for and thus cannot reject H1a.

While an increase in information asymmetry is also evident in prior research, the question remains whether increased liquidity comes at the costs of reduced firm values (Bushee and Leuz 2005; Iliev 2010; Breuer 2021). Table 6 reports the results of our firm value models with *MTB* as the dependent variable in panel A and *Tobin's Q* as the dependent variable in panel B. In panel A, we find a positive relationship between *MTB* and our variable of interest *QLevel* in all regression models. In the preferred IV regression, the coefficient is significant at the conventional 5% level. As expected, the effect of quarterly reporting level on firm value is positive and a decrease in the quarterly reporting level by one reduces *MTB* by between 0.217 and 0.499. Hence, our results evidence a decrease in firm value if quarterly reporting level declines. Our control variables show robust signs across all regression models and are mostly statistically significant at the 1% and 5% levels. While the negative effect of *LnLeverage* and *LnGrowth* on valuation can be attributed to the possible uncertainty of firms with a high leverage and growth firms, the negative sign of *ROA* is rather unexpected. Using *Tobin's Q* as the dependent variable in panel B, again, our variable of interest *QLevel* is positive and statistically significant across all models. Most importantly, the coefficient of *QLevel* is significant at the 1% level in the preferred IV regression. Its value ranges between 0.067 and

0.214, indicating that *Tobin's Q* decreases between 0.064 and 0.167 standard deviations if quarterly reporting declines by one. The coefficients of our control variables are mostly statistically significant at the 1% and 5% levels and signs are consistent with theoretical predictions. Overall, results for our firm value models are in line with our theoretical expectation, indicating that a lower level of quarterly reporting does not lead to more private information in the market after all. Therefore, private information apparently does not increase as a result of lower quarterly reporting levels, leading to an increase in the cost of equity and investors demanding a higher-risk premium (Daske et al. 2008; Ernstberger et al. 2012). Our results show that increased liquidity does not come at the cost of reduced firm values (Bushee and Leuz 2005; Iliev 2010; Breuer 2021). Evidence by Hitz and Moritz (2019) that quarterly reporting has a negative impact on long-term investments and company values is not supported by our analysis. Our firm value results give no indication of managerial short-termism, which is often associated with quarterly reporting (Ernstberger et al. 2017; Kraft et al. 2018; Fu et al. 2020). Rather, our results are consistent with Greenstone et al. (2006) and Downar et al. (2018), who also find an increase in firm value due to additional disclosure requirements. Following these results, H1b is supported by evidence that lower quarterly reporting levels lead to lower firm values.

In general, while previous studies relate capital market effects directly to the regulatory change, we link the observed capital market effects to the extent of reduced quarterly reporting levels subsequent to deregulation. Our results reveal an increase in information asymmetry and a decrease in firm value for firms with lower quarterly reporting levels. Therefore, we find evidence that mandatory quarterly reporting is beneficial for market participants overall. The cost of compliance is apparently not high enough to outweigh the positive impact of having to provide and enforce information on an ongoing basis.

[Tables 5 & 6 About Here]

**Robustness**

To test for the robustness of our results and to consider possible endogeneity concerns, we adopted a matched control sample approach. Panel A of Table 7 reports the results of our information asymmetry measures bid–ask spread and price impact. We find significant, positive coefficients for the interaction term in the bid–ask spread and price impact regression, which provides some evidence that the increase in information asymmetry is not exclusively due to selection effects. Thus, firms opting for a lower quarterly reporting level show higher bid–ask

spreads and price impact than control group firms, which indicates higher information asymmetries. This result provides evidence in line with H1a.

Panel B of Table 7 shows the results for our valuation measures *MTB* and *Tobin's Q*. The interaction term is not statistically significant, indicating that deregulation has no impact on firm value itself. We consider at least three explanations for this. First, because here we are investigating the regulatory change as such, rather than the change in firms' quarterly reporting, the non-significant results might be due to confounding effects. Second, the matching procedure reduced the sample size, which negatively affects the power of our statistical analysis. Third, according to Fu et al. (2012), market participants perceive an increase in reporting as a permanent change but a reduction in reporting only as a temporal policy measure. Nevertheless, our results provide evidence of higher information asymmetries among firms that reduce their quarterly reporting level (H1a) but do not provide additional evidence of reduced firm value (H1b).

[Table 7 About Here]

**Information Environment**

In this section, we examine whether giving firms more leeway with regard to disclosure is an efficient alternative to mandatory disclosure. Table 8 reports results of regressions for our information asymmetry measures as the dependent variable in panel A and firm value measures as the dependent variable in panel B. Our variable of interest identifying the impact of the information environment is the interaction term between the quarterly reporting level (*QLevel)* and index membership (*Index)*. In panel A, we find that the coefficient of *QLevel*×*Index* has a negative value of –0.063 for bid–ask spreads and is statistically significant at conventional levels. For our second measure *price impact*, we also find a negative effect of quarterly reporting level on *price impact* if the firm is part of an index. The coefficient of *QLevel*×*Index* has a value of –1.622 and is significant at the 1% level. Both coefficients of *QLevel* are non-significant in our regressions with *bid–ask spreads* and *price impact*, indicating that for the non-index firms in our sample, information asymmetries are unrelated to quarterly reporting levels. The more concentrated ownership structure of non-index firms is a plausible explanation for why we do not observe any benefits of higher levels of quarterly financial reporting (Jensen and Meckling 1976; Kajüter et al. 2019).[13] Overall, our results show stronger effects of lower

[13] The ownership structure of Demire AG is an example of a firm that is not part of a benchmark index but has a concentrated ownership structure. The annual report from 2019 mentions that only 11% of the shares are in free float.

quarterly reporting on information asymmetry for index firms than for non-index firms. In particular, evidence shows that for index firms, a higher level of reporting reduces information asymmetries, which supports the notion that index firms have higher agency costs that make quarterly reporting worthwhile. Higher agency costs presumably exist in index firms because of larger differences in informational demand due to a more dispersed ownership structure (Jensen and Meckling 1976; Despoers 2000). Presumably because index firms are more homogeneous in different firm characteristics, reducing quarterly reporting leads to an overall increase in information asymmetries. Our results are in contrast with those of Knappstein et al. (2021), who find an increase in information asymmetries in the short run especially for smaller firms that chose to stop quarterly reporting. However, they perform a split-sample analysis, which potentially suffers from possible bias, because the split allows for a differential influence of all regression parameters on the variable of interest. Because index firms are in general larger firms, our results are in line with Kajüter et al. (2019) and show information benefits of mandatory quarterly reporting for these firms.

Panel B of Table 8 shows results for the dependent variables *MTB* and *Tobin's Q*. First, in the regression with *MTB* as the dependent variable, we find a weakly significant, positive coefficient of 0.214 for the interaction term *QLevel×Index*. Our results suggest that *MTB* decreases more severely for index firms if quarterly reporting level declines. Regarding our second measure of firm value, regressions with *Tobin's Q* as the dependent variable provide similar results. The coefficient of *QLevel×Index* is 0.083 and weakly significant at the 10% level, suggesting that Tobin's Q decreases more for index firms if quarterly reporting level declines. Therefore, we find that first-tier stocks that receive greater attention and whose information is of greater interest show a consistent negative effect of quarterly reporting levels on firm value. Although the coefficients are only weakly significant at the 10% level, the direction of the effect is as predicted and consistent across all specifications. In line with Kajüter et al. (2019), our results indicate that informational benefits are also reflected in firm value and do not lead to reduced firm values because of myopic managerial behavior. We therefore do not reject H2.

[Table 8 About Here]

Next, we examine whether increased media attention affects mandatory disclosure. Table 9 reports results of regressions for our information asymmetry measures as the dependent variable in panel A and firm value measures as the dependent variable in panel B. Our variable of interest

identifying the impact of the information environment is the interaction term between the quarterly reporting level (*QLevel)* and the extent of media coverage (*High_MC)*. In panel A, we find that the coefficient of *Qlevel×High_MC* has a value of –0.057 for *bid–ask spread* and is statistically significant at the 1% level. For our second measure *price impact*, we find a negative effect of quarterly reporting level on *price impact* if firms have above-median media coverage. The coefficient of *Qlevel×High_MC* has a value of –1.418 and is also significant at the 1% level. Overall, this corresponds to the assumption that companies with a large media presence receive greater attention from market participants and are more visible in the public eye, which makes a continuous demand for information inevitable (Firth 1979). Therefore, these firms show stronger effects of lower quarterly reporting on information asymmetry than firms with a low amount of media coverage.

Panel B of Table 9 shows the results for the dependent variables *MTB* and *Tobin's Q*. First, in our regression with *MTB* as the dependent variable, we find a significant, positive coefficient of 0.223 for the interaction term *Qlevel×High_MC*. Our results suggest that *MTB* decreases more severely for firms with a high extent of media coverage if quarterly reporting level declines. Regarding our second measure of firm value, regressions with *Tobin's Q* as the dependent variable find similar results. The coefficient of *Qlevel×High_MC* has a value of 0.087 and is positive and significant at the 10% level, suggesting that Tobin's Q decreases more for firms with a low extent of media coverage if quarterly reporting levels decline. Therefore, we find that firms with a high extent of media coverage and whose information is of public interest show a consistent negative effect of quarterly reporting levels on firm value. We therefore do not reject H2.

Overall, we find differential effects for firms whose disclosure and information are of public interest. First, the observed capital market effects of quarterly reporting levels on information asymmetries and firm valuation are stronger for index firms. Second, we find that firms with above-median media coverage show negative effects for reduced levels of quarterly reporting on information asymmetry and firm valuation. We find evidence that firms in the Prime Standard are subject to different information demands, because capital market effects of a lower reporting level are stronger for firms with higher information demand. We assume that index firms and firms with a high media coverage are more homogeneous in various firm characteristics such as size, financial needs, and ownership structure that also come along with higher agency costs. Firms with higher agency costs have a high information demand, making quarterly reporting more beneficial. Consequently, we cannot reject H2 and find that an increase in information asymmetry and the reduction in firm value are stronger for firms that are subject

to high demand for information. Our findings are thus in line with those of Kajüter et al. (2019) that large firms benefit from mandatory quarterly reporting. Moreover, our results emphasize the relevance of accuracy and quantity of quarterly reports for large firms. Arguably, the information demand of non-index firms and firms with low media coverage is generally low. Consequently, they do not benefit from quarterly reports.

[Table 9 About Here]

## VI. CONCLUSION

The current trend towards deregulation of quarterly reporting worldwide once again raises the question of the optimal level of mandatory financial reporting. We address this issue by investigating an instance of deregulation for Prime Standard firms of the FSE in Germany in 2015, whereby the removal of mandatory quarterly financial reporting has led to widespread reductions in quarterly reporting levels. We use a new disclosure measure for quarterly reporting by manually examining the change in disclosure practices in quarterly reports after the deregulation of 2015.

The evidence shows that reduced quarterly disclosure on average increases information asymmetry and diminishes firm value. Our findings are in line with and support prior empirical findings that the removal of quarterly reporting increases information asymmetries between investors (Hitz and Moritz 2019; Knappstein et al. 2021). We extend extant literature by showing that the increase in information asymmetries also holds in the long run. We further find that accuracy and quantity of information provided to investors are crucial aspects for the extent of information asymmetries in the market (Brown and Hillegeist 2007). Our results improve on prior empirical evidence by showing that capital market effects do not occur through deregulation per se but through changes in firms' disclosure practices. In line with Greenstone et al. (2006) and Downar et al. (2018), our results indicate that disclosure requirements such as mandatory quarterly reporting increase firm value and firms opting for lower quarterly reporting levels must accept a decrease in firm value. Compliance costs and managers' myopic behavior are apparently not large enough to outweigh the positive effects of commitment to steady flow of information and enforcement. Therefore, our results support the regulation of disclosure through quarterly reporting. We also find that first-tier stocks and firms with high media coverage react more strongly to deregulation in terms of liquidity and firm value. Thus, our results also add to the understanding of heterogeneous responses to regulatory action, in the sense that quarterly reporting is more relevant for some stocks but not for others.

More precisely, firms with high information demand benefit from quarterly reporting, whereas reducing quarterly reporting is irrelevant for smaller and less visible firms. Therefore, we provide evidence in favor of mandatory quarterly reporting at the previous highest level of a quarterly financial report for first-tier stocks and stocks with high media coverage.

Our results have clear limitations. Classification based on the content of quarterly reports is only one possible approach to measuring the extent and quality of quarterly reports. Therefore, our results may be affected by other characteristics of quarterly reports, such as their readability and complexity. Nevertheless, we consider our classification based on the content elements contained in quarterly reports a valid measure for the quality dimension of quarterly reports—that is, the accuracy and quantity of information resulting from quarterly reports. Moreover, firm-specific missing variables such as the readability and complexity of reports will be captured by firm fixed effects in our empirical model.

The usefulness of quarterly reporting has been called into question in Asia on the Singapore Stock Exchange, in Europe, and in the US (European Commission 2013; SEC 2016; Singapore Exchange 2018). Our findings may therefore be of interest to regulators, exchange authorities, and firms worldwide. While quarterly reporting has previously been assumed to be an additional burden for small firms, the commitment costs are not so high as to outweigh the positive effects of regulating quarterly reporting. From the perspective of investor protection, regular and comprehensive reporting seems to be necessary especially for firms subject to high demand for information.

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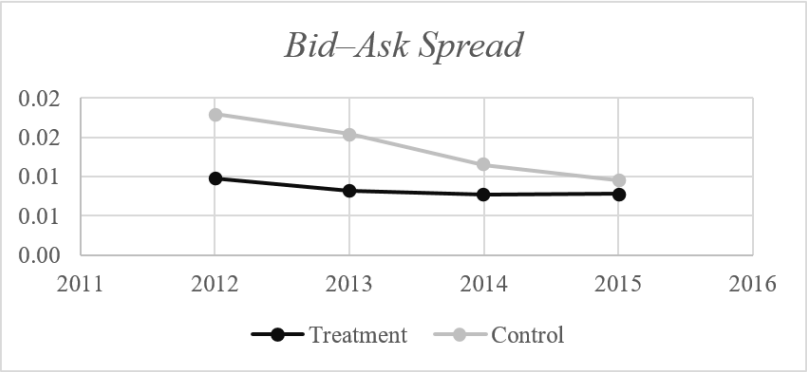
**Figure 1: Classification of Quarterly Reports**

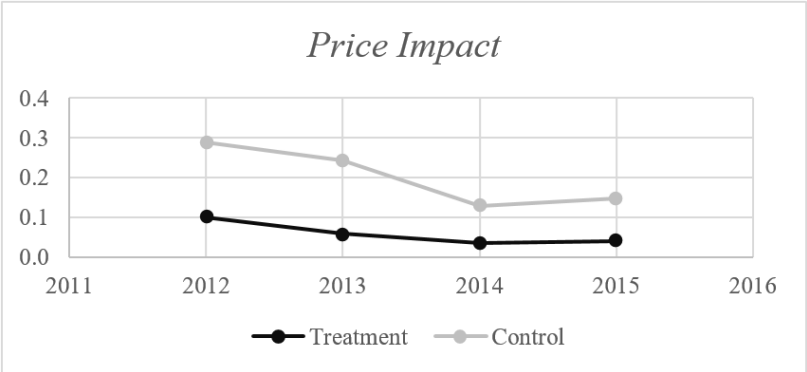
| Definition of Quarterly Report | Content Level | Content Elements |
|---|---|---|
| Quarterly Financial Report | QLevel 4 | Interim Financial Statement in accordance with IAS 34 and Interim Management Report |
| Quarterly Report | QLevel 3 | Interim Financial Statement in accordance with IAS 34 |
| Quantitative Interim Management Statement | QLevel 2 | At least a condensed statement of financial positions, of income and of cash flows |
| Descriptive Interim Management Statement | QLevel 1 | Less than a condensed statement of financial positions, of income and of cash flows |

Classifications of Quarterly Reports were assigned by analyzing firms' quarterly reports from 2016 to 2019. Quarterly reports were obtained from firm websites. Prior to 2016, the disclosure of quarterly financial reports (QLevel 4) was mandatory for our sample firms.

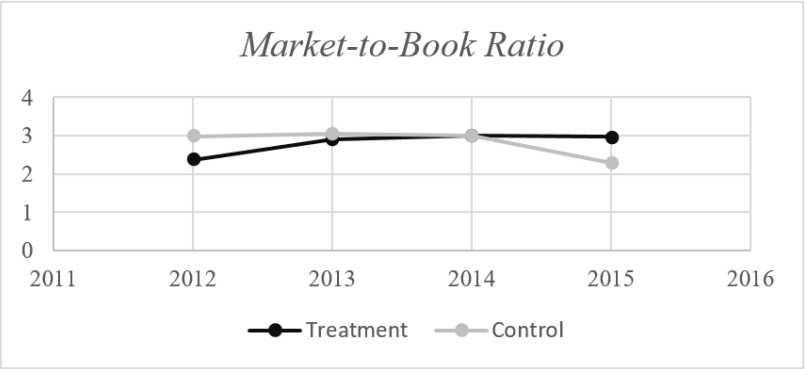
**Figure 2: Common Trend Assumption PRE-Period**

**Panel A: Information Asymmetry Measures**




**Panel B: Valuation Measures**



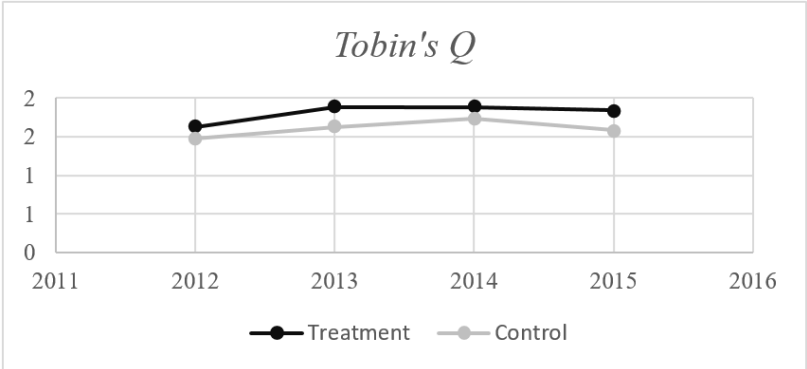



**Table 1: Content Elements of Quarterly Reports**

| *year* | *N* | IAS 34 | Balance Sheet | Income Statement | Cash Flow Statement | Statement of Changes in Equity | Notes | Interim Management Report |
|---|---|---|---|---|---|---|---|---|
| 2012-2015 | 1005 | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| 2016 | 239 | 50% | 94% | 94% | 91% | 68% | 54% | 51% |
| 2017 | 239 | 40% | 92% | 91% | 86% | 58% | 42% | 41% |
| 2018 | 257 | 32% | 92% | 92% | 85% | 51% | 35% | 34% |
| 2019 | 265 | 27% | 90% | 90% | 82% | 46% | 30% | 31% |

The sample includes 2,005 firm-year observations for the period 2012–2019. Before deregulation, all firms were required to publish a quarterly financial report. From 2016 onward, quarterly reports were hand-collected from firm websites and manually examined for the following elements: interim financial statement in accordance with IAS 34, balance sheet, income statement, cash flow statement, statement of changes in equity, notes, and interim management report. The content elements included in quarterly reports for firm i in year t provide the database for the self-constructed explanatory variable *QLevel*.

**Table 2: Quarterly Reporting of Prime Standard Firms**

| year | *N* | *QLevel=1 (%)* | *QLevel=2 (%)* | *QLevel=3 (%)* | *QLevel=4 (%)* | *Mean QLevel* |
|---|---|---|---|---|---|---|
| *2012–2015* | 1,005 | 0.00% | 0.00% | 0.00% | 100.00% | 4.00 |
| *2016* | 239 | 8.37% | 40.17% | 7.11% | 44.35% | 2.87 |
| 2017 | 239 | 13.81% | 44.77% | 7.11% | 34.73% | 2.61 |
| *2018* | 257 | 15.18% | 52.53% | 3.89% | 28.40% | 2.45 |
| *2019* | 265 | 18.49% | 53.96% | 3.40% | 24.15% | 2.32 |

The sample includes 2,005 firm–year observations for the period 2012–2019. Quarterly reporting level data were hand-collected from firm websites and manually examined. *QLevel*=1(%) indicates the percentage of firms with a descriptive quarterly report. *QLevel*=2(%) indicates the percentage of firms publishing a quarterly report with at least a condensed statement of financial positions, of comprehensive income and of cash flows. *QLevel*=3(%) indicates the percentage of firms publishing a quarterly report according to IAS 34. *QLevel*=4(%) indicates the percentage of firms publishing a quarterly report according to IAS 34 and a management report according to German Commercial Law.

**Table 3: Descriptive Statistics**

| | *N* | *Mean* | *Std. Dev.* | *P25* | *P50* | *P75* |
|---|---|---|---|---|---|---|
| *SPREAD* | 2.005 | 0.9714 | 1.0908 | 0.1906 | 0.5244 | 1.4016 |
| *PI* | 2.005 | 9.2129 | 28.1562 | 0.0183 | 0.2767 | 4.1536 |
| *MTB* | 2.005 | 2.9019 | 4.7138 | 1.1188 | 1.7928 | 3.0283 |
| *TobinsQ* | 2.005 | 1.7673 | 1.7876 | 1.0352 | 1.2832 | 1.8165 |
| *Size* | 2.005 | 5,033,659 | 13,400,000 | 122,744.7 | 457,292.3 | 2,391,526 |
| *LnTurnover* | 2.005 | -6.9826 | 1.3620 | -7.8058 | -6.7855 | -5.9747 |
| *LnVolatility* | 2.005 | -4.1126 | 0.3026 | -4.3108 | -4.0904 | -3.8914 |
| *LnLeverage* | 2.005 | -1.0222 | 0.7817 | -1.3737 | -0.8258 | -0.4578 |
| *ROA* | 2.005 | 0.2145 | 0.1181 | 0.0072 | 0.0369 | 0.0678 |
| *LnGrowth* | 2.005 | 0.0437 | 0.2672 | -0.0171 | 0.0539 | 0.1235 |

The sample includes 2,005 firm–year observations for the period 2012–2019. All variables are based on a calendar year. $IA_{Spread}$ is daily bid–ask spreads calculated as the mean of daily differences between bid and ask prices divided by the mean of daily bid–ask spreads. $IA_{Price\ Impact}$ is price impact calculated as the yearly median of the Amihud (2002) illiquidity measure. $V_{MTB}$ is market-to-book ratio, calculated as ratio between the market value of a firm's equity and the book value of its equity. $V_{Tobin's\ Q}$ is calculated as the ratio between the market value of a company and the replacement costs of all assets. *Size* is the average market value of equity at the beginning and end of the prior calendar year. *LnTurnover* is computed as the log of the median of the euro value of all shares traded during the day divided by the market capitalization on that day. *LnVolatility* is the log of the standard deviation of daily returns during the year. *LnLeverage* is total liabilities divided by sum of total liabilities and beginning-of-year market value of equity. *ROA* is return on assets. *LnGrowth* is the log of 1 plus the percentage change in book value of equity. The values of $IA_{Spread}$, $IA_{Price\ Impact}$ are multiplied by 100 for expositional purposes.

**Table 4: Pearson (Upper Diagonal) and Spearman (Lower Diagonal) Correlation Coefficients**

| | *[1]* | *[2]* | *[3]* | *[4]* | *[5]* | *[6]* | *[7]* | *[8]* | *[9]* | *[10]* | *[11]* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *QLevel [1]* | 1 | 0.0555 | 0.0780 | -0.0433 | -0.0737 | -0.0857 | 0.0333 | 0.0891 | 0.1062 | 0.0387 | 0.0047 |
| $IA_{Spread}$ *[2]* | 0.0265 | 1 | 0.7640 | 0.0898 | 0.0342 | -0.6987 | -0.6355 | 0.3647 | -0.0659 | -0.2735 | -0.1455 |
| $IA_{PI}$ *[3]* | 0.0591 | 0.9822 | 1 | 0.0148 | -0.0621 | -0.4023 | -0.3838 | 0.2720 | 0.0439 | -0.2072 | -0.1263 |
| $V_{MTB}$ *[4]* | -0.1365 | -0.0652 | -0.0953 | 1 | 0.8463 | 0.0718 | -0.2027 | 0.1147 | -0.4485 | -0.1757 | -0.1995 |
| $V_{TobinsQ}$ *[5]* | -0.1312 | -0.0389 | -0.0616 | 0.9397 | 1 | 0.0674 | -0.1825 | 0.0978 | -0.6714 | -0.1436 | -0.0732 |
| *LnSize [6]* | -0.0989 | -0.8814 | -0.8954 | 0.1375 | 0.0853 | 1 | 0.3778 | -0.3993 | 0.0934 | 0.1500 | 0.0451 |
| *LnTurnover [7]* | 0.0370 | -0.7338 | -0.7509 | -0.0320 | -0.0320 | 0.4630 | 1 | 0.0795 | 0.1430 | 0.0772 | 0.0826 |
| *LnVolatility [8]* | 0.0678 | 0.3907 | 0.3543 | 0.0175 | 0.0353 | -0.3899 | 0.0550 | 1 | -0.1320 | -0.2855 | -0.1266 |
| *LnLeverage [9]* | -0.0587 | -0.1531 | -0.1481 | -0.5751 | -0.7458 | 0.1164 | 0.1582 | -0.1179 | 1 | 0,0389 | 0.0585 |
| *ROA [10]* | 0.0379 | -0.1618 | -0.1502 | 0.1951 | 0.2863 | 0.0866 | 0.0508 | -0.2281 | -0.3594 | 1 | 0.4663 |
| *LnGrowth [11]* | 0.0240 | -0.1151 | -0.1253 | 0.0284 | 0.0577 | 0.0500 | 0.1011 | -0.0822 | -0.0414 | 0.5235 | 1 |

The sample includes 2,005 firm–year observations for the period 2012–2019. All variables are based on a calendar year. *QLevel* is the level of firms' quarterly reports (based on manually examined quarterly reports from firm websites). $IA_{Spread}$ is daily bid–ask spreads calculated as the mean of daily differences between bid and ask prices divided by the mean of daily bid–ask spreads. $IA_{Price\ Impact}$ is price impact calculated as the yearly median of the Amihud (2002) illiquidity measure. $V_{MTB}$ is market-to-book ratio, calculated as ratio between the market value of a firm's equity and the book value of its equity. $V_{Tobin's\ Q}$ is calculated as the ratio between the market value of a company and the replacement costs of all assets. *LnSize* is the natural log of the average market value of equity at the beginning and end of the prior calendar year. *LnTurnover* is computed as the natural log of the median of the euro value of all shares traded during the day divided by the market capitalization on that day. *LnVolatility* is the natural log of the standard deviation of daily returns during the year. *LnLeverage* is the natural log of total liabilities divided by sum of total liabilities and beginning-of-year market value of equity. *ROA* is return on assets. *LnGrowth* is the natural log of 1 plus the percentage change in book value of equity. The values of $IA_{Spread}$, $IA_{Price\ Impact}$ are multiplied by 100 for expositional purposes.

**Table 5: Information Asymmetry Models**

**Panel A: Bid–Ask Spread as Dependent Variable**

$IA_{Spread} = \alpha + \beta_1 QLevel_{it} + \beta_2 LnSize_{it} + \beta_3 LnTurnover_{it} + \beta_4 LnVolatility_{it} + \varepsilon_{it}$

| Variable | *Pooled* | *Fixed Effects* | *2SLS* |
|---|---|---|---|
| *QLevel* | -0.029*** | -0.036*** | -0.053*** |
| | (-2.43) | (-2.57) | (-2.60) |
| *LnSize* | -0.385*** | -0.312*** | -0.389*** |
| | (-24.46) | (-10.71) | (-23.57) |
| *LnTurnover* | -0.477*** | -0.374*** | -0.478*** |
| | (-28.56) | (-12.06) | (-28.55) |
| *LnVolatility* | 0.975*** | 0.621*** | 0.981*** |
| | (18.04) | (8.52) | (18.18) |
| *Fixed Effects* | *Index* | *Firm* | *Index* |
| $R^2$ *(overall)* | 0.774 | 0.681 | 0.773 |
| $R^2$ *(within)* | | 0.393 | |
| $R^2$ *(between)* | | 0.715 | |
| F-statistic/Wald $Chi^2$ | 547.01 | 57.68 | 4387.47 |
| *N* | 2005 | 2005 | 2005 |

**Panel B: Price Impact as Dependent Variable**

$IA_{Price\ Impact} = \alpha + \beta_1 QLevel_{it} + \beta_2 LnSize_{it} + \beta_3 LnTurnover_{it} + \beta_4 LnVolatility_{it} + \varepsilon_{it}$

| Variable | *Pooled* | *Fixed Effects* | *2SLS* |
|---|---|---|---|
| *QLevel* | -0.019 | -0.581 | 0.023 |
| | (-0.04) | (-1.05) | (0.29) |
| *LnSize* | -8.660*** | -6.001*** | -8.617*** |
| | (-11.83) | (-5.25) | (-11.60) |
| *LnTurnover* | -10.835*** | -8.404*** | -10.825*** |
| | (-12.28) | (-4.99) | (-12.32) |
| *LnVolatility* | 25.439*** | 15.47*** | 25.378*** |
| | (9.57) | (5,26) | (9.59) |
| *Fixed Effects* | *Index* | *Firm* | *Index* |
| $R^2$ *(overall)* | 0.367 | 0.250 | 0.366 |
| $R^2$ *(within)* | | 0.111 | |
| $R^2$ *(between)* | | 0.324 | |
| F-statistic/Wald $Chi^2$ | 47.30 | 9.96 | 387.09 |
| *N* | 2005 | 2005 | 2005 |

The sample includes 2,005 firm–year observations for the period 2012–2019. Information asymmetry is measured by $IA_{Spread}$ or $IA_{Price\ Impact}$ respectively. Panel A and panel B report results when the dependent variable is *MTB* and *Tobin's Q*, respectively. The "*Pooled*" column reports the results based on OLS regressions. The "*Fixed Effects*" column reports the results based on OLS regression with firm fixed effects. The "*2SLS*" column reports results based on simultaneous estimated two-stage least square approach for panel data with firm fixed effects. All variables are based on a calendar year. *Qlevel* is the level of firms' quarterly reports (based on manually examined quarterly reports from firm websites). $IA_{Spread}$ is daily bid–ask spreads calculated as the mean of daily differences between bid and ask prices divided by the mean of daily bid–ask spreads. $IA_{Price\ Impact}$ is price impact calculated as the yearly median of the Amihud (2002) illiquidity measure. *LnSize* is the natural log of the average market value of equity at the beginning and end of the prior calendar year. *LnTurnover* is computed as the natural log of the median of the euro value of all shares traded during the day divided by the market capitalization on that day. *LnVolatility* is the natural log of the standard deviation of daily returns during the year. The values of $IA_{Spread}$, $IA_{Price\ Impact}$ are multiplied by 100 for expositional purposes. The table reports OLS, fixed effects and 2SLS estimates and (in parentheses) t-statistics based on robust standard errors for the OLS and 2SLS estimates and clustered standard errors at the firm level for fixed effects estimates. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed), respectively.

**Table 6: Firm Value Models**

**Panel A: Market-to-Book Ratio as Dependent Variable**

$V_{MTB} = \alpha + \beta_1 QLevel_{it} + \beta_2 LnLeverage_{it} + \beta_3 ROA_{it} + \beta_4 LnSize_{it} + \beta_5 LnGrowth_{it} + \varepsilon_{it}$

| Variable | *Pooled* | *Fixed Effects* | *2SLS* |
|---|---|---|---|
| *QLevel* | 0.217** | 0.3120* | 0.499** |
| | (1.99) | (1.77) | (2.26) |
| *LnLeverage* | -2.738*** | -2.921** | -2.773*** |
| | (-10.37) | (-2.19) | (-10.16) |
| *ROA* | -3.990*** | -0.682 | -4.143*** |
| | (-2.72) | (-0.24) | (-2.82) |
| *LnSize* | 0.822*** | 0.885** | 0.870*** |
| | (4.18) | (2.31) | (4.03) |
| *LnGrowth* | -2.737*** | -3.772*** | -2.705*** |
| | (-3.65) | (-4.35) | (-3.61) |
| *Fixed Effects* | *Index* | *Firm* | *Index* |
| $R^2$ *(overall)* | 0.291 | 0.208 | 0.287 |
| $R^2$ *(within)* | | 0.256 | |
| $R^2$ *(between)* | | 0.167 | |
| F-statistic or Wald $Chi^2$ | 20.01 | 8.11 | 187.98 |
| *N* | 2005 | 2005 | 2005 |

**Panel B: Tobin's Q as Dependent Variable**

$V_{TobinsQ} = \alpha + \beta_1 QLevel_{it} + \beta_2 LnLeverage_{it} + \beta_3 ROA_{it} + \beta_4 LnSize_{it} + \beta_5 LnGrowth_{it} + \varepsilon_{it}$

| Variable | *Pooled* | *Fixed Effects* | *2SLS* |
|---|---|---|---|
| *QLevel* | 0.067* | 0.128* | 0.214*** |
| | (1.79) | (1.78) | (3.17) |
| *LnLeverage* | -1.577*** | -1.561** | -1.595*** |
| | (-15.68) | (-3.47) | (-15.50) |
| *ROA* | -1.876*** | -0.620 | -1.955*** |
| | (-3.12) | (-0.59) | (-3.27) |
| *LnSize* | 0.287*** | 0.322** | 0.311*** |
| | (4.57) | (2.23) | (4.58) |
| *LnGrowth* | -0.161 | -0.468* | -0.144 |
| | (-1.01) | (-1.87) | (-0.92) |
| *Fixed Effects* | *Index* | *Firm* | *Index* |
| $R^2$ *(overall)* | 0.505 | 0.431 | 0.498 |
| $R^2$ *(within)* | | 0.353 | |
| $R^2$ *(between)* | | 0.443 | |
| F-statistic or Wald $Chi^2$ | 47.29 | 7.77 | 446.66 |
| *N* | 2005 | 2005 | 2005 |

The sample includes 2,005 firm–year observations for the period 2012–2019. Valuation is measured by $V_{MTB}$ or $V_{Tobin's\ Q}$ respectively. Panel A and panel B report results when the dependent variable is *MTB* and *Tobin's Q*, respectively. The "*Pooled*" column reports the results based on OLS regressions. The "*Fixed Effects*" column reports the results based on OLS regression with firm fixed effects. The "*2SLS*" column reports results based on simultaneous estimated two-stage least square approach for panel data. All variables are based on a calendar year. *Qlevel* is the level of firms' quarterly reports (based on manually examined quarterly reports from firm websites). $V_{MTB}$ is market-to-book ratio, calculated as ratio between the market value of a firm's equity and the book value of its equity. $V_{Tobin's\ Q}$ is calculated as the ratio between the market value of a company and the replacement costs of all assets. *LnSize* is the natural log of the average market value of equity at the beginning and end of the prior calendar year. *LnLeverage* is the natural log of total liabilities divided by sum of total liabilities and beginning-of-year market value of equity. *ROA* is return on assets. *LnGrowth* is the natural log of 1 plus the percentage change in book value of equity. The table reports OLS, fixed effects and 2SLS estimates and (in parentheses) t-statistics based on robust standard errors for the OLS and 2SLS estimates and clustered standard errors at the firm level for fixed effects estimates. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed), respectively.

**Table 7: Matching Model**

***Panel A: Information Asymmetry Measures***

$IA_{Spread,\ Price\ Impact} = \alpha+\beta_1 Post_{it}+\beta_2 Treat_{it}+\beta_3 Post \times Treat_{it}+\beta_4 LnSize_{it}+\beta_5 LnTurnover_{it}+\beta_6 LnVolatility_{it}+\varepsilon_{it}$

| Variable | $IA_{Spread}$ | $IA_{PI}$ |
|---|---|---|
| *Post* | -0.068 | -6.723*** |
| | (-1.23) | (-3.57) |
| *Treat* | -0.123*** | -6.903*** |
| | (-2.98) | (-3.98) |
| *Post × Treat* | 0.100* | 6.680*** |
| | (1.63) | (3.13) |
| *LnSize* | -0.191*** | -1.882*** |
| | (-18.37) | (-6.44) |
| *LnTurnover* | -0.387*** | -5.978*** |
| | (-21.91) | (-8.87) |
| *LnVolatility* | 0.795*** | 17.197*** |
| | (11.77) | (6.49) |
| $R^2$ | 0.698 | 0.269 |
| F-statistics | 278.66 | 32.61 |
| *N* | 1863 | 1863 |

***Panel B: Valuation Measures***

$V_{MTB,\ TobinsQ} = \alpha+\beta_1 Post_{it}+\beta_2 Treat_{it}+\beta_3 Post \times Treat_{it}+\beta_4 LnSize_{it}+\beta_5 LnLeverage_{it}+\beta_6 ROA_{it}+\beta_7 LnGrowth_{it}+\varepsilon_{it}$

| Variable | $V_{MTB}$ | $V_{TobinsQ}$ |
|---|---|---|
| *Post* | -4.952 | -0.111 |
| | (-1.45) | (-1.09) |
| *Treat* | -0.093 | 0.117 |
| | (-0.28) | (1.10) |
| *Post × Treat* | 0.143 | -0.099 |
| | (0.39) | (-0.81) |
| *LnSize* | 0.379*** | 0.154*** |
| | (4.42) | (5.42) |
| *LnLeverage* | -3.089*** | -1.612*** |
| | (-8.10) | (-12.03) |
| *ROA* | -4.488*** | -1.991*** |
| | (-2.68) | (-3.19) |
| *LnGrowth* | -2.823*** | -0.301 |
| | (-3.02) | (-1.32) |
| $R^2$ | 0.287 | 0.477 |
| F-statistics | 18.06 | 48.71 |
| *N* | 1863 | 1863 |

The sample includes 1,335 observations for treatment firms and control firms 3 years before and after the event year during the period 2013–2019. Control firms are matched on industry, size, and year. The results are based on the model $DV=\alpha+\beta_1 Post_{it}+\beta_2 Treat_{it}+\beta_3 Post\times Treat_{it}+\beta_4 CV_{it}+\varepsilon_i$ . *DV* are the information asymmetry

or valuation measures. *Treat* is the dummy variable coded as 1, for firms that change their quarterly reporting level and 0 for control firms; After is the dummy variable coded as 1 for three years after the change in quarterly reporting level, and 0 for three years before the change. *CV* are the control variables. Information asymmetry is measured by $IA_{Spread}$ or $IA_{Price\ Impact}$. Valuation is measured by $V_{MTB}$ or $V_{Tobin's\ Q}$. Panel A and panel B report results for our information asymmetry measures and valuation measures, respectively. $IA_{Spread}$ is daily bid–ask spreads calculated as the mean of daily differences between bid and ask prices divided by the mean of daily bid–ask spreads. $IA_{Price\ Impact}$ is price impact calculated as the yearly median of the Amihud (2002) illiquidity measure. $V_{MTB}$ is market-to-book ratio, calculated as ratio between the market value of a firm's equity and the book value of its equity. $V_{Tobin's\ Q}$ is calculated as the ratio between the market value of a company and the replacement costs of all assets. *LnSize* is the natural log of the average market value of equity at the beginning and end of the prior calendar year. *LnTurnover* is computed as the natural log of the median of the euro value of all shares traded during the day divided by the market capitalization on that day. *LnVolatility* is the natural log of the standard deviation of daily returns during the year. *LnLeverage* is the natural log of total liabilities divided by sum of total liabilities and beginning-of-year market value of equity. *ROA* is return on assets. *LnGrowth* is the natural log of 1 plus the percentage change in book value of equity. The values of $IA_{Spread}$, $IA_{Price\ Impact}$ are multiplied by 100 for expositional purposes. The table reports OLS estimates and (in parentheses) t-statistics based on clustered standard errors at the firm level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed), respectively.

**Table 8: Interaction Effect of Index Membership**

**Panel A: Information Asymmetry Measures**

$$IA_{Spread,\ Price\ Impact} = \alpha+\beta_1 QLevel_{it}+\beta_2 Index_{it}+\beta_3 QLevel \times Index+\beta_4 LnSize_{it} +\beta_5 LnTurnover_{it}+\beta_6 LnVolatility_{it}+\varepsilon_{it}$$

| Variable | $IA_{Spread}$ | $IA_{Price\ Impact}$ |
|---|---|---|
| *QLevel* | -0.005 | 0.335 |
| | (-0.25) | (0.34) |
| *Index* | 0.133 | 0.110*** |
| | (1.48) | (3.09) |
| *QLevel × Index* | -0.063*** | -1.622*** |
| | (-4.77) | (-4.22) |
| *LnSize* | -0.310*** | -7.451*** |
| | (-10.50) | (-4.49) |
| *LnTurnover* | -0.369*** | -13.567*** |
| | (-11.19) | (-2.93) |
| *LnVolatility* | 0.623*** | 32.71* |
| | (8.65) | (1.96) |
| *Fixed Effects* | *Firm* | *Firm* |
| $R^2$ *(overall)* | 0.683 | 0.255 |
| $R^2$ *(within)* | 0.399 | 0.118 |
| $R^2$ *(between)* | 0.717 | 0.332 |
| F-statistics | 47.30 | 7.53 |
| *N* | 2005 | 2005 |

**Panel B: Valuation Measures**

$$V_{MTB,\ Tobin's\ Q} = \alpha + \beta_1 QLevel_{it} + \beta_2 Index_{it} + \beta_3 QLevel \times Index + \beta_4 LnLeverage_{it} + \beta_5 ROA_{it} + \beta_6 LnSize_{it} + \beta_7 LnGrowth_{it} + \varepsilon_{it}$$

| Variable | $V_{MTB}$ | $V_{Tobin's\ Q}$ |
|---|---|---|
| *QLevel* | 0.417 | 0.177 |
| | (1.44) | (1.50) |
| *Index* | 0.614 | 0.247 |
| | (0.77) | (0.78) |
| *QLevel × Index* | 0.214* | 0.083* |
| | (1.77) | (1.86) |
| *LnLeverage* | -2.929** | -1.566*** |
| | (-2.18) | (-3.46) |
| *ROA* | 0.763 | -0.575 |
| | (0.28) | (-0.56) |
| *LnSize* | 0.986** | 0.320** |
| | (2.26) | (2.20) |
| *LnGrowth* | -3.774*** | -0.469* |
| | (-4.34) | (-1.87) |
| *Fixed Effects* | *Firm* | *Firm* |
| $R^2$ *(overall)* | 0.210 | 0.437 |
| $R^2$ *(within)* | 0.257 | 0.355 |
| $R^2$ *(between)* | 0.168 | 0.446 |
| F-statistics | 6.99 | 10.32 |
| *N* | 2005 | 2005 |

The sample includes 2,005 firm–year observations for the period 2012–2019. Firm Value is measured by $V_{MTB}$ or $V_{Tobin's\ Q}$ respectively. Panel A and panel B report results for our information asymmetry measures and valuation measures, respectively. *QLevel* is the level of firms' quarterly reports (based on manually examined quarterly reports from firm websites). The variable *Index* is coded as one for firms without Index listing. All variables are based on a calendar year. $V_{MTB}$ is market-to-book ratio, calculated as ratio between the market value of a firm's equity and the book value of its equity. $V_{Tobin's\ Q}$ is calculated as the ratio between the market value of a company and the replacement costs of all assets. *LnSize* is the natural log of the average market value of equity at the beginning and end of the prior calendar year. *LnTurnover* is computed as the natural log of the median of the euro value of all shares traded during the day divided by the market capitalization on that day. *LnVolatility* is the natural log of the standard deviation of daily returns during the year. *LnLeverage* is the natural log of total liabilities divided by sum of total liabilities and beginning-of-year market value of equity. *ROA* is return on assets. *LnGrowth* is the natural log of 1 plus the percentage change in book value of equity. The table reports firm fixed effects estimates and (in parentheses) t-statistics based on clustered standard errors at the firm level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed), respectively.

**Table 9: Interaction Effect of Media Coverage**

**Panel A: Information Asymmetry Measures**

$$IA_{Spread,\ Price\ Impact} = \alpha + \beta_1 QLevel_{it} + \beta_2 High\_MC_{it} + \beta_3 QLevel \times High\_MC + \beta_4 LnSize_{it} + \beta_5 LnTurnover_{it} + \beta_6 LnVolatility_{it} + \varepsilon_{it}$$

| Variable | $IA_{Spread}$ | $IA_{Price\ Impact}$ |
|---|---|---|
| *QLevel* | -0.017 | -0.008 |
| | (-0.77) | (-0.01) |
| *High_MC* | 0.171** | 9.773*** |
| | (2.05) | (3.01) |
| *QLevel × High_MC* | -0.057*** | -1.418*** |
| | (-4.21) | (-3.89) |
| *LnSize* | -0.317*** | -6.533*** |
| | (-10.68) | (-5.45) |
| *LnTurnover* | -0.378*** | -8.788*** |
| | (-11.86) | (-5.12) |
| *LnVolatility* | 0.622*** | 15.649*** |
| | (8.58) | (5.32) |
| *Fixed Effects* | *Firm* | *Firm* |
| $R^2$ *(overall)* | 0.682 | 0.254 |
| $R^2$ *(within)* | 0.396 | 0.118 |
| $R^2$ *(between)* | 0.718 | 0.333 |
| F-statistics | 41.76 | 6.85 |
| *N* | 2005 | 2005 |

**Panel B: Valuation Measures**

$$V_{MTB,\ Tobin's\ Q} = \alpha + \beta_1 QLevel_{it} + \beta_2\ High\_MC_{it} + \beta_3 QLevel \times High\_MC + \beta_4 LnLeverage_{it} + \beta_5 ROA_{it} + \beta_6 LnSize_{it} + \beta_7 LnGrowth_{it} + \varepsilon_{it}$$

| Variable | $V_{MTB}$ | $V_{Tobin's\ Q}$ |
|---|---|---|
| *QLevel* | 0.407 | 0.175 |
| | (1.44) | (1.49) |
| *High_MC* | 0.558 | 0.213 |
| | (0.76) | (0.74) |
| *QLevel* × *High_MC* | 0.223* | 0.087** |
| | (1.75) | (1.95) |
| *LnLeverage* | -2.907** | -1.552*** |
| | (-2.19) | (-3.47) |
| *ROA* | 0.775 | -0.564 |
| | (-0.28) | (-0.55) |
| *LnSize* | 0.894** | 0.332** |
| | (2.33) | (2.27) |
| *LnGrowth* | -3.786*** | -0.213 |
| | (-4.32) | (-0.74) |
| *Fixed Effects* | *Firm* | *Firm* |
| $R^2$ *(overall)* | 0.207 | 0.431 |
| $R^2$ *(within)* | 0.256 | 0.355 |
| $R^2$ *(between)* | 0.163 | 0.438 |
| F-statistics | 5.78 | 5.82 |
| *N* | 2005 | 2005 |

The sample includes 2,005 firm–year observations for the period 2012–2019. Firm Value is measured by $V_{MTB}$ or $V_{Tobin's\ Q}$ respectively. Panel A and panel B report results for our information asymmetry measures and valuation measures, respectively. *QLevel* is the level of firms' quarterly reports (based on manually examined quarterly reports from firm websites). The variable *High_MC* is coded as one for firms with an extent of press releases below the average. All variables are based on a calendar year. $V_{MTB}$ is market-to-book ratio, calculated as ratio between the market value of a firm's equity and the book value of its equity. $V_{Tobin's\ Q}$ is calculated as the ratio between the market value of a company and the replacement costs of all assets. *LnSize* is the natural log of the average market value of equity at the beginning and end of the prior calendar year. *LnTurnover* is computed as the natural log of the median of the euro value of all shares traded during the day divided by the market capitalization on that day. *LnVolatility* is the natural log of the standard deviation of daily returns during the year. *LnLeverage* is the natural log of total liabilities divided by sum of total liabilities and beginning-of-year market value of equity. *ROA* is return on assets. *LnGrowth* is the natural log of 1 plus the percentage change in book value of equity. The table reports firm fixed effects estimates and (in parentheses) t-statistics based on clustered standard errors at the firm level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed), respectively.